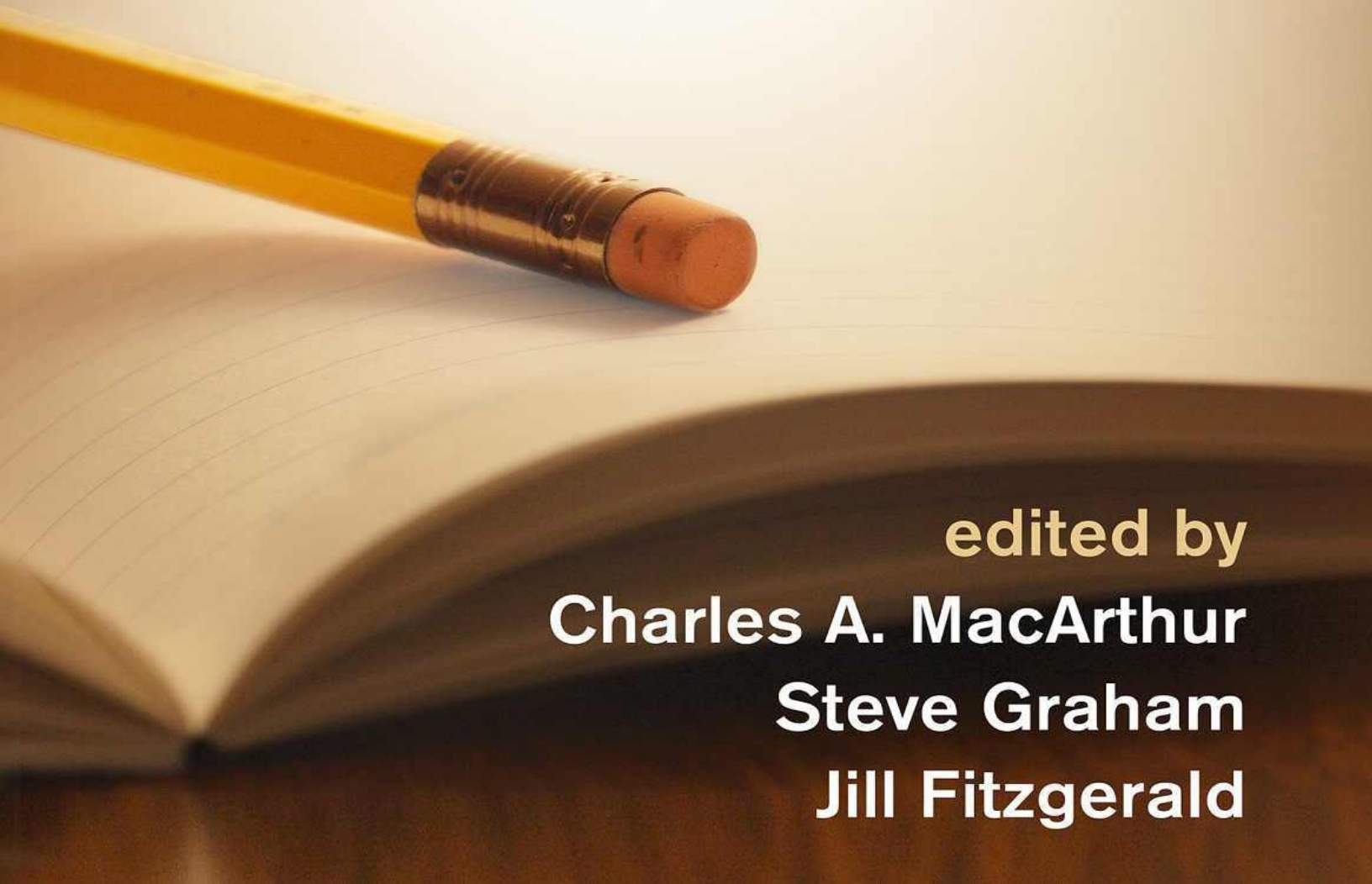
SECOND EDITION

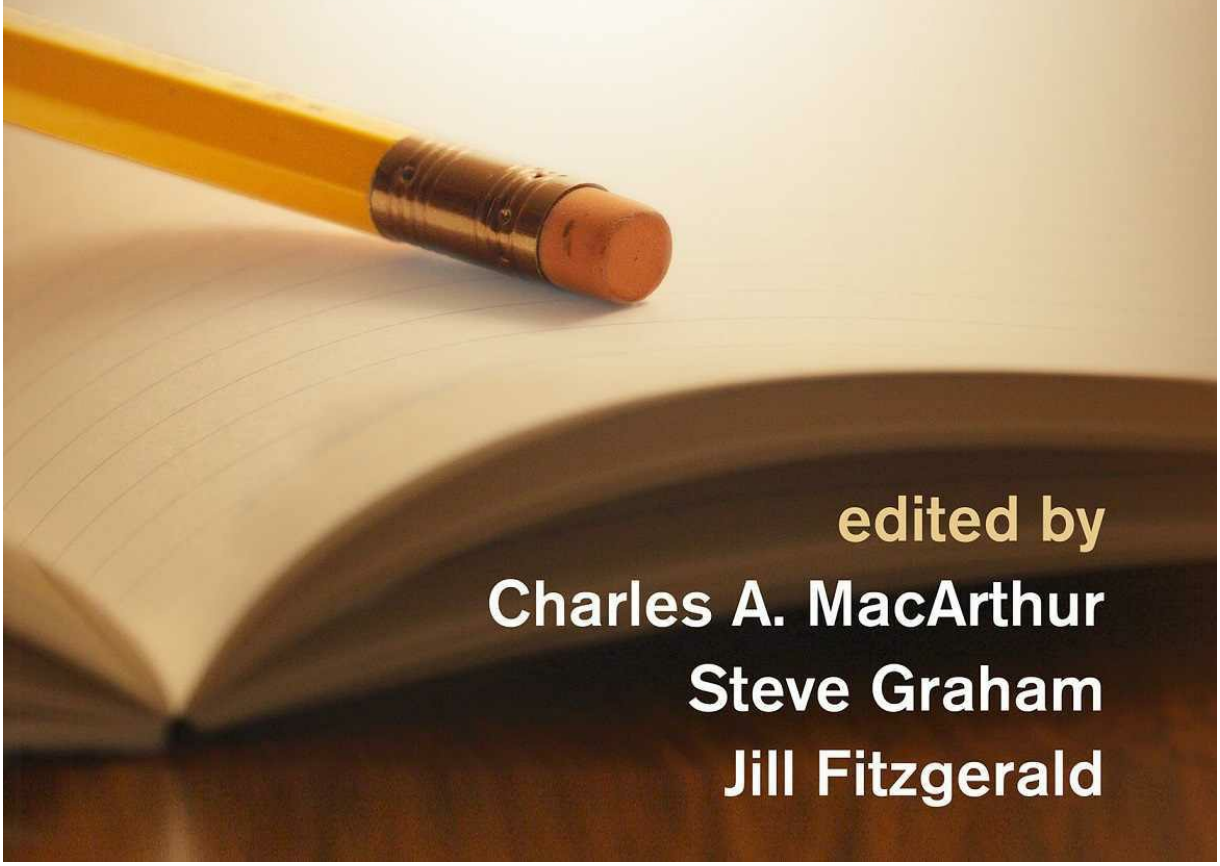
HANDBOOK OF WRITING RESEARCH



edited by
Charles A. MacArthur
Steve Graham
Jill Fitzgerald

SECOND EDITION

HANDBOOK OF WRITING RESEARCH



edited by
Charles A. MacArthur
Steve Graham
Jill Fitzgerald

Also from the Editors

Best Practices in Writing Instruction, Second Edition
Edited by Steve Graham, Charles A. MacArthur, and Jill Fitzgerald

Developing Strategic Writers through Genre Instruction: Resources for Grades 3–5
Zoi A. Philippakos, Charles A. MacArthur, and David L. Coker Jr.

Handbook of Learning Disabilities, Second Edition
Edited by H. Lee Swanson, Karen R. Harris, and Steve Graham

HANDBOOK OF WRITING RESEARCH

SECOND EDITION

edited by
Charles A. MacArthur
Steve Graham
Jill Fitzgerald

THE GUILFORD PRESS
New York London

Epub Edition ISBN: 9781462522453; Kindle Edition ISBN: 9781462522460

A Division of Guilford Publications, Inc.
370 Seventh Avenue, Suite 1200, New York, NY 10001
www.guilford.com

from the publisher.

Last digit is print number: 9 8 7 6 5 4 3 2 1

Library of Congress Cataloging-in-Publication Data

Handbook of writing research / edited by Charles A. MacArthur, Steve Graham, Jill Fitzgerald. — Second edition.

pages cm

Includes bibliographical references and index.

ISBN 978-1-4625-2243-9 (hardback)

1. English language—Rhetoric—Study and teaching—Research—Handbooks, manuals, etc. 2. English language—Composition and exercises—Research— Handbooks, manuals, etc. 3. Report writing—Study and teaching—Research— Handbooks, manuals, etc. 4. Language arts—Research—Handbooks, manuals, etc. I. MacArthur, Charles A., editor. II. Graham, Steve, 1950– editor. III. Fitzgerald, Jill, editor.

PE1404.H358 2015

808′.042071—dc23

2015030840

To Dorothy Hsiao, for her friendship, support, and love
—C. A. M.

To Karen Harris, the love of this life and many to come
—S. G.

To my granddaughter, Lorine Winifred Miller, who loves to write
—J. F.

About the Editors

Charles A. MacArthur, PhD, is Professor of Special Education and Literacy in the School of Education at the University of Delaware. His major research interests include writing development and instruction for struggling writers, development of self-regulated strategies, adult literacy, and applications of technology to support reading and writing. Currently he is coprincipal investigator of a study of writing instruction in first grade. Dr. MacArthur is coeditor of the *Journal of Writing Research* and serves on the editorial boards of several other journals. He has published over 100 articles and book chapters and coedited several books, including *Best Practices in Writing Instruction, Second Edition* (with Steve Graham and Jill Fitzgerald).

Steve Graham, EdD, is the Warner Professor in the Division of Educational Leadership and Innovation at Mary Lou Fulton Teachers College, Arizona State University. He is also Research Professor in the Learning Science Institute at the Australian Catholic University in Brisbane. Dr. Graham is editor of the *Journal of Educational Psychology*. He has coedited several books, including the *Handbook of Learning Disabilities, Second Edition,* and is the coauthor of three influential Carnegie Corporation reports: Writing Next, Writing to Read, and Informing Writing. Dr. Graham has received numerous awards, including the Career Research Award from the Council for

Exceptional Children (CEC), the Kauffman–Hallahan Distinguished Researcher Award from the CEC Division of Research, the Samuel A. Kirk Award from the CEC Division of Learning Disabilities, the Distinguished Researcher Award from the special education interest group of the American Educational Research Association (AERA), and the Weiderholt Distinguished Lecture Award from the Council of Learning Disabilities. He is a Fellow of the AERA and the International Academy for Research in Learning Disabilities.

Jill Fitzgerald, PhD, is Professor Emerita and Adjunct Research Professor at the University of North Carolina at Chapel Hill. She is also Distinguished Research Scientist at MetaMetrics in Durham, North Carolina. A former primary-grades teacher and reading specialist, she conducts research on literacy issues for multilingual learners, understanding text complexity, and vocabulary measurement. Dr. Fitzgerald is a member of the Reading Hall of Fame, a Fellow of the AERA, and a recipient of research awards from Phi Delta Kappa, the International Reading Association, and the AERA. With more than 100 publications, she is associate editor of the *Journal of Educational Psychology* and serves on the editorial boards of several other journals.

Contributors

Laura K. Allen, MA, Department of Psychology, Arizona State University, Phoenix, Arizona

Nina Arcon, BA, Faculty of Education, University of Western Ontario, London, Ontario, Canada

Samanta Baker, BA, Faculty of Education, University of Western Ontario, London, Ontario, Canada

Charles Bazerman, PhD, Department of Education, University of California, Santa Barbara, Santa Barbara, California

Richard Beach, PhD, Department of Curriculum and Instruction, University of Minnesota, Minneapolis, Minnesota

Virginia Berninger, PhD, Educational Psychology, University of Washington, Seattle, Washington

Roger H. Bruning, PhD, Educational Psychology, University of Nebraska–Lincoln, Lincoln, Nebraska

Tanja Burkhard, MA, College of Education and Human Ecology, The Ohio State University, Columbus, Ohio

Jill Burstein, PhD, Educational Testing Service, Princeton, New Jersey

Amber B. Chambers, MEd, Learning, Literacies, and Technology, Arizona State University, Tempe, Arizona

Vince Connelly, PhD, Department of Psychology, Social Work and Public Health, Oxford Brookes University, Oxford, United Kingdom

Julie A. Corrigan, BA, Department of Education, University of Ottawa, Ottawa, Ontario, Canada

Alister Cumming, PhD, Department of Curriculum, Teaching and Learning, Ontario Institute for Studies in Education, University of Toronto, Toronto, Ontario, Canada

Julie Dockrell, PhD, Department of Psychology and Human Development, University College London, London, United Kingdom

Norbert Elliot, PhD, Department of Humanities, New Jersey Institute of Technology, Newark, New Jersey

Yueyue Fan, BA, School of Education, University of Delaware, Newark, Delaware

Michel Fayol, PhD, Social and Cognitive Psychology Department, Blaise Pascal University of Clermont Auvergne, Clermont-Ferrand, France

Ralph P. Ferretti, PhD, School of Education, University of Delaware, Newark, Delaware

Jill Fitzgerald, PhD, School of Education, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina

Peter W. Foltz, PhD, Pearson Knowledge Technologies, Boulder, Colorado

Exequiel Ganding III, MA, Language, Literacy, and Culture, Graduate School of Education, University of California, Berkeley, Berkeley, California

Cristin M. Geoghegan, MA, Curriculum and Instruction, University of Illinois at Urbana–Champaign, Champaign, Illinois

Steve Graham, EdD, Mary Lou Fulton Teachers College, Arizona State University, Tempe, Arizona

Karen R. Harris, EdD, Mary Lou Fulton Teachers College, Arizona State University, Tempe, Arizona

Jennifer Higgs, MS, Graduate School of Education, University of California, Berkeley, Berkeley, California

Richard Hudson, PhD, Division of Psychology and Language Sciences, University College London, London, United Kingdom

Glynda A. Hull, PhD, Graduate School of Education, University of California, Berkeley, Berkeley, California

Matthew E. Jacovina, PhD, Learning Sciences Institute, Arizona State University, Phoenix, Arizona

Karin H. James, PhD, Department of Psychological and Brain Sciences, Indiana University, Bloomington, Indiana

R. Joanne Jao, BS, BA, Department of Psychological and Brain Sciences, Indiana University, Bloomington, Indiana

Douglas F. Kauffman, PhD, Department of Surgery, Boston University School of Medicine, Boston, Massachusetts

Valerie Kinloch, PhD, College of Education and Human Ecology, The Ohio State University, Columbus, Ohio

Perry D. Klein, PhD, Faculty of Education, University of Western Ontario, London, Ontario, Canada

Michelle Nguyen Kwok, MA, School of Education, University of Michigan, Ann Arbor, Michigan

Mariëlle Leijten, PhD, Department of Management, University of Antwerp, and Research Foundation Flanders (FWO), Antwerp, Belgium

Donald J. Leu, PhD, Professor of Education, University of Connecticut, Storrs, Connecticut

Contents

Also from the Editors

Title Page

Copyright Page

Dedication Page

About the Editors

Contributors

Introduction

Charles A. MacArthur, Steve Graham, and Jill Fitzgerald

Part I. Theories and Models of Writing

1. What Do Sociocultural Studies of Writing Tell Us about Learning to Write?
Charles Bazerman

2. Writing Research from a Cognitive Perspective
Charles A. MacArthur and Steve Graham

3. Writing Research through a New Literacies Lens
Donald J. Leu, David Slomp, Lisa Zawilinski, and Julie A. Corrigan

Part II. Writing Development

4. Writing Process Theory: A Functional Dynamic Approach
Huub van den Bergh, Gert Rijlaarsdam, and Elke van Steendam

5. Understanding Planning in Text Production
Mark Torrance

6. A Sociocultural Perspective on Writing Development: Toward an Agenda for Classroom Research on Students' Use of Social Practices
Richard Beach, George E. Newell, and Jennifer VanDerHeide

7. After Writing, After School
Katherine Schultz, Glynda A. Hull, and Jennifer Higgs

8. The Development of Multileveled Writing Systems of the Brain: Brain Lessons for Writing Instruction
Karin H. James, R. Joanne Jao, and Virginia Berninger

9. From Language to Text: The Development and Learning of Translation
Michel Fayol

10. From Text to Language and Back: The Emergence of Written Language
Liliana Tolchinsky

11. Self-Efficacy Beliefs and Motivation in Writing Development
Roger H. Bruning and Douglas F. Kauffman

12. Self-Regulation and Writing: Meta-Analysis of the Self-Regulation Processes in Zimmerman and Risemberg's Model
Tanya Santangelo, Karen R. Harris, and Steve Graham

13. Relationships between Reading and Writing Development
Timothy Shanahan

Part III. Instruction in Writing

14. Evidence-Based Practice and Writing Instruction: A Review of Reviews
Steve Graham, Karen R. Harris, and Amber B. Chambers

15. New Developments in Genre-Based Literacy Pedagogy
David Rose

16. Writing to Learn
Perry D. Klein, Nina Arcon, and Samanta Baker

17. Sociocultural Approaches to High School Writing Instruction: Examining the Roles of Context, Positionality, and Power
Michelle Nguyen Kwok, Exequiel Ganding III, Glynda A. Hull, and Elizabeth Birr Moje

18. Instruction in Evaluation and Revision
Charles A. MacArthur

19. Grammar Instruction
Richard Hudson

20. Argumentative Writing
Ralph P. Ferretti and Yueyue Fan

21. Computer-Based Writing Instruction
Laura K. Allen, Matthew E. Jacovina, and Danielle S. McNamara

22. The Role of Professional Development for Enhancing Writing Instruction
Sarah J. McCarthey and Cristin M. Geoghegan

Part IV. Writing and Special Populations

23. Writing Development and Instruction for Students with Learning Disabilities: Using Diagnostic Categories to Study Writing Difficulties
Vince Connelly and Julie Dockrell

24. Writing Development and Instruction for English Language Learners
Alister Cumming

25. Teaching Writing in Culturally and Linguistically Diverse Classrooms
Valerie Kinloch and Tanja Burkhard

Part V. Analytic Tools for Writing Research

26. Automated Writing Evaluation: An Expanding Body of Knowledge
Mark D. Shermis, Jill Burstein, Norbert Elliot, Shayne Miel, and Peter W. Foltz

27. Keystroke Logging in Writing Research: Analyzing Online Writing Processes
Luuk Van Waes, Mariëlle Leijten, Eva Lindgren, and Åsa Wengelin

28. Linguistic Analysis Tools
Pablo Pirnay-Dummer

Author Index

Subject Index

About Guilford Press

Discover Related Guilford Books

Introduction

Charles A. MacArthur, Steve Graham, and Jill Fitzgerald

The power of writing and the difficulty of writing well are both captured in Mark Twain's quote, "The difference between the right word and the almost right word is the difference between lightning and a lightning bug" (Ayers, 1987). Writing is, indeed, as powerful as lightning, though its power can be harnessed. Politically, it can inflame revolutionary passions, as in Thomas Paine's *The Rights of Man*, or it can codify stable principles of government, as in the *Code of Hammurabi*. Writing is critical to the advancement of knowledge in academic, technical, and business fields as well as to the administration of activities in business, government, and all institutions of social life. Writing is required in the majority of occupations, even those that do not require a college education (Mikulecky, 1998). In our personal lives, writing is a means of expression and a way to communicate with family and friends across distance and time. Writing is also a fundamental part of the school curriculum, both as an important outcome and as a means of gaining and demonstrating learning in the disciplines.

Writing well can also be very challenging. Choosing the "right word" is just one of many difficulties. Writing is a complex social and cognitive process that requires shared understanding with readers about purposes and forms, knowledge of content, proficiency in language, and a range of skills and strategies, as well as motivation. Mastery of writing requires time, opportunities to write for a range of purposes, and quality instruction.

Globally, writing performance is a matter of considerable concern. In the United States, the most recent National Assessment of Educational Progress (NAEP; National Center for Education Statistics [NCES], 2012) revealed that only 27% of students in the final year of high school performed at or above a proficient level in writing; similar results were reported in 2007 and 2002 (Salahu-Din, Persky, & Miller, 2008). In Europe and in the United States, educators face substantial challenges in meeting the needs of students to master writing in both their native and second languages. At the same time in the United States, the recent *Common Core State Standards* (2010) require proficient writing across disciplines, such as science, history, and literature. To address the challenges, educators, researchers, and policy makers need to draw on the best available information about writing, its development, and effective instruction for all students.

As was the case for the first edition of the *Handbook*, the overall purpose of this volume is to meet the challenge by bringing together comprehensive, up-to-date reviews of research on major writing theories, developmental issues, instructional approaches, and research methods. The field has evolved substantially since the first edition of the *Handbook* appeared nearly 10 years ago, and as a consequence, coverage in the second edition is broader and more diverse, including a wider array of perspectives and topics from social, cognitive, linguistic, New Literacy technological, and neuroscience perspectives. Authorship is considerably more diverse geographically, with 11 chapters from outside the United States. Of the 29 chapters, 17 are written by new authors.

THEORETICAL PERSPECTIVES

The first section of the *Handbook* includes chapters about writing research from three different theoretical perspectives. In Chapter 1, Charles Bazerman synthesizes key principles that sociocultural studies have added to our knowledge about writing. Sociocultural researchers have examined writing from social, historical, and cultural perspectives, analyzing how writing is used in social contexts, how social institutions have been influenced by writing, and how individuals develop knowledge of writing in social contexts. Consistent with the overall focus of the *Handbook*, Bazerman focuses on issues related to development and learning. He divides his chapter into four sections that address why people write, the consequences of writing, how writing gets done, and how writing is learned.

Charles A. MacArthur and Steve Graham, in Chapter 2, examine writing from a cognitive theoretical perspective. The overall goal of cognitive research is to understand human performance, development and learning, and individual differences by analyzing cognitive processes. The chapter summarizes five theoretical cognitive models of writing, including the classic models of expert writing by Hayes and Flower and writing development by Bereiter and Scardamalia, as well as Hayes's revised model and models focused on self-regulation of writing and application of domain knowledge to writing. MacArthur and Graham then review research on four issues central to cognitive theories: working memory, transcription, self-regulation including planning and evaluation, and motivation.

In Chapter 3, Donald J. Leu, David Slomp, Lisa Zawilinski, and Julie Corrigan explore new theoretical perspectives needed to understand the impact of new literacies. They argue that the Internet has caused and continues to cause important changes in the nature of literacy and what it means to be literate. Changes in the forms of text and opportunities to access and exchange information are changing both social practices and the cognitive knowledge and strategies needed. Writers need to be prepared to analyze social and rhetorical contexts and apply metacognitive knowledge and strategies to flexibly respond to rapidly changing writing tasks. Acknowledging that research on new literacies is in an early stage, the authors then review selected research with adolescents and young children writing with new technologies in and out of school.

WRITING DEVELOPMENT

The section on writing development includes chapters from a cognitive perspective on process models and planning during text production as well as chapters from a sociocultural perspective on school practices and writing out of school. Other chapters consider the development of basic understandings of written language by children in the preschool and primary years, as well as relationships between reading and writing development. Two chapters address the development of motivation and self-regulation, and a chapter reports recent findings from neuroscience research.

In Chapter 4, Huub van den Bergh, Gert Rijlaarsdam, and Elke van Steendam summarize research focused on designing cognitive models that can explain individual variation in the quality of written products. They demonstrate that it is essential to model cognitive processes dynamically by considering not only which processes (e.g., generating ideas, rereading, revising) occur but also when in the process they occur and in what order. Using such models, they have been able to predict considerable variance in the quality of products from writing process measures. They discuss recent research on the effects of topic and task complexity on cognitive processes, as well as differences between L1 and L2 writing.

Mark Torrance, in Chapter 5, turns a critical eye on research on planning processes in writing. In the first part of the chapter, he explores research on the planning that is required to produce any writing and that occurs during the process of writing as writers plan the content and language of sentences. In the second part, he challenges the common educational assertion that advance planning is important to the production of quality text, and he presents some interesting research suggesting that instruction in planning works not by increasing the amount of planning but by teaching students about the characteristics of good text.

Richard Beach, George Newell, and Jennifer VanDerHeide, in Chapter 6, apply a sociocultural perspective to discuss writing development through writers' use of social practices. The authors illustrate social practices within writing systems by examining research on collaborative writing, learning to contextualize writing, and adopting alternative viewpoints. The authors argue that growth in writing ability ought to be characterized in large part as discourse-in-use—that is, as changes over time in the use of social practices to create and function in situated rhetorical contexts. As part of a proposed agenda for future research, they emphasize the need to develop more sophisticated approaches to assessment that focus on creating meaning in social contexts.

Katherine Schultz, Glynda Hull, and Jennifer Higgs, in Chapter 7, systematically review research since 2000 on writing out of school. The chapter begins with a critical discussion of the theoretical framework for New Literacy Studies, widely used in this area of research, and recent theories that include multiliteracies and incorporate both local and broader social contexts. Most of the research on writing out of school has focused on digitally mediated composing and adolescents and has used ethnographic and case study methods. Research has included writing in a wide range of digital contexts that afforded adolescents opportunities to interact with local and global audiences. Much research has centered on opportunities to create new identities and an increased sense of agency through writing. The authors call for researchers to consider a wider range of research methodologies in continued work on writing beyond school.

In Chapter 8, Karin H. James, R. Joanne Jao, and Virginia Berninger review neuroscience research on writing-related processes. New technologies, such as functional magnetic resonance imaging, have made it possible to study brain activation in response to simple cognitive tasks. The authors present sample findings from studies with participants in early childhood, middle childhood, and adolescence. In early childhood, learning letters with handwriting practice led to different brain activation than learning letters by observing others write them. In middle

childhood, research found processing differences between children with and without dysgraphia for spelling and idea generation. The chapter concludes with discussion of five potential implications of neuroscience research for educational practice.

Michel Fayol, in Chapter 9, reviews research with children on translation, defined as the process of transforming ideas into written text. Translation includes two components—the generation of sentences to represent ideas and the transcription of those sentences into written language. Considerable research has investigated the limiting effects of transcription on children's writing, namely, the effects of spelling and handwriting fluency on writing rate and quality. Research on sentence generation has been more complex; a preverbal mental representation of ideas needs to be translated into linear sentences, with appropriate consideration of the rhetorical situation and linguistic factors to produce cohesive text.

In Chapter 10, Liliana Tolchinsky reviews research on the development of written language in the preschool and primary years. She argues that in spite of general agreement that emergent writing is multidimensional in character, two divergent critical stances exist on the growth of young children's writing ability—an additive–cumulative stance and a mutually enhancing interactive stance. She delineates the divergence through conceptions of the emergence of writing, the direction of writing development, the relative weight placed on different factors involved in text production, and on the role that acquisition of written language plays in linguistic development. Tolchinsky explains the two stances but adopts the second of the two as her own and provides compelling evidence to support the stance.

Roger H. Bruning and Douglas F. Kauffman, in Chapter 11, review research on self-efficacy for writing. Correlational research has consistently shown strong associations between self-efficacy and writing quality. They review research on the factors that influence the development of self-efficacy, in general, as well as experimental research on instructional factors that influence self-efficacy for writing, including feedback on goals and texts, and modeling writing processes. They argue that self-efficacy is an important educational outcome, and they propose further research on the instructional conditions and teacher beliefs and actions that enhance self-efficacy.

In Chapter 12, Tanya Santangelo, Karen R. Harris, and Steve Graham explicate self-regulation processes for writing as outlined by Zimmerman and Risemberg (1997) and then report a meta-analysis of true- and quasi-experimental research on the impact of teaching students to use those processes. They conclude that the evidence strongly (though incompletely) supports Zimmerman and Risemberg's model. With regard to future research, they highlight the lack of developmental research on self-regulation processes for writing.

Timothy Shanahan, in Chapter 13, reviews three theoretical models of the relationship between reading and writing and the research supporting them. Cognitive theories emphasize the shared knowledge used for reading and writing—content, pragmatics, text attributes, and procedural knowledge. Recent research from this cognitive perspective has included more longitudinal studies and studies involving students with disabilities and L2 learners. Sociocognitive theories emphasize reading and writing as reciprocal processes involved in communication between readers and writers. A third theoretical approach is to consider reading and writing as functionally related as parts of activities involving both reading and writing. An especially important feature throughout Shanahan's approach is attention to how reading and writing relationships grow over time.

INSTRUCTION IN WRITING

The section on instruction begins with a meta-analytic review of research on writing instruction. The section includes chapters on genre-based pedagogy, writing to learn, sociocultural perspectives on instruction, evaluation and revision, grammar, argumentative writing, computer-based instruction, and professional development.

Chapter 14, by Steve Graham, Karen R. Harris, and Amber B. Chambers, examines the evidence-based practice movement in writing instruction. They begin by defining the term *evidence-based practice*, how these procedures need to be considered and applied in specific contexts, and why teachers should use them. Drawing on previous meta-analyses and multiple types of studies (true- and quasi-experiments, subjects as own controls, single subject design, and qualitative studies), they provide a general roadmap for teaching writing in grades 1 to 12, embedding identified evidence-based practices within this field guide. Lastly, they consider the advantages as well as the limitations of applying this approach to the teaching of writing.

In Chapter 15, David Rose explains the theoretical foundations and instructional practices of the genre-based literacy pedagogy developed by Australian researchers and educators over the past three decades. The developers drew on the systemic functional linguistic theories of Halliday (2004) to study the genres that students need to read and write for success in school. Further, they argue, based on sociological theory, that explicit instruction in these genres is needed to provide equal opportunities for all students regardless of cultural background. The instructional cycle begins with analysis (deconstruction) of a genre, followed by joint construction, with the teacher guiding the class, and then independent writing. Rose explains the history of the approach and the research supporting its effectiveness for reading and writing instruction.

Perry D. Klein, Nina Arcon, and Samanta Baker, in Chapter 16, review theories and research on writing to learn. They briefly review three theoretical explanations of writing to learn: models of cognition as problem solving, theories of writing as a means of making implicit knowledge explicit, and models of cognition as distributed among persons, tools, and social contexts. They then review research on the effects of various writing tasks, for example, arguments, summaries; the effects of instruction, especially strategy instruction in disciplinary writing; and collaborative writing. The chapter ends with discussion of the need for further research on the cognitive processes involved, on instruction, and on effects on motivation to write.

In Chapter 17, Michelle Nguyen Kwok, Exequiel Ganding, Glynda A. Hull, and Elizabeth Birr Moje review research from a sociocultural perspective in learning and instruction in high school. The research has emphasized some key principles, including the value of communities of practice, cognitive tools, and sociocognitive apprenticeships. However, the authors argue that research has not adequately considered issues of context, positionality, and power. They review three exemplar studies that have addressed these issues.

MacArthur, in Chapter 18, provides a systematic review of research on instruction in revision from 1980 to the present, including the effects on writing of teacher feedback, giving and receiving feedback in peer review, computer feedback, instruction in goals and evaluation criteria, experience as readers or observing readers, and strategy instruction. He argues that learning evaluation criteria is a critical aspect of instruction across all approaches. Instruction in evaluation and revision is important not only because revision is inherently important but also because it offers students an opportunity to learn criteria for self-evaluation.

In Chapter 19, Richard Hudson presents a thorough critique of the common assumption in Anglophone countries that grammar instruction has no positive effect on writing. He argues that the research supporting this conclusion was limited in intensity and quality and lacked application to writing. In contrast, research on sentence combining and recent research on explicit grammar instruction with application has demonstrated positive effects on writing quality. He also notes that grammar instruction is widely accepted as important in foreign language learning.

In Chapter 20, Ralph P. Ferretti and Yueyue Fan review research on instruction in argumentative writing. The review covers three general instructional approaches: brief interventions that provide students with explicit goals for planning or revising; self-regulated strategy instruction in planning or revising; and dialogic approaches that engage students over time in dialogue or debate with peers. All three of these approaches provide attention to the rhetorical situation and the importance of considering opposing perspectives. Ferretti and Fan argue that instruction also

should include evaluation criteria, or critical questions, for judging the reasonableness of arguments. They note that such criteria will vary by type of argument and by discipline.

In Chapter 21, Laura K. Allen, Matthew E. Jacovina, and Danielle S. McNamara review research on intelligent tutoring systems (ITSs) in writing and discuss directions for future development. ITSs use systems for automated writing assessment to provide formative feedback on student writing. In addition, they can provide systematic multimedia instruction in knowledge, strategies, and skills, together with activities and targeted feedback. Challenges include developing better models of individual learners' knowledge, further improvement in evaluation of writing including content, and the design of engaging formats for instruction.

Sarah J. McCarthey and Cristin M. Geoghegan, in the final chapter in the section on instruction, review research on professional development (PD) for teaching writing. They begin with the National Writing Project, which is clearly the largest and oldest PD effort in writing. They review qualitative and quantitative research showing effects on teacher's beliefs and practices as well as on student writing achievement. The review also covers professional learning communities, as well as a limited number of experimental intervention studies, looking at impact on teachers and students, coaching, and online PD networks.

WRITING AND SPECIAL POPULATIONS

The section on special populations includes chapters on students with learning disabilities, English learners, and culturally diverse classrooms.

Vince Connelly and Julie Dockrell, in Chapter 23, systematically review research on individuals with dyslexia, language learning disorders, and developmental coordination disorders. They interpret the research using a theoretical framework of writing development that includes cognitive resources such as working memory and phonological processing, writing processes, and control processes. They argue that understanding the writing problems of individuals with disabilities can contribute to broader theories of writing development.

Alister Cumming, in Chapter 24, takes on the challenging task of reviewing research on English language learners (ELLs), a task made complex by the diversity of populations and definitions of ELL and the diverse research. The review is organized into three topics. First, Cumming discusses educational practices that support students' writing development, including modeling and scaffolding writing strategies, developing academic language, and organizing programs. Next, he considers the importance and value of promoting competence in multiple languages. Finally, he addresses the challenges of valid and useful assessment.

In Chapter 25, Valerie Kinloch and Tanja Burkhard consider the special issues involved in working with culturally and linguistically diverse student populations. They argue that writing, as a socially constructed activity, is connected to issues of identity and power. The tendency of schools to marginalize students from minority cultures must be consciously countered by attempts to develop culturally responsive practices. Kinloch and Burkhard review research, and propose new research, organized around three issues: context, identity, and instructional practices.

ANALYTIC TOOLS FOR WRITING RESEARCH

Technological advances over the past few decades have dramatically changed the purposes, opportunities, and methods of writing. They have also led to significant advances in methods for studying writing. The final section explores three types of computer-based analytic tools: automated essay evaluation, keystroke logging, and linguistic analysis tools.

In Chapter 26, Mark D. Shermis, Jill Burstein, Norbert Elliot, Shayne Miel, and Peter W. Foltz review progress on the development of automated writing evaluation (AWE) systems. They provide descriptions of three of the most widely used systems, which vary in their approaches to writing evaluation. They summarize recent research on the use of AWEs for summative evaluation of essays. In addition, they discuss recent research focused on the development and evaluation of systems for formative evaluation (i.e., for use in classrooms to support revision and monitor student progress).

In Chapter 27, Luuk Van Waes, Mariëlle Leijten, Eva Lindgren, and Åsa Wengelin discuss keystroke logging, a tool that can obtain detailed data on writing processes unobtrusively. The authors present examples of research to illustrate how logging can be used to analyze planning and revising processes, to understand the writing processes of individuals with disabilities, and to analyze writing in professional contexts. They also consider the potential of keystroke logging to contribute to learning by showing writers aspects of their own composing processes. They also discuss possibilities for combining keystroke logging data with qualitative and linguistic analyses to understand writing in multiple contexts.

Pablo Pirnay-Dummer, in Chapter 28, introduces readers to selected computer tools for linguistic analysis. New readability tools include more sophisticated measures of vocabulary, discourse style, and cohesion. Concordance tools explore the contexts of word usage, and syntactic tools analyze grammatical structures. Much of the chapter focuses on semantic analysis tools that can analyze the meaning structures in text for evaluation or comparison. Throughout, Pirnay-Dummer emphasizes the importance of using linguistic analysis tools in combination with human interpretation.

REFERENCES

Ayres, A. (Ed.). (1987). *The wit and wisdom of Mark Twain: A book of quotations*. New York: Penguin Books.

Common Core State Standards Initiative. (2010). *Common Core State Standards for English language arts & literacy in history/social studies, science, and technical subjects.* Washington, DC: Author. Retrieved from *www.corestandards.org*.

Halliday, M. A. K. (2004). *An introduction to functional grammar* (2nd ed.). London: Edward Arnold.

Mikulecky, L. (1998). Adjusting school writing curricula to reflect expanded workplace writing. In M. S. Garay & S. A. Bernhardt (Eds.), *Expanding literacies: English teaching and the new workplace* (pp. 201–223). Albany, NY: State University of New York Press.

National Center for Education Statistics. (2012). *The Nation's Report Card: Writing 2011* (No. NCES 2012–470). Washington, DC: Author.

Salahu-Din, D., Persky, H., & Miller, J. (2008). *The Nation's Report Card: Writing 2007* (No. NCES 2008–468). Washington, DC: National Center for Education Statistics.

Zimmerman, B. J., & Risemberg, R. (1997). Becoming a self-regulated writer: A social cognitive perspective. *Contemporary Educational Psychology*, *22*, 73–101.

PART I

THEORIES AND MODELS OF WRITING

CHAPTER 1

What Do Sociocultural Studies of Writing Tell Us about Learning to Write?

Charles Bazerman

Writing is a social technology designed to communicate among people. It is learned and produced in social circumstances, establishes social relationships, changes the writer's social presence, creates shared meanings, and accomplishes social action. Writing partakes of and contributes to the social circumstances in which it arises and bears the characteristics of the cultures it participates in and the histories it carries forward. The social value of writing motivates the difficult learning of the material and symbolic technologies of writing and the strenuous psychological effort of writing. Social, cultural, and historical approaches to writing have informed many studies and volumes (see, e.g., Castelló & Donahue, 2012; Starke-Meyerring, Paré, Artemeva, Horne, & Yousoubova, 2011) and have been substantially reported in reference books (e.g., Bazerman, 2008) and review chapters (e.g., Russell, 1997b). Rather than replicating these surveys, this chapter synthesizes some of the general principles that sociocultural inquiries have added to our understanding of writing, supported by a few citations of representative studies. Further, rather than drawing a broad picture of writing in societies and history, and the impact of writing on social institutions and practices (see Goody, 1986; Bazerman, 2006), this synthesis focuses on the kinds of issues about writing that have been of interest to educational psychologists—such as the challenges writers face and the development of individuals as writers.

WHY AND WHEN PEOPLE WRITE

• *Writers write to participate in social situations.* Writers write for situations, to accomplish things and make statements within situations. Numerous ethnographic studies of writers inside and outside of school show people planning and composing within specific situations, based on personal estimations of situations and one's roles and interests in those situations, whether young children explaining photographs through captions (Castedo & Ferreiro, 2010), citizens engaged in civic activities (Barton, 1998), or scientists attempting to gain attention to their findings and credibility among various audiences (Bazerman, 1988; Knorr-Cetina, 1979).

To determine what to write, what material to include, and the most effective way of representing it, writers often consciously gather information about the situation and resources appropriate to the situation. Selzer (1983), in studying the writing processes of a working engineer, observed that his subject spent half his time writing, and of that 80% was devoted to planning, consulting colleagues, and gathering and selecting information. This predominance of planning with an eye to understanding the situation is typical of skilled writers, and Selzer's findings have been often replicated (e.g., Huettman, 1996; Dauterman, 1993; Cross, 2001). Further, interaction with audiences can help writers develop their presentations. Blakeslee finds that the scientist she studied, when unsuccessful in communicating findings with scientists in a different specialty, set about creating a series of interactions to learn more about the intended audience, even to the point of sending a post-doc to work in a laboratory in the target specialty (Blakeslee, 2000). In all these cases, writing is a means of continued participation in the forum; maintaining or improving one's presence requires gathering information, planning, and adjusting

writing to meet the needs and opportunities of the situation.

• *Writing fits into temporally changing circumstances.* For writing to be attended to, it must come at the right time (see Miller, 1992) within contingent circumstances, and then attention usually fades. In sciences, citation studies give some indication of this pattern, with even highly cited articles taking time to be noticed, and then have a half-life as citations fade away (Price, 1963). It is rare that any text (such as Darwin's *Origin of Species*) stays in people's attention across decades. Although academic citations are easier to document, we can see the same phenomenon in newspapers read the next day (or with Internet publication in the initial hours and minutes) and then fading rapidly, ultimately to be read only by the occasional historian. Fiction and poetry, reports and forms filed with governments and bureaucracies, school and medical records, and even letters to friends and families have their own temporalities of attention (Bazerman, 2014b).

• *Writing takes place in the context of prior texts.* Writing involves relations to other texts to which they may refer explicitly or implicitly. Although academic disciplines and sciences foreground citation and the explicit mention of prior texts (Bazerman, 1991, 2004), many other domains have well-developed procedures for referring to important texts (Devitt, 1991) or rely directly on foundational texts (McCarthy, 1991). Even journalism relies on readers' implicit knowledge of previous days' stories and regularly refers to government reports, speeches, and other documents from which the news is formed, collected, confirmed, or authenticated. Thus, writers must learn to select prior texts to draw on, represent them appropriately, and apply them to the purposes of the new text (Rinck & Boch, 2012; Nelson, 2001).

• *Technologies influence the situation, form, and production of texts.* Technologies of text production and distribution change the multiple participation and distribution of work in the production of documents, the possibility and convenience of graphic design and multimedia elements, the form and materiality of the document, the temporality of the work, the social circulation of documents, and the social situation of the documents—whether the technologies are older print or newer digital. Electronic tools and social media have now made possible more complex collaborations (e.g., McCarthy, Grabill, Hart-Davidson, & McLeod, 2011; Fernheimer, Litterio, & Hendler, 2011) and the incorporation of visual, sound, and animated elements. They have also created the need for new exigencies in gaining the attention and timely input of participants, requiring new techniques of work coordination (Orlikowski & Yates 2002). Technologies also facilitate new distributions of documents and social formations (Starke-Meyerring et al., 2011; Buehl & Gross, in press).

THE CONSEQUENCES OF WRITING

• *Writing builds relations with readers.* Writing as a communication among people forms specific communicative bonds between writer and reader, and these relations must construct appropriate intimacy or distance (Hyland, 2010). Relations with audiences have long been a concern of rhetoric that has fostered writing practices and forged a means of understanding writing events. The medieval arts of letter writing, advising on how to write correspondence within the church bureaucracy, provided extensive advice on establishing good will, respect, and appropriate work relations with the correspondents (Murphy, 1985). Dyson's studies of children in the early grades of school indicate how much their writing is directed toward carrying out social relations, as the children create characters in plays to

be performed in class based on their friendship networks and attitudes toward their classmates (Dyson, 1989, 2003).

• *Through participation writers gain voice and identities within forums.* Contributing texts within a forum establishes a voice to say something. The more effective and prominently the text appears to other participants, the more clearly and strongly the text is heard and is consequential for future action by others. A news story that gains attention, is mentioned by others, and becomes the basis of future action "speaks more loudly" than a story that never gets past the editor's desk or is buried in the middle of the paper. Similarly, by all measures many published scientific articles are rarely cited and have little voice in the unfolding of their disciplines, whereas a small percentage of articles garner the great majority of citations (Price, 1963; Hamilton, 1991). The figures for engineering, social sciences, and the humanities are even more lopsided.

When Thomas Edison wanted to pique public interest in his latest project of light and power, he used his mounting fame and skill as an interviewee to gain journalistic attention. This presence then increased his standing among financiers willing to back research and development, whom he cultivated through correspondence and personal meetings. To establish his rights of property, Edison and his agents needed to establish and protect legal presence through participation in the patent and court systems by the filing of applications, complaints, and briefs, backed by many documents. Further, to establish the credibility of their claims and technology, Edison and his colleagues had to participate in international technological and scientific communities by publishing papers and submitting reports. They even had to participate in the communicative system of domestic design to make their lighting fixtures acceptable, attractive, and prestigious to consumers in the growing affluent urban market (Bazerman, 1999).

• *Voice is attributed by readers.* Voice is more than loudness at the right time. It is also a character, quality, or identity that readers attribute to the text and by extension to the writer of the text. Recognition of a quality of voice appropriate to and authoritative within a forum can help a text gain credibility and attention, while a failure to project the right voice can stigmatize the writer as an outsider, not worth heeding. This evaluation of appropriate voice affects how scientists read other scientists (Bazerman, 1988) and how teachers evaluate the work of students (Williams, 1981). As a consequence, part of the work of writers is to sound like they belong, to adopt the voice of a profession or other insider group, and to avoid the stigmatizing marks of being an outsider (Castelló & Inesta, 2012; Nelson & Castelló, 2012; Carroll, 2002). Further, if the particular writing task calls for asserting the identity of an institution or a corporation rather than that of an individual, the writer must remove markers of individuality to adopt the voice of the organization (Ketter & Hunter, 2002) or the organization's spokesperson (Smart, 2006; Bruss, 2011)

But within many communities, as long as one has the voice of an insider, appropriate individuality is invited or even expected to mark a unique perspective or achievement. Within literary writing, individuality of voice is foregrounded and is often the core of appreciation and interpretation, but even in professional domains a political commentator, legal scholar, or scientist may seek to have a distinctive voice signaling a unique perspective. Myers's (1990) study of two senior biologists shows how in review essays they create distinctive personae and project different views of the current state and future directions of their fields.

• *Voice can also be reflexively understood by the writer as a characterization of one's self and one's commitments.* As writers look back on the words committed in their texts, they can come to see themselves as having expressed identities and have created their own voices (explicitly exemplified by Fishman, Lunsford, McGregor, & Otuteye, 2005, documenting a strong assertion of public identity through a student's engagement in

performance poetry). Statements asserting stance and attitudes, beliefs, interests, skills, accomplishments, or commitments can then become a sign of who one is becoming, as Smagorinsky (1997) reveals in a study of a high school classroom and as Herrington and Curtis (2000) examine in a longitudinal study of four college student working through personal issues while writing papers in academic courses. These reflexively understood identities can then form a stance for further encounters, even affecting future learning, as Powell (2002) finds in comparing the interactive styles and earning trajectories of three students in the same college classroom. Even young children first learning to write develop a sense of themselves as writers (Rowe, 2003; Martello, 1999). This sense of voice in turn becomes an important motive for the development of writers and an imperative in their writing, both in gaining a sense of social presence and power and in providing an understanding of oneself (Elbow, 2012).

• *Writing creates shareable meanings and representations of the world.* Writing produces representations of the world, establishing situation-appropriate knowledge and then reasoning about those representations (Christie, 2003; McCarthy et al., 2011). Even young children begin to understand the value of making information explicit in order to make messages intelligible to others (e.g., Castedo & Ferreiro, 2010). Short-form social media that are centered on representations of the self, such as Twitter, particularly challenge the need to represent the context from which the writer is responding in order to identify the specific world being indexed and represented in the text (Haas, Carr, & Takayoshi, 2011). The history of knowledge is a process of increasingly representing the world in texts to be contemplated and reasoned about, through varying social criteria and procedures, starting with catalogs of produce and tax rolls and continuing today in the documents of government, military, law, commerce, and academic disciplines. Through shared texts, the social facts that are believed by a society and guide actions are represented, distributed, and given authority. Literacy education has focused on creating people adept in recording knowledge of the world and in recent centuries on creating new knowledge (Bazerman & Rogers, 2008).

• *Written meanings and knowledge can have material consequences.* By creating shareable meanings, writing makes things happen and brings about social change (Faber, 2008). Through writing, organizations get formed (Doheny-Farina, 1986), are regulated, (Zachry & Thralls, 2007), and become sites for power struggles (Winsor, 2003). Buildings get built (Medway, 1996), and students are admitted to the university (Early & DeCosta-Smith, 2010). Group identities are formed, group interests are advocated, and political struggles are engaged (Royster, 2000; Duffy, 2007). Victims' interests are asserted (Propen & Schuster, 2010), and prisoners are sentenced (Converse, 2012). Extended statements are transformative of situations by asserting new meanings into the situations, whether within political and government deliberation, scientific reasoning, philosophic argument, economic forecasting, or religious belief.

HOW WRITING GETS DONE

• *Writing processes allow planning and refinement for social effectiveness.* Written texts, unlike spoken utterances, typically are not immediately received by the intended audiences as soon as they are conceived, but rather they can be worked on to maximize their social effect. The role of audience awareness has long been documented as an aspect of skilled writing and revision (e.g., Berkenkotter, 1981). Audience-directed revision can improve the quality of even middle school students (Midgette, Haria, & MacArthur, 2008). But this improvement must make assumptions about the situation and audience, as there is rarely immediate feedback to allow correction and adjustment to audience response. In those special instances where feedback is available, such as in review

processes for journal publication, writers respond to, act on, and even fundamentally redesign their communications in response to reviewers' and editors' responses (Myers, 1990).

• *Genres guide writers in understanding the situations they are writing for, who their audiences are, what form the texts might take, what material might be appropriately included, and what they may accomplish.* Usually, however, writers have less knowledge about the actual responses of readers. To meet this challenge, writers rely heavily on understanding the genres they are writing in and the activity systems the genres are part of. Genres reflect recurrent solutions to perceived rhetorical problems in situations perceived as similar. Thus, genres are part of a process of typifying situations, roles, and actions as well as textual expectations (Miller, 1984). The fact that many genres (including scientific articles, business documents, financial instruments, legal documents, and newspapers) have developed from letters that explicitly identify social circumstances and anticipate interactions provides strong confirmation of the social nature of genres (Bazerman, 2000). Over time, letter-based genres can lose the initial trappings of letters or other marks of social origins to become recognizable in themselves and embedded in systems of related genres (Bazerman, 1994), which can be construed as activity systems (Russell, 1997a; see also Spinuzzi, 2003; Bawarshi & Reiff, 2010). This genre knowledge helps writers identify potential audiences, criteria of evaluation and other expectations to be met, possible actions to be accomplished, stances, and identities. Genres also are associated with typical contents and knowledge, relevant intertextual sources, and their mode of representation (Devitt, 1994), formal linguistic features (Hyland, 2004), and lines of argument.

Young children develop a sense of genre (Donovan & Smolkin, 2006), and more advanced writers, when entering new writing situations, use their prior knowledge of genre to identify what is similar and what is different about their new situation (Reiff & Bawarshi, 2011). Genres, however, are not fixed but instead evolve with each new instance, responding to the details of each circumstance and at times hybridizing multiple genre understandings to create new genres (Roozen, 2010).

• *Writing processes are influenced by situations and are often distributed among participants.* The multiple social, cultural, material, historical, technological, and personal relational variables influencing writing situations shape not only the final form of the written text, but the processes whereby texts come into being (Prior & Shipka, 2002). For example, Paradis, Dobrin, and Miller (1985) describe the document cycling that engages people of different levels, as part of the production, review, and synthesis within a large corporation. Gunnarsson (1997) documents the complex set of spoken and written interactions that give rise to government documents in a process that involves participation of the public, government employees of different status, and elected officeholders. In less formal settings, public scribes collaborate with less educated clients to prepare documents (Kalman, 1999). Lunsford and Ede (1990) offer an extensive survey of varieties of collaborative practices outside schooling. Marttunen and Laurinen (2012) show that even in school settings, the roles adopted in collaboration are multiple and variable.

HOW WRITING IS LEARNED

• *Development of writing skills depends on a passage through situations, solving problems and becoming articulate in those situations.* Because of the social complexity of written texts and writing processes, learning to write requires writing in many situations across a lifetime. Each new situation requires solving fresh problems. Skills, strategies, and forms may be learned along the way, aided by organized instruction, but the motivating, meaningful challenges give focus to skills learning and provide unifying, meaningful activities that build tolerance,

motivation, or even commitment to technical skill-building. Unfortunately, longitudinal research on writers is limited, covering at best a few years during a single epoch in the writer's life, such as emergent literacy in the family setting, the undergraduate student over the course of 4 years, or the graduate student (see Rogers, 2010, for a review). Nonetheless, the importance of a passage through multiple experiences for writing development is evident. Thaiss and Zawacki (2006), for example, examine the growth of engaged professional voices as students enter more deeply into the practices of their disciplines through assignments in their courses. Different sets of meaningful experiences will lead to different trajectories of writing development, and a paucity of engaging learning opportunities will result in truncated trajectories of learning and development. Meaningful writing opportunities are unequally distributed, depending on many social, economic, and cultural factors, with large consequences for which populations become most skilled to take on influential roles in society.

• *Learning to write within certain domains is closely integrated with learning the knowledge, forms of reasoning, criteria of evaluation, and forms of action in those domains.* Developing as a writer within a specific community is part of enculturation and socialization into the norms, practices, and action goals of a community so as to successfully interact (Besnier, 1995). Heath's (1983) study of literacy practices in three different groups in a small rural Appalachian town shows how strongly community practices of literacy create different school experiences for the children of poor blacks, poor whites, and middle-class whites. Vieira (2011) documents how less educated immigrant adults develop their literacies as part of cultural practices within their church. Karlsson (2009) documents how learning the literacy practices in various occupations is integrated in learning the organization of work practices and developing the values and dispositions of those occupations.

• *Moving from one social domain to another requires adjusting writing, learning new skills, and transforming the knowledge one brings from previous experience.* Dias, Paré, Freedman, and Medway (1999) contrast the differences in the knowledge and cultures that frame the writing in architecture, social work, business, and banking, showing how particular each is for both university students and young professionals, and the adjustments in knowledge and orientation students must make in learning to write for the workplace. Writers who must work in multiple situations accommodate to each of them, writing differently with different genres, different goals, and different ends, even when discussing the same nominal contents. For example, Luzón (2013) found that scientists who write public blogs to communicate with nonspecialist readers adopt new strategies to represent themselves more intimately and dialogically, with greater focus on personal meanings and relevance to daily life. In a similar way, psychotherapists act as intermediaries between the life world of clients and the technical worlds of psychiatric theory (Berkenkotter, 2001).

• *Enculturation into writing is socially sponsored and shaped by the sponsor's agendas*. Within particular domains, sponsors offer opportunities, motivations, and resources to learn to write. Some sponsorship is through direct personal mentorship, but sponsorship may also be through employment requiring certain forms of writing; provision of interesting materials, activities, or rewards for writing; educational opportunities; or other indirect structural support. Consequently, writers tend to develop in pathways in conformity with a sponsor's interests and ideologies (Brandt, 2001). Further, the development of specific forms of writing is integrally tied to the development of intellect that is expected for many elite roles in society (e.g., see Schryer & Lingard, 2002, on learning medical genres). The extensive literature on writing across the curriculum and in the disciplines, is reviewed in Bazerman et al. (2005).

Students may experience major cultural shifts in literacy practices when they enter school. Children initially develop their sense of literacy and early literacy practices within their families and local communities, which may not be a good match with the practices fostered or required within the schools the children attend. Mismatches between home and school literacy cultures can become an obstacle to achievement in school (Heath, 1983). As children develop literacy within school, their learning may draw on and develop those community literacies (Dyson, 1989, 2003), or they may create distance from community and peer life, producing tensions within education and obstacles to learning (Brandt, 2001). These cultural differences and tensions in education are all the stronger when children's schooling is in a different language from that of their family and community (Boyd & Brock, 2004; Durgunoglu & Verhoeven, 1998).

• *School creates specialized writing activities within a specialized activity system with specialized school genres.* Because writing also requires many technical skills that remove one from here-and-now experience, learning to write typically requires special training removed from daily life, in the form of schooling. Indeed, schools were early formed to train scribes. Consequently, for many people, writing is closely associated with schooling and school criteria for acceptable writing. Further, the writing experiences, expectations, genres, skills, and objectives in schooling are typically defined by the classroom setting and are focused on developing skills or student understanding (Christie & Derewianka, 2008; VanDerHeide & Newell, 2013). As those who have studied writing assigned in school have noted, the range of writing activities is regularly narrower than needs be even for curricular purposes (Applebee, 1981, 1984; Applebee & Langer, 2009; Hillocks, 2008)

Within school, most writing is assigned and evaluated rather than being voluntary and spontaneous. The most significant readers of most student writers are teachers or assessors of examinations (Britton, Burgess, Martin, McLeod, & Rosen, 1975). Student engagement in writing, therefore, is dependent on alignment with the educational objectives of the classroom and communicative relations with teachers and/or assessors. Thus, an important variable in student writing is student understanding of teacher's concerns, criteria, and comments. Research, however, indicates that students frequently do not have good understanding of what teachers want and what their criteria are—often viewing teacher preferences as arbitrary and idiosyncratic (McCarthy, 1987). Students also find teacher comments on their writing enigmatic or do not act on those comments in functional ways (Varner, Roscoe, & McNamara, 2013). Because assessment situations are often opaque to students, students may have unrealistic beliefs about who marks exams, under what conditions, and according to what criteria (Giltrow, 2002). Teacher orientations toward students are equally important because teachers set assignments, communicate expectations, and define specific requirements to students who write for them (McCarthey & Mkhize, 2013).

• *Activities and assignments that engage audiences, activities, and collaboration outside teacher assessment of traditional classroom genres help individual writers develop.* To broaden students' sense of the communicative purposes of writing beyond assessment and student teacher relations, peer and community audiences have been introduced into school writing activities. Activities such as writing for parents and families (Wollman-Bonilla, 2000), writing books for younger children, producing school and classroom newspapers and radio (Baltar, 2012), writing within workplace and community service internships, and case simulations all have been found to be motivating, engaging, and learning experiences. Peer response and other collaborative practices have also provided more immediate reactions to student writing in terms that may be more familiar and perhaps more immediately useful to students (Bruffee, 1984; Hillocks 1986; Hattie & Timperley, 2007). In collaborative writing, students explicitly share their problem-solving thinking, planning, revising, and other processes. Providing peer feedback on

the writing of others provides better understanding of one's own writing (Crinon, 2012). A number of automated systems have now been developed to facilitate formative peer review (Passig & Schwartz, 2007; Goldin & Ashley, 2012) as well as collaborative writing. Noncollaborative observational roles also provide strong opportunities to understand how to write and what is successful in writing (Rijlaarsdam et al., 2009).

• *Ideologies of schooling shape school writing experiences and students' trajectories of learning to write.* The ideologies that shape education influence how we teach writing, what we assign, and what we value in writing (Berlin, 1987; Miller, 1997), even if not explicitly recognized by instructors (Barletta Manjarres, Cortez Roman, & Medzerian, 2012). Further, the ideologies and epistemologies that drive testing and implicitly drive school curricular design are often orthogonal to other views of writing and may restrict writing education (Hillocks, 2002). Within the United States, a number of the ideologies that have at times been advocated for and influential (and have since been studied from historical and critical perspectives) include rhetoric, formal correctness, faculty psychology, expository rationalism, cognitive development, expressivism, and social construction. In other countries, different ideologies have given rise to different school practices (see Delcambre & Donahue, 2012; Chitez & Kruse, 2012; Thaiss, Bräuer, Carlino, Ganobcsik-Williams, & Sinha, 2012).

• *Learning to write outside of school requires new learning.* Multiple studies have shown that writing situations, goals for writing, criteria of evaluation, and trajectories of learning outside the classroom in the professional, research, commercial, and civic worlds are substantially different from those within the classroom. Thus, students in moving from the classroom to other settings need to make a transition, and deeply entrenched classroom practices and habits can be counterproductive in the new setting. Dias et al. (1999) found that in architecture, law, social work, and business the shift from writing for evaluation of skill to writing for accomplishing work changed what writers sought to accomplish, their choices as writers, how they sought and used help, and even how they related to peers. Former students who continued to see their writing as individual accomplishments and did not seek the help of mentors and peers did not accomplish work effectively, did not grow as writers in their setting, and did not advance. Similarly, Beaufort (1999) found that writers grew on the job by participating in the organization's projects in increasingly sensitive and important roles, guided by mentors who shaped tasks and offered support while keeping the interests of the organization in mind. Inversely, when practicing writers from the professional world, such as journalists, enter the classroom, they find practices they take for granted as professionals in tension with the organization of the classroom (Stephens, 2012; Kohnen, 2012).

Even within the academic world, as graduate students enter research careers, the nature of their writing also changes as they move toward authentic inquiry to advance knowledge in their field (Bazerman, Keranen, & Encinas, 2012); no longer are they students performing in a class or novice researchers whose relation to the field is mediated through their teacher/mentors who interpret the field for them (Paré, Starke-Meyerring, & McAlpine, 2009; Dysthe, 2002). Even the informal world of student peer relations seems disconnected from their concurrent writing instruction and classroom writing practices. Finders (1996) reported that the middle school girls she studied experienced their private notes and notebooks as far more motivating and authentic than their classroom writing, even though the classroom assignments were designed to encourage candor, reflection, and personal commitment. Similarly, Skaar (2012) found that secondary students in Norway saw only a small connection between their personal Internet writing and the writing they did for school.

IN SUM

Writing is a complex social participatory performance in which the writer asserts meaning, goals, actions, affiliations, and identities within a constantly changing, contingently organized social world, relying on shared texts and knowledge. The projection of meaning and shared orientations at a distance requires making assumptions and predictions about who will be reading the texts, what their interest and knowledge are likely to be, and how they may be using the information. An understanding of genres and activity systems helps in making those judgments and in identifying how to write effective texts in those situations that meet the criteria and expectations of the readers. Because writing involves so many problem-solving judgments, it is best learned through a long sequence of varied problem-solving experiences in varied situations. The teaching of general skills and practices provides only some elements necessary for the complex situated problem solving of writing specific texts, both within the structured and limited worlds of schooling and in the more varied worlds beyond schooling. Research, assessment, and curricular goals would benefit from being attentive to this more complex view of writing for instruction and preparation, as well as for motivation and engagement of students.

ACKNOWLEDGMENTS

Thanks to Deborah Brandt and David Russell for their careful reading of the manuscript and suggestions.

REFERENCES

Applebee, A. N. (1981). *Writing in the secondary school*. Urbana, IL: National Council of Teachers of English.

Applebee, A. N. (1984). *Contexts for learning to write: Studies of secondary school instruction*. Norwood, NJ: Ablex.

Applebee, A. N., & Langer, J. A. (2009). What is happening in the teaching of writing? *English Journal, 98*(5), 18–28.

Baltar, M. (2012). *Radio escolar: Gêneros textuais e letramento radiofônico na escola.* São Paulo, Brazil: Skoob.

Barletta Manjarres, N., Cortez Roman, N. A., & Medzerian, S. (2012). From official educational policy to the composition classroom: Reproduction through metaphor and metonymy. *Journal of Writing Research, 4*(1), 31–351.

Barton, D. (1998). *Local literacies*. London: Routledge.

Bawarshi, A. (2003). *Genre and the invention of the writer*. Logan: Utah State University Press.

Bawarshi, A., & Reiff, M. J. (2010). *Genre: An introduction to history, theory research and pedagogy*. Fort Collins, CO: WAC Clearinghouse.

Bazerman, C. (1988). *Shaping written knowledge: The genre and activity of the experimental article in science*. Madison: University of Wisconsin Press.

Bazerman, C. (1991). How natural philosophers can cooperate. In C. Bazerman & J. Paradis (Eds.), *Textual dynamics of the professions* (pp. 13–44). Madison: University of Wisconsin Press.

Bazerman, C. (1994). Systems of genre and the enactment of social intentions. In A. Freedman & P. Medway (Eds.), *Genre and the new rhetoric* (pp. 79–101). London: Taylor & Francis.

Bazerman, C. (1999). *The languages of Edison's light.* Cambridge, MA: MIT Press.

Bazerman, C. (2000). Letters and the social grounding of differentiated genres. In D. Barton & N. Hall (Eds.), *Letter writing as a social practice* (pp. 15–30). Amsterdam: John Benjamins.

Bazerman, C. (2004). Intertextualities: Volosinov, Bakhtin, literary theory, and literary studies. In A. Ball & S. W. Freedman (Eds.), *Bakhtinian perspectives on languages, literacy, and learning* (pp. 53–65). New York: Cambridge University Press.

Bazerman, C. (2006). The writing of social organization and the literate situating of cognition. In D. Olson & M. Cole (Eds.), *Technology, literacy and the evolution of society: Implications of the work of Jack Goody* (pp. 215–240), Mahwah NJ: Erlbaum.

Bazerman, C. (Ed.). (2008). *Handbook of research on writing*. Mahwah NJ: Erlbaum.

Bazerman, C. (2014a). *Rhetoric of literate action*. Fort Collins, CO: WAC Clearinghouse.

Bazerman, C. (2014b). *Theory of literate action*. Fort Collins, CO: WAC Clearinghouse.

Bazerman, C., Keranen, N., & Encinas, F. (2012). Immersed in the game of science. In C. Bazerman et al. (Eds). *Advances in international writing research: Cultures, places, and measures* (pp. 387–402). Fort Collins, CO: WAC Clearinghouse.

Bazerman, C., Little, J., Chavkin, T., Fouquette, D., Bethel, L., & Garufis, J. (2005). *Writing across the curriculum*. Fort Collins, CO: WAC Clearinghouse.

Bazerman, C., & Rogers, P. (2008). Writing and secular knowledge. In C. Bazerman (Ed.), *Handbook of research on writing* (pp. 139–171). Mahwah, NJ: Erlbaum.

Beaufort, A. (1999). *Writing in the real world: Making the transition from school to work*. New York: Teachers College Press.

Berkenkotter, C. (1981). Understanding a writer's awareness of audience. *College Composition and Communication, 32*(4), 388–399.

Berkenkotter, C. (2001). Genre systems at work: DSM-IV and rhetorical recontextualization in psychotherapy paperwork. *Written Communication*, *18*(3), 326–349.

Berkenkotter, C., & Huckin, T. (1995). *Genre knowledge in disciplinary communication: Cognition/culture/power*. Hillsdale, NJ: Erlbaum.

Berlin, J. (1987). *Rhetoric and reality: Writing instruction in American colleges 1900–1985*. Carbondale: Southern Illinois University Press.

Besnier, N. (1995). *Literacy, emotion, and authority: Reading and writing on a Polynesian atoll.* London: Cambridge University Press.

Blakeslee, A. M. (2000). *Interacting with audiences: Social influences on the production of scientific writing.* Mahwah, NJ: Erlbaum.

Boyd, F., & Brock, C. (Eds.). (2004). *Multicultural and multilingual literacy and language: Contexts and practices.* New York: Guilford Press.

Brandt, D. (2001). *Literacy in American lives.* New York: Cambridge University Press.

Britton, J., Burgess, A., Martin, N., McLeod, A., & Rosen, R. (1975). *The development of writing abilities* (pp. 11–18). London: Macmillan.

Bruffee, K. (1984). Peer tutoring and the "Conversation of Mankind." In Gary Olson (Ed.), *Writing centers: Theory and administration* (pp. 3–15). Urbana, IL: National Council of Teachers of English.

Bruss, K. S. (2011). Ghosting authenticity: Characterization in corporate speechwriting. *Journal of Business and Technical Communication, 25*, 159–183.

Buehl, J., & Gross, A. (Eds.). (in press). *Science and the Internet: Communicating knowledge in a digital age*. Amityville, NY: Baywood.

Carroll, L. (2002). *Rehearsing new roles.* Urbana: Southern Illinois University Press.

Castedo, M., & Ferreiro, E. (2010). Young children revising their own texts in school settings. In C. Bazerman, B.

Krut, K. Lunsford, S. McLeod, S. Null, P. Rogers, et al. (Eds.), *Traditions of writing research* (pp.135–150). New York: Routledge.

Castelló, M., & Donahue, C. (Eds.). (2012). *University writing: Selves and texts in academic societies.* Bradford, UK: Emerald.

Castelló, M., & Inesta, A. (2012). Texts as artifacts-in-activity: Developing authorial identity and academic voice in writing academic research papers. In M. Castelló & C. Donahue (Eds.), *University writing: Selves and texts in academic societies* (pp. 179–200). Bradford, UK: Emerald.

Chitez, M., & Kruse, O. (2012). Writing cultures and genres in European higher education. In M. Castelló & C. Donahue (Eds.), *University writing: Selves and texts in academic societies* (pp. 151–175). Bradford, UK: Emerald.

Christie, F. (2003). Writing the world. In N. Hall, J. Larson, & J. Marsh (Eds.), *Handbook of early childhood literacy* (pp. 287–298). London: Sage.

Christie, F., & Derewianka. B. (2008). *School discourse: Learning to write across the years of schooling.* London: Continuum.

Converse, C. W. (2012). Unpoetic justice: Ideology and the individual in the genre of the presentence investigation. *Journal of Business and Technical Communication, 26*, 442–478.

Crinon, J. (2012). The dynamics of writing and peer review in elementary school. *Journal of Writing Research, 4*(2), 121–154.

Cross, G. A. (2001). *Forming the collective mind.* New York: Hampton Press.

Dauterman, J. (1993). Negotiating meaning in a hospital discourse community. In R. Spilka (Ed.), *Writing in the workplace: New research perspectives* (pp. 98–110). Carbondale: Southern Illinois University Press.

Delcambre, I., & Donahue, C. (2012) Academic writing activity: Student writing in transition. In M. Castelló & C. Donahue (Eds.), *University writing: Selves and texts in academic societies* (pp. 129–149). Bradford, UK: Emerald.

Devitt, A. (1991). Intertextuality in tax accounting: Generic, referential, and functional. In C. Bazerman & J. Paradis (Eds.), *Textual dynamics of the professions* (pp. 336–380). Madison: University of Wisconsin Press.

Dias, P., Paré, A., Freedman, A., & Medway, P. (1999). *Worlds apart: Acting and writing in academic and workplace contexts*. Mahwah, NJ: Erlbaum.

Doheny-Farina, S. (1986). Writing in an emerging organization. *Written Communication, 3*, 158–185.

Donovan, C., & Smolkin, L. (2006). Children's understanding of genre and writing development. In M. Macarthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 131–143). New York: Guilford Press.

Duffy, J. (2007). *Writing from these roots: Literacy in a Hmong-American community*. Manoa: University of Hawaii Press.

Durgunoglu, A. Y., & Verhoeven, L. (Eds.). (1998). *Literacy development in a multilingual context: Cross-cultural perspective*. Mahwah, NJ: Erlbaum.

Dyson, A. H. (1989). *Multiple worlds of child writers: Friends learning to write*. New York: Teachers College Press.

Dyson, A. H. (2003). *The brothers and sisters learn to write: Popular literacies in childhood and school cultures*. New York: Teachers College Press.

Dysthe, O. (2002). Professors as mediators of academic text cultures. *Written Communication, 19*, 493–536.

Early, J. S., & DeCosta-Smith, M. (2010). Making a case for college: A genre-based college admission essay intervention for underserved high school students. *Journal of Writing Research, 2*(3), 299–329.

Elbow, P. (2012). *Vernacular eloquence*. New York: Oxford University Press.

Faber, B. (2008). Writing and social change. In C. Bazerman (Ed.), *Handbook of research on writing* (pp. 265–276). Mahwah, NJ: Erlbaum.

Fernheimer, J. W., Litterio, L., & Hendler, J. (2011). Transdisciplinary texts and the future of web-scale collaboration. *Journal of Business and Technical Communication, 25*, 322–337.

Finders, M. (1996). Just girls. *Written Communication, 13*(1), 93–129.

Fishman, J., Lunsford, A., McGregor, B., & Otuteye, M. (2005). Performing writing, performing literacy. *College Composition and Communication, 57*(2), 224–352.

Giltrow, J. (2002). Legends of the centre: System, self, and linguistic consciousness. In C. Bazerman & D. Russell (Eds.), *Writing selves, writing society* (pp. 363–392). Fort Collins, CO: WAC Clearinghouse.

Goldin, I. M., & Ashley, K. D. (2012). Eliciting formative asessment in peer review. *Journal of Writing Research, 4*(2), 203–237.

Goody, J. (1986). *The logic of writing and the organization of society*. Cambridge, UK: Cambridge University Press.

Gunnarsson, B.-L. (1997). The writing process from a sociolinguistic viewpoint. *Written Communication, 14*(2), 139–188.

Haas, C., Carr, B. J., & Takayoshi, P. (2011). Building and maintaining contexts in interactive networked writing. *Journal of Business and Technical Communication, 25*, 276–298.

Hamilton, D. P. (1991, January 4). Research papers: Who's uncited now? *Science, 251*(4989), 25.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*, 81–112.

Heath, S. B. (1983). *Ways with words: Language, life and work in communities and classrooms*. Cambridge. UK: Cambridge University Press.

Herrington, A., & Curtis, M. (2000). *Persons in process.* Urbana, IL: National Council of Teachers of English.

Hillocks, G. (1986). *Research on written composition*. Urbana, IL: National Council of Teachers of English.

Hillocks, G. (2002). *The testing trap: How state writing assessments control learning.* New York: Teachers College Press.

Hillocks, G. (2008). Writing in secondary schools. In C. Bazerman (Ed.), *Handbook of research on writing* (pp. 307–325). Mahwah, NJ: Erlbaum.

Huettman, E. (1996). Writing for multiple audiences: An examination of audience concerns in a hospitality consulting firm. *Journal of Business Communication, 33*(3), 257–273.

Hyland, K. (2004). *Disciplinary discourses: Social interactions in academic writing*. Ann Arbor: University of Michigan Press.

Hyland, K. (2010). Constructing proximity: Relating to readers in popular and professional science. *English for Academic Purposes, 9*, 116–127.

Kalman, J. (1999). *Writing on the plaza: Mediated literacy practices among scribes and clients in Mexico City*. New York: Hampton Press.

Karlsson, A.-M. (2009). Positioned by reading and writing: Literacy practices, roles, and genres in common occupations. *Written Communication, 26*, 53–76

Ketter, J., & Hunter, J. (2002). Creating a writer's identity on the boundaries of two communities of practice. In C. Bazerman & D. Russell (Eds.), *Writing selves, writing society* (pp. 307–330). Fort Collins, CO: WAC Clearinghouse.

Knorr-Cetina, K. (1979). Tinkering toward success: Prelude to a theory of scientific practice. *Theory and Society, 8*(3), 347–376.

Kohnen, A. (2012). Teachers as editors, editors as teachers. In C. Bazerman et al. (Eds.), *International advances in writing research: Cultures, places, measures* (pp. 305–318). Fort Collins, CO: WAC Clearinghouse.

Laquintano, T. (2012). Online book reviews and emerging generic conventions. In C. Bazerman, C. Dean, J. Early, K. Lunsford, S. Null, P. Rogers, & A. Stansell (Eds.), *International advances in writing research: Cultures, places, measures* (pp. 525–542). Fort Collins, CO: WAC Clearinghouse.

Lunsford, A., & Ede, L. (1990). *Singular texts, plural authors: Perspectives on collaborative writing.* Carbondale: Southern Illinois University Press.

Luzón, M. J. (2013). Public communication of science in blogs. *Written Communication, 30*, 428.

McCarthey, S. J., & Mkhize, D. (2013). Teachers' orientations towards writing. *Journal of Writing Research, 5*(1), 1–33.

McCarthy, J. E., Grabill, J. T., Hart-Davidson, W., & McLeod, M. (2011). Content management in the workplace. *Journal of Business and Technical Communication, 25*, 367–395.

McCarthy, L. (1987). A stranger in strange lands: A college student writing across the curriculum. *Research in the Teaching of English, 21*, 233–365.

McCarthy, L. P. (1991). A psychiatrist using DSM-III: The influence of a charter document in psychiatry. In C. Bazerman & J. Paradis (Eds.), *Textual dynamics of the professions* (pp. 358–378). Madison: University of Wisconsin Press.

Martello, J. (1999). In their own words: Children's perceptions of learning to write. *Australian Journal of Early Childhood, 24*(3), 32–37.

Marttunen, M., & Laurinen, L. (2012). Participant profiles during collaborative writing. *Journal of Writing Research, 4*(1), 53–79.

Medway, P. (1996). Virtual and material buildings: Construction and constructivism in architecture and writing. *Written Communication, 13*(4), 473–514.

Midgette, E., Haria, P., & MacArthur, C. (2008). The effects of content and audience awareness goals for revision on the persuasive essays of fifth- and eighth-grade students. *Reading and Writing, 21*, 131–151.

Miller, C. (1984). Genre as social action. *Quarterly Journal of Speech, 70*, 151–167.

Miller, C. (1992). *Kairos* in the rhetoric of science. In S. Witte, N. Nakadate, & R. Cherry (Eds.), *A rhetoric of doing* (pp. 310–327). Carbondale: Southern Illinois University Press.

Miller, T. P. (1997). *The formation of college English: Rhetoric and belles lettres in the British cultural provinces*. Pittsburgh: University of Pittsburgh Press.

Murphy, J. J. (Ed.). (1985). *Three medieval rhetorical arts*. Berkeley: University of California Press.

Myers, G. (1990). *Writing biology: Texts in the social construction of scientific knowledge.* Madison: University of Wisconsin Press.

Nelson, N. (2001). Discourse synthesis: Process and product. In R. G. McInnis (Ed.), *Discourse synthesis: Studies in historical and contemporary social epistemology* (pp. 379–396). Westport, CT: Praeger.

Nelson, N., & Castelló, M. (2012). Academic writing and authorial voice. In M. Castelló & C. Donahue (Eds.), *University writing: Selves and texts in academic societies* (pp. 33–51). Bradford, UK: Emerald.

Orlikowski, W., & Yates, J. (2002). It's about time: Temporal structuring in organizations. *Organization Science, 13*(6), 684–700.

Paradis, J., Dobrin, D., & Miller, R. (1985). Writing at Exxon ITD: Notes on the writing environment of an R & D organization. In L. Odell & D. Goswami (Eds.), *Writing in nonacademic settings* (pp. 281–307). New York: Guilford Press.

Paré, A., Starke-Meyerring, D., & McAlpine, L. (2009). The dissertation as multi-genre: Many readers, many readings. In C. Bazerman, A. Bonini, & D. Figueiredo (Eds.), *Genre in a changing world* (pp. 179–194). Fort Collins, CO: WAC Clearinghouse.

Passig, D., & Schwartz, G. (2007). Collaborative writing: Online versus frontal. *International Journal on E-Learning, 6*(3), 395–412.

Powell, K. T. (2002). Participant and institutional identity: Self-representation across multiple genres at a Catholic college. In C. Bazerman & D. Russell (Eds.), *Writing selves, writing societies* (pp. 280–306). Fort Collins, CO: WAC Clearinghouse. Available at *http://wac.colostate.edu/books/selves_society*.

Price, D. (1963). *Little science, big science*. New York: Columbia University Press.

Prior, P., & Shipka, J. (2002). Chronotopic lamination: Tracing the contours of literate activity. In C. Bazerman & D. Russell (Eds.), *Writing selves, writing society* (pp. 180–239). Fort Collins, CO: WAC Clearinghouse.

Propen, A., & Schuster, M. L. (2010). Understanding genre through the lens of advocacy: The rhetorical work of the victim impact statement. *Written Communication, 27*, 3–35.

Reiff, M. J., & Bawarshi, A. (2011). Tracing discursive resources: How students use prior genre knowledge to negotiate new writing contexts in first-year composition. *Written Communication, 28*, 312–337.

Rijlaarsdam, G., Braaksma, M., Couzin, T., Janssen, T., Kieft, M., Raedts, E., et al. (2009). The role of readers in writing development. In R. Beard, D. Myhill, M. Nystrand, & J. Riley (Eds.), *Sage handbook of writing development* (pp. 436–452). London: Sage.

Rinck, F., & Boch, F. (2012). Enunciative strategies and expertise levels in academic writing: How do writers manage point of view and sources? In M. Castelló & C. Donahue (Eds.), *University writing: And texts in academic societies.* Bradford, UK: Emerald.

Rogers, P. (2010). The contributions of North American longitudinal studies of writing in higher education to our understanding of writing development. In C. Bazerman, B. Krut, K. Lunsford, S. McLeod, S. Null, P. Rogers, et al. (Eds.), *Traditions of writing research* (pp. 365–377). New York: Routledge.

Roozen, K. (2010). Tracing trajectories of practice: Repurposing in one student's developing disciplinary writing processes. *Written Communication, 27*, 318–354.

Rowe, D. (2003). Nature of young children's authoring. In N. Hall, J. Larson, & J. Marsh (Eds.), *Handbook of early childhood literacy* (pp. 258–270). London: Sage.

Royster, J. (2000). *Traces of a stream: Literacy and social change among African American women.* Pittsburgh: University of Pittsburgh.

Russell, D. (1997a). Rethinking genre in school and society: An activity theory analysis. *Written Communication, 14*, 504–554.

Russell, D. R. (1997b). Writing and genre in higher education and workplaces. *Mind, Culture, and Activity, 4*(4), 224–237.

Schryer, C., & Lingard, L. (2002). Structure and agency in medical case presentations. In C. Bazerman & D. Russell (Eds.), *Writing selves, writing society* (pp. 62–96). Fort Collins, CO: WAC Clearinghouse.

Selzer, J. (1983). The composing processes of an engineer. *College composition and communication, 34*(2), 178–187.

Skaar, H. (2012). Does the Internet connect writing in and out of educational settings? Views of Norwegian students on the threshold of higher education. In C. Bazerman, C. Dean, J. Early, K. Lunsford, S. Null, P. Rogers, & A. Stansell (Eds.), *International advances in writing research: Cultures, places, measures* (pp. 235–252). Fort Collins, CO: WAC Clearinghouse.

Smagorinsky, P. (1997). Personal growth in social context. *Written Communication, 14*(1), 63–105.

Smart, G. (2006). *Writing the economy*. Oakville, CT: Equinox.

Spinuzzi, C. (2003). *Tracing genres through organizations: A sociocultural approach to information design*. Cambridge, MA: MIT Press.

Starke-Meyerring, D., Paré, A., Artemeva, N., Horne, M., & Yousoubova, L. (2011) *Writing in knowledge societies*. Fort Collins, CO: WAC Clearinghouse.

Stephens, Y. (2012). Transcending the border between classroom and newsroom. In C. Bazerman, C. Dean, J. Early, K. Lunsford, S. Null, P. Rogers, & A. Stansell (Eds.), *International advances in writing research: Cultures, places, measures* (pp. 289–304). Fort Collins, CO: WAC Clearinghouse.

Tardy, C. M., & Matsuda, P. K. (2009). The construction of author voice by editorial board members. *Written Communication, 26*, 32–35.

Thaiss, C., Bräuer, G., Carlino, P., Ganobcsik-Williams, L., & Sinha, A. (Eds.). (2012) *Writing programs worldwide: Profiles of academic writing in many places*. Fort Collins, CO: WAC Clearinghouse.

Thaiss, C., & Zawacki, T. M. (2006). *Engaged writers and dynamic disciplines: Research on the academic writing life*. Portsmouth, NH: Boynton/Cook.

VanDerHeide, J., & Newell, G. (2013). Learning of argumentative writing in classrooms. *Written Communication*, 300–329.

Varner, L. K., Roscoe, R. D., & McNamara, D. S. (2013). Evaluative misalignment of 10th-grade student and teacher criteria for essay quality: An automated textual analysis. *Journal of Writing Research, 5*, 35–59.

Vieira, K. (2011). Undocumented in a documentary society: Textual borders and transnational religious literacies. *Written Communication, 28*, 436–461.

Williams, J. M. (1981). The phenomenology of error. *College Composition and Communication, 32*(2), 152–168.

Winsor, D. (2003). *Writing power: An ethnographic study of writing in an engineering center*. Albany, NY: SUNY Press.

Wollman-Bonilla, J. E. (2000). Teaching science writing to first graders: Genre learning and recontextualization. *Research in the Teaching of English, 35*, 35–65.

Zachry, M., & Thralls, C. (Eds.). (2007). *Communicative practices in workplaces and the professions.* Amityville, NY: Baywood.

CHAPTER 2

Writing Research from a Cognitive Perspective

Charles A. MacArthur and Steve Graham

Systematic research on the cognitive processes involved in writing began in the late 1970s when Hayes and Flower (1980) set out to apply the methods of cognitive psychology to the study of expertise in writing. Cognitive psychology, or the broader area of cognitive science, had taken off as a major research field in the 1950s as the theoretical and methodological limitations of behavioral psychology had become increasingly evident. Two seminal publications that appeared in 1956 provide an introduction to some of the key ideas that have occupied cognitive psychology.

In 1956, Miller published a paper called “The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information.” He reviewed a wide range of research showing that humans’ capacity for making sensory discriminations (e.g., pitches of sound, phonemes), estimating quantities of objects, and

remembering items (e.g., objects, words, numbers) was limited to about seven items. Below seven, most individuals performed quite well; above seven, performance declined dramatically. This general finding suggested a fundamental limitation in the architecture of the human mind, in particular in short-term memory. To remember more things or to process more complex information, additional cognitive processing or learning was needed. Theories about the mental structures underlying memory—short-term memory, working memory, and long-term memory—continue to interest cognitive psychologists, including those who study writing. Theories about memory processes are important to understanding writing performance, development and learning, and individual differences.

Also in 1956, Bruner and his colleagues (Bruner, Goodnow, & Austin, 1956) published an influential book, *A Study of Thinking*, which focused on learners as active problem solvers. The research targeted traditional psychological tasks involving concept formation. For example, using a set of geometric figures of varying color, shape, and size, the experimenter would target a concept (e.g., small red squares). Participants would be shown one card at a time, asked whether it was a member of the targeted concept, and told whether they were correct. The goal was to figure out the targeted concept. The methodological and theoretical innovation was to ask participants to describe their thinking processes as they worked on the problem and to focus the analysis on identifying the cognitive strategies used by participants. Subsequently, a great deal of research was conducted on problem solving, using think-aloud methods to understand the conscious problem-solving strategies of participants in a range of areas including math, physics, logic puzzles, and chess (see, e.g., Newell & Simon, 1972). It is this method that Hayes and Flower (1980) used in their seminal research on writing as a problem-solving process.

These two early publications illustrate two of the issues that have engaged cognitive researchers and that have been applied in understanding writing. Research has ranged from questions about conscious problem solving to questions about underlying unconscious processes like short-term memory. The overall aim of cognitive research is to contribute to an understanding of human performance, learning and development, and individual differences by analyzing thinking or cognitive processes. To understand thinking, cognitive researchers posit mental representations and theoretical models that connect those representations. These abstract mental representations and theories are tested through rigorous empirical research with the commitment to finding replicable and generalizable results. The goal is to develop models that explain empirical findings about performance, learning, and individual differences and that, therefore, are useful in understanding performance and guiding learning.

Cognitive researchers understand that people think, learn, and develop in social contexts using socially developed tools, including language itself. Writing is situated in social contexts that provide purposes for writing, genre, content, and audience, as well as resources to support writing (see Bazerman, Chapter 1, this volume). Within those social contexts, writers apply their knowledge of context and content, their skills, and strategic problem solving to the difficult task of making meaning. Cognitive writing researchers have included social processes in their research. Flower (1994) developed a social-cognitive theory of writing and applied it to study instruction and development, and Hayes (1996) expanded the role of social factors in his later model. Research on instruction necessarily involves social interaction (e.g., modeling, collaboration), and research on motivation also involves social perceptions and influences (see Bruning & Kauffman, Chapter 11, this volume). However, cognitive researchers tend to focus on the effects of social context and interaction on learning and cognition. Over time, more work is needed to integrate cognitive and sociocultural theories and research.

The first systematic program of cognitive research on writing was the seminal work of Hayes and Flower beginning in the late 1970s (Hayes & Flower, 1980). Hayes, from cognitive psychology, and Flower, from rhetoric, set out to apply the methods of problem-solving research to understand expertise in writing, in particular the method of think-aloud, or verbal, protocol analysis, in which participants think aloud as they work on problem-solving tasks.

These think-aloud protocols are then coded inductively and analyzed for evidence of problem-solving processes or strategies. The approach was productive because writing is a complex intentional problem solving activity with much conscious problem solving. The model that Hayes and Flower developed will be discussed later in this chapter.

However, the think-aloud method is limited to the study of conscious cognitive processes and to writers old enough to simultaneously compose and think aloud. For example, Hayes and Flower learned little about the process of sentence generation because writers are generally unaware of their thought processes at that level. Other research methods were needed to get at basic cognitive processes such as working memory, sequential processing, language generation, and transcription skills. Fortunately, the broader field of cognitive psychology had been studying similar processes for some time using theory-guided experimentation.

This chapter is organized as follows: In the next section, we explain five theoretical models of writing. Hayes and Flower's (1980) seminal model of writing as a problem-solving process remains influential in writing research. Hayes's revised and expanded model (1996) incorporated a wider range of psychological constructs and evidence about cognition. Bereiter and Scardamalia (1987) accounted for development of writing by proposing contrasting models of developing and proficient composing. A model by Zimmerman and Risemberg (1997) focused on self-regulation and its development. Finally, we discuss a model of domain learning applied to writing (Alexander, 1998). The remainder of the chapter discusses four key aspects of cognition for writing that continue to engage cognitive researchers: working memory, transcription, self-regulation including planning and evaluation, and motivation.

MODELS OF THE WRITING PROCESS

Hayes and Flower (1980) Model

As noted earlier, during the 1970s, Hayes and Flower (1980) began studying the mental processes college students employed as they solved a writing problem, utilizing a technique referred to as protocol analysis, asking research participants to make their thoughts visible by "thinking aloud" while tackling a writing task. The resulting verbal protocol was analyzed for cues to identify mental operations used by the writer, providing a window into the cognitive and psychological processes involved in writing. Their analyses of the resulting protocols led to the development of what is arguably the most influential cognitive model of writing to this point in time, providing a relatively simple but elegant model of the writing process.

Hayes and Flower's 1980 model included three basic components. One component, *task environment*, involves everything outside the writer that influences task performance. These external factors include the writing assignment (e.g., topic, audience, and motivating cues) and the text produced so far. Another component, *cognitive processes*, provides a description of the mental operations writers employ while composing. These include planning what to say and how to say it, translating plans into written text, and reviewing to improve existing text. Planning is broken down into three mental operations: setting goals, generating ideas, and organizing ideas into a writing plan. Reviewing, in turn, involves reading and editing text. The use of these cognitive processes is under the writer's direct control (managed by a control process referred to as the Monitor), and they can be applied flexibly, as virtually any subprocess can interrupt or incorporate any other subprocess during writing. For instance, a writer might combine translation and reviewing, generating a section and then revising it, then generating and revising a second section, and so on. Somewhat similarly, planning might interrupt reviewing, if a writer identifies an additional writing goal while reviewing and editing text. The third component, *writer's long-term memory*, includes

the author's knowledge about the topic, the intended audience, and general plans or schemas for accomplishing various writing tasks.

Hayes and Flower's (1980) analysis of verbal protocols showed that composing is a goal-directed process. For example, skilled writers typically establish their main writing goals (e.g., be convincing, funny, and succinct) early in the process and commonly establish subgoals for meeting these main goals (e.g., use strong arguments and refute counterarguments to convince the reader). They also made it clear that skilled writing is a conscious, demanding, and self-directed activity, involving the coordination of a variety of mental operations in order to satisfy the writer's goals. A skilled writer must deal with many demands at once, much like a busy switchboard operator, trying to juggle simultaneously a number of demands on attention. This includes making plans, drawing ideas from memory, developing concepts, creating an image of the reader, testing ideas and text against that image, and so forth. As another cognitive researcher noted, writing does "not simply unfold automatically and effortlessly in the manner of a well learned motor skill . . . writing anything but the most routine and brief pieces is the mental equivalent of digging ditches" (Kellogg, 1993, p. 17).

The Hayes and Flower (1980) model not only fixed much of the vocabulary that people use when talking about the process of composing, but it also served as a catalyst for most of the subsequent research on the cognitive nature of writing and the architecture of the writing process (Alamargot & Chanquoy, 2001). For instance, Kellogg (1986) indexed the cognitive effort involved in each of the three major cognitive processes in the Hayes and Flower model by measuring interference from a secondary task. In a series of studies, Kellogg examined the pattern of attentional allocation of cognitive processes by college students as they wrote (Kellogg, 1987, 1996). Moreover, Rijlaarsdam and his colleagues (Breetvelt, van den Bergh, & Rijlaarsdam, 1994, 1996; van den Bergh & Rijlaarsdam, 1996) extended Kellogg's work by doing an even more detailed analysis of how writers employ the mental operations identified by Hayes and Flower (see also van den Bergh, Rijlaarsdam, & van Steendam, Chapter 4, this volume, for a summary of more recent research in this area).

Hayes (1996) Model

In a 1996 book chapter, Hayes presented a revised version of the 1980 Hayes and Flower model. The new model reorganized and expanded the previous framework so that it captured and integrated the ensuing 16 years of writing research as well as related cognitive research from areas such as reading, memory, and motivation. For instance, the *task environment* component was expanded to include social (e.g., audience, other texts read while writing, and collaborators) and physical components (e.g., text read so far, writing medium). He further modified the relationship between the *task environment* and *cognitive processes*, indicating a much more reciprocal relation between the two.

The *cognitive processes* component of the old model underwent considerable modification, as Hayes proposed that writers rely on general problem-solving (including planning) and decision-making skills to devise a sequence of steps to reach their writing goals, drawing inferences about audience, possible writing content, and so forth as they engage in these reflective processes. Cues from the writer's plan or text produced so far act to guide the retrieval of possible ideas for text. A suitable idea(s) is then held in working memory, as the writer expresses it vocally or subvocally as sentence parts, evaluating what to keep and modify as text is produced. Throughout the writing process, the writer engages in reading to define the writing task, obtain writing content, or evaluate text produced so far. For each of these tasks, the writer forms an internal representation of the text that can then be acted upon. For example, revising text produced so far includes critically reading it, problem solving to determine how to fix an identified problem, and implementing the change.

Hayes also expanded the 1980 model by including a *motivation/affect* component, indicating that cognitive and

affective factors such as goals, predispositions, beliefs, and attitudes influence the writing process. He further upgraded the *long-term memory component* of the old model from accessing knowledge of the audience, writing topic, and stored writing plans to include linguistic and genre knowledge as well as task schemas that specify how to carry out specific writing tasks. Finally, a *working memory* component was added to the new model. This component provides a limited place for holding information and ideas for writing as well as carrying out cognitive processes that require conscious attention, while at the same time providing an interface between *cognitive processes*, *motivation/affect*, and *long-term memory*.

Hayes's (1996) newer model provides a much more sophisticated and complicated view of skilled writing. The inclusion of motivation and working memory as part of the writing equation was an especially important addition (Graham, 2006). However, one limitation of both models is that they do not account for development or provide substantial insight into how novice and competent writers differ.

Bereiter and Scardamalia (1987) Models

Based on their study of children's writing, Scardamalia and Bereiter (1986) proposed that beginning or novice writers use a greatly simplified version of the idea generation process included in the 1980 Hayes and Flower model. In essence, novice writers convert the writing task into simply telling what is known about the topic (i.e., writing-as-remembering or writing-by-pattern). The architecture of this *knowledge-telling* model involves three components: (1) forming a mental representation of the assignment by defining the topic and the type of text to be produced; (2) drawing topic and discourse knowledge from long-term memory to complete the writing assignment; and (3) the knowledge-telling process itself, which includes the writer's search for topic or discourse knowledge, which if appropriate is transcribed as text and serves as a stimulus for conducting the next search of long-term memory.

Scardamalia and Bereiter (1987) also proposed a *knowledge-transforming* model of writing to describe more skilled writing. This model involves planning text content in accordance with rhetorical, communicative, and pragmatic constraints. Once the writer develops a mental representation of the assignment, problem analysis and goal setting are undertaken to determine what to say (content planning) as well as how to say it and who to say it to (rhetorical planning). These two types of planning are carried out in separate spaces, but operate in close interaction through a problem translation component, where topic knowledge can be transformed by taking into account content goals as well as rhetorical and pragmatic constraints. Similarly, rhetorical and pragmatic dimensions can be altered by content constraints. The resulting plans are elaborated in writing through the knowledge-telling process described above. The resulting text can be fed back into the content and rhetorical planning spaces, providing the writer with an additional opportunity to transform ideas and content.

The movement from knowledge telling to knowledge transforming likely involves a series of intermediate stages (see Hayes, 2011). Although the knowledge-telling model appears to provide a reasonably sound description of how inexperienced writers compose (e.g., Olinghouse, Graham, & Gillespie, in press), and has served as a focal point for much instructional research (see Graham & Harris, 2003), the validity of the knowledge-transforming model is less certain and its impact more limited. In addition, none of the models so far have addressed how novice writers become more competent.

The Zimmerman and Risemberg (1997) Model

A model developed by Zimmerman and Risemberg (1997), focusing on self-regulation in writing (see also Santangelo, Harris, & Graham, Chapter 12, this volume), specified mechanisms through which writers learn and

grow, at least in terms of their use of self-regulation procedures and self-efficacy. According to this model, self-regulation in writing occurs when writers use personal (or self-) processes to strategically regulate their writing behavior or the environment. They propose that writers manage the composing process by bringing into play three general classes of self-regulatory behaviors: strategies for controlling their actions, the writing environment, and their internal thoughts and processes. As they employ these strategies, writers monitor, evaluate, and react to their use of them, allowing them to learn from the consequences of their actions. Strategies that are viewed as successful are more likely to be retained, whereas those that are viewed as unsuccessful are more likely to be abandoned. A writer's sense of efficacy, in turn, may be enhanced or diminished depending on the perceived success of the strategies, whereas self-efficacy influences intrinsic motivation for writing, the use of self-regulatory processes during writing, and eventual literary attainment.

It is important to note that learning in the Zimmerman and Risemberg (1997) social cognitive model is not determined just by personal processes put into play by the writer. The use of personal processes is influenced by behavioral and environmental events in a reciprocal fashion. For instance, regulating the writing environment by arranging a quiet place to compose involves intervening behavioral actions, such as turning off the radio and closing the door. However, the continued use of these environmental regulation strategies depends on the writer's perceptions of their effectiveness in facilitating writing.

The model proposed by Zimmerman and Risemberg (1997) is somewhat narrow, as it focuses primarily on the role of self-regulation in writing. It does, however, offer an explicit explanation of how (1) writers exert deliberate control over the act of writing, (2) their beliefs about competence influence and in turn are influenced by their self-regulatory actions and subsequent performance, and (3) writers acquire new self-regulatory behaviors.

Model of Domain Learning Applied to Writing

The issue about how a person progresses from being a novice to a skilled writer has also been addressed through application of the model of domain learning (Alexander, 1998). According to this model, development within a specific domain, such as writing, is fueled by changes in a writer's self-regulatory or strategic behaviors, knowledge, and motivation. It is assumed that learning arises from a continual interplay between these cognitive and affective factors, but that progress toward competence in a domain is catapulted forward by the force of any one of these components (Alexander, 2004).

Graham (2006) examined the proposition that strategies, knowledge, and motivational factors contribute to writing development. He reasoned that a factor such as knowledge shapes writing development if the following tenets are supported by empirical evidence: (1) skilled writers possess more of the attribute (e.g., knowledge about writing) than less skilled writers, (2) developing writers increasingly possess the attribute with age and schooling, (3) individual differences in the attribute predict writing performance, and (4) instruction designed to increase the attribute improves writing performance.

Graham's 2006 review of the literature was generally consistent with the proposition that strategies, knowledge, and motivation each contribute to writing development. He found that the available evidence provided support for the four tenets above when applied to writing strategies and knowledge about writing. Although the role of motivation in writing development was generally supported, it was less definitive. Skilled writers were typically more motivated than less skilled ones, but some aspects of motivation declined over time (e.g., attitude toward writing) and others like self-efficacy increased or declined depending on the study. Individual differences in motivation, however, predicted writing performance, and a small number of studies showed that efforts to enhance motivation (i.e., self-efficacy) boosted writing performance.

Summary

Since the publication of the Hayes and Flower (1980) model more than 30 years ago, increasingly sophisticated cognitive descriptions of the composing process have emerged. These models, however, are still incomplete. To illustrate, they do not take full advantage of the increasingly sophisticated body of motivational theory and research now available (Pintrich, 2000). Nor do they adequately consider the role of genetic factors or new research on the brain. The influence of a broad array of environmental, contextual, cultural, and social influences on writing and its development remain relatively untouched in the cognitive models of writing developed to date. There is also a pressing need to create models that capture what the writing process looks like at different levels of development, extending the work of Bereiter and Scardamalia (1987) and Kellogg (1996), as well as models that explain how writing development is fostered.

SELECTED RESEARCH AREAS

Working Memory

As Miller (1956) demonstrated, humans have a limited capacity for remembering and processing information. Long-term memory contains vast stores of knowledge and experience acquired in the past, including in the case of writing, knowledge of content, writing forms and qualities, audiences and social situations, language, writing processes and strategies, transcription skills, and many other topics. However, in order to use that knowledge, one must bring it to consciousness and hold it there while thinking about it. This capacity to hold varying amounts of information in memory while processing it is what cognitive psychologists call working memory. As noted above, Hayes (1996) gave it a central place in his revised model of writing. Working memory increases from childhood to adulthood (Case, 1985) and varies among individuals (Swanson & Zheng, 2013), so it is potentially important in understanding development of writing and individual differences in writing, especially for developing writers with disabilities. In writing, researchers have found correlations between working memory and writing fluency and quality (for a review, see McCutchen, 1996).

The most commonly cited model of working memory (Baddeley, 1986) consists of three components: the *phonological loop*, which stores and processes auditory and verbal information; the *visuo–spatial sketchpad*, which stores and processes visual and spatial information; and a *central executive* that regulates attention, retrieval from long-term memory (LTM), and other cognitive processes. Highly automated processes do not draw on working memory, but any task that requires conscious or sustained effort draws on the central executive to manage the process using appropriate processing schema from long-term memory. Psychological research generally supports the validity of these three components of working memory (Swanson, 2008). They are further supported by neurological research showing that verbal and visual information are processed in the left and right hemispheres, respectively, and that executive functions are located primarily in the frontal lobe (for a review, see Wager & Smith, 2003).

Kellogg (1996) proposed a componential model of working memory in writing based on Baddeley's conception. According to this model, various component writing processes draw differentially on verbal and visual–spatial working memory. Planning draws on visual–spatial memory because ideas are often recalled from long-term memory as visual images and plans are often organized as spatial diagrams. Translating ideas into sentences and evaluating and revising draw more heavily on verbal working memory. All components (except transcription in proficient adults) draw on the central executive. Several studies have found that planning and translating, respectively, engage visual–spatial and verbal working memory (Olive, 2004, 2012; Olive, Kellogg, & Piolat, 2008).

More writing research has focused on the overall capacity limitations of working memory rather than separate components, particularly with regard to development and individual differences. Bereiter and Scardamalia (1987) conducted several investigations related to how working memory capacity might limit the ability of children to coordinate multiple ideas while composing. They drew on neo-Piagetian research by Case and colleagues (Case, 1985) showing developmental changes in the number of chunks of information children, adolescents, and adults can hold in memory while executing an attention-demanding process. In one series of studies (Bereiter & Scardamalia, 1987, Chapter 6), students were asked to write brief texts explaining the information in a 2 × 2 matrix. For example, one matrix provided information on climate (warm, cool) and crop (oranges, apples) in two states. Not until adolescence (grade 7) were most students able to write sentences that integrated all four dimensions (e.g., "In Michigan's cool climate they grow apples but with California's warm climate oranges may be grown"; Bereiter & Scardamalia, 1987, p. 160). In another study, they analyzed children's essays looking for evidence of coordination of ideas, for example, claim and reason, claim-reason-evidence. Most children in grades 3–5 showed evidence of coordinating two ideas, with increasing numbers of children in grade 5 coordinating three ideas. For Bereiter and Scardamalia (1987), limited working memory is one reason that children follow the simpler knowledge-telling model. To our knowledge, this line of research on children's developing ability to coordinate multiple ideas in writing has not been pursued further. However, it is consistent with some later research. For example, Ferretti, MacArthur, and Dowdy (2000) gave students either general goals to persuade an audience or an elaborated goal that included responding to potential opposing positions. Sixth-grade students but not fourth-graders wrote higher-quality essays with more counterarguments in the elaborated goal condition. The results might be explained by the limited ability of the fourth-grade students to coordinate reasons on both sides without more support.

Perhaps the largest amount of research on working memory and writing has focused on competition for working memory resources between low-level processes of transcription and higher-level planning and evaluation processes. As children learn to write, much of their attention, that is, their working memory, is focused on transcription issues of spelling and handwriting, leaving less working memory available for higher-level composing concerns. As transcribing becomes more fluent and eventually automatic, writers are able to engage in more planning and evaluation as they write. The demands of transcription on working memory and the effects on composing have been studied in several ways. One way is to compare handwriting (or typing) to dictation, which removes demands on transcription. Another way is to investigate correlations between transcription skills and writing quality across ages. Finally, experimental studies have been conducted on the effects of instruction on composing. Research using all of these approaches is discussed in the next section on transcription.

Recent research on working memory has addressed some apparent limitations of earlier models. Ericsson and Kintsch (1995) have argued that the very limited capacity in Baddeley's model cannot adequately explain complex expert performance. They proposed a model of 'long-term working memory' in which working memory contains retrieval links to long-term memory, making it possible for experts in a domain to access far more information relatively quickly. McCutchen (2000) explored the implications of this model for writing. Baddeley (2007) later added a new component to his own model, "episodic" memory, which stores experiential memories and can integrate visual and verbal information.

Others have focused increased attention on the central executive, arguing that executive functions are critical to complex processes such as writing. Vanderberg and Swanson (2007) measured the three components of working memory and found that only the executive functions predicted writing outcome measures of planning, structure, and vocabulary complexity. More complex models of the executive functions have also been applied to understanding writing and writing disabilities. For example, Altemeier, Abbott, and Berninger (2008) found that separate executive functions, such as inhibition, attention shifting, and sustaining attention, helped to explain reading and writing

performance in children with and without dyslexia. For further discussion of new directions in research on working memory and writing, see Olive (2012).

Overall, theories of working memory help to explain development and individual differences in writing. Working memory capacity, both memory storage and executive function, increases from childhood to adolescence and adulthood as the brain matures. In addition, as transcription becomes more fluent and automatic, working memory is freed for greater attention to composing. Limitations on working memory help explain why children adopt a knowledge-telling strategy (Bereiter & Scardamalia, 1987), which permits sequential composing by attending to topic, discourse form, and the text just written. In addition, students with learning disabilities (LDs) may have deficits in components of working memory and problems with transcription (Altemeier et al., 2008). Proficient writers manage the limitations of working memory by using goal-directed strategies that break down the writing process into manageable chunks. Although children do not normally do much advance planning, elementary children can learn planning strategies that enable them to manage more information and produce texts that are more complex and higher in quality (Graham, Kiuhara, McKeown, & Harris, 2012).

Transcription Skills

One issue not addressed in the cognitive models of writing presented earlier is the role of transcription skills in writing and writing development (see also Fayol, Chapter 9, this volume). Transcription involves transcribing the words the writer wants to say into written symbols on the page (Graham, 2006). This involves the use of writing skills such as handwriting, keyboarding, and spelling.

For skilled writers, transcription is mostly an unconscious, automatic task (Willingham, 1998). This is not always the case, however, as conscious attention to transcribing skills would occur in the following example situations: using a word whose spelling is unknown or deciding to write all letters as capitals when texting or emailing in order to emphasize what is being said.

For beginning writers, transcription skills require considerable effort and attention (Berninger, 1999; Graham, 1999). Until these skills become efficient and relatively automatic, they may exact a toll on both the reader and the writer. If we just consider the skill of handwriting, there are at least two ways it may constrain writing. One, text that is illegible cannot be understood by the reader (Graham, Harris, & Herbert, 2011). Somewhat similarly, text that is readable, but hard to decipher due to poor handwriting, may be devalued by the reader, as the legibility of text influences others' evaluation of its content (see Graham, Harris, & Hebert, 2011). Two, handwriting may impede beginning writers' efforts by interfering with other writing processes (Scardamalia & Bereiter, 1986). Having to switch attention during composing to thinking about how to form a particular letter, for example, may lead a child to forget writing ideas or plans being held in working memory. Likewise, they are likely to lose some writing ideas as they compose, as their handwriting is often not fast enough for them to record all of their ideas before they start forgetting some of them. Difficulties with handwriting may also constrain young children's development as writers. McCutchen (1995) proposed that transcription skills such as handwriting are so demanding for beginning writers that they minimize the use of other writing processes, such as planning and revising, because they exert considerable processing demands as well. In addition, Berninger, Mizokawa, and Bragg (1991) found that difficulties with handwriting led children they worked with to avoid writing and develop a negative view of their writing capabilities.

Evidence demonstrating the impact of transcription skills on writers and writing development is varied and relatively conclusive. For example, eliminating transcription skills by having writers dictate their compositions has a positive impact on writing performance. A review by De La Paz and Graham (1995) found that young and old writers produced more text when they dictated versus wrote their compositions, but effects on quality of writing

were found only for young children just learning to write (preschool and first grade) and older elementary-age children with poorly developed handwriting and spelling skills, not for older typical learners. However, the comparison between normal dictation and handwriting is not a fair test of the effects of removing transcription demands because dictation has the disadvantage that writers cannot see the text they have already written. Reece and Cumming (1996) conducted a series of studies comparing dictation in which students could see their text being typed on a screen to normal dictation and handwriting. In these studies, upper elementary students wrote better essays in the visible-text-dictation condition than with normal dictation or with handwriting; poor writers did better in both dictation conditions than with handwriting. This effect seems to change with older students. A study using speech recognition software (which displays the text as it is dictated) (MacArthur & Cavalier, 2004), high school students with LDs wrote higher-quality essays dictating to the computer than with handwriting, but typical students wrote equally well in both conditions.

Researchers in France (Bourdin & Fayol, 1994) have further demonstrated that the process of transcribing ideas onto paper is more demanding for children than for adults. In their experiments, adults were equally adept at recalling information and generating sentences when responding orally or in writing, but children's performance was significantly poorer when writing. Thus, transcription processes imposed greater cost on those whose transcription skills were still developing (such skills are not fully mastered until high school; Farr, Hughes, Robbins, & Greene, 1990; Graham, Berninger, Weintraub, & Schaefer, 1998). Other studies have shown that students with less developed transcription skills are weaker writers than same grade peers with stronger transcription skills (e.g., Deno, Marsten, & Mirkin, 1982; Juel, 1989; Olinghouse & Graham, 2009)

Individual differences in transcription skills also predict how well students' write. In a review of 13 studies, Graham, Berninger, Abbott, Abbott, and Whitaker (1997) reported that handwriting fluency and spelling were moderately correlated with measures of writing achievement. In an empirical study reported in the same paper, they found that, collectively, handwriting and spelling skills accounted for 25% and 42% of the variance in writing quality at the primary and intermediate grades, and 66% and 41% of the variance in writing output at these same grade levels, respectively.

Finally, teaching text transcription skills has a positive impact on developing writers. In a meta-analysis conducted by Graham et al. (2012), text produced by primary grade students who were taught handwriting, typing, and/or spelling evidenced a half-standard deviation improvement in writing quality over children who were not taught these skills. These findings provide support for the contention that the teaching of text transcription skills needs to be part of early writing instruction. Another meta-analysis by Graham and Santangelo (2014) provides additional support for this contention in terms of spelling instruction, showing that students become better spellers when this skill is directly taught versus relying on incidental methods, such as frequent reading and writing, as a catalyst for spelling development. This review further found that spelling instruction enhanced students' reading skills.

Self-Regulation

A common point of agreement in the models of skilled writing reviewed earlier is that writing is a self-directed process (see also Santangelo et al., Chapter 12, this volume). To achieve their intentions, skilled writers employ a variety of strategies for regulating the writing process, their behavior, and the writing environment (Scardamalia & Bereiter, 1985; Zimmerman & Risemberg, 1997). These strategies include: goal setting and planning (e.g., establishing rhetorical goals and tactics to achieve them), seeking information (e.g., gathering information pertinent to the writing topic), record keeping (e.g., making notes), organizing (e.g., ordering notes or text), transforming

(e.g., visualizing a character to facilitate written description), self-monitoring (e.g., checking to see if writing goals are met), reviewing records (e.g., reviewing notes or the text produced so far), self-evaluating (e.g., assessing the quality of text or proposed plans), revising (e.g., modifying text or plans for writing), self-verbalizing (e.g., saying dialogue aloud while writing or personal articulations about what needs to be done), rehearsing (e.g., trying out a scene before writing it), environmental structuring (e.g., finding a quiet place to write), time planning (e.g., estimating and budgeting time for writing), self-consequating (e.g., going to a movie as a reward for completing a writing task), seeking social assistance (e.g., asking another person to edit the paper), and self-selecting models (e.g., emulating the tactics or style of writing of a more gifted author).

In contrast, novice or beginning writers, as described in the knowledge-telling model proposed by Scardamalia and Bereiter (1987), employ an approach to writing that minimizes the role of goal setting, planning, revising, and other self-regulation strategies (McCutchen, 1988). They commonly convert the task of writing into telling what one knows, with little attention directed to what they want to accomplish, the organization of text, the needs of the reader, or even the constraints imposed by the topic. This retrieve-and-write approach to writing relies heavily on a single composing process, the generation of ideas, involving little in the way of thinking, planning, and reflecting (Graham, Harris, & McKeown, 2013).

These differences in self-regulation are evident in cross-sectional studies examining self-regulation strategies such as planning. For example, in a study by Bereiter and Scardamalia (1987), college students planned their entire composition during a scheduled preplanning period, generating multiple and abbreviated lists of ideas that were connected by lines or arrows. Conceptual planning notes, evaluative statements, and structural markers were also quite common in the plans they generated. In contrast, the planning notes produced by children in grades 4, 6, and 8 mostly involved generating complete sentences that were edited into a final draft during writing, with little attention devoted to developing other types of goals. Conversely, the planning of the writers in this study became increasingly sophisticated with age, as the number of planning notes produced between grades 4 and 6 doubled, and conceptual planning notes became more common from grades 4 to 8.

There is a relatively rich set of studies showing that the use of many of the self-regulation strategies described above is associated with better writing (see van den Bergh, Rijlaarsdam, & van Steendam, Chapter 4, this volume, as well as MacArthur, Chapter 18, this volume). For some self-regulation strategies, this may occur at a younger or older age. Consider, for example, planning and revising. In a literature review, Hayes and Nash (1996) reported that the correlations between writing quality and amount of planning ranged from 0.23 to 0.87 for students in grades 6 through college. Moreover, Graham and his colleagues (study in process) found that advanced planning made a statistically significant contribution to predicting the overall quality of persuasive text written from source with even younger students (after first controlling for variance due to gender, transcription skills, and motivational variables). In contrast, revising behavior is generally unrelated to overall writing performance until high school or later (Fitzgerald, 1987), probably because young children do not revise much and limit most of their revising efforts to proofreading and minor word changes (Graham & Harris, 2000).

Hayes and Nash (1996) have raised the concern that the positive relations observed between self-regulation strategies such as planning and writing performance may be due to a confounding variable, namely, time-on-task. Previously, significant correlation between planning and writing quality became statistically nonsignificant in several studies Hayes and Nash reviewed once time-on-task was held constant via the technique of partial correlations. This has not been a consistent finding in the literature, however, as statistically significant positive correlations were obtained between planning and writing performance in other studies where time-on-task was not a confounding factor (e.g., Berninger, Whitaker, Feng, Swanson, & Abbott, 1996; Troia & Graham, 2002).

In any event, a growing body of evidence shows that teaching developing writers how to regulate various aspects

of the writing processes leads to better writing (see Santangelo et al., Chapter 12, this volume). For instance, a series of meta-analyses have demonstrated that teaching planning and revising strategies to students enhanced their writing performance (Graham et al., 2012, 2013; Graham & Perin, 2007; Rogers & Graham, 2008). The positive effects of such instruction have occurred as early as first grade with planning (Zumbrunn & Bruning, 2013) and fourth grade with revising (Graham & MacArthur, 1988). These findings suggest that with proper scaffolding and instruction, self-regulation strategies can shape the writing of very young children, even though influential models of early writing like knowledge telling propose that such strategies are not normally used (McCutchen, 1988).

Motivation

Writing is a demanding task that presents motivational challenges even for proficient writers. Many of the self-regulation strategies used by experienced writers and discussed in the previous section function to motivate writers to work productively. Learning to write can also be frustrating and difficult for many students, and motivation to engage in writing generally declines across the school years (Hidi & Boscolo, 2006). Motivation is influenced both by social and situational factors and by internal cognitive and affective factors.

Motivation is a complex concept that has been studied from multiple theoretical perspectives (Murphy & Alexander, 2000). However, not all prominent theories of motivation have been studied with writing. For example, expectancy-value theory (Wigfield & Eccles, 2000) has seldom been studied with writing. Here we briefly discuss three motivational constructs that have been applied to understand writing motivation: self-efficacy, achievement goals, and interest.

The largest body of cognitive research on writing motivation has focused on self-efficacy. Self-efficacy is defined as individuals' judgments "of their capabilities to organize and execute the courses of action required to attain designated types of performances" (Bandura, 1986, p. 391). People tend to engage in activities that make them feel competent and to avoid tasks that they think are beyond their ability. Self-efficacy has been found to predict engagement, persistence, affective reactions, and performance across many areas of achievement (Bandura, 1986; 1997; Pajares, 1996). In writing, self-efficacy has been shown rather consistently to predict writing performance even after controlling for prior writing achievement (for reviews, see Pajares & Valiante, 2006; Bruning & Kauffman, Chapter 11, this volume).

Self-efficacy is measured with questionnaires that ask individuals to rate their confidence that they will be able to successfully complete specific tasks. Conceptually, self-efficacy refers to specific capabilities, so individuals might vary in their self-efficacy for particular aspects of writing skills, strategies, and knowledge. Some research has found multiple separate factors of self-efficacy. For example, separate factors have been found for composing tasks (e.g., structuring an essay) and skills (e.g., grammar) (Shell, Murphy, & Bruning, 1989; Pajares, 2007). Pajares (2007) found that writing achievement was predicted best for elementary school students by self-efficacy for skills but for high school students by composing self-efficacy. One research group (Bruning, Dempsey, Kauffman, McKim, & Zumbrunn, 2013) found three separate self-efficacy factors for ideas, conventions, and self-regulation. They found that conventions self-efficacy best predicted the writing test scores of secondary students, but ideas and self-regulation were more related to liking writing.

Self-efficacy is an important motivational outcome that can influence future writing achievement and should be addressed in instruction. Self-efficacy can be influenced by mastery experiences, vicarious experience (modeling), social persuasion, and emotional reactions (e.g., anxiety) (Bandura, 1997). Research in areas other than writing has consistently found that mastery experience is the strongest source of self-efficacy beliefs, and one study that addressed writing confirmed this finding (Pajares, Johnson, & Usher, 2007). Modeling writing processes,

encouraging students to believe they can be successful, and helping them control negative emotions are all parts of effective writing instruction, but unless these efforts lead to successful independent writing experience, they may not enhance self-efficacy.

Another established motivational theory that has been applied to writing is achievement goal theory (Elliot & Church, 1997; Pintrich, 2000). Current theory in this area includes three contrasting goal orientations: mastery, performance-approach, and performance-avoidance. A mastery goal orientation characterizes individuals who seek to develop knowledge and competence. Individuals with a performance goal orientation seek to demonstrate competence relative to others. Performance-avoidance goals refer to efforts to avoid unfavorable judgments by others. Research on academic achievement in multiple areas (for a review, see Senko, Hulleman, & Harackiewicz, 2011) has found that mastery goals are related to interest, persistence, deep learning strategies, positive affect, and achievement; performance-approach goals are positively related to academic achievement; and performance-avoidance goals are related to low achievement, low interest, poor study habits, and anxiety. Also, mastery and performance-approach goals are usually positively correlated.

Research on goal orientation in writing has been conducted by researchers in combination with self-efficacy (Kauffman et al., 2010; MacArthur, Philippakos, & Graham, in press; Pajares, Britner, & Valiante, 2000; Pajares & Cheong, 2003). All four studies found positive correlations between mastery goals and self-efficacy and negative correlations between performance-avoidance goals and self-efficacy. Kauffman and colleagues (2010) reported positive correlations with grades for both mastery and performance goals. Interestingly, a study with basic (remedial) college writers (MacArthur et al., in press) did not find any positive correlations among self-efficacy, mastery and performance goals, and writing achievement. However, they did find negative correlations of performance-avoidance goals with self-efficacy and with five measures of reading and writing achievement, suggesting that for this population negative motivational goals may be highly influential. This interpretation is supported by a qualitative study (Cox, 2009); in interviews with students from six community college composition classes, 80% of students mentioned experiences of prior failure with writing or fear of failure, and many reported counterproductive effects consistent with performance-avoidance goals, such as dropping classes, avoiding speaking in class, and not submitting papers.

The third motivational construct that has often been studied for writing is interest. Unlike the cognitive concepts of self-efficacy and goal orientation, interest includes both affect and cognition. Experiencing interest involves an affective reaction that is integrated with cognition. Interest theory distinguishes between situational and individual interest (Hidi & Boscolo, 2006). Situational interest is an affective response to something in the environment that focuses attention and that may or may not have a lasting impact. In writing, interesting topics or assignments can evoke such situational interest. Individual interest is "a relatively enduring predisposition to attend to events and objects, as well as to reengage in activities" (Hidi & Boscolo, 2006, p. 146). Individual interest develops over time and is associated with increased knowledge and value.

Both situational and individual interest have been shown to be related to academic performance, attention, and levels of learning (Hidi & Renninger, 2006). In writing, much of the research has focused on interest in content topics. Topic interest and knowledge are often related. Together, knowledge and interest affect the quality of writing, but knowledge has more influence (Hidi & Boscolo, 2006). Some research has also focused on development of individual interest in writing as an activity. Hidi and Renninger (2006) have proposed a four-phase model of development from situational interest to stable individual interest. This development may include movement from situational interest in topics to interest in writing itself.

Developing positive motivation toward writing is an important outcome of instruction. Teachers can help students develop a sense of competence and self-efficacy by designing instruction to ensure success on writing tasks along

with a belief that success was due to one's own effort and learning. It is also important to provide writing tasks that are interesting and challenging and that students see as meaningful. When students perceive writing as useful for learning and communication, they are more likely to adopt mastery goals focused on learning rather than performance goals. Self-efficacy and interest are likely to reinforce each other since people tend to be interested in things they are good at and to develop skill based on their interests. Both also support mastery goals making it possible for students to see writing as a challenging but attainable goal.

FINAL THOUGHTS

From a cognitive perspective, proficient writing is a complex goal-directed problem-solving process that makes substantial demands on writers' knowledge, strategies, language, skills, and motivational resources. Beginning with often ill-defined goals established by the social contexts and purposes, writers analyze problems to set specific goals and subgoals, generate content, organize their ideas, craft sentences and choose appropriate words, and produce text, all the while evaluating everything against their communicative goals. The need to maintain focus while switching attention among ideas and processes places heavy demands on self-regulation and motivation.

The writing processes of young, developing writers are much simpler. Having made the basic discovery that language can be represented by marks on paper, children focus primarily on generating ideas and getting them on paper. Much development and learning occurs on the way to proficient writing. Through instruction and practice, children develop increasing skill and fluency in the transcription processes of spelling and handwriting. Language proficiency develops, aided greatly by experiences learning to read. Also through reading and writing experiences, individuals gain knowledge about written genres and the characteristics of good writing. Cognitive maturation increases working memory, including executive control as well as verbal and visual storage, thus increasing capacity for integrating ideas and balancing content and rhetorical demands. Capacity for planning and self-regulation also grows, and students develop increasingly sophisticated strategies for planning and revising. Development varies among individuals based on differences in cognitive capacities as well as experience and instruction. In particular, students with learning disabilities that affect phonological processing, memory, or executive function may have particular problems with aspects of writing.

All of these aspects of development can be enhanced through well-designed instruction. Reading instruction that emphasizes both decoding and comprehension is fundamental for supporting development of writing. Instruction to develop fluent handwriting and spelling facilitates writing by freeing capacity for more complex processes. Teaching genre features can enhance both reading comprehension and writing. Instruction in strategies for planning and revising can enhance knowledge of writing and writing achievement from early elementary through college and adult education. Furthermore, teaching self-regulation strategies, such as goal-setting, monitoring, evaluation, and managing the environment, enhances the effect of strategy instruction. Writing instruction can also increase reading comprehension and learning in content areas of science and history. Experiences with meaningful writing activities that promote content learning and communication enhance students' understanding of writing purposes and forms and motivate interest in writing. Motivation is also critically dependent on instruction that provides mastery experiences to develop self-efficacy.

Overall, cognitive research has made, and continues to make, substantial contributions to understanding writing performance, learning and development, individual differences, and instruction. Ultimately, a comprehensive understanding of writing and its development will require research with greater integration of social and cognitive perspectives.

REFERENCES

Alamargot, D., & Chanquoy, L. (2001). *Through the models of writing*. Dordrecht, The Netherlands: Kluwer.

Alexander, P. (1998). The nature of disciplinary and domain learning: The knowledge, interest, and strategic dimensions of learning from subject-matter text. In C. Hynd (Ed.), *Learning from text across conceptual domains* (pp. 55–76). Mahwah, NJ: Erlbaum.

Alexander, P. (2004). The development of expertise: The journey from acclimation to proficiency. *Educational Researcher, 32*(8), 10–14.

Altemeier, L., Abbott, R. D., & Berninger, V. (2008). Executive functions for reading and writing in typical literacy development and dyslexia. *Journal of Clinical and Experimental Neuropsychology, 30,* 58–606.

Baddeley, A. D. (1986). *Working memory*. Oxford, UK: Oxford University Press.

Baddeley, A. D. (2007). *Working memory, thought, and action*. Oxford, UK: Oxford University Press.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: Freeman.

Bereiter, C., & Scardamalia, M. (1987). *The psychology of written composition*. Hillsdale, NJ: Erlbaum.

Berninger, V. (1999). Coordinating transcription and text generation in working memory during composing: Automatic and constructive processes. *Learning Disability Quarterly, 22*, 99–112.

Berninger, V., Mizokawa, D., & Bragg, R. (1991). Theory-based diagnosis and remediation of writing disabilities. *Journal of School Psychology, 29*, 57–79.

Berninger, V., Whitaker, D., Feng, Y., Swanson, L., & Abbott, R. (1996). Assessment of planning, translating, and revising in junior high writers. *Journal of School Psychology, 34*, 23–32.

Bourdin, B., & Fayol, M. (1994). Is written language production more difficult than oral language production? A working memory approach. *International Journal of Psychology, 29*, 591–620.

Breetvelt, I., van den Bergh, H. & Rijlaarsdam, G. (1994). Relations between writing processes and text quality: When and how. *Cognition and Instruction, 12*, 103–123.

Breetvelt, I., van den Bergh, H. & Rijlaarsdam, G. (1996). Rereading and generating and their relation to text quality: An application of mutilevel analysis on writing process data. In G. Rijlaarsdam, H. van den Bergh, & M. Couzjin (Eds.), *Theories, models and methodologies on writing research* (pp. 10–21). Amsterdam: Amsterdam University Press.

Bruner, J. S., Goodnow, J., & Austin, G. (1956). *A study of thinking*. New York: John Wiley.

Bruning, R., Dempsey, M., Kauffman, D. F., McKim, C., & Zumbrunn, S. (2013). Examining dimensions of self-efficacy for writing. *Journal of Educational Psychology, 105*, 25–38.

Case, R. (1985). *Intellectual development: Birth to adulthood*. Orlando, FL: Academic Press.

Cox, R. D. (2009). "It was just that I was afraid": Promoting success by addressing students' fear of failure. *Community College Review, 37*, 52–80.

De La Paz, S., & Graham, S. (1995). Dictation: Applications to writing for students with learning disabilities. In T. Scruggs & M. Mastropieri (Eds.), *Advances in learning and behavioral disabilities* (Vol. 9, pp. 227–247). Greenwich, CT: JAI Press.

Deno, S., Marston, D., & Mirkin, P. (1982). Valid measurement procedures for continuous evaluation of written expression. *Exceptional Children, 48*, 368–371.

Elliot, A. J., & Church, M. A. (1997). A hierarchical model of approach and avoidance achievement motivation.

Journal of Personality and Social Psychology, 72, 218–232.

Ericsson, K. A., & Kintsch, W. (1995). Long-term working memory. *Psychological Review, 102*, 211–245.

Farr, R., Hughes, C., Robbins, B., & Greene, B. (1990). *What students' writing reveals about their spelling*. Bloomington, IN: Center for Reading and Language Studies.

Ferretti, R. P., MacArthur, C. A., & Dowdy, N. S. (2000). The effects of an elaborated goal on the persuasive writing of students with learning disabilities and their normally achieving peers. *Journal of Educational Psychology, 92*, 694–702.

Fitzgerald, J., (1987). Research on revision in writing. *Review of Educational Research, 57*, 481–506.

Flower, L. (1994). *The construction of negotiated meaning: A social cognitive theory of writing*. Carbondale, IL: Southern Illinois University Press.

Graham, S. (1999). Handwriting and spelling instruction for students with learning disabilities: A review. *Learning Disability Quarterly, 22*, 78–98.

Graham, S. (2006). Writing. In P. Alexander & P. Winne (Eds.), *Handbook of educational psychology* (pp. 457–477). Mahway, NJ: Erlbaum.

Graham, S., Berninger, V., Abbott, R., Abbott, S., & Whitaker, D. (1997). The role of mechanics in composing of elementary school students: A new methodological approach. *Journal of Educational Psychology, 89*, 170–182.

Graham, S., Berninger, V., Weintraub, N., & Schafer, W. (1998). Development of handwriting speed and legibility. *Journal of Educational Research, 92*, 42–51.

Graham, S., & Harris, K. (2000). The role of self-regulation and transcription skills in writing and writing development. *Educational Psychologist, 35*, 3–12.

Graham, S., & Harris, K. R. (2003). Students with learning disabilities and the process of writing: A meta-analysis of SRSD studies. In L. Swanson, K. R. Harris, & S. Graham (Eds.), *Handbook of research on learning disabilities* (pp. 383–402). New York: Guilford Press.

Graham, S., Harris, K. R., & Hebert, M. (2011). It is more than just the message: Analysis of presentation effects in scoring writing. *Focus on Exceptional Children, 44*(4), 1–12.

Graham, S., Harris, K. R., & McKeown, D. (2013). The writing of students with LD and a meta-analysis of SRSD writing intervention studies: Redux. In L. Swanson, K. R. Harris, & S. Graham (Eds.), *Handbook of learning disabilities* (2nd ed., pp. 405–438). New York: Guilford Press.

Graham, S., Kiuhara, S., McKeown, D., & Harris, K. R. (2012). A meta-analysis of writing instruction for students in the elementary grades. *Journal of Educational Psychology, 104*, 879–896.

Graham, S., & MacArthur, C. (1988). Improving learning disabled students' skills at revising essays produced on a word processor: Self-instructional strategy training. *Journal of Special Education, 22*, 133–152.

Graham, S., & Perin, D. (2007). A meta-analysis of writing instruction for adolescent students. *Journal of Educational Psychology, 99*, 445–476.

Graham, S., & Santangelo, T. (2014). Does spelling instruction make students better spellers, readers, and writers? A meta-analytic review. *Reading and Writing: An Interdisciplinary Journal, 27*, 1703–1743.

Hayes, J. (1996). A new framework for understanding cognition and affect in writing. In M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences, and applications* (pp. 1–27). Mahwah, NJ: Erlbaum.

Hayes, J. (2011). Kinds of knowledge-telling: Modeling early writing development. *Journal of Writing Research, 3*, 73–92.

Hayes, J., & Flower, L. (1980). Identifying the organization of writing processes. In L. Gregg & E. Steinberg (Eds.), *Cognitive processes in writing* (pp. 3–30). Hillsdale, NJ: Erlbaum.

Hayes, J., & Nash, J. (1996). On the nature of planning in writing. In M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences, and applications* (pp. 29–55). Mahwah, NJ: Erlbaum.

Hidi, S., & Boscolo, P. (2006). Motivation and writing. In C. A. MacArthur, S. Graham & J. Fitzgerald (Eds.), *Handbook of Writing Research* (pp. 144–157). New York: Guilford Press.

Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational Psychologist, 41*, 111–127.

Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children from first through fourth grade. *Journal of Educational Psychology, 80*, 437–447.

Kauffman, D. F., Zhao, R., Dempsey, M. S., Zeleny, M. G. Wang, S., & Bruning, R. H. (2010, May). *Achievement goals' impact on 11th grade students' affect, self-efficacy, and writing achievement.* Paper presented at the annual conference of the American Educational Research Association, Denver.

Kellogg, R. (1986). Designing idea processors for document composition. *Behavior Research, Methods, Instruments, and Computers, 18*, 118–128.

Kellogg, R. (1987). Effects of topic knowledge on the allocation of processing time and cognitive effort to writing processes. *Memory and Cognition, 15*, 256–266.

Kellogg, R. (1993). Observations on the psychology of thinking and writing. *Composition Studies, 21*, 3–41.

Kellogg, R. (1996). A model of working memory in writing. In C. M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences, and applications* (pp. 57–72). Mahwah, NJ: Erbaum.

King, M. L., & Rentel, V. M. (1981). Research update: Conveying meaning in written texts. *Language Arts, 58*, 721–728.

MacArthur, C. A., & Cavalier, A. (2004). Dictation and speech recognition technology as accommodations in large-scale assessments for students with learning disabilities. *Exceptional Children, 71*, 43–58.

MacArthur, C. A., Philippakos, Z. A., & Graham, S. (in press). A multi-component measure of writing motivation with basic college writers. *Learning Disability Quarterly*.

McCutchen, D. (1988). "Functional automaticity" in children's writing: A problem of metacognitive control. *Written Communication, 5*, 306–324.

McCutchen, D. (1995). Cognitive processes in children's writing: Developmental and individual differences. *Issues in Education: Contributions from Educational Psychology, 1*, 123–160.

McCutchen, D. (1996). A capacity theory of writing: Working memory in composition. *Educational Psychology Review, 8*, 299–325.

McCutchen, D. (2000). Knowledge, processing, and working memory: Implications for a theory of writing. *Educational Psychologist, 35*, 13–23.

Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review, 63*, 81–97.

Murphy, P. K., & Alexander, P. A. (2000). A motivated exploration of motivation terminology. *Contemporary Educational Psychology, 25*, 3–53.

Newell, A., & Simon, H. A. (1972). *Human problem solving*. Englewood Cliffs, NJ: Prentice-Hall.

Olinghouse, N., & Graham, S. (2009). The relationship between the writing knowledge and the writing performance of elementary-grade students. *Journal of Educational Psychology, 101*, 37–50.

Olinghouse, N., Graham, S., & Gillespie, A. (in press). The relationship of discourse and topic knowledge to writing performance. *Journal of Educational Psychology*.

Olive, T. (2004). Working memory in writing: Empirical evidence from the dual-task technique. *European Psychologist, 9*(1), 32–42.

Olive, T. (2012). Working memory in writing. In V. W. Berninger (Ed.), *Past, present, and future contributions of cognitive writing research to cognitive psychology* (pp. 485–503). New York: Psychology Press.

Olive, T., & Kellogg, R. T. (2002). Concurrent activation of high- and low-level production processes in written composition. *Memory and Cognition, 30*, 594–600.

Olive, T., Kellogg, R. T., & Piolat, A. (2008). Verbal, visual, and spatial working memory demands during text composition. *Applied Psycholinguistics, 29*, 669–687.

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research, 66*, 543–578.

Pajares, F. (2007). Empirical properties of a scale to assess writing self-efficacy in school contexts. *Measurement and Evaluation in Counseling and Development, 39*, 239–249.

Pajares, F., Britner, S. L., & Valiante, G. (2000). Relation between achievement goals and self-beliefs of middle school students in writing and science. *Contemporary Educational Psychology, 25*, 406–422.

Pajares, F., & Cheong, Y. F. (2003). Achievement goal orientations in writing: A developmental perspective. *International Journal of Educations Research, 39*, 437–455.

Pajares, F., Johnson, M., & Usher, E. (2007). Sources of self-efficacy beliefs of elementary, middle, and high school students. *Research in the Teaching of English, 42*, 104–120.

Pajares, F., & Valiante, G. (2006). Self-efficacy beliefs and motivation in writing development. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 158–170). New York: Guilford Press.

Pintrich, P. R. (2000). An achievement goal theory perspective on issues in motivation terminology, theory, and research. *Contemporary Educational Psychology, 25*, 92–104.

Reece, J., & Cumming, G. (1996). Evaluating speech-based composition methods: Planning, dictation, and the listening word processor. In M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences, and applications* (pp. 361–380). Mahwah, NJ: Erbaum.

Rogers, L., & Graham, S. (2008). A meta-analysis of single subject design writing intervention research. *Journal of Educational Psychology, 100*, 879–906.

Scardamalia, M., & Bereiter, C. (1985). Fostering the development of self-regulation in children's knowledge processing. In S. Chipman, J. Segal, & R. Glaser (Eds.), *Thinking and learning skills: Current research and open questions* (Vol. 2, pp. 563–577). Hillsdale, NJ: Erlbaum.

Scardamalia, M., & Bereiter, C. (1986). Written composition. In M. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 778–803). New York: Macmillan.

Senko, C., Hulleman, C. S., & Harackiewicz, J. M. (2011). Achievement goal theory at the crossroads: Old controversies, current challenges, and new directions. *Educational Psychologist, 46*, 26–47.

Shell, D. F., Murphy, C. C., & Bruning, R. H. (1989). Self-efficacy and outcome expectancy mechanisms in reading and writing achievement. *Journal of Educational Psychology, 81*, 91–100.

Swanson, H. L. (2008). Working memory and intelligence in children: What develops? *Journal of Educational Psychology, 100*, 343–379.

Swanson, H. L., & Zheng, X. (2013). Memory difficulties in children and adults with learning disabilities. In H. L. Swanson, K. R. Harris, & S. Graham (Eds.), *Handbook of learning disabilities* (2nd ed.). New York: Guilford Press.

Troia, G., & Graham, S. (2002). The effectiveness of a highly explicit, teacher-directed strategy instruction routine: Changing the writing performance of students with learning disabilities. *Journal of Learning Disabilities, 35*, 290–305.

van den Bergh, H., & Rijlaarsdam, G. (1996). The dynamics of composing: Modeling writing process data. In C. Levy & S. Ransdell (Eds.), *The science of writing* (pp. 207–232). Mahwah, NJ: Erlbaum.

Vanderberg, R., & Swanson, H. L. (2007). Which components of working memory are important in the writing process? *Reading and Writing, 20*, 721–752.

Wager, T. D., & Smith, E. E. (2003). Neuroimaging study of working memory: A meta-analysis. *Cognitive, Affective, and Behavioral Neuroscience, 3*, 255–274.

Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology, 25*, 68–81.

Willingham, D. (1998). A neuropsychological theory of motor skill learning. *Psychological Review, 105*, 558–584.

Zimmerman, B., & Risemberg, R. (1997). Becoming a self-regulated writer: A social cognitive perspective. *Contemporary Educational Psychology, 22*, 73–101.

Zumbrunn, S., & Bruning, R. (2013). Improving the writing and knowledge of emergent writers: The effects of self-regulated strategy development. *Reading and Writing: An Interdisciplinary Journal, 26*, 91–110.

CHAPTER 3

Writing Research through a New Literacies Lens

Donald J. Leu, David Slomp, Lisa Zawilinski, and Julie A. Corrigan

The Internet is a profoundly disruptive force, altering many elements of society (Christensen, 1997), including the nature of writing. Writing is shifting from page to screen, where new tools continuously appear, requiring new literacies to fully exploit their potential (Kist, 2005). These new literacies are not just new today, they are new every day of our lives as new tools for writing are continuously distributed online, each containing new affordances and requiring additional social practices, skills, strategies, and dispositions.

How can we develop adequate theory when the object that we study rapidly changes? Our field has never faced such a conundrum; literacy has generally been static, permitting us, over time, to carefully study and understand it. Recently, a dual-level theory of new literacies has been proposed to respond to this problem (Leu, Kinzer, Coiro, Castek, & Henry, 2013), conceptualizing theory on two levels: uppercase (New Literacies) and lowercase (new literacies).

New Literacies, as the broader concept, benefits from work taking place in the multiple, lowercase dimensions of *new literacies*, where rapid changes are more easily studied and identified. Lowercase new literacies research currently explores several phenomena in relation to online technologies: (1) the additional social practices and processes required as a result of the Internet, such as online writing and communication (e.g., Greenhow, Robelia, & Hughes, 2009); (2) a developing disciplinary base, such as the semiotics of multimodality in online media (e.g., Jewitt & Kress, 2003) or gaming (e.g., Gee, 2003); or (3) a broader conceptual approach such as new literacy studies (e.g., Street, 2003). Common findings across multiple perspectives may then be integrated into a broader New Literacies theory that is likely to be more stable over time. The greater stability of New Literacies theory may provide theoretical direction to inform the multiple and rapidly changing contexts at lowercase levels.

New Literacies, the uppercase theory, includes the common principles that appear across most or all areas. These are likely to be more stable in a context in which the technologies of literacy rapidly change. Eight principles were recently identified to be generally common to multiple lowercase lines of research in new literacies:

1. The Internet is this generation's defining technology for literacy and learning within our global community.
2. The Internet and other technologies require New Literacies to fully access their potential.
3. New Literacies are deictic.
4. New social practices are a central element of New Literacies.
5. New Literacies are multiple, multimodal, and multifaceted, and, as a result, our understanding of them benefits from multiple points of view.
6. Critical literacies are central to New Literacies.
7. New forms of strategic knowledge are required with New Literacies.
8. Teachers become more important, though their role changes, in new literacy classrooms. (Leu et al., 2013. p. 1158)

New Literacies theory takes an open-source approach, inviting everyone who systematically studies the Internet's impact on literacy to contribute to theory development and to benefit from others' contributions. This approach permits everyone to fully explore their unique, lowercase perspective of new literacies, allowing scholars to maintain close focus on many different aspects of the rapidly shifting landscape of literacy during a period of rapid change. By assuming change in the model, everyone is open to an evolving definition of New Literacies. This definition evolves based on the most recent and consistently emerging data across multiple perspectives, disciplines, and research traditions.

The purpose of this chapter is to consider a developing perspective for how we might think about writing with a lowercase new literacies lens. We begin with a broad view to look at the changes in writing taking place as new technologies redefine what it means to be a writer. A range of new conceptions about writing are integrated around two ideas: (1) conceptual knowledge about the nature of writing and (2) metacognitive knowledge about the best ways to solve problems that emerge during writing. Next, we focus on the new literacies of writing at two developmental levels: adolescents and young children. Finally, we look across these areas to identify common themes that may be used to describe current work in the new literacies of online writing and communication.

A BROAD VIEW OF WRITING: NEW TECHNOLOGIES REDEFINE WHAT IT MEANS TO BE A WRITER

The mechanical age is being surpassed by the digital age, one that sees an intertwining of digitality and literacy (Stroupe, 2000). Increasing use of the Internet for communication purposes has raised the profile and importance of written communication and has provided us with an ever-shifting array of technologies and modalities for writing (Leu et al., 2013). These technological changes are causing a shift in what it means to be literate (Jewitt & Kress, 2003). The changes require writers to develop both new technological knowledge needed to compose multimodal texts and the knowledge needed to function effectively within the ethos that is born of these technological shifts (Lankshear & Knobel, 2007).

In concert with these technological changes, the global economy has moved increasingly away from a long-term stable career model toward a focus on hiring a largely contingent workforce that shifts between jobs as demand requires (Pennell, 2007). While writing knowledge is contextually bound, these trends demonstrate that the contexts in which and from which people write are legion and shifting (Brandt & Clinton, 2002). The implications of these changes for writing instruction are clear: More than ever before, student writers need to learn not simply how to write specific texts and genres, but more significantly, how *to continually learn to write* across this ever-changing constellation of technologies, modalities, and contexts.

This shift in thinking implies a new developmental foundation for today's writers, one focused on developing the capacity to *transfer* (Royer, Mestre, & Dufresne, 2005), *generalize* (Wardle, 2007), or *transform* (Brent, 2011) knowledge about writing learned in one context, so that it can be enacted in new contexts. This focus on *transliteracy* (Alexander, 2009) repudiates Thorndike and Woodworth's (1901) assertion that knowledge is constructed incrementally, instead compelling us to move "beyond a pyramid-like, sequential model of literacy development . . . [because we] expect complex thinking to develop alongside and with beginning skills" (Yancey, 2009, p. 6).

Different models (Smit, 2004; Beaufort, 2007; White, Elliot, & Peckham, 2015) have been proposed for articulating this new definition of writing ability. The specific elements of these models can be combined around two broad categories of writing knowledge: "conceptual knowledge about the nature of writing" and "metacognitive knowledge about the best way of solving the problems of writing" (Davies & Birbili, 2000, p. 441).

Conceptual Knowledge about Writing

Several frameworks define conceptual knowledge about writing and capture both the technical knowledge and knowledge about how to navigate the new ethos emerging from these new technologies.

Composition as Design

The multiliteracies concept of design (The New London Group, 1996) shifts our attention away from thinking about writing in terms of products and instead focuses our attention on the act or process of production. It also highlights the multimodal nature of composition. Written composition has long been associated with visual design elements, including font design, choice of margins and line spacing, and the use of headings (George, 2002). Each of these visual design choices is loaded with meaning. In a world of multimodal composition, this becomes especially important (Duncum, 2004, p. 259). *Composition as design* (George, 2002), then, recognizes that multimodal design choices are as important to the creation of text as are choices of diction, syntax, and structure. This concept of design also fits well with sociocultural theories of transfer as writers repurpose available design material in their own redesign work. During this process, writers draw on collective practice "influenced by global flows of media [and situated] within local contexts" to create meaning (Black, 2009, p. 399). They also draw on intertextual knowledge, which involves "borrowing, appropriating, juxtaposing, blending, remixing, and recontextualizing" material into new texts (Lewison & Heffernan, 2008, p. 457).

Beaufort's Conceptual Model of Expertise in Writing

Beaufort's (2007) conceptual model describes the broad knowledge domains that writers draw on when engaging in this design work. Although the model was developed with a more traditional view of composition in mind, it adequately describes the knowledge domains necessary for multimodal forms of writing as well.

Similar to notions of problem-based learning (Savery & Duffy, 1995), composing can be understood as a problem-solving exercise. For each writing task, writers are required to deconstruct the rhetorical context for which they are writing and then create a text that responds to what was learned in the process of deconstruction. Beaufort's model describes five knowledge domains writers use to solve the writing problems presented to them: discourse community knowledge, rhetorical knowledge, genre knowledge, writing process knowledge, and subject matter knowledge.

Discourse Community Knowledge

Discourse community knowledge involves a writer's ability to understand and respond to the values and expectations of the communities within which or for which one is writing. Failure to meet those expectations reduces a writer's ability to reach or integrate into that discourse community (Alexander, 2009). Within the framework of new literacies, this challenge becomes greater because the capacity to write online exposes writers to an increasingly diverse array of discourse communities. Social networking platforms such as Twitter, Facebook, Blogger, and Linkedin expose writers to multiple online discourse communities with a single posting.

Rhetorical Knowledge

Rhetorical knowledge involves the capacity to deliver on the intention that motivates a writer's creation of text. Given its roots in oration, it is not difficult to see how the concept of rhetorical knowledge can be applied to the creation of multimodal text. The New London Group's (1996) concept of design defines rhetorical mechanics as a means to create, imagine, improvise, and enact meaning in oral, print, and multimodal contexts (Rice, 2008). The expansion of communication forms available today greatly enhances the challenges involved in developing and applying rhetorical knowledge. Writers need to understand how to deliver on intentions through their choice and organization of words on a page; through the choice and design of images, sounds, and spaces (both virtual and concrete); and through the integration and juxtaposition of design choices across these available modalities.

Genre Knowledge

Genres are context-specific, complex, and recurring tools used to accomplish work central to a discourse community. They signal insider status, structure ideas in expected ways, establish interactional patterns within communities, and evolve in response to group needs and behaviors. Within the context of a new literacies framework, we understand the challenge of developing genre knowledge not to be limited to acquiring the capacity to create text that meets the expectations of specific genres. More importantly, it involves developing the capacity to analyze discourse communities, understanding the range of genres employed within those communities, the purposes each of those genres serves, and how specific features of those genres have been designed to meet the needs of those communities.

Writing Process Knowledge

Writing process knowledge involves developing an understanding of the skills and strategies involved in the design of text. The Internet has radically changed the way people collaborate on the creation of text. The new ethos that emerges around these collaborative platforms and within the communities that use them redefines writing process knowledge in terms of a participatory process model (Lankshear & Knobel, 2007). Today's writers, then, need to understand more than simply the range of strategies and process tools that will enable them to create texts, they also need to understand how to function effectively within the ethos of the communities within which they are writing (Alexander, 2009).

Subject Matter Knowledge

Developing subject matter knowledge involves gaining an understanding of both the content one is writing about and how one's discourse community comprehends that subject matter. This is not to say that a text needs to pander to the perspective of the discourse community, but it does mean that regardless of whether or not it agrees with or challenges a community's perspective, such a text needs to at least emerge from a shared understanding of that content.

Metacognitive Knowledge

Both Beaufort's model and the New London Group's concept of design focus on metacognition—the capacity of writers to make purposeful choices and to reflect upon and refine this decision-making process. These models compel us to focus on the development of writing ability with a view to metacognitive processes more than a view to products. The product, after all, is an imperfect illustration of the metacognitive design work the writer has engaged in: It masks both the gaps between what a writer knows and is able to do, and the gap between what a writer can do and the writer's understanding of why he or she does this.

More pointedly, Hacker, Keener, and Kircher (2009) define writing ability as applied metacognition. The theory of writing they propose emphasizes both the monitoring and control functions of metacognitive thought. Within this model, reading, rereading, reflecting, editing, drafting, generating ideas, producing words, translating, diagnosing, and revising are used as either monitoring or control strategies that drive text creation (p. 161).

Current metacognitive theory recognizes that both sociocultural and historical realities of literacy, along with an individual's cognitive processes, interact in the process of creating text (Hacker et al., 2009). Similarly, the concept of design is an attempt to explain how we make meaning through various communication technologies, as situated individuals who both act on and are acted upon by the cultures in which we live (Sefton-Green, 2006).

Situated Metacognition

Conceptualizing writing as situated metacognition carries with it implications for teaching, assessment, and research into how writing ability develops. When we study the development of writing ability, we need to understand how that development occurs, both in terms of the contextual factors that support or hinder development and in terms of the intrapersonal factors that shape development. This ecological model of development acknowledges that individuals, their knowledge about writing, and the social contexts in which they write are all dynamic (Roozen, 2009; Beach, 1999; Tuomi-Gröhn & Engeström, 2003). Few studies using an ecological lens focus on the role that intrapersonal factors play in the development of writing ability (Slomp, 2012). Yet, evidence that intrapersonal factors in writing development matter is clear. O'Byrne and McVerry (2009), for example, point out that an individual's disposition toward technology is important to their online reading ability. Clearly, this would also impact their online writing ability as well. Rowsell and Pahl (2007) demonstrate that the texts children create "hold traces of literacy practices that tap into prior experiences and sediment layers of identities, social practices, and dispositions learned at home and school" (Wohlwend, 2009, p. 59). In addition, Pajares (2003) demonstrates that students' self-beliefs can have either positive or negative impacts on their development as writers.

Driscoll and Wells (2012) and Slomp (2012) point out that a new literacies conception of writing necessitates a more complex research agenda than earlier conceptions demanded. It requires examining the intrapersonal, institutional, and broader contextual factors that shape the demands that writers face, and it also requires examining how writers acquire and repurpose knowledge about writing as they apply it across a range of contexts. In our current moments of transition within the field, it also demands that we pay attention to how new literacies are being

taken up in schools and to the contextual factors that either support or limit the adoption of these new literacies practices in schools.

ADOLESCENTS AND WRITING IN AN AGE OF NEW LITERACIES

Adolescents are often considered the innovators and trendsetters of our society (Tufte, Rasmussen, & Christensen, 2005), rapidly pushing the boundaries of writing and language, more generally. What does this mean for the secondary English classroom? This section examines this issue.

Adolescents' Out-of-School Writing Practices

Outside the classroom, students are developing highly skilled new literacy practices that extend far beyond traditional notions of writing. For the most part, however, these out-of-school literacies go undervalued and the potential knowledge transfer unrecognized (Alvermann, 2011). A growing body of research on adolescents' out-of-school literacies shows teens developing skills, strategies, dispositions, and social practices across a range of communication technologies such as video games (Gee, 2003), digital storytelling (Hull & Katz, 2006), instant messaging (Lewis & Fabos, 2005), and online fan fiction (Black, 2009).

As Sanford and Madill (2007) noted in their study about understanding new literacies through video game play and design, the "unique richness of [adolescent boys'] literate lives is not being recognized in school" and "teachers do not understand or ignore many of their literacy practices" (p. 435). The researchers discovered that, despite participants' lack of success on traditional literacy assessments, the participants in the study demonstrated tremendous skill with reading and writing "non-linear, multi-layered, intertextual texts, as well as reading [and writing] images and other semiotic sign systems" (Sanford & Madill, 2007, p. 434). A growing number of researchers are recognizing the value of the literacy and problem-solving practices developed through video game play (Gee, 2003; Lankshear & Knobel, 2003).

Of course, it is not only through video games that students are developing these highly skilled new literacies practices. In a multiyear digital storytelling project set in a community center, Hull and Katz (2006) document how two young adults became emerging authors while engendering in themselves a sense of agency, all the while developing highly technical multimedia skills. Yet another study looked at the functions of instant messaging among youth, documenting how the teens used IMing to manipulate tone, voice, word choice, and subject matter; designed complex social relationships and statuses across contexts; circulated certain texts while combating unwanted ones, assumed alternative identities, and found ways around gatekeeping designed to keep their IMing restricted (Lewis & Fabos, 2005). Research is also mounting regarding how English language learners use technology to extend other technological and language skills. For example, youth participating in online fan fiction communicated using multiple forms of language and multimodal representations, developed transnational social networks, and experimented with new genres and formats for composition (Black, 2009). Yet, while adolescents increasingly experiment with notions of writing in and out of school settings, these new forms of literacies are not always recognized at school (Chandler-Olcott & Mahar, 2003).

Challenges with Integrating New Communication Practices in the Classroom

Research has uncovered a number of challenges with integrating new communication practices in the secondary

classroom. An important disincentive to teaching new communication practices is that, by and large, these are not a part of the construct included in large-scale writing assessments (Slomp, Corrigan, & Sugimoto, 2014; Stagg Peterson, McClay, & Main, 2011). Indeed, it would seem that if it is tested, it will be taught. In assessment, this refers to the concept of washback, the extent to which a test influences what is, or is not, being taught in the classroom (Messick, 1996). Stagg Peterson et al. (2011) problematize the lack of large-scale assessments of new literacies by highlighting how removed these tests are from the "actual literacy practices of literate people" (p. 439) and warn about the growing irrelevance of such outdated tests.

Outdated standardized testing alone cannot be blamed for the deficit of digital writing. Various studies cite lack of proper infrastructure to be a factor in discouraging teachers from implementing new communication practices; for example, it is not uncommon for a computer to be shared among five or more students (Honan, 2008; Lowther, Ross, & Morrison, 2003). Another barrier to implementation is teachers' lack of knowledge regarding new semiotic systems associated with new literacies (Bruce, 2009). The words of a teacher participant in Honan's (2008) study of the barriers teachers face in implementing digital texts in the literacy classroom are telling: "you treat digital texts the way you would treat any other texts" (p. 42), said one teacher, a point with which the other teacher participants agreed. Many teachers are either afraid to lose their role of "sage on the stage" as teens bring an impressive array of expertise into the classroom or, like the teacher in Honan's study, they remain unaware of the differences. Whatever the trajectory may be for new literacies in the classroom, one thing is certain: Teachers will play a central role in determining what new communication practices, if any, will be implemented, as well as how they will be implemented (Edwards-Groves, 2011).

When secondary schools do implement new literacy practices, they face a variety of challenges. One challenge schools face is providing appropriate professional development so that teachers can focus on supporting the development of new social practices as well as the encoding and decoding of digital texts, rather than technical or operational skills such as keyboarding, word processing, and using various software programs (Honan, 2008). Teachers' overattention to technical skills stems from their failure to understand the new literacies that their students bring to the classroom, and how students might transpose skills gained from using new technologies into new contexts (Honan, 2008).

In addition, teachers often require training to incorporate additional instructional approaches into their classrooms that are consistent with the communication and problem-solving affordances that exist with digital technologies. It is common to see claims in studies about the need for students to develop computer skills applicable to solving real-life problems; as such, "constructivist theoretical orientations encourage student uses of the computer-as-a-tool for active inquiry and problem solving" (Lowther et al., 2003, p. 24). This orientation runs contrary to what sometimes happens in the classroom where technology is used in teacher-centered approaches as simply a presentation tool, a means of entertainment, and a way to have students practice skills (Lowther et al., 2003; Windschitl & Sahl, 2002). Even in schools with one-to-one laptop programs, teachers often maintain teacher-centered approaches reflective of their school's institutional practices and their beliefs about what constitutes good teaching—unless otherwise dissatisfied with these approaches (Windschitl & Sahl, 2002).

In terms of promising practices regarding the integration of new communication technologies, studies show how some innovative classrooms bridge learning between in-school and out-of-school literacy practices via a productive *third space* where "alternative and competing discourses and positionings transform conflict and difference into rich zones of collaboration and learning" (Gutiérrez, Baquedano-López, & Tejeda, 1999, p. 286). In such a third space, teachers recognize the competing discourses that students bring to the classroom not from a deficit model (focusing on how students fail to appropriate standard English and academic discourse), but rather from the perspective of harnessing the diversity and complexity of a variety of literary practices, both digital and cultural, to enrich and

extend communication. For example, in a study of students' blogging practices in an 11th-grade Advanced Placement American literature class, teacher/researcher Kathleen West (2008) noticed students using hybridized discursive patterns, as formal academic and informal digital languages competed for primacy. Students played with identities, at times assuming the identity of a Web-savvy communicator by appropriating conventions associated with texting and IMing such as an informal discourse style; the frequent use of abbreviations and acronyms; and a relaxed stance toward standard English. At other times, students assumed the role of the literary scholar by evaluating characters, defending theories, and developing complex argumentation. Assuming different identities in a third space often allows students to take risks in the classroom while exploring challenging concepts (West, 2008).

Although research is accruing regarding the role of third space (Lotherington, 2004; Smythe & Neufeld, 2010), other research also shows successful new communication practices in a more traditional, discipline-specific manner. Many disciplines now rely on multimodal representations to communicate knowledge and ideas. New literacies recognizes that literacy is about more than letteracy (Lankshear & Knobel, 2008), instead viewing literacies as multiple, multifaceted, and multimodal. Studies are accruing that show the benefits of multimodality for learning disciplinary practices for both representing ideas and differentiating instruction and assessment. Gunel, Hand, and Gunduz (2006), for example, discovered that students who were required to represent their thinking using a greater range of modalities outperformed a control group. Studies also show that multimodal communication helps to differentiate instruction and assessment, although these studies concerned primary students (Smythe & Neufeld, 2010; Sylvester & Greenidge, 2009). Further studies are needed concerning this topic for secondary students.

YOUNG CHILDREN AND WRITING IN AN AGE OF NEW LITERACIES

Knowing about the early development of new literacies in writing can inform our ability to support student growth in this area at all ages (Marsh, 2011). As we review the research that exists with young children and writing, three patterns arise. First, there is a paucity of studies examining young children's writing and new literacies. Next, studies of young children tend to examine writing as the creation of a common genre product rather than written communication between the student and others. Finally, existing studies use a relatively narrow range of research methodologies.

A Paucity of Studies Examine Young Children's Writing and New Literacies

Despite the importance of this area, few studies are currently available that systematically study young children's writing and new literacies. Of the few studies that exist, some examine out-of-school contexts, whereas others examine writing and new literacies work in the classroom through a multimodal lens. Relatively few studies, to date, examine writing in the classroom with Internet technologies.

Out-of-School Contexts

Wollman-Bonilla (2003) studied one 6-year-old's use of email at home before the school year began. A variety of differences between the child's handwritten messages and the email exchanges appeared. The email messages were abbreviated and informal, and lacked the use of more typical conventions as compared with handwritten products. In another study of a popular virtual world, children used online communication to develop identities and experience with online interactions. Marsh (2011) observed children, ages 5–11, interacting online in Club Penguin. In this

study, online writing served to create and maintain a sense of social order and friendships. Children negotiated online interaction order as they participated in the virtual world. Knowledge of and skill with determining an effective interaction sequence seemed to be an important new literacies skill. Although these studies provide an initial look at new literacies, writing, and young children, we need to understand much more about how embedding new literacies instruction in young children's classrooms influences their written communication skills, strategies, and dispositions.

Writing and New Literacies Work in the Classroom through a Multimodal Lens

Edwards-Groves (2011), Ranker (2007), Schaenen (2013), and Vincent (2006) examined the role of technology and media in children's creation of multimodal products. These studies examined writing, through the lens of design, and considered the choices children made with available media and technology, especially composing with multiple modes such as text and image. This research seems to suggest that teachers and researchers should reexamine what is considered "text," to include multimodal elements. Findings demonstrate that expanding our definition of text in this way can scaffold children's complex understandings, shed light on their identities as writers, and bring together in school the digital media conventions children experience outside of school. However, these studies of multimodality, though conducted in classroom contexts, did not examine writing and new literacies in online contexts.

Writing in the Classroom Using Internet Technologies

A few studies of new literacies and writing in classroom contexts begin to do this. Handsfield, Dean, and Cielocha (2009) examined the use of blogs in fourth-grade classrooms and discovered that students gave more attention to revision and editing because they were writing for their peers who would read their writing on the blog. Zawilinski (2012) found that, while communicating with one another on a blog, first and fifth graders developed new literacies specific to written communication. In addition, young students were quite willing to teach new literacies strategies to one another and their teachers. Pifarré and Li (2012) examined the use of a wiki to support collaborative learning in a primary classroom. Findings in this study suggest the importance of clearly defining the task, the role of the student, and the role of the teacher. When these elements are considered, a wiki was found to enhance student collaboration and learning. Merchant (2009) examined the use of a 3D virtual world in primary classrooms. Findings suggest a disconnect between classroom routines around literacy and the new forms of literacy necessary when participating in digital and virtual contexts.

The studies reviewed suggest that the integration of Internet communication technologies within the classrooms of young children is rare but can be beneficial. Young children can develop new literacies. Also, collaborative learning can be enhanced when Internet technologies are included within classroom instruction. However, most of the current research on writing instruction seems to emphasize creating written products rather than ongoing communication using Internet technologies.

Writing as the Creation of a Traditional Genre Product Rather Than as Written Communication

Current research, examining in-school writing and new literacies, often focus on traditional offline genres such as narrative and biographies using digital tools such as word processors. Work exploring young children's use of online tools to communicate through writing is limited. Lotherington (2005) examined the creation of digital, postmodern

fairy tales. Ranker (2007) and Sylvester and Greenidge (2009) examined students' creation of digital stories. In a study of children's writing and multimodal communication, Schaenen (2013) examined young children's identity as writers through the composing of biography, and argument artifacts. Many studies focus on the genres associated with traditional school writing, and prioritize text over other elements (images, video, etc.) that communicate information and support understanding. Vincent (2006) noted that multimodal literacies are not necessarily valued in young children's curriculum, suggesting that printcentric perceptions exist in writing classrooms with young children.

In a recent study, Hawkins and Razali (2012) examined primary documents from the last 100 years of elementary writing instruction and found that writing instruction has focused on penmanship, product, and process. They note that entire sections of recent curriculum guides focus on the creation of a variety of genre products (Hawkins & Razali, 2012). Cutler and Graham (2008) surveyed primary grade teachers about their writing instruction. Survey items included typical writing products (e.g., book reports, personal narratives, and biographies) to the exclusion of other types of written communication. The creation of traditional written products of specific genres, primarily narrative, seems to dominate recent studies of young children's writing in school.

With much of the focus on constructing traditional genres, there has been only limited research into online written communication with young children. Missing in classroom research is writing instruction that emphasizes the audience's needs, an important aspect of written communication online. The audience for student writing in traditional genres is typically some distant, unknown other or the teacher and classmates. Thus, studies appear to emphasize some of Beaufort's (2007) concepts, namely, genre knowledge and writing process knowledge, but they largely exclude discourse community knowledge beyond the school or the classroom. This seems problematic, as understanding audience needs is important during online communication, a skill important to our students' future.

The Internet contexts that currently exist require the communicator or producer of the message to consider the reader, receiver, or audience. The failure to teach young children to think about an audience for written communication is an important issue. Perhaps more opportunities to communicate with others through safe Internet technologies would provide a necessary first step in developing broader discourse community knowledge. In addition, if considered from Bronfenbrenner and Morris's (2006) bioecological model of human development mentioned earlier, "proximal processes—socially constructed methods of interaction between individuals, objects, and symbols within a person's environment" could be developed earlier rather than later. Providing opportunities for young students to interact with others, through written communication online, might be a useful step in a developmental trajectory for supporting the acquisition of new literacies in writing.

Existing Studies Use a Relatively Narrow Range of Research Methodologies

A focus on qualitative designs and small sample sizes is not surprising given the sparse research corpora examining young children, writing, and new literacies. The majority of studies of young children's writing and new literacies have utilized a case study design (e.g., see Edwards-Groves, 2011; Ranker, 2007; Schaenen, 2013; and Vincent, 2006). In addition, many of the studies used either multimodal, semiotic, or discourse analytic methods of data analysis. These methods provide important information upon which other studies can build. However, the complexity of writing, new literacies, and communication calls for increased attention to additional and multiple types of designs and methods of analysis. For example, design-based research (Barab & Squire, 2004) and formative experiment designs (Reinking & Bradley, 2008) might provide direction about how best to organize and integrate online written communication with other classrooms. These types of studies, examining the communication shared between students through both multimodal and new literacies lenses, might provide important information about the

skills, strategies, and dispositions developed as children communicate through online writing. These approaches may help researchers and practitioners to better understand the developmental trajectory, beginning in early grades, necessary to help prepare students for the complex, participatory society that awaits them.

PATTERNS IN THE NEW LITERACIES OF ONLINE WRITING AND COMMUNICATION RESEARCH

The purpose of this chapter has been to develop an initial perspective for how we might think about writing within a lowercase new literacies lens. Our review has considered research from both a broad perspective and two developmental levels: adolescents and young children. Several initial patterns have emerged.

It is clear that the Internet is bringing about profound changes in the nature of writing, especially as it increases the use of writing for online communication. It is also clear that we are only beginning to consider these changes in our research and in classrooms as we rethink the nature of writing in an online world. Much more will be required in both areas.

As youths are often innovators with respect to the adoption and use of technology, we need to ensure that the gap between their out-of-school writing practices are linked to their in-school writing experiences. Perhaps, as Comber and Kamler (2005) suggest, we now require "turnaround" pedagogies for reconnecting youth with the academic literacies of school. Our review of research indicates an important need to engage in identifying the factors and strategies affecting successful integration of new literacy practices with writing in school classrooms. We have far too little research from far too limited a set of methodologies to thoughtfully inform our way forward with developing online writing ability. The need is especially acute among our youngest students.

Studying writing within a new literacies framework also requires a focus on how writing ability develops from the earliest levels to the highest levels of proficiency as well as how transferable knowledge about writing is cultivated. This work needs to recognize the complete and complex nature of development. Without looking at the full picture —person, context, and time—in which writing tasks are completed, it is difficult to understand when and how this transfer is or is not occurring (Slomp, 2012).

Related is the need to understand the challenges that teachers face as they work to implement changes in writing pedagogies. As with students, teacher development is best understood through a rich and complex lens. Person, context, and time all play a role in determining the extent to which change does or does not occur. Specifically, the research we reviewed points to challenges related to the following: intrapersonal factors such as teachers' resistance to new technologies, decentered classrooms, and distribution of expertise within the classroom; contexts such as the constraints imposed by high-stakes assessment and issues connected to accessing new technologies; and the speed with which technological change is occurring today. The latter poses special challenges for the reconceptualization of research, teaching, and assessment practices.

The more we learn about writing, the development of writing ability, and the teaching of writing, the more complex we realize this work to be. This complexity highlights the need for more integrated theories of writing, writing development, writing pedagogies, and writing assessment practices within new literacies practices. It also highlights the need for more integrated approaches to researching these issues, including the use of a greater variety of research methodologies. Clearly, we have much to discover together.

ACKNOWLEDGMENTS

Portions of this material are based on work supported by both the U.S. Department of Education under Award No.

R305G050154 and R305A090608 and by a grant from the Social Sciences and Humanities Research Council of Canada. Opinions expressed herein are solely those of the authors and do not necessarily represent the position of the U.S. Department of Education, Institute of Education Sciences. We would like to thank Yanna Martinek and Nicole Timbrell for their work as research assistants on this project.

REFERENCES

Alexander, J. (2009). Gaming, student literacies, and the composition classroom: Some possibilities for transformation. *College Composition and Communication, 61*(1), 35–63.

Alvermann, D. E. (2011). Popular culture and literacy practices. In M. L. Kamil, P. D. Pearson, E. B. Moje, & P. P. Afflerbach (Eds.), *Handbook of reading research* (Vol. 4, pp. 541–560). New York: Routledge/Taylor Francis & Group.

Barab, S. A., & Squire, K. D. (2004). Design-based research: Putting a stake in the ground. *Journal of the Learning Sciences, 13*(1), 1–14.

Beach, K. (1999). Consequential transitions: A sociocultural expedition beyond transfer in education. *Review of Research in Education, 24*(1), 101–139.

Beaufort, A. (2007). *College writing and beyond*. Logan: Utah State University Press.

Black, R. W. (2009). Online fan fiction, global identities, and imagination. *Research in the Teaching of English, 43*(4), 397–425.

Brandt, D., & Clinton, K. (2002). Limits of the local: Expanding perspectives on literacy as a social practice. *Journal of Literacy Research, 34*(3), 337–356.

Brent, D. (2011). Transfer, transformation, and rhetorical knowledge: Insights from transfer theory. *Journal of Business and Technical Communication, 25*(4), 396–420.

Bronfenbrenner, U., & Morris, P. A. (2006). The bioecological model of human development. In R. M. Lerner & W. Damon (Eds.), *Handbook of child psychology: Vol. 1. Theoretical models of human development* (6th ed., pp. 793–828). New York: Wiley.

Bruce, D. L. (2009). Writing with visual images: Examining the video composition process of high school students. *Research in the Teaching of English, 43*(4), 426–450.

Chandler-Olcott, K., & Mahar, D. (2003). Tech-savviness" meets multiliteracies: Exploring adolescent girls' technology-mediated literacy practices. *Reading Research Quarterly, 38*(3), 356–385.

Christensen, C. M. (1997). *The innovator's dilemma: When new technologies cause great firms to fail*. Boston: Harvard Business School Press.

Comber, B., & Kamler, B. (2005). *Turn-around pedagogies: Literacy interventions for at-risk students*. Sydney, Australia: Primary English Teaching Association.

Cutler, L., & Graham, S. (2008). Primary grade writing instruction: A national survey. *Journal of Educational Psychology, 100*(4), 907–919.

Davies, C., & Birbili, M. (2000). What do people need to know about writing in order to write in their jobs? *British Journal of Educational Studies, 48*(4), 429–445.

Driscoll, D. L., & Wells, J. (2012). Beyond knowledge and skills: Writing transfer and the role of student dispositions. *Composition Forum, 26*. Available at *http://compositionforum.com/issue/26/beyond-knowledge-skills.php*.

Duncum, P. (2004). Visual culture isn't just visual: Multiliteracy, multimodality and meaning. *Studies in Art Education, 45*(3), 252–264.

Edwards-Groves, C. J. (2011). The multimodal writing process: changing practices in contemporary classrooms. *Language and Education, 25*(1), 49–64.

Gee, J. P. (2003). What video games have to teach us about learning and literacy. *Computers in Entertainment, 1*(1), 1–4.

George, D. (2002). From Analysis to Design: Visual communication in the teaching of writing. *College Composition and Communication, 54*(1), 11–39.

Greenhow, C., Robelia, B., & Hughes, J. (2009). Web 2.0 and classroom research: What path should we take now? *Educational Researcher, 38*, 246–260.

Gunel, M., Hand, B., & Gunduz, S. (2006). Comparing student understanding of quantum physics when embedding multimodal representations into two different writing formats: Presentation format versus summary report. *Science Education, 90*(6), 1092–1112.

Gutiérrez, K. D., Baquedano-López, P., & Tejeda, C. (1999). Rethinking diversity: Hybridity and hybrid language practices in the third space. *Mind, Culture, and Activity, 6*(4), 286–303.

Hacker, D. J., Keener, M. C., & Kircher, J. C. (2009). Writing is applied metacognition. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), *Handbook of metacognition in education.* New York: Routledge.

Handsfield, L. J., Dean, T. R., & Cielocha, K. M. (2009). Becoming critical consumers and producers of text: Teaching literacy with Web 1.0 and Web 2.0. *The Reading Teacher, 63*(1), 40–50.

Hawkins, L. K., & Razali, A. B. (2012). A tale of 3 P's—Penmanship, product, and process: 100 years of elementary writing instruction. *Language Arts, 89*(5), 305–317.

Honan, E. (2008). Barriers to teachers using digital texts in literacy classrooms. *Literacy, 42*(1), 36–43.

Hull, G. A., & Katz, M.-L. (2006). Crafting an agentive self: Case studies of digital storytelling. *Research in the Teaching of English, 41*(1), 43–81.

Jewitt, C., & Kress, G. R. (2003). *Multimodal literacy*. New York: Peter Lang.

Kist, W. (2005). *New literacies in action: Teaching and learning in multiple media*. New York: Teachers College Press.

Lankshear, C., & Knobel, M. (2003). *New literacies: Changing knowledge and classroom learning*. Buckingham, UK: Open University Press.

Lankshear, C., & Knobel, M. (2007). Researching New Literacies: Web 2.0 practices and insider perspectives. *E–Learning, 4*(3), 224–240.

Lankshear, C., & Knobel, M. (2008). *Digital literacies: Concepts, policies, and practices*. New York: Peter Lang.

Leu, D. J., Kinzer, C. K., Coiro, J., Castek, J., & Henry, L. A. (2013). New literacies: A dual level theory of the changing nature of literacy, instruction, and assessment. In D. E. Alvermann, N. J. Unrau, & R. B. Ruddell (Eds.), *Theoretical models and processes of reading* (pp. 1150–1181). Newark, DE: International Reading Association.

Lewis, C., & Fabos, B. (2005). Instant messaging, literacies, and social identities. *Reading Research Quarterly, 40*(4), 470–501.

Lewison, M., & Heffernan, L. (2008). Rewriting writers' workshop: Creating safe spaces for disruptive stories. *Research in the Teaching of English, 42*(4), 435–465.

Lotherington, H. (2004). Emergent metaliteracies: What the Xbox has to offer the EQAO. *Linguistics and Education, 14*(3), 305–319.

Lotherington, H. (2005). Writing postmodern fairy tales at Main Street School: Digital narratives and evolving transliteracies. *McGill Journal of Education, 40*(1), 109–119.

Lowther, D. L., Ross, S. M., & Morrison, G. M. (2003). When each one has one: The influences on teaching strategies and student achievement using laptops in the classroom. *Educational Technology Research and*

Development, 51(3), 23–44.

Marsh, J. (2006). Popular culture in the literacy curriculum: A Bourdieuan analysis. *Reading Research Quarterly, 41*(2), 160–174.

Marsh, J. (2011). Young children's literacy practice in a virtual world: Establishing an online interaction order. *Reading Research Quarterly, 46*(2), 101–118.

Merchant, G. (2009). Literacy in virtual worlds. *Journal of Research in Reading, 32*(1), 38–56.

Messick, S. (1996). *Validity and washback in language testing* (pp. 1–18). Princeton, NJ: Educational Testing Service.

The New London Group. (1996). A pedagogy of multiliteracies: Designing social futures. *Harvard Educational Review, 66*(1), 60–92.

O'Byrne, W. I., & McVerry, J. G. (2009). Measuring the dispositions of online reading comprehension: A preliminary validation study. In K. Leander, D. Rowe, D. Dickson, M. Hundley, R. Jiménez, & V. Risko (Eds.), *The 57th National Reading Conference Yearbook* (pp. 362–375). Oak Creek, WI: National Reading Conference.

Pajares, F. (2003). Self-efficacy beliefs, motivation, and achievement in writing: A review of the literature. *Reading and Writing Quarterly, 19*(2), 139–158.

Pennell, M. (2007). "If Knowledge Is Power, you're about to become very powerful": Literacy and labor market intermediaries in postindustrial America. *College Composition and Communication, 58*(3), 345–384.

Pifarré, M., & Li, L. (2012). Teaching how to learn with a wiki in primary education: What classroom interaction can tell us. *Learning, Culture and Social Interaction, 1*(2), 102–113.

Ranker, J. (2007). Designing meaning with multiple media sources: A case study of an eight-year-old student's writing processes. *Research in the Teaching of English, 41*(4), 402–434.

Reinking, D., & Bradley, B. A. (2008). *On formative and design experiments: Approaches to language and literacy research*. New York: Teachers College Press.

Rice, J. E. (2008). Rhetoric's mechanics: Retooling the equipment of writing production. *College Composition and Communication, 60*(2), 366–387.

Roozen, K. (2009). "Fan Fic-ing" English Studies: A case study exploring the interplay of vernacular literacies and disciplinary engagement. *Research in the Teaching of English, 44*(2), 136–169.

Rowsell, J., & Pahl, K. (2007). Sedimented identities in texts: Instances of practice. *Reading Research Quarterly, 42*(3), 388–401.

Royer, J. M., Mestre, J. P., & Dufresne, R. J. (2005). Introduction: Framing the transfer problem. In J. P. Mestre (Ed.), *Transfer of learning from a modern multidisciplinary perspective* (pp. vii–xxvi). Greenwich, CT: Information Age Publishing.

Sanford, K., & Madill, L. (2007). Understanding the power of New Literacies through video game play and design. *Canadian Journal of Education / Revue canadienne de l'éducation, 30*(2), 432–455.

Savery, J. R., & Duffy, T. M. (1995). Problem based learning: An instructional model and its constructivist framework. *Educational Technology, 35*(5), 31–38.

Schaenen, I. (2013). Hand-I coordination: Interpreting student writings and drawings as expressions of identity. *The Qualitative Report, 18*(24), 1–22.

Sefton-Green, J. (2006). Youth, technology, and media cultures. *Review of Research in Education, 30*, 279–306.

Slomp, D. H. (2012). Challenges in assessing the development of writing ability: Theories, constructs and methods. *Assessing Writing, 17*(2), 81–91.

Slomp, D. H., Corrigan, J. A., & Sugimoto, T. (2014). A framework for using consequential validity evidence in evaluating large-scale writing assessments. *Research in the Teaching of English, 48*(3), 276–302.

Smit, D. (2004). *The end of composition studies.* Carbondale, IL: Southern Illinois University Press.

Smythe, S., & Neufeld, P. (2010). "Podcast time": Negotiating digital literacies and communities of learning in a middle years ELL classroom. *Journal of Adolescent and Adult Literacy, 53*(6), 488–496.

Stagg Peterson, S., McClay, J., & Main, K. (2011). An analysis of large-scale writing assessments in Canada (grades 5–8). *Alberta Journal of Educational Research, 57*(4), 424–445.

Street, B. (2003). What's new in new literacy studies? *Current Issues in Comparative Education, 5*(2), 1–14.

Stroupe, C. (2000). Visualizing English: Recognizing the hybrid literacy of visual and verbal authorship on the web. *College English, 62*(5), 607–632.

Sylvester, R., & Greenidge, W. (2009). Digital storytelling: Extending the potential for struggling writers. *The Reading Teacher, 63*(4), 284–295.

Thorndike, E. L., & Woodworth, R. S. (1901). The influence of improvement in one mental function upon the efficiency of other functions. *Psychological Review, 8*, 247–261.

Tufte, B., Rasmussen, J., & Christensen, L. B. (Eds.). (2005). *Frontrunners or copycats?* Copenhagen, Denmark: Copenhagen Business School Press.

Tuomi-Gröhn, T., & Engeström, Y. (2003). Conceptualizing transfer: From standard notions to developmental perspectives. In T. Tuomi-Gröhn & Y. Engeström (Eds.), *Between school and work: New perspectives on transfer and boundary-crossing* (pp. 19–38). Kidlington, UK: Elsevier Science.

Vincent, J. (2006). Children writing: Multimodality and assessment in the writing classroom. *Literacy, 40*(1), 51–57.

Wardle, E. (2007). Understanding "transfer" from FYC: Preliminary results of a longitudinal study. *WPA: Writing Program Administration, 31*(1–2), 65–85.

West, K. C. (2008). Weblogs and literary response: Socially situated identities and hybrid social languages in English class blogs. *Journal of Adolescent and Adult Literacy, 51*(7), 588–598.

White, E. M., Elliot, N., & Peckham, I. (2015). *The assessment of writing programs: Very like a whale.* Logan: Utah State University Press.

Windschitl, M., & Sahl, K. (2002). Tracing teachers' use of technology in a laptop computer school: The interplay of teacher beliefs, social dynamics, and institutional culture. *American Educational Research Journal, 39*(1), 165–205.

Wohlwend, K. E. (2009). Damsels in discourse: Girls consuming and producing identity texts through Disney princess play. *Reading Research Quarterly, 44*(1), 57–83.

Wollman-Bonilla, J. E. (2003). E-mail as genre: A beginning writer learns the conventions. *Language Arts, 81*(2), 126–134.

Yancey, K. (2009). *Writing in the 21st century: A report from the National Council of Teachers of English*. Urbana, IL: National Council of Teachers of English.

Zawilinski, L. (2012). *An exploration of a collaborative blogging approach to literacy and learning: A mixed method study*. Unpublished doctoral dissertation, University of Connecticut, Storrs.

PART II

WRITING DEVELOPMENT

CHAPTER 4

Writing Process Theory

A Functional Dynamic Approach

Huub van den Bergh, Gert Rijlaarsdam, and Elke van Steendam

This chapter is an updated and extended version of the chapter published in the first edition of this handbook (2006). We start by presenting key elements of a theory of writing processes, based on observations from studies we conducted over the last 20 years, weaving in support and refinement from other studies. The theoretical framework rests upon the writing process model introduced by Hayes and Flower (1980; see also Hayes's 1996 and 2012 revisions), which we assume readers of this chapter are familiar with (see MacArthur & Graham, Chapter 2, this volume). In accordance with Hayes's 2012 model, we see the writing process as a functional dynamic system, basically involving a relatively small set of cognitive activities that interact with the task environment (i.e., task elements, coauthors, sources, technology, and the emerging text) and that are bound by internal constraints involving a writer's resources (i.e., working memory, genre knowledge, topic knowledge, and linguistic proficiency). A control mechanism regulates this system through metacognitive activities such as goal setting and planning, and through motivational control. In this chapter we focus on the set of cognitive activities and their relations to the quality of the resulting text. Then we discuss factors from the task environment and the resource level that influence the writing process and the relation between writing processes and text quality.

We depart from a weak novice/strong novice paradigm, studying writing process within a relatively homogeneous group (i.e., a certain age level, or a certain grade). In such a group, the variation in processes and writing skill is already so large that we can speak of weak novices and strong novices. In our studies, we investigate the writing process of writers of several age groups, and study the natural variance within these groups. In most cases, we study argumentative writing tasks, with documentation provided (clippings from newspapers and journals, data, tables and figures). Students wrote under think-aloud conditions; protocols were fragmented into cognitive activities, and a jury evaluated the quality of the resulting text written by the students. In later studies, we also captured writing processes via keylogging (Leijten & Van Waes, 2013).

COMPONENTS AND FUNCTIONS

In a study by Breetvelt, van den Bergh, and Rijlaarsdam (1994), all writing process categories in the Hayes and Flower (1980) model contributed to the prediction of resulting text quality, which provided support for the validity of the distinctions Hayes and Flower made regarding these processes. The frequencies of 11 (broad) categories of cognitive activities explained 76% of the (true score) variance in product quality Categories adapted and derived from the Hayes and Flower model and supported in this study were Reading the external sources (assignment, documentation), Planning text (goal setting, generating, structuring), Text production/translating, Text reprocessing (rereading already written text, evaluating already written, revising already written text), and Monitoring (self-instructions, meta-comments, pausing). The contribution of these categories varied in direction, size, and moment in

the process (see Table 4.1).

TABLE 4.1. Summary of Relations between Occurrences of Cognitive Activities and the Quality of the Resulting Text

	Writing episode		
	Start	Middle	End
Reading writing task and documentation	Positive	Negative	Negative
Self-instructions			Positive
Goal setting	Negative	Positive	Positive
Generating ideas	Negative	Positive	
Structuring	Negative	Positive	
Meta comments		Negative	
Pausing		Negative	
Writing/text production		Positive	Positive
Rereading text			Positive
Evaluating text	Positive	Negative	
Revising text	Negative	Negative	

Note. Blank, no significant relation. Data from Breetvelt, van den Bergh, and Rijlaarsdam (1994).

According to the findings from our research, the basic activities identified above are all available during the whole writing process. The functionality of each activity, however, varies during the writing process (e.g., van den Bergh & Rijlaarsdam, 2001). Consequently, the moment at which writers implement a certain activity is critical. In essence, the configuration of planning, production, and reprocessing activities varies during the process to create a good text. As the text grows, the task situation changes, and the system must adapt to these changes. The general patterns we observed with 15-year-olds also appeared with younger children and older students. Van der Hoeven (1997) showed similar patterns with 11-year-olds, Tillema (2012) with 15-year-olds, and van Weijen (2009) with freshmen in college. At different points in the writing process, different cognitive activities dominate the configuration.

A cognitive activity serves a specific purpose, but purposes vary depending on the circumstance. For instance, when text revision activities are common at the beginning of the writing process, this might indicate that a writer is experiencing start-up difficulties, beginning over and over again. Another writer, revising just as frequently as the first one but at the end of the writing process, likely revises with a different purpose. These two periods of Revision function differently. In the first case, the writer may struggle to define the task representation, the tone, voice, or focus of the text, and as a result create text options to evaluate and revise. In the second case, the text-revising activities seem to be meant to align the text to the goals established by the writer in the writing process. One and the same activity can thus fulfill different functions depending on its position in the writing process and depending on the phase in the writing process in which it occurs in different contexts and with other neighboring activities. This indicates that different means–end relations can be established between cognitive activities. Two examples illustrate the varying functional relations between cognitive activities as the writer composes.

The first example is “generation of ideas” as a second member of an adjacent pair of cognitive activities. Depending on the preceding activity, generating ideas can form at least five different pairs (van den Bergh & Rijlaarsdam, 1999): It can follow generating ideas, reading external sources, a pause (>5 seconds), reading already-produced text, and text production. All of these combinations with generating ideas show different patterns of distribution over the writing process. This observation itself indicates that functional relationships vary: If the

combinations were just random adjacent pairs, the distributions across processes would have overlapped.

These findings led us to reconsider the unit of analysis for theory building. When combinations of cognitive activities behave as functional pairs, implying that the function of each activity varies according to the preceding activity, then combinations rather than single activities should be considered as the unit of analysis.

The second example is the activity of "rereading already written text." Hayes distinguished several functions of reading during writing (Hayes, 1996, pp. 18–20): "In addition to reading to evaluate, two other kinds of reading play an important role in writing: reading source texts and reading to define tasks" (Hayes, 1996, p. 18). From eye movement studies we know that writers read text already produced to generate content or to evaluate text produced so far (Alamargot, Chesnet, Dansac, & Ros, 2006; Alamargot, Dansac, Chesnet, & Fayol, 2007). From our protocols, we learned that "rereading already written text" and "generating ideas" is a rather rare combination across the writing process. It is ineffective at the beginning of the process, but effective when the writing process proceeds. "Generating," for example, reaches a maximum of about .12 (proportion: 12% chance, 12 out of 100) around 20 minutes after the start of the writing process and decreases slowly afterwards. This means that at around 20 minutes of writing 12 out of 100 cognitive activities are "generating" activities, and this proportion decreases slowly after the peak.

The pattern for "rereading already written text" is different. The probability for this activity increases during the first half hour of composing, stays more or less constant for the next hour, and then rises to a probability of about .30.

When we relate the distribution of these processes to the quality of written text, two pictures emerge (Breetvelt, van den Bergh, & Rijlaarsdam, 1996). Writers who generate relatively often at the beginning write relatively weak texts, whereas writers who gradually increase the number of generating activities write the best texts. For rereading the already written text, the correlation changes during the course of writing, but it is always positive. If we leave the single-activity interpretation and hypothesize that rereading already written text, in some instances, supports generating text, then the picture changes. Reading already written text is then a springboard for generating new content. Indeed, if we account for rereading, the correlation between generating and text quality changes and becomes stronger (see Figure 4.1).

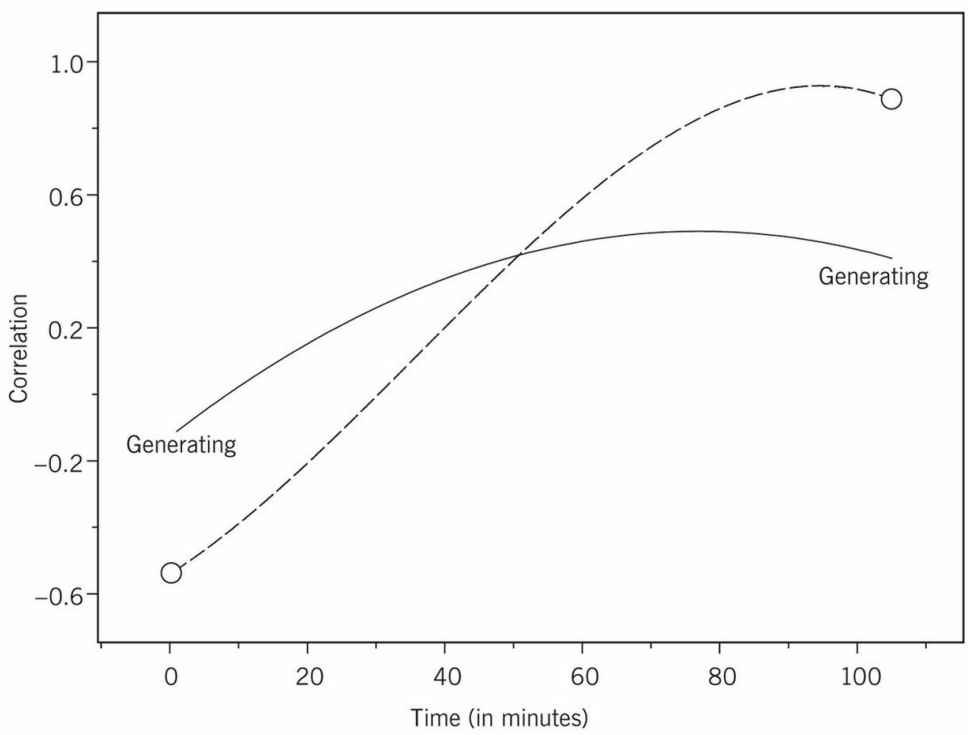


FIGURE 4.1. The changes in correlation (vertical axis) between generating and text quality in two conditions: raw correlation (solid line) and purified for rereading (dashed line). Reanalyzed data from Breetvelt, van den Bergh, and Rijlaarsdam (1996).

As these findings show, the occurrence of rereading is related to the occurrence of generating. On the other hand (not in the figure), the correlation between rereading and text quality changes only marginally when generating ideas is taken into account. This implies that generating ideas does not have the same effect on rereading that rereading has on generating. Therefore, it is plausible that rereading promotes generating ideas for some writers and has other functions as well as serving as a springboard of the onset for generating ideas.

Figure 4.1 shows that the effect of the frequency of generating ideas on text quality is larger when we correct for rereading. However, the correction has a different effect depending on its position in (the separate halves) writing process. Relying on rereading already written text as input for generating ideas is not effective in the beginning of the writing process, but in the second half of the process, it is an effective strategy. Thus rereading to generate ideas inhibits quality of text in the first half but facilitates text quality in the second half. As a result, functional relations between activities change over the course of the writing process.

In summary, there is considerable agreement about what the basic mental activities are in the writing processes. Contextual factors like digital writing environments and professional writing situations, however, require additional functional activities. Leijten, Van Waes, Schriver, and Hayes (2014), for instance, showed the necessity of including "Search" as an important activity to describe text production processes in the workplace, where writers draw content and text from various other documents. Collaborative writing, another contextual factor, requires steering group performance (Marttunen & Laurinen, 2012). But irrespective of these necessary contextual additions, the study of writing processes is basically the study of effective strings of activities in terms of their contribution of text quality. These strings, at least pairs of them, form means–ends relations. The impact of these strings on text quality varies over the writing process.

PROCESSES AND TEXT QUALITY

If we assume that writers try to deliver the best text they can, provided the circumstances, they must adapt how they write to the circumstances. When Kellogg (1987) studied the effect of topic knowledge on the writing process, he found that topic knowledge did not affect the global quality of text, but that for low topic knowledge writers, the writing process was slowed down. When Ransdell, Levy, and Kellogg (2002) manipulated the working memory available to the writer, they observed that with increasing cognitive load the process of writing changed, but text quality remained stable, until the load became extremely high.

Adapting processes to circumstances requires that writers have access to some variety of strategies or that they can establish different configurations of subprocesses. Kellogg (2008) noted that learning to write skillfully takes about 20 years, as it requires a high degree of control over the multiple representations of the text and over all cognitive activities. This implies that during the acquisition of this control mechanism, a certain level of instability is the default situation. In longitudinal measurement of writing, this instability in text quality is evident (Verheyden, van den Branden, Rijlaarsdam, van den Bergh, & De Maeyer, 2011, in a study in which most of the students were L2 students).

At least two explanations, not mutually exclusive, are possible for the instability described above. One explanation is that some so-called lower-order motor skills (handwriting, typing) or language skills (spelling, grammar) are far from automatized. Accordingly, a writer has to devote explicit attention to these skills at the cost of text organization and content. Another explanation is, that even if lower-order skills are more or less automatized, developing writers, at least some of them, will tend to experiment, trying to include what they have learned in class or from reading texts into their own texts. This process was demonstrated in a longitudinal study by Verheyden (2010), when she observed and analyzed the writing and learning of third graders in different classes. These third graders tried, for instance, to include dialogue in a narrative text because they were told to do so, or because they were familiarized with the concept of dialogue through the stories they read in class. Part of their attentional focus, therefore, was on the new learning element (e.g., integrating dialogue), and as a trade-off, this may have resulted in less attention for language and organization. With experience, however, we expect that text quality becomes more stable and that the writing process becomes more flexible to cope with specific task and learner circumstances in order to deliver the best text possible under the circumstances.

Increased flexibility can be induced by intervention (Braaksma, Rijlaarsdam, van den Bergh, & van Hout-Wolters, 2004). Braaksma and coworkers showed students (grade 8) videos of same-age peers writing under think-aloud conditions, and asked students to compare and contrast these processes. Compared to a control condition in which students practiced writing tasks, these students showed more complex patterns of cognitive activities across the writing process at the posttest, which led to better text quality.

TASK ENVIRONMENT

It is well documented that there are large differences in text quality scores for different texts produced by the same writers over a short period of testing time, which excluded learning and maturation effects. A writer might produce a relatively good text for one assignment, but a relatively poor one for another assignment, whereas for a second writer this could be the other way around. In other words the generalizability of text quality scores is rather low. All in all, 20% or less of the observed variance is related to differences in writing skill (Coffman, 1966; Schoonen, 2005; Bouwer, Béguin, Sanders, & van den Bergh, 2015), and about 10% of the observed variance is related to

genre (Bouwer et al., 2015). The question in this section of this chapter is whether this also holds for writing processes: Are writing processes, and relations between processes and text quality affected by task conditions? Until recently, we were less concerned with differences between tasks in writing process studies. In the vast majority of investigations, writing processes were studied for only one task per writer. But if the observed writing skill varies widely across tasks and genres, why not the writing process. And, if this is the case, we cannot rely on a single measurement of the writing process with only one task to obtain a representative picture of one's writing.

The Topic Effect in Writing Processes

A handful of studies have focused on the effects of tasks. Van Weijen (2009) studied the writing processes of first-year students when writing highly similar tasks: namely, students had to write four short argumentative texts in their L1 (Dutch) under think aloud conditions. These argumentative texts were short essays for an essay contest for the University newspaper. In their essays, students had to give their opinion and argue for or against a topic, such as education in English: Is this a good idea or a bad suggestion? Life as a student: A hard life full of stress? Or is it not that bad? Do surveillance cameras in inner-city areas increase public safety? Is downloading music for free criminal, or should it be possible? All assignments had the same task parameters in terms of aim, audience, length, and publication medium, but they varied in topic.

Results showed that for some cognitive activities patterns of occurrence were relatively similar across tasks, but for other activities considerable variance between tasks could be shown. For instance, formulating activities rarely occurred very early in the writing process for a typical writer, but then increased, after which they gradually faded out (see Figure 4.2, the solid line for writer 4 in the top left figure). Differences in patterns between tasks for this type of writer were relatively small. The differences in patterns of occurrence are indicated by the 80% confidence intervals for an average writer (see the dotted lines in the top left of Figure 4.2). Thus, if different but similar texts are written, how a writer formulates in one task reflects how she or he formulates in similar tasks. The average pattern of formulating activities varies between writers, but the pattern of a specific writer does not vary much between different tasks.

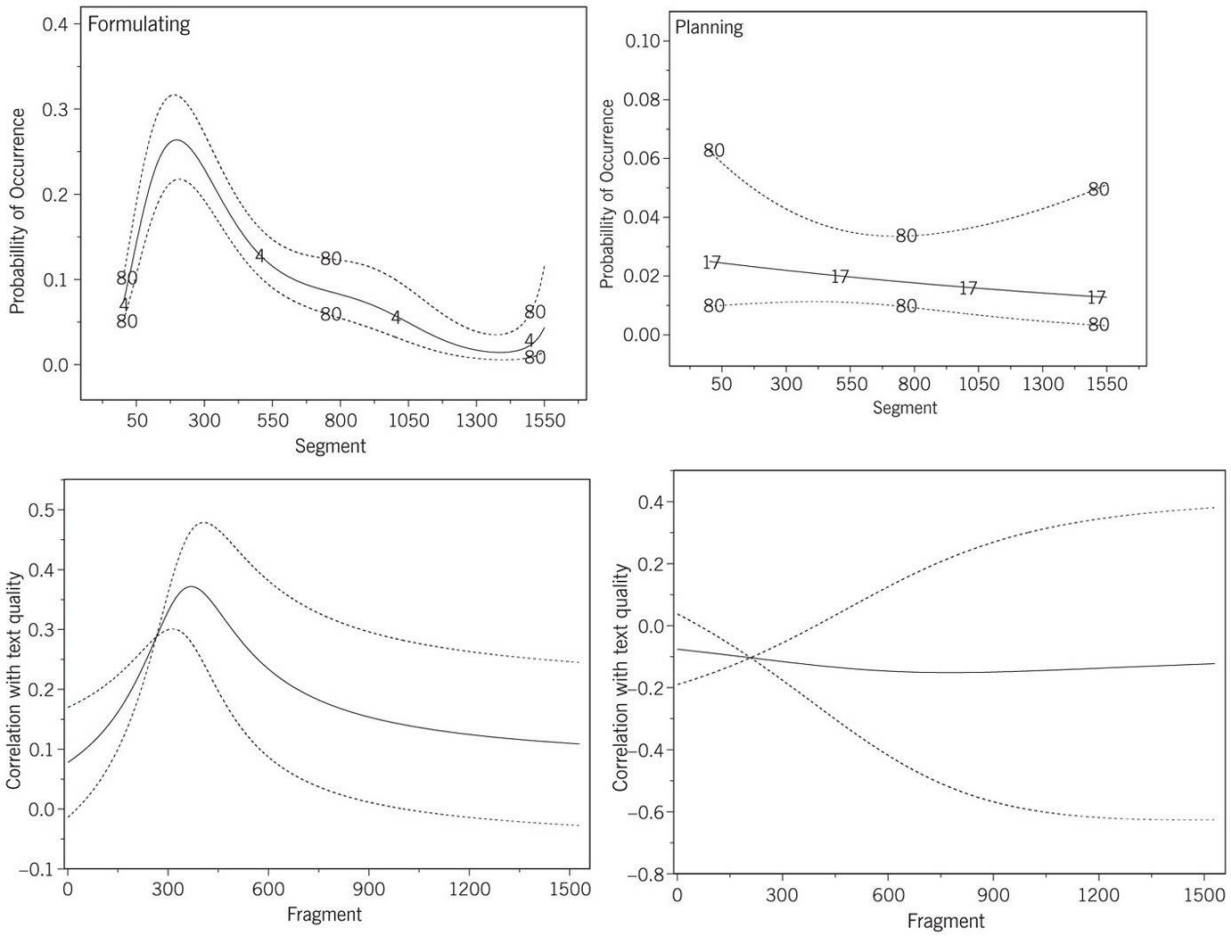


FIGURE 4.2. Average distribution. The course of formulating activities (solid line, top left) and planning activities (solid line, top right) over the writing process, as well as correlations with text quality (formulating: solid line, bottom right; planning: solid line, bottom left). The dashed lines represent the variation due to topic: that is, the 80% confidence intervals for differences between comparable assignments. Target group: freshman college students. Data from van Weijen (2009).

The distribution of planning activities for a typical writer is shown in the top right panel of Figure 4.2 (i.e., writer 17). The average pattern of planning activities for this writer shows a slow decrease, from the probability of occurrence of 0.03 in the beginning to 0.02 at the end of the writing process (the solid line in Figure 4.2, top right). Note that differences between tasks are large; depending on the task. The probability varies from ± 0.01 to ± 0.09 at the start of the writing process (see the dotted lines in Figure 4.2, top right). During task execution, the differences between tasks first decrease and then increase during the later phases of the writing process. Hence, the way a writer deals with planning activities during writing is not very stable across (highly comparable) tasks.

So for processes such as formulating, the between-task variance is relatively small, whereas for other processes such as planning the between-task variance is relatively large. Thus, to reach more generalizable conclusions on the writing process, the writing process of writers should be investigated with multiple tasks.

Not only does the pattern of occurrence of activities differ between tasks (within writers), but the quality of texts produced by a writer differs as well. Hence, the relation between (patterns of) activities and text quality is likely to differ between tasks as well. For formulating, the correlation between activities and text quality in general increases

from the beginning of the writing process, after which a maximum is reached and the correlation with text quality decreases (see the solid line in Figure 4.2, bottom left). Consequently, students who produced much text shortly after the beginning of writing wrote better texts. However, the size of the correlation clearly varied between assignments. For some assignments, the increase in correlation with text quality in the beginning of the writing process is much stronger than for other comparable tasks, and the correlation between the occurrence of formulating activities and text quality decreases faster for some tasks. In general, it makes sense to postpone formulating somewhat and to concentrate on other aspects of the assignment. In general, formulating at the end of the writing process does not appear to contribute to the quality of the resulting text. However, there are clearly differences between assignments, showing that the general picture does not apply equally to all tasks.

Planning activities (see Figure 4.2, bottom right) show a different pattern of correlations with text quality. On average, there is a weak correlation between planning activities and text quality. Depending on the specific task, however, the correlation can increase in strength during task execution. Sometimes the correlation between patterns of planning processes becomes positive, whereas for another, similar task, it reaches high negative values. At the end of the writing process, the correlation between the occurrence of planning activities and text quality varies between –0.6 and 0.4, which is a relatively large range.

At present virtually no empirical research addresses the effects of features of assignments (topic, genre) in either pattern of processing. This is also true for the relation between patterns of processing and text quality.

Differences between genres have been reported by Olive, Favart, Beauvais, and Beauvais (2009). These researchers studied the writing process of students (fifth and ninth graders) in two different genres: narrative and argumentative essays. On the process side, they focused on the cognitive effort of writers, which was operationalized as the time writers need to react to an auditory signal while writing. Results showed that writing requires less cognitive effort for ninth graders than for fifth graders. Differences in cognitive effort between the two genres was not observed. A complicating factor in interpreting these effects is that writers wrote just one narrative and one argumentative essay. Assignment and genre are thus confounded. In an ideal study, writers should have written multiple texts in both genres in order to be sure that observed differences are not due to a specific assignment.

The Language Effect: L1 versus L2

Van Weijen (2009) studied the writing processes of university freshmen in their L1 (Dutch) and their second language (L2 = English). It appeared that in L2 the pattern of occurrence of cognitive activities is much like that in L1. For instance, the likelihood that a writer engages in formulating activities in L2 first increases to decrease during later phases in the writing process (see the bold line in the top right-hand graph of Figure 4.3). The same holds for planning activities; both in L2 and in L1, the probability of planning slowly decreases during the writing process (see bold line at the top right of Figure 4.3). The curves for different activities have the same pattern in L1 and in L2 (although the averages always differ significantly for all processes studied thus far). A remarkable difference between writing in L1 and writing in L2 concerns the differences between tasks (as indicated by an 80% confidence interval). In L2, the variance between similar assignments is always substantially smaller than in L1. In other words: the writing process of freshmen writing different texts in L2 are much more alike than their writing processes in L1.

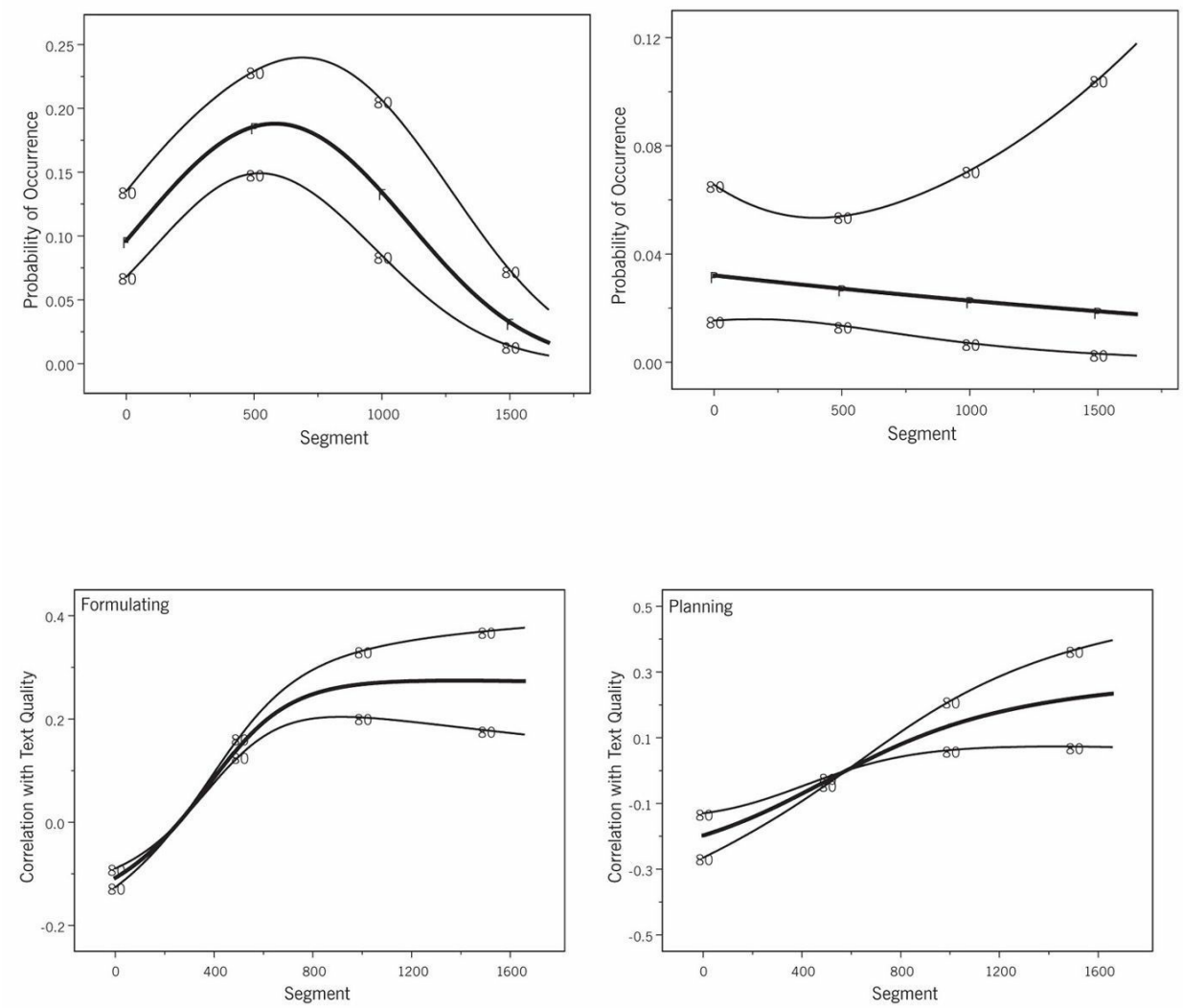


FIGURE 4.3. Average distribution of formulating (bold line, top left) and planning activities (bold line, top right) over the writing process in L2 and correlations between these activities and text quality (formulating: bold line, bottom right; planning: bold line, bottom left). The hairlines represent the variation due to topic: that is, the 80% confidence intervals for differences between comparable assignments. Target group: freshmen English (as foreign language). Produced from data in van Weijen (2009).

The bottom two figures in Figure 4.3 show the change in correlation between activities (formulating: left; planning: right) and text quality. For both of these activities, the average correlation increases. College freshmen who formulate or plan relatively frequently in the beginning of their L2 writing process wrote poorer texts than students who postponed these two activities. Furthermore, the correlation between activities and text quality differs somewhat due to the specific assignment, as indicated by the 80% confidence intervals. However, the variation between L2 assignments is much smaller than the variation for L1.

Differences between tasks are hard to interpret in their own right. It is easier to interpret the proportion of between-writer variance (compare Brennan, 1992; Cronbach, Gleser, Nanda, & Rajaratnam, 1972) because this is the key to generalization. Without further theory, the other factors (i.e., the variance between tasks [items], and the interaction between writer and task) can be seen as noise as long as it concerns highly comparable tasks. Therefore,

the proportion of writer variance is a relevant index of the amount of communality between tasks and hence of the amount of "writing variance" associated with writers. Table 4.2 presents the average proportion between writer variance for the start, the middle, and the end of the writing process,

TABLE 4.2. The (Average) Proportion of between-Writer Variance at the Start, Middle, and End of the Writing Process for Four Cognitive Activities for Freshmen

	Cognitive activity							
	Reading		Formulating		Planning		Generating	
	L1	L2	L1	L2	L1	L2	L1	L2
Start	.23	.75	.40	.77	.40	.68	.50	.71
Middle	.43	.62	.23	.33	.48	.61	.58	.70
End	.44	.65	.80	.73	.30	.45	.40	.58

Note. Based on data from van Weijen (2009).

When writing in L1, at the start of the process, 40% of the observed differences in formulating are associated with the writers. This implies that 60% of the observed differences in formulating activities are due to L1 assignment-specific elements and to the interaction between writer and assignment. The proportion of writer-related variance for formulating decreases to 23% in the middle of the writing process, after which it increases to 80% at the end of the process. As a result, in the beginning of the writing process, the correlation between formulating activities in different tasks is relatively high (r = .60); this decreases to r = .50 in the middle of the writing process; and again increases to .90 at the end of the writing process.

For all cognitive activities at each point in the writing process, the variance between writers is relatively large for L2 writing. When college freshmen write different assignments, their writing process in one task much more resembles that of other tasks when writing in L2 as compared to L1. For instance, for formulating activities in L2, the proportion of common variance between tasks is .77 in the beginning, dropping to .33 in the middle, and rising to .73 at the end of the writing process. (This coincides with a correlation in formulating activities of .90 in the beginning, to .60 in the middle and .90 at the end of the writing process.)

These results can be interpreted in different ways. First, as the proportion of between-writer variance is larger for L2 writing, L2 writing is a more stable characteristic of writers. Hence, L2 writing is a better predictor of the less stable L1 writing (compare, for instance, van Weijen, van den Bergh, Rijlaarsdam, & Sanders, 2009). Second, it is tempting to infer that writers are less flexible when they write in L2; they cannot adjust their writing process as easily to the requirements of the task-situation at hand (Tillema, 2012). Third, from a practical point of view, it shows that we need more information (i.e., more tasks) to draw firm conclusions on the writing process in L1 than in L2.

Task Complexity

Especially in L2 writing studies, task complexity is a subject of investigation. Kuiken and Vedder (2008), for instance, manipulated the number of requirements to be fulfilled in a letter to be written in a foreign language (French, Italian). They found that complexity raised students' attention. More complex tasks resulted in fewer errors, irrespective of language proficiency.

Ong (2014) studied the effects in L2 writing of planning time conditions (pretask, extended pretask, free writing, and control) and task conditions (the level of task assistance, by providing topic, or topic and ideas, or topic, ideas,

and macrostructure) on the frequencies of five metacognitive processes during planning and writing: generating new ideas, elaborating new ideas, organizing new ideas, thinking of essay structure, and thinking of the language aspects of the task. These processes were measured with a retrospective questionnaire. The effects of the task condition were found for two task conditions: topic only versus topic, ideas, and macrostructure. In the topic condition, participants reported more frequent activities in generating and organizing new ideas during the planning stage. During the writing stage, they put more time into elaborating and organizing ideas. In the writing stage, a main effect of the planning time variable was observed: The two conditions with prompted planning time (33% or 66% of the time) put more time into thinking about language than the writers in the control condition, in which no planning time was allocated.

Ong and Zhang (2010) explored the effects of task complexity on the fluency and lexical complexity of English as a Foreign Language (EFL) argumentative writing. Task complexity was manipulated using three factors: (1) availability of planning time (0%, 33%, and 66% of total time) versus a control group (write as you do normally); (2) provision of assistance (topic, ideas, and macrostructure given; topic and ideas given; and topic given); and (3) draft availability when writing the second version. Fluency was assessed by two indicators: the mean number of words during transcription, and the mean number of words written during the whole process. Results showed that the most complex condition (no planning time available) resulted in more fluent writing processes and larger lexical complexity. Increasing task assistance (provision of ideas and macrostructure) produced significantly greater lexical complexity, but this had no effect on fluency. Revising with or without the draft available had no effect on fluency or lexical complexity.

RESOURCE LEVEL: WRITERS' CHARACTERISTICS

Up to now we have considered writing processes and their orchestration across the writing process as an object of study in their own right. We hardly touched upon an explanation for the differences in orchestration. Why does one writer show a different distribution of an activity over the writing process than another writer? We argue that differences in orchestration are (at least partly) related to differences in the command of cognitive and linguistic skills and writing style routines.

Subskills

In Section 1, we observed that writers differ in the extent to which they functionally combine rereading already written text and generating ideas. One possible reason for these different strategies is that writers with weak generation skills need the input of the already written text as a springboard for generating a new idea to write about. This interpretation could be tested if data about the writers' generation skills were available, which is not the case. However, we obtained an indication that some differences in processes are related to the quality of the skills involved in these processes from a study by van der Hoeven (1997). In her study, on the writing processes of 11-year-olds, revising skills were measured using offline independent tasks. Van der Hoeven observed that revision skill was positively related to most of the cognitive activities appearing in the writing-aloud protocols: structuring, writing (production of written text), rereading, evaluating, and transforming already written text. The higher the student's competence in evaluating already written text, the more instances of rereading, evaluating, and transforming were observed, and the better the resulting text. Interestingly, the competence of evaluating already written text was negatively related with the quality of text. Only by employing writing process activities of revision

was this negative relation changed to a positive relation. This implies that skill itself is not sufficient; writers have to apply the skill online as they write.

Another important conclusion from the study by van der Hoeven (1997) was that revision skill was related not only to the number of cognitive activities applied, but more importantly, to their temporal distribution over the writing process as a whole. Participants with low revision skills generated fewer ideas in the beginning of the writing process compared to participants with relatively high revision skill scores. Although the number of ideas gradually decreased in the high revision skill group, this number increased in the low revision skill group. Students with high revision skills reread, evaluated, and revised relatively little in the beginning of the writing process, and more toward the end of the writing process. These findings suggest that skill in revising affects the way the writer organizes the writing process, and thus affects the quality of the resulting text.

Inspired by Schoonen, Snellings, Stevenson, and van Gelderen (2009), Tillema (2012) studied the relation between the orchestration of several cognitive activities and vocabulary knowledge in L1 and L2. Three findings from this study demonstrated that the effect of vocabulary interacts with language, L1 and L2. First, the study showed no effect of vocabulary knowledge on the distribution of verbal formulating activities, neither in L1 nor in L2. Second, the distribution of planning activities of these ninth graders was influenced by vocabulary knowledge, but only in L2, not in L1. Students with relatively high L2 vocabulary knowledge were more likely to show content (goal setting, structuring) and process (monitoring) planning activities in the beginning of the writing process, than students with lower levels of vocabulary knowledge. This finding indicates that low levels of vocabulary in L2 suppress planning and monitoring at the start of L2 writing processes in this group of beginning writers, while this effect does not play a role when they write in their L1 at intermediate levels. Third, in L1 and not in L2, vocabulary knowledge affects the activity of evaluating one's own text. Students with a relatively high L1-vocabulary knowledge are more likely to evaluate their own text, especially in the beginning of the writing process. This indicates that at this level of writing skill verbal knowledge does not make a difference in the production of texts (formulating activities), but it does in reflecting on text (evaluating).

Writing Process Style

Tillema, van den Bergh, Rijlaarsdam, and Sanders (2011) studied the relation between offline measurement of writing process style as measured with two scales: planning style and revising style. Planning style is indicated by writing on the basis of an external plan produced before writing; revising style is indicated by using a first draft as a planning tool and extensive revising to shape the text into a communicative text. The two scales were moderately correlated (r = .39), which implied that high scores on planning style can go along with high scores on the revising scale. Participants wrote four texts to increase the generalizability of the findings.

The researchers found the main effects of writing style on proportions of cognitive activities and in two cases different distributions across the process. Students with high scores on planning style, compared with low planners, engaged in more text production activities, revised more often, and read the external sources less frequently. They distributed their planning activities differently: They evidenced more planning activities at the start of the writing process. These patterns of findings support the contention that a high preplanning writing style results in planning at the beginning of the process, and then in text production and revising. Students with high scores for planning are also less dependent on external sources than students with low planning scores.

Students with high revising style scores evidenced more planning activities than students with low revising style scores, and read their own text less frequently. They also distributed the reading of external sources differently. They read the sources less often in the beginning of the writing process than students with a low revising style score.

This pattern was reversed later in the process as high revising style students read sources far more often than students with a low revising style score as they continued to compose. This pattern indicates that writers with a high revising style first invest in developing their own thinking—content generating and content organizing—and keep doing this throughout the writing process at a more intense level than students with a low revising style. They refer to external sources only in the second half of the process, when they have established the gist of their argument.

ISSUES RELATED TO AN EMPIRICALLY BASED WRITING PROCESS MODEL

In this chapter, we illustrated that with a limited set of cognitive activities and the factor of time, much of the variance in text quality can be predicted. These activities are the building blocks for the writing process model. This model should predict how these building blocks are organized during a writing process: how individual activities have distinct temporal distributions, and changes in functional relations over time. This model should also predict how differences in cognitive and linguistic skills lead to different processes. In a number of studies, we have tried to show empirical evidence supporting parts of the model presented above (e.g., Braaksma et al., 2004; Breetvelt et al., 1994, 1996; Rijlaarsdam & van den Bergh, 1996, 1997; van den Bergh, Rijlaarsdam, & Breetvelt, 1992, 1993; van den Bergh & Rijlaarsdam, 2001) or presented the statistical model behind the analysis (e.g., van den Bergh & Rijlaarsdam, 1996; or more in general Goldstein, 1995, especially chap. 7). Nevertheless, there remain several unresolved issues that touch upon the heart of the model.

One important issue to tackle is the *controlling system*: How does a cognitive system "'know"' which activity should follow a particular activity, and how does a system "know" that some combinations of activities must be frequent at certain phase of the process? How do we specify the guide and control mechanisms, and the mechanisms that determine the employment of specific cognitive activities (Bruce, Collins, Rubin, & Genter, 1979; Fayol, 1994)? Traditionally this task is reserved for the monitor. In the early Hayes and Flower model, a monitor was introduced as a check and balance system and was fed with blueprints of processes ("monitor configurations" or writer style; Hayes & Flower, 1980, p. 20). In his revised 1996 model, Hayes implemented "task schemas" that guide and control the process (Hayes, 1996, pp. 4, 17). Finally, in the 2012 model, Hayes proposes a control level that regulates the whole system of activities, via goal setting, motivational control, and stored and actualized writing schemes. During the writing process, writers must continuously decide which activity to employ next. Will a writer generate new information, structure the information already available, or reread the text already written? In think-aloud protocols, writers appear to instruct themselves from time to time (Breetvelt et al., 1994). Apparently, this monitoring activity, or the choice of activities to be employed, is at least partly under conscious control and therefore requires attention. This allows for the intrusion of general knowledge (topic knowledge or procedural knowledge) in the writing process. It is assumed that the sequence of activities is based partly on routine, and is therefore automatic and does not require conscious attention, whereas it allows for an intrusion of other activities based on some evaluation of the product or process thus far. The question that remains is how these routines work.

An interesting perspective on building a theory about processing routines is the parallel distributed processing model proposed and tested by Rumelhart, McClelland, and the PDP Research Group (1999). They proposed a probabilistic system. Through experience, during processing, connections between units are established. This probabilistic system of connection strengths between units develops over time. This system is not a stored task schema that must be retrieved: The patterns of activation or connection strengths are part of the cognitive units themselves. It seems likely that if the text grows (changes), the activated cognitive nodes change as well. By these changes, processes like automatic spreading activation activate other nodes (compare Hinton & Anderson, 1981;

Anderson, 1983; Rumelhart et al., 1999). Hence, the internal representation of the text changes with changes in the task situation. Writers react to these changes in terms of the cognitive activities they employ.

Spreading activation theory accounts for parallel processing; that is, a writer can do two things at the same time, when cognitive load allows it. Parallel processing is efficient. Think-aloud protocols cannot reveal parallel processing, but eye movement studies show that writers do multitask from time to time: While the pen writes a sentence, the eye goes back and reads already written text (Alamargot et al., 2006).

The second issue is the *unit of observation*. In our illustrations, we started with cognitive activities as units, and we demonstrated that units can form functional pairs, where it is not the single cognitive activity that contributes to the quality of the resulting text, but a certain combination, at a certain moment in the process. We need to identify larger functional units, consisting of at least two related cognitive activities. Where does a functional unit start and where does it end? And how does it relate (coordinated, superordinated–cause, subordinated–consequence) to the former and the following functional unit? In the first section of this chapter, we presented adjacent pairs, with some context. In some cases, it is apparent that the adjacent pair is part of a larger unit. The translation-driven-generation example, for instance, appears to be driven by another fragment, where the writer rereads already written text. With cognitive activities as the building blocks of writing process theory, we must now try to identify the generative syntax that accounts for the hierarchically related patterns of building blocks.

That brings us to the third issue, the writer's characteristics that must be taken into account in writing process research, or in Hayes's 2012 terms: the effect of elements from the resource level. Writing skill is such an element, as are linguistic skills, writing process style, topic knowledge, and genre knowledge. For writing process research, we must take into account that the unit of analysis may be different for different writers and may vary during a writing process within writers. Van Weijen (2009) showed that writers vary their strings of writing activities for L1 and L2, with more strings in L1 and more variation in length of strings in L1 compared with L2. Alternatively, skilled writers might show specific patterns of activities in their writing process. For example, they have a pattern of generating, structuring, and formulating (compare van den Bergh, Herrlitz, & Klein Gunnewiek, 1999; Dansac & Alamargot, 1999). Thus, relatively skilled writers might not operate solely on the level of individual activities. Instead, for these writers specific combinations of activities may be considered as one unit (see Kunst, 1978). We may expect that topic knowledge and genre knowledge affect the quality of the text, as Olinghouse, Graham, and Gillespie (in press) showed: for informative, narrative, and persuasive texts, between 30% and 43% of the variance in holistic scores was explained by topic knowledge (6 to 30%) and discourse knowledge (13 to 23%) in fifth-grade students. Kellogg (1987) did not find a relation between topic knowledge and text quality in university students, but rather found an effect on processes. When topic knowledge and genre knowledge affect text quality with younger students, we may expect these resources to affect differences in writing processes, in terms of the organization of cognitive activities in strings.

A last issue we would like to note is the progression of research techniques and tools (for an overview, see Olive, 2010). More fine-grained research questions can be studied with more precise and less obtrusive observation tools. Advances in technology will help us better understand the intricacies of writing processes. At the same time, it is important to realize that the domain is still in the explorative, observational phase, providing us with correlational insights. There is no strong theory with testable claims about the effective coordination of the activities that constitute the writing process. We hope that observational and explorative studies will be supplemented with experimental studies.

REFERENCES

Alamargot, D., Chesnet, D., Dansac, C., & Ros, C. (2006). Eye and pen: A new device for studying reading during writing. *Behavior Research Methods, Instruments, and Computers, 38*, 287–299.

Alamargot, D., Dansac, C., Chesnet, D., & Fayol, M. (2007). Parallel processing before and after pauses: A combined analysis of graphomotor and eye movements during procedural text production. In G. Rijlaarsdam (Series Ed.) & M. Torrance, L. Van Waes, & D. Galbraith (Vol. Eds.), *Studies in Writing, Vol. 20, Writing and Cognition: Research and Applications* (pp. 13–29). Amsterdam: Elsevier.

Anderson, J. R. (1983). A spreading activation theory of memory. *Journal of Verbal Learning and Verbal Behavior, 22*, 261–295.

Bouwer, R., Béguin, A., Sanders, T., & van den Bergh, H. (2015). Effect of genre on the generalizability of writing scores. *Language Testing, 32*(1), 21–38.

Braaksma, M. A. H., Rijlaarsdam, G., van den Bergh, H., & van Hout-Wolters, B. H. A. M. (2004). Observational learning and its effects on the orchestration of writing processes. *Cognition and Instruction, 22*(1), 1–36.

Breetvelt, I., van den Bergh, H., & Rijlaarsdam, G. (1994). Relations between writing processes and text quality: When and how? *Cognition and Instruction, 12*(2), 103–123.

Breetvelt, I., van den Bergh, H., & Rijlaarsdam, G. (1996). Rereading and generating and their relation to text quality: An application of multilevel analysis on writing process data. In G. Rijlaarsdam & E. Esperet (Series Ed.) & G. Rijlaarsdam, H. van den Bergh, & M. Couzijn (Vol. Eds.), *Studies in writing: Vol. 1. Theories, models and methodology in writing research* (pp. 10–21). Amsterdam: Amsterdam University Press.

Brennan, R. L. (1992). Generalizability theory. *Educational Measurement: Issues and Practice, 11*(4), 27–34.

Bruce, B., Collins, A. M., Rubin, A. D., & Genter, D. (1979). *A cognitive science approach to writing*. Technical Report no. 89. Champaign, IL: Center for the Study of Reading, University of Illinois.

Coffman, W. E. (1966). On the validity of essay tests of achievement. *Journal of Educational Measurement, 3*(2), 151–156.

Cronbach, L. J., Gleser, G. C., Nanda, H., & Rajaratnam, N. (1972). *The dependability of behavioral measurements: Theory of generalizability for scores and profiles*. New York: Wiley.

Dansac, C., & Alamargot, D. (1999). Accessing referential information during text composition: When and why? In G. Rijlaarsdam & E. Esperet (Series Eds.) & M. Torrance & D. Galbraith (Vol. Eds.), *Studies in writing: Vol. 4. Knowing what to write: Conceptual processes in text production* (pp. 79–98). Amsterdam: Amsterdam University Press.

Fayol, M. (1994). From declarative and procedural knowledge to the management of declarative and procedural knowledge. *European Journal of Psychology of Education, 6*, 99–117.

Goldstein, H. (1995). *Mulitlevel statistical models* (2nd ed.). London: Arnold.

Hayes, J. R. (1996). A new framework for understanding cognition and affect in writing. In C. M. Levy & S. Ransdell (Eds.), *The science of writing. Theories, methods, individual differences and applications* (pp. 1–27). Mahwah, NJ: Erlbaum.

Hayes, J. R. (2012). Modeling and remodeling writing. *Written Communication, 29*, 369–388.

Hayes, J. R., & Flower, L. (1980). Identifying the organization of writing processes. In L. W. Gregg & E. R. Steinberg (Eds.), *Cognitive processes in writing: An interdisciplinary approach* (pp. 3–30). Hillsdale, NJ: Erlbaum.

Hinton, G. E. & Anderson, J. A. (Eds.). (1981). *Parallel models of associative memory*. Hillsdale, NJ: Erlbaum.

Kellogg, R. T. (1987). Effects of topic knowledge on the allocation of processing time and cognitive effort to writing processes. *Memory and Cognition, 15*, 256–266.

Kellogg, R. T. (2008). Training writing skills: A cognitive developmental perspective. *Journal of Writing Research,*

1(1), 1–26.

Kuiken, F., & Vedder, I. (2008). Cognitive task complexity and written output in Italian and French as a foreign language. *Journal of Second Language Writing, 17*, 48–60.

Kunst, H. (1978). *Cognitie van semantische systemen: Strategieën en interpretaties bij een structure of intellect vaardigheid*. [Cognition of semantic systems: Strategies and interpretation of a structure of intellect skill]. Dissertation. Amsterdam: University of Amsterdam.

Leijten, M., & Van Waes, L. (2013). Keystroke logging in writing research: Using Inputlog to analyze and visualize writing processes. *Written Communication, 30*(3), 358–392.

Leijten, M., Van Waes, L., Schriver, K., & Hayes, J. R. (2014). Writing in the workplace: Constructing documents using multiple digital sources. *Journal of Writing Research, 5*(3), 285–337.

Marttunen, M., & Laurinen, L. (2012). Participant profiles during collaborative writing. *Journal of Writing Research, 4*(1), 53–79.

Olinghouse, N., Graham, S., & Gillespie, A. (in press). The relationship of discourse and topic knowledge to fifth-graders' writing performance. *Journal of Educational Psychology*.

Olive, T. (2010). Methods, techniques, and tools for the on-line study of the writing process. In N. L. Mertens (Ed.), *Writing processes, tools and techniques* (pp. 1–18). New York: Nova Science.

Olive, T., Favart, M., Beauvais, C., & Beauvais, L. (2009). Children's cognitive effort and fluency in writing: Effects of genre and of handwriting automatisation. *Learning and Instruction, 19*(4), 299–308.

Ong, J. (2014). How do planning time and task conditions affect metacognitive processes of L2 writers? *Journal of Second Language Writing, 23*, 17–30.

Ong, J., & Zhang, L. J. (2010). Effects of task complexity on fluency and lexical complexity in EFL students' argumentative writing. *Journal of Second Language Writing, 19*, 218–233.

Ransdell, S., Levy, C. M., & Kellogg, R. T. (2002). The structure of writing processes as revealed by secondary task demands. *L1—Educational Studies in Language and Literature, 2*(2), 141–163.

Rijlaarsdam, G., & van den Bergh, H. (1996). Essentials for writing process studies: many questions and some answers. In M. C. Levy & S. Ransdell (Eds.), *The science of writing* (pp. 107–126). Hillsdale, NJ: Erlbaum.

Rijlaarsdam, G., & van den Bergh, H. (1997). Cognitieve activiteiten tijdens het schrijfproces en hun relaties met tekstkwaliteit: Plannen en formuleren. [Cognitive activities during the writing process and their relations with text quality: Planning and formulating]. In H. van den Bergh, D. Janssen, N. Bertens, & M. Damen (Eds.), *Taalgebruik ontrafeld* (pp. 275–284). Dordrecht, The Netherlands: Foris.

Rumelhart, D. E., McClelland, J. L., & the PDP Research Group (1999). *Parallel distributed processing. Explorations in the microstructure of cognition, vol. I*. Cambridge, MA: MIT Press.

Schoonen, R. (2005). Generalizability of writing scores: An application of structural equation modeling. *Language Testing, 22*(1), 1–30.

Schoonen, R., Snellings, P., Stevenson, M., & van Gelderen, A. (2009). Towards a blueprint of the foreign language writer: The linguistic and cognitive demands of foreign language writing. In R. M. Manchón (Ed.), *Writing in foreign language contexts: Learning, teaching, and research* (second-language acquisition, 43) (pp. 77–101). Bristol, UK: Multilingual Matters.

Tillema, M. (2012). *Writing in first and second language. Empirical studies on text quality and writing processes*. Dissertation Utrecht University.

Tillema, M., van den Bergh, H., Rijlaarsdam, G., & Sanders, T. (2011). Relating self-reports of writing behaviour and online task execution using a temporal model. *Metacognition Learning, 6*, 229–253.

Tillema, M., van den Bergh, H., Rijlaarsdam, G., & Sanders, T. (2013). Quantifying the quality difference between

L1 and L2 essays: A rating procedure with bilingual raters and L1 and L2 benchmark essays. *Language Testing, 30*(1), 71–97.

Torrance, M. (1996). Is writing expertise like other kinds of expertise? In G. Rijlaarsdam & E. Esperet (Series Eds.) & G. Rijlaarsdam, H. van den Bergh, & M. Couzijn (Vol. Eds.), *Studies in writing: Vol. 1. Theories, models and methodology in writing research* (pp. 3–9). Amsterdam: Amsterdam University Press.

Van den Bergh, H., Herrlitz, W., & Klein Gunnewiek, L. (1999). Entwicklung von Fähigkeiten in einer Fremdsprache—vorsichtige Hypothesen. In G. Kischel & E. Gotsch (Eds.), *Wege zur Mehrsprachigkeit im Fernstudium* (pp. 115–138). Hagen: Fernuniversität.

van den Bergh, H., & Rijlaarsdam, G. (1996). The dynamics of composing. Modeling writing process data. In C. M. Levy & S. Ransdell (Eds.), *The science of writing* (pp. 207–232). Hillsdale, NJ: Erlbaum.

van den Bergh, H., & Rijlaarsdam, G. (1999). The dynamics of idea generation during writing: An online study. In G. Rijlaarsdam & E. Esperet (Series Eds.) & M. Torrance & D. Galbraith (Vol. Eds.), *Studies in writing: Vol. 4. Knowing what to write: Cognitive perspectives on conceptual processes in text production* (pp. 99–120). Amsterdam: Amsterdam University Press.

van den Bergh, H., & Rijlaarsdam, G. (2001). Changes in cognitive activities during the writing process, and relations with text quality. *Educational Psychology, 21*, 373–385.

van den Bergh, H., Rijlaarsdam, G., & Breetvelt, I. (1992). Het stellen van doelen: relaties met productkwaliteit [Formulating aims: Relations with text quality]. *Tijdschrift voor Taalbeheersing, 14*, 221–233.

van den Bergh, H., Rijlaarsdam, G., & Breetvelt, I. (1993). Revision processes and text quality: An empirical study. In G. Eigler & Th. Jechle (Eds.), *Writing: Current trends in European research* (pp. 133–147). Freiburg, Germany: Hochschul Verlag.

van der Hoeven, J. (1997). *Children's composing. A study into the relationships between writing processes, text quality, and cognitive and linguistic skills.* Utrecht Studies in Language and Communication, vol. 12. Amsterdam: Rodopi.

van Weijen, D. (2009). *Writing processes, text quality, and task effects. Empirical studies in first and second language writing*. Dissertation, Utrecht University.

van Weijen, D., van den Bergh, H., Rijlaarsdam, G., & Sanders, T. (2008). Differences in process and process-product relations in L2 Writing. *International Journal of Applied Linguistics, 156*, 203–226.

van Weijen, D., van den Bergh, H., Rijlaarsdam, G., & Sanders, T. (2009). L1 use during L2 writing: An empirical study of a complex phenomenon. *Journal of Second Language Writing, 18*(4), 235–250.

Verheyden, L. (2010). *Achter de lijn. Vier empirische studies over ontluikende stelvaardigheid.* [The story behind the line. Four empirical studies on writing by third and fourth graders of primary school]. Dissertation KU Leuven, Belgium.

Verheyden, L., van den Branden, K., Rijlaarsdam, G., van den Bergh, H., & De Maeyer, S. (2011). Translation skills and trade-off inn Young L2-learners'written narrations. In M. Fayol, D. Alamargot, & V. Berninger (Eds.), *Translation of thought to written text while composing: Advancing theory, knowledge, methods, and applications* (pp. 181–212). New York: Psychology Press/Taylor Francis Group/Routledge.

CHAPTER 5

Understanding Planning in Text Production

Mark Torrance

Writing researchers appear to agree that planning is a central part of the writing process. Planning was the major focus of the original Hayes and Flower model (Flower & Hayes, 1980), and subsequently it has been rare for planning not to receive at least a mention in papers that explore how text is produced. Familiarity does not necessarily equate with understanding, however. “Planning,” like “working memory,” has become a go-to concept for writing researchers despite, arguably, a lack of clear theory and evidence around how it might function: Use of the term has persisted over the three decades since the Flower and Hayes chapter, but the rigor they brought to its meaning perhaps has not.

Most fundamentally, planning is any cognitive activity in which future action is prepared. Achieving a particular goal typically requires a set of actions that must be completed in a particular order. This is true for language production: Ideas need to be introduced in a particular order, sentences must be generated one word at a time, words are created by an ordered series of pen or keystrokes. One of the founding principles of cognitive psychology is that serial behavior of this kind requires, at least in some cases, mental preparation in the form of hierarchically ordered plans (Lashley, 1951). Determining whether or not a behavioral sequence is planned, and if so to what level, is not altogether straightforward. Planning activity is often not available to introspection: For many behaviors, plans are constructed rapidly, implicitly, and unconsciously, and therefore will not be uncovered by asking people to think aloud. Of particular value to researchers interested in text planning is the fact that if a behavioral sequence is planned, then we would predict a positive relationship between the length of the sequence and the duration of the preparation time immediately prior to the start of the behavior. I return to this issue below. When writing researchers talk about planning, however, they typically mean more than just any mental preparation of action. Planning also involves forms of representation different from that in which the final output will appear. This is partly for reasons of economy. Hayes and Nash (1996) describe planning in writing as analogous to architects making drawings in advance of building buildings. An architect’s sketch, or the computer equivalent, is capable of capturing important features of the final product, and does so both more successfully and with massively greater economy than if the planning were in the same medium as the intended product (in this case, bricks and mortar). More generally, a strong distinction is typically made between *thought* as the planning medium and *language* as the medium in which the resulting plans are enacted. Planning text is seen as a nonlinguistic thinking-and-reasoning process, with conversion into language at a late stage. This is the basis of using the term *translation* to refer to those aspects of text production associated directly with words appearing on the page (Fayol, Alamargot, & Berninger, 2012).

In educational contexts, planning has two further meanings. It is associated with an activity that the writer explicitly engages in as a discrete stage in the production of a document. This is the understanding of planning that is tapped by the question “Did you make a plan?” Related, but distinct, is an understanding of planning as self-regulation. Writing extended text is a task typically performed alone and with minimal prompting or scaffolding. Self-regulated writers therefore deliberately and explicitly adopt strategies that they believe will help them to produce good text. Zimmerman and Risemberg (1997) give Alex Haley’s decision to chain himself in the hold of a ship, in preparation for writing *Roots*, as an example of a self-regulated writing behavior. A writer’s choice to produce a written plan in advance of writing is a less extreme form of the same thing.

My aim in the first (and main) part of this chapter is to explore some of the ways in which planning processes are implicated in writing. Answers will be far from complete, both because the topic is broad and because the research base is not extensive. I hope at minimum, however, to suggest a framework within which we might continue

discussion about the cognitive processes around text planning. The second part of the chapter has an applied focus. If we require writers to plan before drafting, or if we train them in specific planning methods, what effect does this have on the quality of their text?

COGNITIVE PROCESSES—WHAT LEVEL OF PLANNING IS OBLIGATORY?

Deliberate, advance planning writing is clearly possible. I can, if I so choose, mentally rehearse my next sentence, though this becomes difficult if the sentence is long. I can also prepare, either mentally or on paper, a "paragraph plan," which I may or may not actually stick to, for some or all of the remainder of this chapter. There are educationally important questions to ask about whether or not doing so will improve the quality of my text, and the answer to these questions is likely to vary with the characteristics of both the task and the writer. A more basic question, however, is what planning processes are obligated by the linguistic and cognitive constraints within which writing must function?

Writers work within constraints imposed both externally and internally. Text needs to obey linguistic rules and to cohere across sentences and paragraphs. Linguistic and content knowledge is structured, represented, and accessed within the mind in particular ways, and there are severe limits on the amount of information that can be held available for processing at any one time. Given these constraints, what is the minimum level of planning required to permit successful writing? "Level" here refers both to planning scope and to what is planned: For final text to be correct and coherent, what kinds of plan must the writer construct, and how far ahead must they plan?

Writing Timescales and Mental Timescales

A powerful source of evidence for mental planning is the fact that the length of the delay prior to performance sometimes correlates with the length and complexity of the behavioral sequence that follows. Turning this around, if we start from the assumption that some sort of planning is occurring, then the production time course—the pattern of pauses and fluent action—gives insight into what form this planning might take. In the context of written production, at least with keyboarded output, this pattern is particularly easy to study simply by measuring times between keypresses (henceforth "keystroke latencies").

Studies that have analyzed keystroke data suggest the following. First, and most obviously, keystroke latencies vary. Writing tends to proceed as a sequence of bursts of activity during which writers produce several words, and pauses during which no text is produced. For example, Ofstad Oxborough (doctoral thesis, in preparation), in a sample of undergraduate students writing short expository essays, found mean burst lengths of around 13 words (between pauses of 2 seconds or more). Twenty-five percent of these bursts were of more than 18 words. Reducing the threshold to 1 second gave mean burst lengths of 5 words. Increasing it to 3 seconds gave a mean burst length of 25 words, which was greater than the average sentence length in the students' finished texts. These values are, of course, for competent writers writing relatively straightforward texts. Burst lengths are shorter when writers are younger, poorer typists, writing in a second language, or are language impaired (Alves, Branco, Castro, & Olive, 2012; Chenoweth & Hayes, 2001; Connelly, Dockrell, Walter, & Critten, 2012; Hayes & Chenoweth, 2007).

Second, the pattern of interkey latencies is dependent on location within the text. The shortest latencies occur within words. Pauses at the start of midsentence words tend to be longer. Latencies around sentence boundaries—and before the full-stop (period) at the end of the previous sentence—are longer still. In Ofstad Oxborough's sample, estimated mean latencies within words, before words, before sentences, and before paragraphs were, respectively,

170 milliseconds (ms), 770 ms, 2,560 ms, and 5,630 ms. Higher level boundaries of course coincide with boundaries at all lower levels: paragraph initial latencies are also at the start of sentences, and words, and so forth. This suggests that the contribution made to pause times specifically as a result of location in sentence- and paragraph-initial positions were around 2 seconds and 3 seconds respectively. Wengelin (2002) found a similar pattern with perhaps slightly shorter latencies (she reports medians, making direct comparison difficult), with little difference across students from seventh grade to university. Schilperoord, in an analysis of legal letters composed by dictation, found similar sentence- and paragraph-initial latencies (3 seconds and 8 seconds, respectively; Schilperoord, 1996, p. 89). Schilperoord goes on to demonstrate that pause durations are predicted by position within rhetorical structures (analyzed in ways similar to that shown in Figure 5.1 in the next section).

An obvious understanding of these pauses is that they are occupied, at least in part, by processing associated with preparing the text that follows. Other activity during these pauses is possible, of course, including reading text that has already been written. Analysis of writers' eye movements indicates the tendency to look back at previously produced text that mirrors the hierarchy of pause times: Writers are more likely to look back (and tend to look back further) at paragraph boundaries, compared to sentence boundaries, and at sentence boundaries compared to word boundaries (Ofstad Oxborough, in preparation; Torrance & Wengelin, 2010). It is reasonable to assume, though, that at least some of this time is devoted to preparation of what is coming next.

Just noting that latencies are longer at higher-level boundaries within the text does not, however, get us very far in understanding what kinds of processing might be engaged in during these pauses. To do this we need an understanding of the timescales on which the mind works. Newell (1992) makes a useful distinction between Cognitive Band operations that occur in timescales in the region of 100 ms to 10 seconds and Rational Band operations that take longer than this. The Cognitive Band involves simple operations such as retrieving an item from memory or performing a simple action or small chains of simple actions. For example, Bonin, Malardier, Méot, and Fayol (2006) found times of around 2.3 seconds between participants seeing the two familiar objects on a computer screen and starting to handwrite a noun phrase that names them. Operations in the Cognitive Band—in Bonin's experiment, object perception, name retrieval, orthographic planning, and so forth—occur without deliberate control and are not available to introspection. They cannot be uncovered by asking participants to think aloud during processing or to describe them retrospectively. Operations in the Rational Band involve complex chains of Cognitive Band operations and occur at timescales that are sufficiently long (Newell argues 10 seconds or more) for speed of retrieval and other low-level factors not to constrain processing. Rational Band operations are therefore associated with thinking-and-reasoning or problem-solving activities that can be explained in terms of what knowledge is manipulated without reference to lower-level processing. Explanations at this level can, potentially, be built on evidence from participants' introspections.

Cognitive processes associated with planning in writing have typically been theorized as Rational Band operations (e.g., Scardamalia & Bereiter, 1991). This contrasts with literature on sentence planning in speech production, discussed briefly below, which focuses on low-level Cognitive Band processes. The reasons are as follows. Speech, in the context of conversation, typically occurs as short utterances. Written output typically involves multiple sentences that require some sort of superordinate structure (or at least that was true in the pre-text-messaging world in which cognitive models of writing were first developed). Thinking-and-reasoning accounts of written production therefore have plausibility and relevance. The keystroke latency data discussed earlier, however, place activity during production firmly within the Cognitive Band: For the writers in these studies, most cognitive operations associated with producing their text occurred either in parallel with production or in timescales of 3 or 4 seconds. Whatever is happening during these pauses, it is rapid and probably implicit.

In the two sections that follow, I look first at planning associated with sentence production and then at what kinds

of planning might be necessary to generate higher level text structure.

Sentence Planning (The Translator)

Hayes (2012b) describes transition from idea to words-on-the-page in terms of three processes. A Planner, theorized at a thinking-and-reasoning (Rational Band) level, is responsible for generating preverbal content—the ideas that will be expressed in the text. This delivers an "idea package" to the Translator. The Translator is responsible for morphosyntactic encoding, outputting a linguistic representation of the idea package, but without phonological or orthographic information. Finally, the Transcriber either adds phonology to provide inner speech that can be inspected internally before output, or orthography to provide written words.

Hayes cites the kinds of pause-burst patterns discussed above as evidence in support of this account. Three seconds—the typical sentence-initial keystroke latency—seems, however, an implausibly short period of time in which to plan both content and syntax for a whole sentence.

The "syntactic planning scope" question has been explored quite extensively in the context of spoken production (e.g., Martin, Crowther, Knight, Tamborello, & Yang, 2010). The detail of these studies varies, but they follow a broadly similar form. Participants are shown a picture, or array of pictures, that they have to describe. This elicits a response in the form of a simple, single-clause sentence such as "The tree and the dog are above the house." There are three planning-scope possibilities. Participants may mentally plan the whole sentence before starting to speak, they may plan just the subject noun phrase ("The tree and the dog"), or they may plan just the first noun ("The tree"). Clearly, it is possible (in fact easy) to plan the whole sentence in advance of starting to speak. However, participants are encouraged to respond as quickly as possible and therefore tend to plan only to the extent that is obligated by the underlying psycholinguistic processes. By manipulating the sentence that the participant is required to produce (e.g., by contrasting "The tree and the dog are above the house" with "The tree is above the dog and the house"), and comparing the times between the images appearing on the screen and when the participant starts to speak in these two conditions, it is possible to draw strong conclusions about the extent of advance planning. Findings vary to some extent across studies, but the consensus, for spoken production, is that participants typically start to speak once they have planned, at most, the subject noun phrase ("The tree and the dog") and that they definitely do not advance-plan the whole clause.

In three experiments following this experimental paradigm but with participants writing rather than speaking their responses, Nottbusch and coworkers found very similar results (Nottbusch, Weingarten, & Sahel, 2007; Nottbusch, 2009; Torrance & Nottbusch, 2012). Across these studies, initial latencies varied between 2.1 and 3.5 seconds, similar times both to those found by Bonin et al., (2006) for the production of a two-noun noun phrase, and to the sentence-initial latencies in the more spontaneous writing processes described above. There is even evidence that planning scope can, in some contexts, extend no further than the first noun in a sentence. Griffin (2001) showed participants arrays comprising just three images in response to which participants generated sentences of the form "The A and the B are above the C" where A, B, and C were images of simple objects. By tracking their eye movements, she was able to determine which images participants looked at before starting to speak. I replicated this experiment with written output (Torrance & Nottbusch, 2012). Effects mirrored Griffin's findings and were very clear: Almost without exception, participants planned just the first noun and its determiner ("The A") before starting to write. The design of this experiment is not above criticism (Martin et al., 2010). However, at minimum, it demonstrates that in some contexts it is possible to generate sentences entirely incrementally, with very little advance planning.

These findings suggest three things: (1) Some level of planning is obligated in written sentence production. (2)

This planning may only extend a short distance ahead—up to maybe 5 to 7 words—and across units below the level of a clause. (3) In the hands of competent writers, this action takes in the region of 2 to 3 seconds. So, in the terms of the Planner → Translator → Transcriber model, the work of the Translator is rapid—certainly a Cognitive Band operation—but the idea package that is passed by the Planner to the Translator is either small or translated incrementally and in parallel with output.

Planning Content and Structure (The Planner)

Successful text requires syntactically correct sentences. It also requires that these sentences tie together into a coherent whole. The end product of the writing process of one of the students from the Ofstad Oxborough sample described in the previous section had the structure and content shown in Figure 5.1. This is derived from an analysis based in Rhetorical Structure Theory (RST; Mann & Thompson, 1988). RST is based on the assumption that texts gain meaning not just through the propositions expressed within each text segments (e.g., sentences), but in the links that the text makes between these. Thus, content determination and rhetorical structuring are inseparable during production, and there is no clear distinction between content and structure in the final product. From an RST perspective, a text is globally coherent, if and only if it is possible to identify its RST tree.

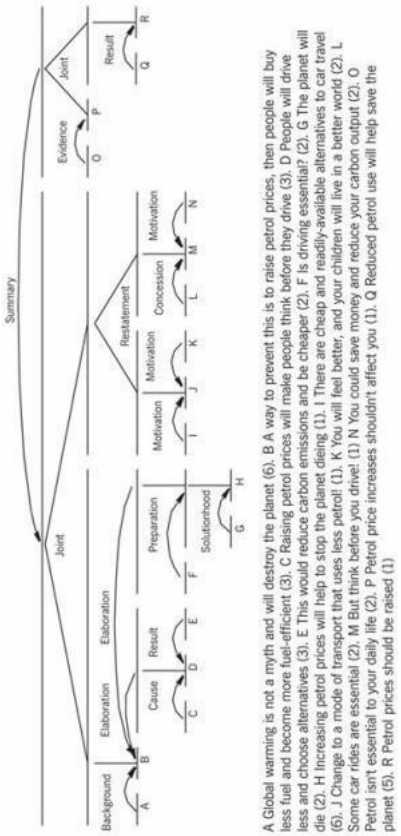


FIGURE 5.1. Rhetorical structure of a short argumentative essay, showing just higher-level spans. The text below the figure gives a summary of the content of each terminal span (spans A to R), with the number of elementary discourse units in the essay (typically, T-units) that comprised that span indicated in parentheses.

The ultimate aim of planning processes that operate above the sentence level is, therefore, to generate a final

product that displays the kind of hierarchical structure shown in Figure 5.1. Identifying this structure within the text does not say anything directly about the processes by which this structure was produced. It does, however, make clear what planning processes need to achieved. This text was produced linearly—the first sentence that appears in the text was written first, followed by the second, and so forth—and the writer started writing 34 seconds after starting to read the topic statement. Somehow, however, the emerging text has a clear top-to-bottom structure (and it would not be a "text" if this was not present). How is this vertical structure achieved?

Few researchers have attempted detailed accounts of how planning might operate to create discourse structure. Two exceptions are work by Sanders, van Wijk, and coworkers (Sanders & Schilperoord, 2006; van Wijk, 1999) and Hayes (2012a). Both work backwards from rhetorical structure to suggest possible algorithms by which these structures might be created, and both claim psychological validity for their models. Similar issues have, however, been explored by research in Natural Language Generation (NLG), which aims at creating computer models that generate well-formed text (see Dale, 1999, for a discussion targeted at writing researchers). Researchers in this field are not primarily concerned with modeling human cognitive processes (but see Perez & Sharples, 2001). However, because the models that they produce result in the same end state as human writing processes (i.e., they produce text), they provide both a rigorous understanding of task requirements—what kinds of functions human writing processes must perform—and hypotheses about the form these processes might take. A third possible source of ideas about planning comes, again, from research in speech production. Speech typically occurs in short bursts during conversation and single utterances tend not to have sophisticated vertical structure of the kind shown in Figure 5.1. However, speakers must still achieve interpersonal (rhetorical) goals, and what they say must cohere with what has already been said. Research exploring ways in which this is achieved may contribute to understanding of writing processes, not least because we learn to converse before we learn to write: Cognitive processes developed to function in conversation are likely to transfer to writing.

Drawing on ideas from these rather disparate literatures, I want to briefly discuss two issues, among several, that need to be addressed by theories of how content/structure is planned.

Deliberative versus Reactive Planning

Planning can be either deliberative or reactive. Deliberative planning occurs prior to action, laying out a series of steps that will achieve a specified end state. Reactive planning involves interleaving plan-making with action: Plans are made in direct response to a changing task environment, taking the results of previous actions as input into planning what to do next. Reactive planning is clearly necessary when the task environment—the external constraints within which planning must operate—is continually changing (e.g., when playing soccer). It is less obviously essential when writing. Note, however, that the task environment when writing includes the text produced so far (Hayes & Flower, 1980), and this *is* constantly changing, albeit under the control of the writer.

Hierarchical goal-plan expansion (e.g., Sacredoti, 1977) is a strongly top-down, deliberative approach to planning. The planner first specifies a high-level goal state. This is then expanded into subgoals, and so forth, until goals reach a level of refinement that permits use of available actions. The structure presented in Figure 5.1 may have been produced by the writer first setting a high-level goal ("I want to convince my reader that raising petrol prices is good"), which is then decomposed into subgoals ("make them realise the seriousness of global warming" / "show mechanisms that link petrol price to global warming" / . . .), and so forth. Alternatively, goal-states might be expressed in terms of text structure—a schema "short argumentative essay" which provide slots that can be filled with sub-goals or result directly in retrieval of content to be expressed (e.g., McKeown, 1985). Deliberative planning does not necessarily involve preparing the discourse structure from beginning to end in advance of any transcription.

It would be possible, for example, just to develop the highest levels of the structure and then pause to expand each branch as it was needed during production. However, the nonreactive nature of this planning—plans are developed from superordinate goals and do not rely on input from (a mental representation of) the text produced so far—means that complete advance planning is in principle possible. More importantly, it means that plan content will be the same whether the planning is completed fully in advance or is interleaved with transcription.

Deliberative planning of this kind is perhaps what is envisaged by teachers who exhort students to "write a plan." As an account of writers' planning process, it is, at best, incomplete. Even when writers do plan extensively in advance of writing full text, the structure and content of the text they create often varies substantially from their plan. In a study of undergraduate students writing short argumentative essays, I used combined evidence from think-aloud and written notes to identify content and rhetorical structure (RST trees similar to those shown in Figure 5.1) for the plans students generated prior to drafting (Torrance, Thomas, & Robinson, 1996; Torrance & Bouayad-Agha, 2001). A planning period prior to writing was enforced, and in all cases students produced outlines for the whole of their text. Comparison with the content and structure of completed essays indicated that (1) 60% of the idea units in the final text (the terminal nodes in the RST tree) were not generated during preplanning, (2) only 42% of the idea units in the plan appeared in the text, (3) only 74% of planned nonterminal spans (i.e., of the planned rhetorical structure) was reproduced in the final text, and (4) 25% of nonterminal spans in the text showed no overlap with spans in the plan. Only 19% of nonterminal spans in the final text showed overlap with spans in the plan of greater than 60%. These findings suggest, at minimum, that some of the students' planning was reactive. Note, however that the findings are also consistent with *all* planning being reactive. Overlap between plan and text may simply have occurred because both were generated by the same writer and so were derived from search of the same knowledge base. If we had asked students to plan and then took away the writers' notes and somehow (by magic) erased their mental representations of their plan, and then asked them to write full text, we might well have found similar plan/text overlap.

It is at least plausible that coherent text might emerge from planning processes that are reactive and focused entirely on what to say immediately next. PAULINE (Hovy, 1990), an early NLG system aimed at generating texts from the same knowledge base but for different audiences, planned text in this way. PAULINE starts with topic knowledge and knowledge about the communicational context, including the audience's interest, knowledge, and stance on the topic. It also starts with interpersonal goals—to switch audience opinion, contribute to audience knowledge, and so forth. PAULINE adopts a "limited-commitment" approach to planning. Just sufficient advance planning occurs for the system to start producing some text. When it reaches a decision point, it then identifies what to say next on the basis of goals and constraints imposed by what has just been said. The fact that what is said next must follow thematically from what has just been said substantially constrains the number of available options. This reduced set of possibilities is then rated in terms of the various goals (Does this change audience opinion? Does the audience need to know this?), and the top-scoring option is then realized as text. Hovy observed that although some goals are finite, in the sense that they can be dropped once an end state is reached, others remain continually active and can either be acted upon or deferred, depending on the constraints imposed by the writer's current position in their text. The examples given by Hayes and Flower (1980a, p. 15)—"I need to write a transition" and "better keep things simple"—are examples of these two kinds of goal.

This approach to planning shares much with established psychological accounts of planning, in domains other than writing. Hayes-Roth and Hayes-Roth (1979) observed that while people do engage in abstract (top-down, deliberative) planning, they also will act to fulfill goals if an opportunity presents itself. The central question then becomes, How do opportunities and goals become associated? When the current state of the text makes possible the inclusion of content that would achieve (or work toward) one of the writer's pending goals, how does the writer

recognize this fact? Researchers talk of keeping rhetorical considerations or a model of audience in working memory (Kellogg, 2008; van Wijk, 1999). However what these representations might look like (how goals are encoded), how they might act to cue or evaluate content, and whether it is plausible to maintain them within a very limited capacity working memory, has yet to be systematically explored. Research exploring encoding and retrieval of goals in domains outside writing suggest that if goals are associated directly with cues from the context in which they might be fulfilled they come easily to mind when appropriate opportunities arise (Patalano & Seifert, 1997). This is the case even when goals are learned implicitly and participants are not strategically searching for opportunities in which the goals might be fulfilled (Moss, Kotovsky, & Cagan, 2007).

Is Abstract Planning Necessary?

Planning in writing is almost certainly reactive, at least in part. A different question is whether or not writers construct explicit, abstract representations of the text that they are going to produce. For Hayes and Nash (1996, p. 42), some level of abstraction is central to what it means to plan: As I noted earlier, using "translation" to describe sentence production processes assumes that the writer holds a nonlinguistic plan that needs translating. However, several researchers have noted that text generation can proceed, at least some of the time, without any obvious explicit thinking and reasoning by the writer ("knowledge telling," e.g., Scardamalia & Bereiter, 1991; the "Select" procedure, van Wijk, 1999; "dispositional text production," Galbraith, 2009). Writers are clearly capable of abstract planning, and in some situations abstract planning of some kind might aid the production of well-formed text. However, it would be wrong to assume that, just because a final text has a clear top-down rhetorical structure, this means that the writer necessarily engaged in abstract planning.

MEXICA, a computer program that generates short stories developed by Perez and Sharples (2001), alternates between "Engagement" and "Reflection." Engagement is the default state. New story elements are retrieved on the basis of similarity (defined in several different ways) to elements in the story produced so far. During engagement, therefore, existing content acts to cue new content in long-term memory (LTM) without the need to invoke abstract plans or goals. The Reflection state is necessary, however, to break impasses—situations in which existing content fails to cue new content—and to ensure global coherence. Reflection operates using abstract, top-down planning processes. The contrast between Engagement and Reflection in MEXICA parallels Bereiter and Scardamalia's distinction between Knowledge Telling and Knowledge Transforming, and Galbraith's distinction between Dispositional Text Production and Rhetorical Planning. Galbraith differs from other researchers, however, in arguing that during engaged phases of production writers are not retrieving ready-formed propositions from LTM. Instead, ideas form as the language is produced. Thus, instead of distinct planning and translating mechanisms, the processes of outputting language and developing content are inseparable. Content (and, in fact, writer knowledge) is *constituted by*, rather than expressed through, the production of text. This distinction doesn't deny the importance of some form of rhetorical, abstract planning, but it does contradict Hayes's (2012b) account in which output only results from the Planner passing content to the Translator.

Some support for this position comes from Pickering and Garrod's (2004) Interactive Alignment theory of dialogue. Established models of speech production (Levelt, 1989) follow the same pattern as the Planner → Translator → Transcriber model: Speakers first generate a nonlinguistic (abstract) representation of the text and then formulate this as language. Participants in a conversation understand each other, and their conversation maintains thematic coherence, because they engage in abstract conceptual processing to generate appropriate messages. Arguably, this account does not sit well with the fact that the conversational turns are often both rapid and effortless. Pickering and Garrod argue, instead, that the main mechanisms by which understanding and flow are maintained are

not primarily abstract, strategic, and conceptual, but instead result from priming effects that are low level, automatic, and implicit. Priming occurs at multiple levels simultaneously. The sentences that I hear from my conversational partner do not just convey meaning, but also include particular word forms, word meanings, word sounds, and syntactic structure. Each of these will directly activate matching and related forms in my own LTM. My next utterance will therefore be shaped by activation at all of these levels. I am, for example, likely to use the same words, or words closely related to those that my partner used not (or not only) because these best achieve my communicational goals, but because they have just been primed by my partner's last utterance. My next utterance is not, therefore, created by translating preverbal propositions into language. It is a direct response to the linguistic characteristics of the utterance that I have just heard.

Pickering and Garrod's theory relates to spoken dialogue. However, as Glucksberg (2004) observed, if low-level priming can explain the production of utterances in dialogue, then these same mechanisms must be available to solo speakers and to writers: The text-just-written may prime what is written next. This is consistent with Galbraith's argument that text doesn't express the products of thinking, but rather is where the thinking takes place (2009, p. 63). Marcu (1997) has demonstrated how high-level rhetorical structure (and, therefore, communicational goals) can be generated incrementally and bottom-up. His method exploits the fact that rhetorical relations tend to follow particular patterns. So the next relation (horizontally) in an RST tree can be predicted on the basis of preceding relations. On this basis, well-formed text can emerge without the need for any explicit goals or top-down planning.

Explaining text production in terms of low-level priming processes (i.e., processes within the Cognitive Band) has three advantages over thinking and reasoning (Rational Band) explanations. First, it fits better with the writing time-course findings described above. If whole texts are produced fluently with only very rare pauses of more than 3 or so seconds, then the time available for the abstract planning becomes vanishingly small. Second, we already have a good understanding of the mechanisms that might be involved: Priming at various representational levels has been the focus of considerable research. By contrast, although abstract planning is often seen as being central to writing, there has been no concerted program of research exploring what abstract planning mechanisms might look like. Third, and related, explanations at this level are parsimonious. Hypothesizing abstract, prelinguistic planning necessarily involves explaining how planning operations, and the resulting plans, are represented in mind. Newell, whose work with Simon sowed the seeds for Hayes and Flower's original description of planning in writing (Hayes, 2012a), argued that mental processing requires a representational scheme that permits "composable internal transformations" (Newell, 1992, p. 427), and suggested a cognitive architecture called SOAR as a theory of what this system looks like. Bickerton (1992), commenting on Newell's claim, observed that we don't need to hypothesize a new representational system in which rational processing can occur. We already have such a system, and it's called language.

SCAFFOLDING AND SELF-REGULATION—IS PLANNING USEFUL?

In principle, instructional practice should be informed by understanding of basic cognitive processes. However, what I think the previous discussion shows is that we are some way away from a useful understanding of the mechanisms that underlie planning text. But writing still needs to be taught, and therefore writing instructors need to be able to make evidence-based decisions about whether or not they should encourage students to engage in deliberative, abstract planning. School students, in the UK at least, have traditionally been urged to "always write an outline" or, more generally, to "think before you write." This assumption, albeit in more nuanced form, is present in Flower and Hayes's original work. One potential criticism of their claim that the writing process involves discrete "organizing"

subprocesses is simply that not all writers appear to engage in explicit organizing. Flower and Hayes's response to this was that their model is of competent writers, and that writers who do not organize are not competent (Hayes & Flower, 1980, p. 29).

The effects of teaching planning, in the broad sense of both product and process goals, are discussed in Chapters 2 and 22 of this volume. In the next two sections, I want to briefly explore two narrower questions: (1) What are the effects of requiring students to "write a plan" before drafting full text? and (2) What evidence is there that the positive effects of strategy-focused instruction that includes teaching planning result from students learning planning procedures?

Plan Before You Write?

Relatively few studies have directly assessed the effects of planning in advance of writing full text. Findings are mixed as to whether or not this benefits writers, and the mechanisms by which benefit might be achieved are unclear. Glynn, Britton, Muth, and Dogan (1982) gave competent adult writers 10 minutes in which to engage in one of four different prewriting activities, followed by 10 minutes to produce polished text. Participants who were required to write unordered notes, with no requirement to form sentences, then produced final text that contained many more ideas than texts produced by students whose prewriting task was to write structured outlines or grammatically correct sentences. The highly time-constrained nature of this task makes findings difficult to interpret, however. Glynn et al. suggest that when writing the final texts participants simply reproduced the ideas that they had planned, with students in the more constrained prewriting conditions expressing fewer ideas but in more elaborate sentences. Kellogg (1988, 1990) compared prewriting activities in which students generated written outlines, mental outlines, spider diagrams, and rough full text. He found positive, though relatively small, effects on text quality for both mental and written outlining. Unlike Glynn et al. (1982), Kellogg did not impose strict time constraints. Students who outlined spent more time writing their final draft and wrote more. Time during the production of the final draft, measured by probed self-report, was substantially less, per sentence, in the outlining conditions. Total planning time per word written (including time spent outlining in the outlining condition) was roughly the same in both outlining and nonoutlining conditions. Limitations associated with self-report aside, this might suggest that, holding task and writer skills constant, a certain amount of planning time is required for a given amount of text, but that there is flexibility about whether this planning occurs prior to the start of or interleaved with translation. It also suggests that there are some advantages to some of this planning being deliberative and abstract (or at least with reduced linguistic constraints).

Rau and Sebrechts (1996) explored both product and process effects of mental and written outlining. The effects on product quality were mixed, with significant benefits for prewriting in a first experiment, based on a rather unusual writing task, but not in a second experiment involving straightforward narrative or expository writing. Rau and Sebrechts also measured time spent pausing during writing and found in both experiments that this was greater in prewriting conditions. The authors did not give a breakdown of pause duration, or explore where pauses were located, and this more detailed analysis is needed. However, assuming that pause time can be treated as an indicator of the amount of time spent in planning, this finding suggests that, contrary to conclusions drawn from Kellogg's self-report data, planning prior to drafting tends to increase, rather than decrease the need for interleaved (and possibly reactive) planning once transcription has started. Rau and Sebrechts argue that as a result of advance planning writers become aware of more options. These options then need to be resolved concurrently with drafting. Few other studies have looked at the process effects of advance planning. Rau and Sebrechts's paper has received just five citations in journal articles found in the ISI Social Science Citation Index, and none of these report

developments of their work.

These three studies all involved competent writers. It is possible that advance planning is particularly useful for less experienced writers, or for writers who struggle with the linguistic demands of writing, as would be the case if they were writing in a second language. Arugments in terms of reducing load on working memory are often invoked as a rationale for advance planning in this context (e.g., Ellis & Yuan, 2004), although it is not clear how this resource conservation might actually occur. Studies in which students received specific training in how to plan and/or which give students prompts that encourage particular forms of planning (e.g., Reece & Cumming, 1996; Scardamalia, Bereiter, & Steinbach, 1984) have shown positive effects, but conflate advance planning per se with giving students specific rhetorical goals. Brodney, Reeves, and Kazelskis (1999) gave fifth-grade writers 20 mintues to advance-plan using whatever approach they wished, and then 30 minutes to write an expository essay. They found no text quality benefits over a control group that was not given this prewriting time. Ellis and Yuan (2004) found that the texts of second-language writers were longer and more syntacticaly diverse when they were required to advance-plan. Johnson, Mercado, and Acevedo (2012) conducted a similar study of L2 writers, with much larger sample size and implementing several different forms of advance-planning activity. They found significant but negligibly small effects on fluency, and no effects on measures of lexical and grammatical complexity.

Benefits of advance planning therefore do not appear to be strongly evidenced in the literature. Few published studies have found clear effects, and it would be interesting to know how many studies that suggest no effect currently languish in file drawers. There is one in mine. Evidence for the benefits of advance planning in tasks other than writing is also not strong. Davies (2003), for example, found that advance planning benefited performance on simple Tower of Hanoi tasks, but that benefits dissappeared as the task became more complex. There are probably substantially more decision points associated with the production of a 30-minute essay than in even a large Tower of Hanoi problem.

Self-Regulated Planning Procedures

Broadly, there are two, mutually compatible ways in which developing writers can be encouraged to engage in explicit, abstract planning. Students can be encouraged to devote specific periods of time to planning. They might, for example, be told to “always write a plan.” Or students can be given specific goals for their text or be encouraged to set their own. Students might be told to “make sure you introduce your characters at the start of your story,” to “use plenty of adjectives,” or to decide what their audience needs to know. So planning can be taught by focusing attention on procedure, giving students process goals (“I must spend time planning”) in the hope that they will then use this planning time to make good decisions about what to communicate. Alternatively, planning can be taught by setting product-focused goals, in the hope that students will find time while writing to allow these goals to constrain what they say.

In practice, of course, it makes sense to teach both. This is the approach taken by strategy-focused writing instruction, a method of teaching writing that has been found to be particularly effective in improving the quality of students’ texts, relative to other forms of instruction (Graham & Perin, 2007; Graham, McKeown, Kiuhara, & Harris, 2012). These studies either make direct use of or draw heavily on an approach to instruction called self-regulated strategy development (discussed in more detail in Chapters 11, 12, 20, and 22 of this volume).

It is not clear, however, whether these effects result from increasing students’ tendency to plan or from increasing their tendency to set appropriate goals for the finished text. This becomes a particularly important issue if instruction is genre-specific. If students are taught to plan using, for example, a story grammar study (Glaser & Brunstein, 2007; Sawyer, Graham, & Harris, 1992) or structure conventions for compare–contrast essays (Torrance, Fidalgo, &

Garcia, 2007), and these features are then found in written outlines or final texts, it is not clear whether this effect is due to students developing planning skills or developing discourse knowledge. A strong test of the claim that students are benefiting specifically from developing their planning skills per se would be if performance gains transfer to genres that are radically different from those focused on during instruction. To my knowledge, these strong transfer effects have not been demonstrated.

In principle, teaching planning procedures and teaching product goals are separable. It is possible, for example, to teach students to deliberately and strategically set product goals but without teaching planning procedures. In two recent studies, Raquel Fidalgo and I have compared the effects of full process-and-product strategy instruction, using a successful approach based on SRSD (Torrance et al., 2007), with a modified version of the same intervention from which we removed any direct reference to planning strategies (Fidalgo, Torrance, Lopez-Campelo, Olivares, & Lopez-Gutierrez, 2014; Torrance, Fidalgo, & Robledo, 2015). We found that, as in our previous studies, sixth-grade students who were taught planning procedures tended to incorporate these strategies within their writing processes, and consequently on posttest tasks their total time-on-task was substantially longer than for students who were not taught planning. However, we found that both interventions had large, and similar, effects on the quality of students' texts.

CONCLUSIONS

My aim in this chapter was to explore some of what we know and what we do not yet know about how planning operates in writing. This is a broad topic that deserves a more detailed and systematic treatment than I have provided here. However, I think three things are clear. First, planning in writing is a hugely complex phenomenon. Given the task that it must perform, we would not expect otherwise. Second, we are a long way away from having a good grasp of the cognitive mechanisms by which planning occurs. Third, and rather discouragingly, few researchers have taken up the challenge of developing and testing detailed theory in this area. Hayes and Flower's early work (1980a) presented a sophisticated sketch of how different planning subprocesses might function. This chapter is often described as seminal, and Google Scholar lists 1,360 works in which it is cited. My guess is that nearly all of these papers simply state that "writing involves planning." Only a small handful have taken up Hayes and Flower's original challenge and sought to refine and develop models of how writers plan.

Answering questions about how planning occurs in writing is difficult. The problem is not intractable, however, and the literature reviewed in this chapter suggests a way forward. First, we need detailed and appropriate strategies for representing completed texts—the end states of the planning process. Texts are sophisticated objects with both horizontal and vertical structure that is not captured by quality ratings. Theories of planning need to explain how writers produce this structure. Second, analyses of writing time courses—the locations within the emerging text where transcription slows or stops—provide a way of testing different hypotheses about how text is planned. Third, theories of planning, and interpretations of pause durations must be psychologically plausible in the sense that they must be constrained by an understanding of the basic mechanisms and timespans within which low-level mental functions operate. Text, like speech, is often produced with remarkable speed and fluidity, and within tight working-memory constraints. Our understanding of underlying planning processes must be able to account for this.

We do not yet have sufficient data to draw strong conclusions about whether planning as it is traditionally understood—deciding content and structure before generating text—plays an essential role in writing. The alternative is that structure/content emerges primarily as a direct result of processes that occur at the time of and directly associated with the production of language. For reasons outlined in this chapter, this is at least plausible and

fits well with the easy flow and short pause times often observed in experienced writers. The idea of planning as reactive and implicit is captured nicely by the following quote:

> I believe that many an important orator did not yet know what he was going to say at the moment he opened his mouth. But the conviction that he would draw the necessary wealth of thoughts from the situation and the resulting commotion of his mind made him bold enough to just make a start on the venture. (von Kleist, 1805, cited in Timmermans, Schriefers, Sprenger, & Dijkstra, 2012)

Swap writer for orator, and this fits well with both experimental data and (at least some) writers' experience. Participants in the sentence production experiments discussed above who only planned one word ahead in a very literal sense "did not yet know what they were going to say" when they started to write, but could do so in the confidence that content would be at hand when they needed it. This understanding of writing as constructing or "constituting" knowledge (Galbraith, 2009) does not deny a role for planning before writing, but affects how we understand its function. Teaching children to plan character, plot, location, and so forth for their stories, or giving students extended planning time before writing argumentative essays may well *increase* the "commotion of their minds," and the resulting text may substantially deviate from their advance-planned ideas. However, the enriched semantic associations that result from this prewriting activity will stand them in good stead as, sentence by sentence, they construct content through their writing.

REFERENCES

Alves, R. A., Branco, M., Castro, S. L., & Olive, T. (2012). Effects of handwriting skill, output modes, and gender on fourth graders' pauses, language bursts, fluency, and quality. In V. W. Berninger (Ed.), *Past, present, and future contributions of cognitive writing research to cognitive psychology* (pp. 389–402). New York: Psychology Press.

Bickerton, D. (1992). Unified cognitive cheory: You can't get there from here. *Behavioral and Brain Sciences, 15*, 437–438.

Bonin, P., Malardier, N., Méot, A., & Fayol, M. (2006). The scope of advance planning in written picture naming. *Language and Cognitive Processes, 21*(1–3), 205–237.

Brodney, B., Reeves, C., & Kazelskis, R. (1999). Selected prewriting treatments: Effects on expository compositions written by fifth-grade students. *Journal of Experimental Education, 68*(1), 5–20.

Chenoweth, N. A., & Hayes, J. R. (2001). Fluency in writing: Generating text in L1 and L2. *Written Communication, 18*, 80–98.

Connelly, V., Dockrell, J. E., Walter, K., & Critten, S. (2012). Predicting the quality of composition and written language bursts from oral language, spelling, and handwriting skills in children with and without specific language impairment. *Written Communication, 29*, 278–302.

Dale, R. (1999). Content determination in natural language generation. In M. Torrance & D. Galbraith (Eds.), *Knowing what to write: Conceptual processes in text production* (pp. 51–64). Amsterdam: Amsterdam University Press.

Davies, S. P. (2003). Initial and concurrent planning in solutions to well-structured problems. *Quarterly Journal of Experimental Psychology Section a-Human Experimental Psychology, 56*(7), 1147–1164.

Ellis, R., & Yuan, F. Y. (2004). The effects of planning on fluency, complexity, and accuracy in second language narrative writing. *Studies in Second Language Acquisition, 26*(1), 59–84.

Fayol, M., Alamargot, D., & Berninger, V. (2012). From cave writers to elite scribes to professional writers to universal writers translation is fundamental. In V. Fayol, D. Alamargot, & V. Berninger (Eds.), *Translation of thought to written text while composing: Advancing theory, knowledge, methods, and applications* (pp. 3–14). New York: Psychology Press.

Fidalgo, R., Torrance, M., Lopez-Campelo, B., Olivares, F., & Lopez-Gutierrez, P. (2014, March 19–22). Exploring the effects of writing instruction focused on products vs. Processes of writing in sixth grade students. Poster presented at *Writing Research Across Borders III*. Paris.

Flower, L., & Hayes, J. (1980). The dynamics of composing: Making plans and juggling constraints. In L. W. Gregg & E. R. Steinberg (Eds.), *Cognitive processes in writing* (pp. 31–50). Hillsdale, NJ: Erlbaum.

Galbraith, D. (2009). Writing about what we know: Generating ideas in writing. In R. Beard, D. Myhill, J. Riley, & M. Nystrand (Eds.), *Sage handbook of writing development* (pp. 48–64). London, Sage.

Glaser, C., & Brunstein, J. C. (2007). Improving fourth-grade students' composition skills: Effects of strategy instruction and self-regulation procedures. *Journal of Educational Psychology, 99*(2), 297–310.

Glucksberg, S. (2004). Dialogue: Can two be cheaper than one? *Behavioral and Brain Sciences, 27*(2), 199.

Glynn, S. M., Britton, B. K., Muth, K. D., & Dogan, N. (1982). Writing and revising persuasive documents: Cognitive demands. *Journal of Educational Psychology, 74*(lev-p1), 557–567.

Graham, S., McKeown, D., Kiuhara, S., & Harris, K. R. (2012). A meta-analysis of writing instruction for students in the elementary grades. *Journal of Educational Psychology, 104*(4), 879–896.

Graham, S., & Perin, D. (2007). A meta-analysis of writing instruction for adolescent students. *Journal of Educational Psychology, 99*(3), 445–476.

Griffin, Z. M. (2001). Gaze durations during speech reflect word selection and phonological encoding. *Cognition, 82*(1), B1–B14.

Hayes, J. (2012a). My past and present as writing researcher and thoughts about the future of writing research. In V. Berninger (Ed.), *Past, present, and future contributions of cognitive writing research to cognitive psychology* (pp. 3–26). New York: Psychology Press.

Hayes, J. (2012b). Translation and its relation to other writing processes: evidence from language bursts, revision, and transcription. In V. M. Fayol, D. Alamargot, & V. Berninger (Ed.), *Translation of thought to written text while composing: Advancing theory, knowledge, methods, and applications.* New York: Wiley.

Hayes, J., & Flower, L. (1980). Identifying the organisation of writing processes. In L. Gregg & E. R. Steinberg (Eds.), *Cognitive processes in writing* (pp. 3–30). Hillsdale, NJ: Erlbaum.

Hayes, J., & Nash, J. (1996). On the nature of planning in writing. In C. M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences and applications* (pp. 29–55). Mahwah, NJ: Erlbaum.

Hayes, J. R., & Chenoweth, N. A. (2007). Working memory in an editing task. *Written Communication, 24*(4), 283–294.

Hayes-Roth, B., & Hayes-Roth, F. (1979). *A cognitive model of planning, 310*(157), 275–310.

Hovy, E. (1990). Pragmatics and natural language generation. *Artificial Intelligence, 43*, 153–197.

Johnson, M. D., Mercado, L., & Acevedo, A. (2012). The effect of planning sub-processes on L2 writing fluency, grammatical complexity, and lexical complexity. *Journal of Second Language Writing, 21*(3), 264–282.

Kellogg, R. (1988). Attentional overload and writing performance: Effects of rough draft and outline strategies. *Journal of Experimental Psychology: Learning, Memory and Cognition, 14*(2lev-p1), 355–365.

Kellogg, R. T. (1990). Effectiveness of prewriting strategies as a function of task demands. *American Journal of*

Psychology, 103, 327–342.

Kellogg, R. T. (2008). Training writing skills?: A cognitive developmental perspective. *Journal of Writing Research, 1*(1), 1–26.

Lashley, K. (1951). The problem of serial order in behavior. In L. Jeffress (Ed.), *Cerebral mechanisms in behavior* (pp. 112–136). New York: Wiley.

Levelt, W. (1989). *Speaking: From intention to articulation*. Cambridge, MA: MIT Press.

Mann, W., & Thompson, S. (1988). Rhetorical structure theory: Toward a functional theory of text organisation. *Text, 8*, 243–281.

Marcu, D. (1997, July). From global to local coherence: A bottom-up approach to text planning. In *Proceedings of the Fourteenth National Conference on Artificial Intelligence*, Providence, RI.

Martin, R. C., Crowther, J. E., Knight, M., Tamborello, F. P., & Yang, C. L. (2010). Planning in sentence production: Evidence for the phrase as a default planning scope. *Cognition, 116*(2), 177–192.

McKeown, K. (1985). *Text generation: Using discourse strategies and focus constraints to generate natureal language text*. Cambridge, UK: Cambridge University Press.

Moss, J., Kotovsky, K., & Cagan, J. (2007). The influence of open goals on the acquisition of problem-relevant information. *Journal of Experimental Psychology. Learning, Memory, and Cognition, 33*(5), 876–891.

Newell, A. (1992). Precis of unified theories of cognition. *Behavioral and Brain Sciences, 15*, 425–492.

Nottbusch, G. (2009). Grammatical planning, execution, and control in written sentence production. *Reading and Writing, 23*(7), 777–801.

Nottbusch, G., Weingarten, R., & Sahel, S. (2007). From written word to written sentence production. In D. Galbraith, M. Torrance, & L. Van Waes (Eds.), *Writing and cognition: Research and applications.* Dordrecht, The Netherlands: Kluwer.

Ofstad Oxborough, G. H. (in preparation). *The visual writer*. Unpublished doctoral thesis. University of Stavanger.

Patalano, A. L., & Seifert, C. M. (1997). Opportunistic planning: Being reminded of pending goals. *Cognitive Psychology, 34*(1), 1–36.

Perez, R. P. Y., & Sharples, M. (2001). MEXICA: A computer model of a cognitive account of creative writing. *Journal of Experimental and Theoretical Artificial Intelligence, 13*(2), 119–139.

Pickering, M. J., & Garrod, S. (2004). Toward a mechanistic psychology of dialogue. *Behavioral and Brain Sciences, 27*(2), 169–226.

Rau, P. S., & Sebrechts, M. M. (1996). How initial plans mediate the expansion and resolution of options in writing. *Quarterly Journal of Experimental Psychology Section a-Human Experimental Psychology, 49*(3), 616–638.

Reece, J. E., & Cumming, G. (1996). Evaluating speech-based composition methods. In M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods individual differences and applications* (pp. 361–382). Mahwah, NJ: Erlbaum.

Sacredoti, E. (1977). *A structure for plans and behaviour*. New York: Elsevier.

Sanders, T., & Schilperoord, J. (2006). Text structure as a window on the cognition of writing: How text analysis provides insights in writing products and writing processes. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 386–401). New York: Guilford Press.

Sawyer, R. J., Graham, S., & Harris, K. R. (1992). Direct teaching, strategy instruction, and strategy instruction with explicit self-regulation— Effects on the composition skills and self-efficacy of students with learning-disabilities. *Journal of Educational Psychology, 84*(3), 340–352.

Scardamalia, M., & Bereiter, C. (1991). Literate expertise. In K. A. Ericsson & J. Smith (Eds.), *Toward a general theory of expertise: Prospects and limits* (pp. 172–194). Cambridge, UK: Cambridge University Press.

Scardamalia, M., Bereiter, C., & Steinbach, R. (1984). Teachability of reflective processes in written composition. *Cognitive Science, 8*, 173–190.

Schilperoord, J. (1996). *It's about time: Temporal aspects of cognitive processes in text production*. Amsterdam: Rodopi.

Timmermans, M., Schriefers, H., Sprenger, S., & Dijkstra, T. (2012). Describing simple events: The dynamics of incremental grammatical encoding. *Journal of Cognitive Psychology, 24*(4), 441–456.

Torrance, M., & Bouayad-Agha, N. (2001). Rhetorical structure analysis as a method for understanding writing processes. In L. Degand, Y. Bestgen, W. Spooren, & L. V. Waes (Eds.), *Multidisciplinary approaches to discourse* (pp. 51–60). Amsterdam: Amsterdam & Nodus Publications.

Torrance, M., Fidalgo, R., & Garcia, J. N. (2007). The teachability and effectiveness of cognitive self-regulation in sixth grade writers. *Learning and Instruction, 17*(3), 265–285.

Torrance, M., Fidalgo, R., & Robledo, P. (2015). Do sixth-grade writers need process strategies? *British Journal of Educational Psychology, 85*(1), 91–112.

Torrance, M., & Nottbusch, G. (2012). Written production of single words and simple sentences. In V. Berninger (Ed.), *Past, present, and future contributions of cognitive writing research to cognitive psychology*. New York: Taylor & Francis.

Torrance, M., Thomas, G. V., & Robinson, E. J. (1996). Finding something to write about: Strategic and automatic processes in idea generation. In M. Levy & S. Ransdell (Eds.), *The science of writing*. Mahwah, NJ: Erlbaum.

Torrance, M., & Wengelin, A. (2010). Writers' eye movements. In C. Bazerman, R. Krut, K. Lunsford, S. McLeod, S. Null, P. Rogers, & A. Stansell (Eds.), *Traditions of writing research* (pp. 394–405). New York: Routledge.

van Wijk, C. (1999). Conceptual processes in argumentation. A developmental perspective. In M. Torrance & D. Galbraith (Eds.), *Knowing what to write. Conceptual processes in text production*. Amsterdam: Amsterdam University Press.

von Kleist, H. (1805). Uber die Allmahliche Verfertigung der Gedanken beim reden [On the progressive elaboration of thought while speaking]. In H. Sembdner (Ed.), *samtliche werke und briefe*. Darmstadt, Germany: Wissenschaftliche Buchgesellschaft.

Wengelin, Å. (2002). *Text production in adults with reading and writing difficulties.* Gothenburg Monographs of Linguistics, 20. Gothenburg, Sweden: Gothenburg University.

Zimmerman, B. J., & Risemberg, R. (1997). Becoming a self-regulated writer: A social cognitive perspective. *Contemporary Educational Psychology, 22*(1), 73–101.

CHAPTER 6

A Sociocultural Perspective on Writing Development

Toward an Agenda for Classroom Research on Students' Use of Social Practices

Richard Beach, George E. Newell, and Jennifer VanDerHeide

To consider a sociocultural perspective for the study of writing development, we begin with a description of a

sociocultural perspective and discourse that enable and extend the potentialities of such a lens. Literacy scholars and researchers employing a sociocultural view of writing development understand the world as socially constructed, where knowing is a dynamic process and matters of teaching and learning are complex. Schultz and Fecho (2000) describe such complexities as

> deep structures of multiply-perceived meaning grounded in the histories of individuals as well as of institutions. Causal relations or simple process-product assumptions are difficult to ascertain due to the multiplicity of variables that could either by themselves or in combination affect the outcome. What people come to know, understand and believe about the world is always contextualized in the time, place, and circumstances in which the knowing was constructed. (p. 51)

Within the context of classrooms, we believe that teachers and students address the institutional contexts in which they find themselves, and they collaboratively construct classroom rhetorical contexts for writing to and for familiar audiences. They often do so imaginatively, appropriating the social practices and structures thrust upon them by broader social forces in ways that push against the ideological agenda of the institutions in which their classrooms are embedded.

In this chapter, we apply a sociocultural perspective to discuss research on writing development with a focus on writers' use of social practices. To illustrate what we mean by social practices within writing systems, we explore research that examined students' uses of three particular social practices: contextualizing writing activity, writing collaboratively, and adopting alternate viewpoints. We then discuss the potential implications of studying writing development defined as changes in students' uses of social practices for communicating their experiences and ideas with audiences.

SOCIOCULTURAL RESEARCH PERSPECTIVES ON WRITING DEVELOPMENT

In adopting a sociocultural research perspective in analyzing writing development, researchers who analyze students' writing go beyond a focus on text features or use of certain cognitive strategies to examine writing development as discourse-in-use (Bloome & Clark, 2006) that is, in terms of how students employ certain social practices related to the enhanced ability to construct and operate in particular rhetorical contexts (Behizadeh & Engelhard, 2011).

In his critique of decontextualized models of development, Applebee (2000) calls for a "social action" perspective —learning to write means providing students with social contexts constituted by particular demands requiring them to make rhetorical decisions related to purpose, audience, genre, and situation. In Chapter 1, this volume, Charles Bazerman, describing a sociocultural perspective on writing, posits the need to examine writing development through how students learn to build relationships with readers, draw on prior texts, share meanings, represent the world, and exploit uses of material and technology tools to construct voice and identities. Bazerman argues that development is most likely to occur through student engagement in different problem-solving writing experiences in different contexts and domains using different genres.

Development is therefore more likely to occur when students are given ample time and support for making their own rhetorical decisions related to topic, genre, audience, and purpose. As an example, in one study tenth-grade students were given a problem-based writing task lasting an entire quarter period that required them to select their

own topic, engage in extensive research, pitch their topic idea to peers using presentation tools, reflect on their progress using a blog, and then share their final report with peers. This assignment was compared with a highly prescribed writing assignment based on the Pennsylvania Common Core State Standards. Students indicated that the highly prescribed assignment helped them incorporate facts, edit errors, and cite information, with little reference to writing process, whereas the problem-based assignment helped them acquire decision-making processes associated with making choices about purpose, audience, and situation (Ward, 2014).

A sociocultural focus therefore differs from most theories of writing development that frame development as the acquisition of text-level psychological skills or cognitive processes employed by individual writers to compose a written text (Applebee, 2000). From a textual or cognitive process perspective, the purpose of writing instruction is to provide students with the requisite skills and psychological processes to perform writing tasks effectively. The degree to which students acquire the targeted psychological skills and processes is viewed as a result of the effectiveness of instruction and the "writing abilities" of students. Conversely, the difficulties that an individual student or a group of students experience are viewed as the result of inadequate instruction or as a missing element in the students' repertoire of writing skills.

Since the 1980s, scholars working from a sociocultural perspective have argued that rather than understanding learning to write as having only a textual dimension (e.g., from learning to write a report and then an analytic essay) or a cognitive dimension (e.g., shifting from knowledge telling to knowledge transforming), writing should be viewed as a social event involving construction of that event and relationships with others. Learning and teaching writing, from a textual or cognitive perspective, are technical matters. Large quantities of instructional materials have been produced and made available to teachers based on direct instruction in the use of textual features or cognitive strategies, which certainly are not unimportant aspects of the development of students as writers.

As Beck (2009) argued, all writing acts have textual, cognitive, and social dimensions. For example, students' metacognitive awareness of differences in particular rhetorical contexts constituted by differences in objects and audiences is critical to a sociocultural perspective (Slomp, 2012). Metacognitively reflecting on their writing represents a challenge for secondary students in terms of identifying their use of certain rhetorical processes or social practices (Mateos, Martín, Villalón, & Luna, 2008); for example, students have difficulty inferring their audience's knowledge of their topic to determine how much explication of their topic they need to provide relative to their audience's prior knowledge.

As Shanahan in Chapter 13, this volume, notes in describing a sociocognitive perspective on how reading influences writing, adolescent writers may be able to infer the nature of their readers, but, compared to adult professional writers, they have difficulty revising their writing to adapt to different audience needs (Lindgren, Leijten, & Van Waes, 2011) or to transfer their audience awareness to apply to subsequent writing (Moore & MacArthur, 2012). From a sociocultural research perspective, rather than focus on whether or not students can engage in metacognitive reflection, what's more important is the degree to which the use of certain activities such as collaborative peer or teacher/student interactions serves to foster metacognitive reflection as well as analysis of variations in use of metacognition specific to certain writing contexts.

What distinguishes a sociocultural from a cognitive perspective is that, as Bazerman argues, a sociocultural perspective foregrounds the *social practices* student writers acquire through learning to adopt and adapt in constructing social and cultural contexts for their writing. A sociocultural perspective therefore highlights the importance of understanding how both teachers and students construct these contexts, given the vast differences in classrooms and the differences in writing practices made available to students within different contexts. Participation in these different contexts requires students' growing awareness and understanding of "rights and obligations for participation" (Bloome & Katz, 1997) that are distributed in ways that shape how students write and respond to one

another's writing, how identities or ethos are assumed, and how meaning is constructed within rhetorical contexts.

A SOCIOCULTURAL FRAMING OF WRITING DEVELOPMENT

How then does such a sociocultural perspective frame writing development? Wardle and Roozen (2012) define a vertical model of writing development associated with acquiring increased knowledge of norms and genre expectations constituting certain kinds of writing through participation in particular discourse communities or disciplinary cultures (Hyland, 2012). As Shanahan notes in Chapter 13, this volume, in the use of reading to write, students learn to read science texts to cite empirical evidence for their claims, whereas in reading history texts, they focus more on a writer's perspective on an historical event (Shanahan, Shanahan, & Misischia, 2011). They are judging texts such as science reports not "because they communicate independently existing truths about the external world, but because they appeal to community-grounded and subjectively shared beliefs of members" of a certain disciplinary culture (Hyland, 2010, p. 34).

Wardle and Roozen (2012) contrast this vertical model of writing development with an ecological model of horizontal writing development that considers how students' participation in a range of different literacy events within and outside of school influences their writing development (Prior & Shipka, 2003; Roozen, 2010; Schultz & Fecho, 2000). In this chapter, we therefore focus on the need to go beyond examining writing development simply in terms of changes in students' texts or composing processes over time to determining those features of social and cultural contexts that serve to foster particular changes over time. These changes occur not only in their texts, but also in their use of the social practices such as contextualizing writing, making connections between texts, adopting alternative perspectives, and collaborating with others.

Drawing on the activity theory of learning (Cole, 1996; Engeström, 2014), a sociocultural model of writing development examines how participation in a particular activity mediated by uses of social practices leads to employment of certain composing processes. This focus on activity reverses traditional literacy learning that presupposes that students need to first acquire competency in language, grammar, rhetorical structures, genres, or literary forms prior to effectively engaging in writing. The alternative approach presupposes that students inductively acquire knowledge of language, genres, discourses, and tools through active participation in writing (Pennycook, 2010).

We therefore perceive writing development as occurring *within* a particular activity through which students acquire the use of language, genres, discourses, and tools unique to that activity, pointing to the importance of analysis of how students and teachers are constructing the meaning of activity in different ways in different contexts mediated by different uses of certain social practices. In a recent study of the teaching of argumentative writing in 31 English language arts classrooms, two of the authors (Newell and VanDerHeide) found that what counted as argument and effective argumentative writing varied from classroom to classroom, and in turn the types of activities the teachers and students engaged in varied, leading to different trajectories of writing development made available to the students (Newell, VanDerHeide, & Wynhoff Olsen, 2014). For example, in one class, the goal of argumentative writing was to know and make use of argumentative elements in writing. The students were therefore engaged in identifying argumentative elements in writing and enacting verbal debates to practice the use of those elements. In another class, the goal of argumentative writing was to use argument to develop original ideas about literature. In turn, the students were involved in discussions of the literature and in writing about their ideas. In just these two classrooms, contrasting the uses of social practices constituting writing required analysis of how teachers and students were constructing the meaning of these argumentative writing tasks, given very different learning

opportunities. This study reflects a primary application of a sociocultural perspective on analyzing writing development as shaped by differences in how certain kinds of activities and genres—analysis and use of argumentative elements versus use of argument to generate original literary interpretations—resulted in different kinds and degrees of writing development.

In drawing on a sociocultural perspective, researchers analyze how writing as a tool mediates activity regarding the relationships between students and objects/outcomes related to certain audience uptake(s) based on certain norms, roles, and a sense of community constituting the activity (Engeström, 2014). Given the importance of contrasting writing *across* different activity systems—for example, writing in academic versus workplace contexts (Russell, 2010)—researchers examine how writers experience tensions and contradictions that require boundary-crossing transfer of social practices across these contexts (Kostouli, 2008; Prior & Shipka, 2002; Spinuzzi, 2003). Writing essays in a high school or first-year college composition class primarily for an instructor differs from writing reports primarily for employers or coworkers enrolled in a college internship program within a workplace context (Russell, 2010). Analysis of writing development for students in the internship program therefore requires a focus on how they recognize tensions and contradictions between writing for their previous general writing courses and writing in the workplace—for example, the fact that in the general writing course they were writing primarily for the teacher's evaluation of the use of certain genre features, while in the workplace context, they were writing to convince coworkers to accept product marketing recommendations.

WRITING DEVELOPMENT AS STUDENTS CHANGE IN PARTICIPATION IN SOCIAL PRACTICES

We therefore posit the need to examine writing development as a continuous, ongoing trajectory in the uses of certain social practices that are continuously evolving as students encounter new challenges (Roozen, 2010). This conception of social practices suggests that rather than "mastering" a certain practice, students' use of that practice is continually evolving *through* activity as they learn to negotiate and use the resources available within and across different communities or ecological systems (Camp, 2012; VanDerHeide & Newell, 2013).

Students' Social Practices in Writing Activity

To illustrate what we mean by social practices in writing activity, we turn to examples of research on students' participation in social practices, focusing on what we consider to be some of the primary practices: contextualizing writing activity, recontextualizing, learning to write collaboratively, and adopting alternative perspectives and practices that overlap and influence each other. We also perceive the adoption of social practices as leading to development of certain dispositions or "habits of mind," as "ways of approaching learning that are both intellectual and practical," that include curiosity, openness, engagement, creativity, persistence, responsibility, flexibility, and metacognition (Council of Writing Program Administrators, National Council of Teachers of English, and National Writing Project, 2011, p. 1).

Contextualizing Writing Activity

One key social practice involves the ability to contextualize activity (Goffman, 1986) by defining or framing writing activity based on certain goals or objects driving an activity, audiences, and situation related to relevant choices in the use of certain genres, registers, discourses, or media forms as well as construction of persona/ethos (Andrews &

Smith, 2011). The focus on contextualizing goes beyond the metaphors of contexts as container or learning in contexts to a focus on "context in learning" (Erstad, 2013, p. 169), so that:

> rather than a thing, context is an outcome of activity or is itself a set of practices—contextualizing rather than context becomes that upon which we focus. Practices are not bounded by context but emerge relationally and are polycontextual, i.e., have the potential to be realized in a range of strata and situations based upon participation in multiple settings. (p. 3) (Edwards, Biesta, & Thorpe, 2009). (Erstad, 2013, p. 171)

More experienced, effective student writers are more likely to contextualize their writing in relation to global rhetorical contexts, focus more on idea generation, and revise based on global intentions and idea generation than less experienced/effective writers (de Milliano, van Gelderen, & Sleegers, 2012; Myhill & Jones, 2007). This suggests the need for writing assignments that require students to generate their own ideas in writing for global contexts as well as the clarity of assignments, so that students understand the expectations for their writing and perceive their writing as resulting in successful, potential uptake with actual audiences (Freadman, 2002).

Students are often more capable of, and engaged in, contextualizing self-initiated writing for social purposes outside the classroom, given their familiarity with their topic and audience in lived-world contexts (Addisson & McGee, 2010). Having a familiar, tangible audience creates conditions that motivate students' contextualizing of writing in terms of understanding the actual social consequences or uptake of their rhetorical actions. For example, middle school students collaboratively crafting a letter to their school board arguing to keep their school open were highly engaged in their writing, given their understanding of how their writing could influence the school board's decision (Sheehy, 2003). Twelfth-grade students engaged in an online role-play activity involving adopting different roles and debating the pros and cons of administrators blocking students' access to websites perceived as problematic would then use their writing to present the case for unblocking the sites to the school administration. This would lead to their reflecting on the effectiveness of their arguments, given administrators' concerns about access to problematic websites (Beach & Doerr-Stevens, 2011). In both studies, students were using argumentative writing to posit the need for change with actual audiences in ways that motivated them to reflect on the degree to which their writing would achieve their intended uptake. By reflecting on the degree to which their writing achieves positive audience uptake, students then acquire knowledge of effective use of rhetorical strategies for engaging audiences.

The increased use of blogs, online discussion forums, curation bulletin boards, digital stories/poetry, and wikis in the classroom has created new spaces for students to contextualize their writing based on communicating with online public, global audiences beyond the classroom (Erstad, 2013; Hull & Stornaiuolo, 2010; Purcell, Heaps, Buchanan, & Friedrich, 2013). Writing in public digital contexts serves to foster development based on the need to consider the social dimensions shaping their writing in ways that may differ from school-based writing. When 444 high school and middle school students were asked what motivated them to write in digital contexts, both in and out of school, half of the students in the study indicated that they were motivated to write for social communication outside of school, while, in contrast, most indicated that they were motivated to write primarily for grades inside schools (Dredger, Woods, Beach, & Sagstetter, 2010). In another study, college students indicated that text messages, emails, and shared lecture notes were the three most frequent types of writing they employed for social purposes outside the classroom to maintain social relationships with others (Pigg, Grabill, Brunk-Chavez, Moore, Rosinski, et al., 2014).

At the same time, in contextualizing writing in digital contexts, students can experience the challenge of "context collapse" related to defining contexts based on distinctions between their familiar peer versus unfamiliar invisible audiences (Boyd, 2014). As they garner online comments from their invisible audiences, they learn to cope with "context collapse," an illustration of how development occurs through active participation in activity over time.

Transfer and Recontextualization: Reading the Rhetorical Context

Given the importance of recontextualization in fostering writing development, such transfer entails recontextualizing students' use of informal language and texts for social purposes outside of the classroom for more formal, academic uses in the classroom (Blommaert, 2005). Van Leeuwen (2008) illustrates the process of recontextualizing texts with the example of conducting research on children's first day of school and initially writing one's observational findings for the students' teacher and parents related to advice on how to prepare students for the first day, but then, adopting a different stance in crafting a research report for publication for larger audiences, a recontextulization of genre and stance given differences in purpose and audience.

Recontextualizing requires recognizing disparities between students' unofficial peer world, the world of the classroom, and the official school world (Dyson, 2013). For example, students learn to code-switch between use of language for informal social purposes such as texting and their formal, academic writing (Wood, Kemp, & Plester, 2013). Similarly, bilingual students learn to transfer use of different languages or voices across different contexts and audiences, particularly when they adopt roles of intended audiences (Martínez, Orellana, Pacheco, & Carbone, 2008).

Students also learn to recontextualize texts across different social genres, for example, moving from open-ended oral discussion to formulation of a written position statement (Bazerman, Bonini, & Figueiredo, 2009). This focus on recontextualizing based on social genres moves away from analysis based primarily on adherence to structural forms to analysis based on social, dialogic interaction with actual and potential audiences. In engaging in argumentative writing, students are continually recontextualizing their claims and supporting reasons given their need to address competing perspectives and counterclaims in order to establish their ethos as someone who is perceived to be aware of these perspectives and within a certain social arena (Newell et al., 2014). Our own 2012 RRQ review of research on argumentative writing (Newell, Beach, Smith, & VanDerHeide, 2011), as well as a more recent review of 97 studies in *Review of Educational Research* (Rapanta, Garcia-Mila, & Gilabert, 2013), reflects a shift in more recent research to analyzing argumentation as a social, dialogic, interactive genre requiring a focus on activity.

Teachers can foster writing development through activity that includes students' shared metacognitive reflection on how they recontextualized their writing through transfer of practices across different contexts. In a longitudinal study of the teaching and learning of argumentation in a ninth-grade English language arts classroom, Wynhoff Olsen (2013) traced three case studies detailing students' participation in instructional conversations grounded in argumentation over two school years. Through transfer across contexts, students created intertextual links through instructional conversations that helped students build relationships with one another. In doing so, they recontextualized argument as dialogic understanding. Thus, writing development occurred through conversations involving students' recognition of the dialogic complexity of knowledge, pointing to the importance of the instructional activity as effectively facilitating conversations about writing and knowledge that served to foster development over the 2-year period.

Learning to Write Collaboratively

Another social practice involves the ability to engage in collaborative writing. Although the definition of collaborative writing is contested (Duffy, 2014), we refer here to students working with each other on writing tasks with a shared sense of roles and responsibilities, as opposed to competing with each other (Ede & Lunsford, 1990). A sociocultural perspective on collaborative writing emphasizes the importance of collaborators sharing common goals and tools mediating that collaboration (Mercer & Howe, 2012).

Collaborative writing is often mediated through digital tools such as wikis, class blogs, or Google Docs (Thompson, 2012). Students use digital annotation applications such as Diigo, DocAS, or iAnnotate to engage in collaborative sharing of written annotations in response to texts (Herman, Gomez, Gomez, Williams, & Perkins, 2008), leading them to generate insights beyond what they may have generated on their own through fostering social interaction (Xin, Glass, Feenberg, Bures, & Abrami, 2011). Students are also more likely to extend their collaborative online arguments by posing questions of each other, with the ability to do so increasing with age (Lai & Law, 2013).

By engaging in collaborative writing mediated by use of digital tools, students are also exposed to their peers' different, alternative thinking processes or perspectives. Such exposure can itself lead to their acquiring or modifying their own processes or perspectives (Laurinen & Marttunen, 2007). At the same time, in collaborating with peers, students may resist their peers' alternative perspectives and suggested revisions as a challenge to their status quo perspectives, generating frustrations that undermine collaboration (Duffy, 2014). Providing students with opportunities to collaboratively reflect on their collaboration itself leads to their identifying those practices contributing to effective collaboration. For example, they may recognize the value of collaboratively grappling with alternative perspectives, recognition that enhances their ability to collaboratively compose texts (Duffy, 2014). Similarly, through engaging in collaborative peer-feedback conferences, students are not only more likely to employ more revisions than if they are self-editing (Diab, 2011), but they are also learning to value collaboration as a means of enhancing the quality and complexity of their writing. Through participation in these collaborative activities, students therefore develop an increased awareness of the value of the dialogic complexity of texts, an awareness that itself is a marker of writing development.

Adopting Alternative Perspectives

In contextualizing texts or writing collaboratively, students are also engaged in adopting alternative social, cultural, and critical perspectives and acquiring the dispositions of curiosity, openness, creativity, and flexibility which enhance their writing (Council of Writing Program Administrators, National Council of Teachers of English, and National Writing Project, 2011).

Argumentative reading and writing pushes students to consider alternative perspectives. Learning to read in order to engage in argumentative writing entails the ability to employ "rhetorical reading" (Warren, 2013) or "reading-to-argue" (Felton, 2004), to read texts on a certain issue to infer an author's stance or perspective on that issue and to locate that author within a set of competing stances or perspectives. That reading practice then transfers to student writers adopting their audiences' perspectives to recognize the need to provide audiences with an understanding of how their evidence serves to support their claim (De La Paz, Ferretti, Wissinger, Yee, & MacArthur, 2012).

Differences in students' knowledge can influence their awareness of alternative perspectives. In summarizing authors' positions, students who are more knowledgeable about authors' perspectives and ideas are more likely to adopt a critical stance on those perspectives than less knowledgeable students (Warren, 2013). Differences in

students' knowledge of race, class, and gender differences in public rhetorical contexts lead to what Flower (2008) defines as "transformed and transformative understanding" (p. 168) through the practice of "rivaling" in which adversaries are perceived as the source for adopting alternative perspectives (Flower, Long, & Higgens, 2000).

By considering alternative perspectives, students then critique their audiences' and their own perspectives on a topic or issue, leading to adoption of more inclusive stances in their writing evident in the use of citing competing perspectives or adding qualifications of their positions in their writing. Comparison of first-year college writing with writing by advanced-level college students showed that advanced students used more qualifiers and hedging that reflected their need to acknowledge their potential audiences' awareness of alternative perspectives on topics addressed in their writing (Aull & Lancaster, 2014).

Students are more likely to develop the ability to engage in audience analysis through receiving reactions from their audiences so that they can assess audience uptake to make necessary revisions. In our online role-play research in which 12th-grade students were debating the need to change their school's Internet policies related to access to different sites, students were continually exposed to their peers' reactions to their claims and evidence, leading them to recognize the need to revise or bolster their claims or evidence to voice counterarguments (Beach & Doerr-Stevens, 2011).

IMPLICATIONS FOR RESEARCH ON WRITING DEVELOPMENT

A sociocultural perspective suggests the need to determine writing development based on changes in students' use of social practices over time through participation in particular contexts. Documenting whether and how development occurs entails analysis of specific features of instructional activity designed to foster contextualization, collaboration, and adoption of alternative perspectives—for example, analysis of whether and how contexts with actual audience uptake contributes to enhanced metacognitive reflection on potential audience uptake. In response to context "A" mediated by use of certain social practices, groups of students may display use of certain social practices in ways that differ from their response to context "B," differences that point to use of context "A" for fostering writing development.

Analysis of activity entails identifying features of rhetorical contexts that are particularly effective in fostering certain kinds of development. For example, a year-long analysis of instruction in an untracked English language arts classroom identified activities that differed from methods typically employed in teaching heterogeneous groups (Freedman, Delp, & Crawford, 2005). Instead of teacher-organized small groups (as in cooperative learning or complex instruction), the teacher relied on whole-group, multimodal activities and one-on-one teacher–student interactions during group activities for "building a long-term curriculum that promotes the recycling of structures and ideas, with room for ever-deepening levels of complexity" (Freedman et al., p. 118). This pedagogical model of development emphasizes students' continual recontextualization of the same practices "in which carefully selected critical ideas could cycle across the year. Students worked with the same concepts over and over, in different contexts, in different ways, and at different points in the year" (p. 107).

Another needed research agenda involves examining how students from a range of social, cultural, and linguistic backgrounds benefit from changes in social practices for learning to write in a range of different contexts. Given that most of the current understanding of writing development derives from studies of white mainstream students, researchers need to work collaboratively with teachers in a range of school contexts that include nonmainstream students. In one project resulting in Freedman's *Inside City Schools* (1999), participating teachers spent an entire academic year investigating issues of literacy and learning that were particular to teaching diverse groups of students

from multicultural communities and classrooms. Teachers employed teacher research methods to generate teaching narratives, capturing how their particular instructional activities built on students' diverse background experiences and created contexts that tapped into students' cultural experiences supporting their writing development, projects documenting features of classroom activity that served to foster writing development.

In conducting this research, there is a need to adopt a more dialogic approach to writing development by rejecting the notion that development occurs only in individuals or only through use of social practices. Rather than simply assuming that individual writers learn new practices from social contexts, a more robust theory would assume that as writers become aware of various contexts, they also become aware of how practices develop in dialogue within and across social contexts—that the individual writer's practices shape and are, in turn, shaped by other writers. A way to conceptualize and study writing development as a social practice is illustrated by a collaborative writing project involving a group of middle school students in an inner-city Detroit school (Curry & Bloome, 1998). So that Curry's students learned to produce rather than reproduce academic writing, Bloome taught them how to adapt an ethnographic framework and then apply relevant strategies and insights to school writing, ethnographic practices that served as a resource to produce academic texts that integrate community-based knowledge and school writing. Acquiring such frameworks enhances students' ability to contextualize their writing based on the cultural aspects of their rhetorical contexts—for example, recognizing the norms and expectations operating in certain online writing sites such as fanfiction.net, so that one is socialized into use of writing according to these norms and expectations.

Finally, in conducting this research, we need a new conceptualization of growth and development in writing that moves researchers and teachers beyond quantitative or linear models that do not capture the complexity of change over time, particularly when studying changes in social practices that may only occur over long time periods, for example, the ability to effectively collaborate with others. Large-scale assessment practices continue to be shaped by the assumption that individual psychological development is the most significant unit of analysis. In an historical analysis of the alignment between writing theory and writing assessment, Behizadeh and Engelhard (2011) describe a widening gap between high-stakes, standardardized assessments of writing as decontextualized skill measured by limited rubrics versus writing to produce meaning within a social context. Given the need to minimize the effects of contextual factors in writing assessments, the writing task prompts employed for assessment purposes often do not include specific contextual descriptors. An analysis of 222 prompts employed in writing assessment by 44 American states found that that approximately half of the prompts did not specify an audience, two-thirds of the prompts provided little choice in terms of topic or procedural task, and 22% specified the stance students needed to adopt (Olinghouse, Zheng, & Morlock, 2012). One possible explanation for the lack of complex writing assessment prompts has to do with the difficulty of devising scoring rubrics to achieve high validity and reliability on analysis of students' use of voice or stance in assessments (DiPardo, Storms, & Selland, 2011). This suggests the need for rubrics that focus more on students' uses of social practices of contextualizing and adopting alternative perspectives.

There is also a need to recognize that different writers may develop in different ways according to different criteria. The assumption that writing development can be assessed according to a singular continuum based on the same criteria or rubric such as "organization" or "language use" is challenged by analysis of successful writers that identified four distinctly different participant profiles with different writing styles: an action and depiction style, an academic style, an accessible style, and a lexical style (Crossley, Roscoe, & McNamara, 2014). Although all of the writers in the study were perceived to be "successful," those writers who adopted an action and depicture style employed more verbs and descriptive adverbs and fewer cohesive devices, while writers adopting an academic style employed more expository structures and syntactically complex sentences, differences in language use that may be a function of their preferred social persona constituting their relationships with their audiences.

Researchers could also employ mediated discourse analysis to track students' trajectories over time in how their

use of writing as a tool contributes to a "nexus of practice" as a shared, aggregate understanding of writing as mediated action within a community or culture (Jones & Norris, 2005; Scollon & Scollon, 2004). For example, students can create digital video representations of how their metacognitive reflections of certain social practices constitute their shared understanding of composing processes—for example, how use of peer collaboration serves to foster self-assessment and revision, leading to their writing development (Hawisher et al., 2010). Researchers would identify instances of peer comments that triggered peer self-assessment as portrayed in the videos as leading to recontextualizing purpose and audience and then how such recontextualizing fosters further revisions. Researchers could then track how repeated instances of productive self-assessment and revisions led to development over time.

Michaels's (1987) notion of a "writing system," or "the activities, norms, rights, and obligations for speaking and acting which influence and constrain student writing in the classroom" (p. 323), offers another approach that brings together information about social organization and recurring writing practices in the classroom, instructional conversations, and the texts that are shaped by them. Such an approach provides a useful tool to document differential treatment and differential access to instructional help within the complexities of classroom life that teachers often find challenging. Moreover, this approach allows for detailed microanalysis of talk and written text located in the analysis of the influences of teacher expectations, instructional practices, and of schools as institutions on the outcome of students' written products and social practices.

Digital tools such as e-portfolios or software analytics programs can be used to track how certain kinds of activity fostered certain social practices that resulted in certain types of writing development from elementary school to postsecondary education (Hillocks, 2002; Wills & Rice, 2013). Such research could focus on the transfer of practices across different social worlds—home/family, peer group, school, and workplace/community, as well as different disciplinary contexts. For example, researchers at the University of Central Florida are analyzing first-year college students' e-portfolio writing samples across the curriculum to determine how the writing they completed in their first-year writing courses transferred to their other courses (Wardle & Roozen, 2012), an approach that could be applied to secondary students. Robust tools such as screencasting tools for video self-analysis for capturing students' reflections can be used to track changes in students' self-analysis relative to writing within and across different contexts. These changes in students' self-assessments can then be linked to use of teacher activities such as modeling self-assessment in conferences, activities that may reflect certain productive "instructional chains" within and across teachers' instruction (VanDerHeide & Newell, 2013).

At the same time, use of assessment tools for analyzing growth in social practices creates a tension for researchers between *describing* students' writing for the purposes of engaging in qualitative research versus *judging* or assessing students' writing for the purpose of determining development in writing quality in the classroom (Lillis, 2013). Engaging in the former entails adopting a descriptive stance for understanding those particular social practices employed in writing as shaped by certain contextual factors. Engaging in the latter entails defining evaluative criteria in ways that may transcend these particular contextual factors for the purpose of making generalizations about students' writing development. Basing analysis of student development on use of assessment tools often reflects adherence to institutional norms or assumptions regarding writing quality that can skew researchers' qualitative insights into the particular social practices operating in unique rhetorical contexts.

IMPLICATIONS FOR INSTRUCTION TO FOSTER WRITING DEVELOPMENT

Our review has implications for teaching use of the social practices of contextualizing, fostering collaboration, and adopting alternative perspectives in the classroom. Adopting a sociocultural perspective on writing development

highlights the importance of creating activities that involve students in contextualizing and recontextualizing their writing across different rhetorical contexts, requiring metacognitive reflection on how their writing differs across alternative contexts. For example, in writing for their different subject matter areas, students are learning how to recontextualize their use of language, discourses, and genres according to disciplinary differences (Shanahan et al., 2011), recontextualization that entails metacognitive reflection. They are more likely to engage in metacognitive reflection about varying their writing through collaboration with peers in which they need to make explicit their decisions to address differences in rhetorical contexts.

Students are also more likely to adopt alternative perspectives in classroom cultures where teachers support open-ended, dialogic exploration of ideas that do not limit students to adopting certain prescribed outcomes or strategies (Aukerman, 2013). Reducing prescribed outcomes or strategies invites students to make more of their own choices regarding topic, purpose, perspectives, genres, and audience appeals, decision making that itself is essential for writing development. If students are limited to achieving a certain predetermined outcome or demonstrating use of a certain strategy in a prescribed manner, they may be less likely to entertain alternative perspectives than when they are operating in a classroom culture that values open-ended exploration of ideas. Such exploration fosters adoption of originality, creativity, and imaginativeness (Council of Writing Program Administrators, National Council of Teachers of English, and National Writing Project, 2011).

SUMMARY

In summary, drawing on a sociocultural perspective, we proffer a definition of writing development based on development of students' use of social practices over time, focusing particularly on the social practices of contextualizing writing, collaborating with peers, and adopting alternative perspectives. We posit that research on the development of the use of these practices needs to include both how use of these practices results in changes in writing over time and analysis of the influence of instructional activity fostering development over time, including how instruction enhances students' ability to recontextualize and transfer use of practices across disparate contexts. We also posit the need for research on how teachers devise and construct open-ended contexts that support growth in students' decision making related to use of contextualization, collaboration, and adoption of alternative perspectives, as well as teachers' use of e-portfolios and data analytics to track students' development over time. This development can then be linked to use of certain instructional activities.

REFERENCES

Addisson, J., & McGee, S. J. (2010). Writing in high school/writing in college: Research trends and future directions. *College Composition and Communication, 62*(1), 147–179.

Andrews, R., & Smith, A. (2011). *Developing writers: Teaching and learning in the digital age*. New York: Open University Press.

Applebee, A. N. (2000). Alternative models of writing development. In R. Indrisano & J. R. Squire (Eds.), *Perspectives on writing: Research, theory, and practice* (pp. 90–111). Newark, DE: International Reading Association.

Aukerman, M. (2013). Rereading comprehension pedagogies: Toward a dialogic teaching ethic that honors student sensemaking. *Dialogic Pedagogy: An International Online Journal, 1*. Retrieved from *http://dpj.pitt.edu*.

Aull, L. L., & Lancaster, Z. (2014). Linguistic markers of stance in early and advanced academic writing: A corpus-

based comparison. *Written Communication, 31*, 151–183.

Bazerman, C., Bonini, A., & Figueiredo, D. (Eds.). (2009). *Genre in a changing world*. Fort Collins, CO: WAC Clearinghouse and Parlor Press.

Beach, K. (1999). Consequential transitions: A sociocultural expedition beyond transfer in education. In A. Iran-Nejad & P. Pearson (Eds.), *Review of research in education* (pp. 101–139). Washington, DC: American Educational Research Association.

Beach, R., & Doerr-Stevens, C. (2011). Using social networking for online role-plays to develop students' argumentative strategies. *Journal of Educational Computing Research, 45*, 165–181.

Beck, S. W. (2009). Composition across secondary and post-secondary contexts: Cognitive, textual and social dimensions. *Cambridge Journal of Education, 39*, 311–327.

Behizadeh, N., & Engelhard, G. (2011). Historical view of the influences of measurement and writing theories on the practice of writing assessment in the United States. *Assessing Writing, 16*, 189–211.

Blommaert, J. (2005). *Discourse: A critical introduction*. Cambridge, UK: Cambridge University Press.

Bloome, D., & Clark, C. (2006). Discourse-in-use. In J. Green, G. Camilli, & P. Elmore (Eds.), *Complementary methods in research in education* (pp. 227–242). Mahwah, NJ: Erlbaum.

Bloome, D., & Katz, L. (1997). Literacy as social practice and classroom chronotopes. *Reading and Writing Quarterly, 13*(3), 205–225.

Boyd, D. (2014). *It's complicated: The social lives of networked teens*. New Haven, CT: Yale University Press.

Brent, D. (2012). Crossing boundaries: Co-op students relearning to write. *College Composition & Communication, 63*(4), 558–592.

Camp, H. (2012). The psychology of writing development—And its implications for assessment. *Assessing Writing, 17*, 92–105.

Cole, M. (1996). *Cultural psychology: A once and future discipline*. Cambridge, MA: Belknap Press.

Council of Writing Program Administrators, National Council of Teachers of English, and National Writing Project. (2011). *Framework for success in postsecondary writing*. Urbana, IL: Authors.

Crossley, S. A., Roscoe, R., & McNamara, D. S. (2014). What is successful writing? An investigation into the multiple ways writers can write successful essays. *Written Communication, 31*, 184–214.

Curry, T., & Bloome, D. (1998). Learning to write by writing ethnography. In A. Egan-Robertson & D. Bloome (Eds.), *Students as researchers of culture and language in their own communities* (pp. 37–58). Cresskill, NJ: Hampton Press.

De La Paz, S., Ferretti, R., Wissinger, D., Yee, L., & MacArthur, C. (2012). Adolescents' disciplinary use of evidence, argumentative strategies, and organizational structure in writing about historical controversies. *Written Communication, 29*(4), 412–454.

de Milliano, I., van Gelderen, A., & Sleegers, P. (2012). Patterns of cognitive self-regulation of adolescent struggling writers. *Written Communication, 29*(3), 303–325.

Diab, N. M. (2011). Assessing the relationship between different types of student feedback and the quality of revised writing. *Assessing Writing, 16*, 274–292.

DiPardo, A., Storms, B. A., & Selland, M. (2011). Seeing voices: Assessing writerly stance in the NWP Analytic Writing Continuum. *Assessing Writing, 16*, 170–188.

Dredger, K., Woods, D., Beach, C., & Sagstetter, V. (2010). Engage me: Using new literacies to create third space classrooms that engage student writers. *Journal of Media Literacy Education, 2*(2), 85–101.

Duffy, W. (2014). Collaboration (in) theory: Reworking the social turn's conversational imperative. *College English, 76*(5), 416–435.

Dyson, A. H. (2013). *ReWRITING the basics: Literacy learning in children's cultures*. New York: Teachers College Press.

Ede, L., & Lunsford, A. (1990). *Singular texts/plural authors: Perspectives on collaborative writing*. Carbondale: Southern Illinois University Press.

Edwards, R., Biesta, G., & Thorpe, M. (Eds.). (2009). *Rethinking contexts for learning and teaching: Communities, activities and networks*. New York: Routledge.

Engeström, Y. (2014). *Learning by expanding: An activity-theoretical approach to developmental research*. New York: Cambridge University Press.

Erstad, O. (2013). *Digital learning lives: Trajectories, literacies, and schooling*. New York: Peter Lang.

Felton, M. K. (2004). Developing discourse strategies in adolescent argumentation. *Cognitive development, 19*, 35–52.

Flower, L. (2008). *Community literacy and the rhetoric of public engagement*. Carbondale: Southern Illinois University Press.

Flower, L., Long, E., & Higgins, L. (2000). *Learning to rival: A literate practice for intercultural inquiry*. Mahwah, NJ: Erlbaum.

Freadman, A. (2002). Uptake. In R. M. Coe, L. Lingard, & T. Teslenko (Eds.), *The rhetoric and ideology of genre: Strategies for stability and change* (pp. 39–53). Cresskill, NJ: Hampton Press.

Freedman, S. W. (Ed.). (1999). *Inside city schools: Investigating literacy in multicultural classrooms*. New York: Teachers College Press.

Freedman, S. W., Delp, V., & Crawford, S. (2005). Teaching English in untracked classrooms. *Research in the Teaching of English, 40*, 62–126.

Goffman, I. (1986). *Frame analysis: An essay on the organization of experience*. Boston: Northeastern University Press.

Hawisher, G. E., Prior, P., Berry, P., Buck, A., E. Gump, S. E., Holding, C., et al. (2010). Ubiquitous writing and learning: Digital media as tools for reflection and research on literate activity. In B. Cope & M. Kalantzis (Eds.), *Ubiquitous learning* (pp. 254–264). Urbana: University of Illinois Press.

Herman, P., Gomez, L. M., Gomez, K., Williams, A., & Perkins, K. (2008). Metacognitive support for reading in science classrooms. In P. A. Kirschner, F. Prins, V. Jonker, & G. Kanselaar (Eds.), *Proceedings of the 8th international conference of the learning sciences*, Vol. 1 (pp. 342–349). Utrecht, The Netherlands: International Society of the Learning Sciences.

Hillocks, G. (2002). *The testing trap: How state writing assessments control learning*. New York: Teachers College Press.

Hull, G. A. & Stornaiuolo, A. (2010). Literate arts in a global world: Reframing social networking as cosmopolitan practice. *Journal of Adolescent and Adult Literacy, 54*(2), 84–96.

Hyland, K. (2010). *Second language writing* (8th ed.). New York: Cambridge University Press.

Hyland, K. (2012). *Disciplinary identities: Individuality and community in academic discourse*. New York: Cambridge University Press.

Jones, R. H., & Norris, S. (2005). *Discourse in action: Introducing mediated discourse analysis*. New York: Routledge.

Kostouli, T. (2008). Introduction: Making social meanings in contexts. In T. Kostouli (Ed.), *Writing in context(s): Textual practices and learning processes in sociocultural settings* (pp. 1–26). New York: Springer.

Lai, M., & Law, N. (2013). Questioning and the quality of knowledge constructed in a CSCL context: A study on two grade-levels of students. *Instructional Science, 41*(3), 597–620.

Laurinen, L. I., & Marttunen, M. J. (2007). Power of language through chat debates. *Computers and Composition, 24*(3), 230–246.

Lillis, T. (2013). *The sociolinguistics of writing*. Edinburgh, UK: Edinburgh University Press.

Lindgren, E., Leijten, M., & Van Waes, L. (2011). Adapting to the reader during writing. *Written Language and Literacy, 14*, 188–223.

Martínez, R., Orellana, M. F., Pacheco, M., & Carbone, P. (2008). Found in translation: Connecting translating experiences to academic writing. *Language Arts, 85*(6), 421–431.

Mateos, M., Martín, E., Villalón. R. Y., & Luna, M. (2008). Reading and writing to learn in secondary education: Online processing activity and written products in summarizing and synthesizing tasks. *Reading and Writing, 21*, 675–697.

Mercer, N., & Howe, C. (2012). Explaining the dialogic processes of teaching and learning: The value and potential of sociocultural theory. *Learning, Culture, and Social Interaction, 1*, 12–21.

Michaels, S. (1987). Text and context: A new approach to the study of classroom writing. *Discourse Processes, 10*, 121–346.

Moore, N. S., & MacArthur, C. A. (2012). The effects of being a reader and of observing readers on fifth-grade students' argumentative writing and revising. *Reading and Writing, 25*, 1449–1478.

Myhill, D., & Jones, S. (2007). More than just error correction: Students' perspectives on their revision processes during writing. *Written Communication, 24*(4), 323–343.

Newell, G. E., Beach, R., Smith, J., & VanDerHeide, J. (2011). Teaching and learning argumentative reading and writing: A review of research. *Reading Research Quarterly, 46*, 273–304.

Newell, G. E., VanDerHeide, J., & Wynhoff Olsen, A. (2014). High school English language arts teachers' argumentative epistemologies for teaching writing. *Research in the Teaching of English, 49*, 95–119.

Olinghouse, N. G., Zheng, J., & Morlock, L. (2012). State writing assessment: Inclusion of motivational factors in writing tasks. *Reading and Writing Quarterly, 28*, 97–119.

Pennycook, A. (2010). *Language as local practice*. New York: Routledge.

Pigg, S., Grabill, J. T., Brunk-Chavez, B., Moore, J. L., Rosinski, P., & Curran, P. G. (2014). Ubiquitous writing, technologies, and the social practice of literacies of coordination. *Written Communication, 31*(1), 91–117.

Prior, P., & Shipka, J. (2003). Chronotopic lamination: Tracing the contours of literate activity. In C. Bazerman & D. Russell (Eds.), *Writing selves, writing society* (pp. 180–239). Fort Collins, CO: Clearinghouse.

Purcell, K., Buchanan, J., & Friedrich, L. (2013). *The impact of digital tools on student writing and how writing is taught in schools.* Washington, DC: Pew Research Center's Internet & American Life Project.

Purcell, K., Heaps, A., Buchanan, J., & Friedrich, L. (2013). *How teachers are using technology at home and in their classrooms*. Washington, DC: Pew Research Center's Internet & American Life Project.

Rapanta, C., Garcia-Mila, M., & Gilabert, S. (2013). What is meant by argumentative competence? An integrative review of methods of analysis and assessment in education. *Review of Educational Research, 83*(4), 483–520.

Roozen, K. (2010). Tracing trajectories of practice: Repurposing in one student's developing disciplinary writing processes. *Written Communication, 27*, 318–354.

Russell, D. R. (2010). Writing in multiple contexts: Vygotskian CHAT meets the phenomenology of genre. In C. Bazerman, B. Krut, K. Lunsford, S. McLeod, S. Null, P. Rogers, et al. (Eds.), *Traditions of writing research* (pp. 353–364). New York: Routledge.

Salomon, G., & Perkins, D. N. (1989). Rocky roads to transfer: Rethinking mechanisms of a neglected phenomenon. *Educational Psychologist, 24*, 113–142.

Schultz, K., & Fecho, B. (2000). Society's child: Social context and writing development. *Educational Psychology,*

35, 51–62.

Scollon, R., & Scollon, S. B. K. (2004). *Nexus analysis: Discourse and the emerging internet*. New York: Routledge.

Shanahan, C., Shanahan, T., & Misischia, C. (2011). Analysis of expert readers in three disciplines: History, mathematics, and chemistry. *Journal of Literacy Research, 43*(4), 393–429.

Sheehy, M. (2003). The social life of an essay. *Written Communication, 20*(3), 333–353.

Slomp, D. H. (2012). Challenges in assessing the development of writing ability: Theories, constructs and methods. *Assessing Writing, 17*, 81–91.

Smart, G., & Brown, N. (2002). Learning transfer or transforming learning? Student interns reinventing expert writing practices in the workplace. *Technostyle, 18*(1), 117–141.

Spinuzzi, C. (2003). *Tracing genres through organizations: A sociocultural approach to information design*. Cambridge, MA: MIT Press.

Thompson, I. (2012). Planes of communicative activity in collaborative writing. *Changing English: Studies in Culture and Education, 19*(2), 209–220.

Thompson, I. (2013). The mediation of learning in the zone of proximal development through a co-constructed writing activity. *Research in the Teaching of English, 47*(3), 247–276.

VanDerHeide, J., & Newell, G. E. (2013). Instructional chains as a method for examining the teaching and learning of argumentative writing in classrooms. *Written Communication, 30*, 300–329.

Van Leeuwen, T. (2008). *Discourse and practice: New tools for critical discourse analysis*. New York: Oxford University Press.

Ward, J. (2014, May 18). Researching research [web log post]. Retrieved from *http://digitalis.nwp.org/site-blog/researching-research/6062.*

Wardle, E., & Roozen, K. (2012). Addressing multiple dimensions of writing development: Toward an ecological model of assessment. *Assessing Writing, 17*, 106–119.

Warren, J. E. (2013). Rhetorical reading as a gateway to disciplinary literacy. *Journal of Adolescent and Adult Literacy, 56*(5), 391–399.

Wills, K. V., & Rice, R. (2013). *Eportfolio performance support systems: Constructing, presenting, and assessing portfolios*. Anderson, SC: Parlor Press.

Wood, C., Kemp, N., & Plester, B. (2013). *Text messaging and literacy: The evidence*. New York: Routledge.

Wynhoff Olsen, A. (2013). *A longitudinal examination of interactional, social, and relational processes within the teaching and learning of argumentation and argumentative writing.* (Doctoral dissertation). Retrieved from *https://etd.ohiolink.edu.*

Xin, M. C., Glass, G., Feenberg, A., Bures, E. M., & Abrami, P. (2011). An investigation of annotation-enhanced online discussion forums. In F. Pozzi & D. Persico (Eds.), *Techniques for fostering collaboration in online learning communities: Theoretical and practical perspectives* (pp. 300–318). Hershey, PA: IGI Global.

CHAPTER 7

After Writing, After School

Katherine Schultz, Glynda A. Hull, and Jennifer Higgs

Our review of scholarship on writing in out-of-school contexts, research that has been carried out over the last 15 years, pushes the field to redefine writing and to redefine school. Digital tools have opened the door to composing in a range and blend of genres, modes, languages, and platforms, forever expanding sets of audiences and purposes. Writing, long identified with essayist traditions and logocentric values, has exploded, and its variety will not now be tamed or contained. Similarly, as new configurations for the delivery of education have emerged in multiple arenas —public and private, national and international, formal and informal—conceptions of schools have shifed as well. State-supported, conventionally organized schools still dominate the educational landscape, to be sure, but their singular provenance as the most important institution that socializes and educates youth has long been under siege. These developments and the research we reviewed led us to title our chapter "After Writing" and "After School." They also led us to ask: How do we conceptualize the productive, designful, creative, diverse acts of symbol use to which many increasingly have access, practices that force us to broaden typographic, printcentric notions of writing? And how do such acts increasingly occur within and across spaces, places, and times, challenging old borders between school and nonschool hours and contexts?

Scholarship on writing out of school began to flourish in the 1990s, as researchers in a range of disciplines noticed that children and adults excelled at cognitive tasks in nonschool contexts that they struggled with in school (Hull & Schultz, 2002). From candy-sellers in Brazil to homemakers in Southern California, researchers documented successful engagement in a variety of domains outside of school, raising interest in the contextual bases of performance as well as worries that, for many children, school had a stultifying effect. Similar worries galvanized scholars in anthropology, linguistics, and education who set about understanding the poor school-based performance of certain groups of children, especially African Americans, through an examination of different patterns of language use in home, school, and the community (e.g., Cazden, John, & Hymes, 1972). In the field of writing, research in nonschool settings was also buoyed by the emergence of sociocultural perspectives on literacy, especially the "New Literacy Studies" (NLS; Gee, 1996; Street, 1993). The calling card of this perspective was the multiple nature of literacy—that is, instead of one version of writing, there are many situated writing practices, each representing a blend of particular technologies, forms of knowledge, and skills (Scribner & Cole, 1981). Such a view freed researchers to widen their writing gaze—and to document the writing and literacy practices of taxi drivers in South Africa, skateboarders in Iowa, basketball players in Chicago, churchgoers in the American South, immigrant families from Mexico settled across the United States, young men banded together in gangs, frontline workers in factories, youthful participants in community drama programs, and on and on. It seemed that writing flourished everywhere, except in school, and researchers leapt to document its functions and to understanding its embeddedness in daily life.

When we turn to the most recent research on writing out of school that we review in this chapter, the continuities are clear, since researchers have continued to document writing in daily life and in the context of nonschool programs. But we also see a shift, what has come to be called the "digital turn" (Mills, 2010), whereby most research on writing beyond school now takes as its centerpiece compositional practices mediated by digital technologies. Of the 56 pieces that we reviewed, 45 focused on digitally mediated writing and composing—broadly conceived to include, not only, or even majorly, alphabetic texts and genres, but rather a range and blend of semiotic systems, including the making of music, videos, images, and code. In out-of-school settings, "writing" has indeed been blended with "making," and the boundaries that establish contexts in which making is viewed as possible and proper are elastic and permeable, spanning school, home, community, and even spaces normally reserved for other functions and purposes, such as church, public transportation, and movie theaters (cf. Ito et al., 2010; Sefton-Green, 2013).

After briefly describing our methodology for selecting studies, in the sections that follow we describe the major

conceptual frameworks used by literacy researchers in their work on out-of-school writing and the central findings from this research. We conclude with a discussion of future directions for research after school and after writing, along with the implications for this work.

METHODOLOGY

We searched for studies on nonschool writing published from 2000 to 2014, which is the time period immediately prior to and following the publication of *School's Out* (Hull & Schultz, 2002), an edited book that heralded research on writing and literacy out of school. Using three major search engines for education research—EBSCO Academic Search Premier, ERIC, and Google Scholar—we combined the following descriptive terms and keywords in the searches to maximize the number of potential studies (with some adjustments for different search engines): *Informal or nonschool or outside school* were combined with the terms (using the connector *and*) *writing*, *composition*, *composing*, *youth*, *children*, *digital*, *media*, *technology*, *techno**, *multimedia*, and *data*. The term *data* was included to help winnow out nonempirical pieces. As we were interested in empirical examinations of young people's writing in nonschool spaces, we looked for peer-reviewed studies that reported empirical research in a variety of settings (e.g., after-school programs, prisons, community centers, online); provided details on methodological approaches; and focused explicitly on writing practices (versus or in addition to literacy practices). Although we did not target a specific age range, it became clear during our searches that most studies of outside-school writing have focused on adolescents. As we examined the studies, we also found that a number of them focused on school-based writing in after- or extra-school programs, even though their titles and/or abstracts suggested a focus on nonschool writing. These were removed from the corpus we examined, although we found it noteworthy that these studies often positioned school-based writing as the goal of nonschool composing practices. As of April 2014, our searches of databases as well as hand searches of reference lists yielded a total of 56 studies of nonschool writing.

THEORETICAL FRAMEWORKS

For the past 15 years, literacy scholars, and particularly those who study literacy in out-of-school contexts, have increasingly theorized literacy by drawing on perspectives from anthropology, sociolinguistics, and social theory. Naming this framework the New Literacy Studies (NLS), they emphasize the interplay between the meanings of local events and an analysis of broader discursive, historical, geographic, cultural, and political institutions and practices (e.g., Barton & Hamilton, 1998; Gee, 1996; Hull & Schultz, 2001; Street, 1993). In this section we elaborate the NLS framework and describe how this conceptual lens has been extended by the New London Group's work on multiliteracies and through recent critiques that draw on actor–network theory (ANT), performance and spatial theories, as well as analyses that highlight the importance of power and agency.

According to researchers in the NLS tradition, literacy practices are most usefully conceptualized as situated in time, space, institution, and culture, as well as negotiated, contested, and striated with power (e.g., Barton & Hamilton, 1998; Street, 2003). As Kress and van Leeuwen (2001) elaborate, writing always exists within a range of semiotic resources that are intrinsically tied to meaning making. The use of this framework has led to many rich qualitative, ethnographic, and design-based studies of literacy practices in a wide range of settings.

Scholars developed the NLS framework in response and in opposition to the oral/literate binaries that characterized literacy research from the 1960s to the early 1980s. These so-called Great Divide theories had posited essential cognitive differences between literate and nonliterate individuals and societies (e.g., Goody & Watt, 1963).

In contrast to what came to be recognized as exaggerated claims about the effects of literacy in tandem with erroneous assumptions about its unitary nature (or a single dimension that defines whether or not people are literate), scholars documented a multiplicity of literacy practices within a range of local contexts (e.g., Basso, 1974; Cazden et al., 1972; Heath, 1983; Szwed, 1981), as well as the varied cognitive and social effects of literacy in those contexts, given different combinations of knowledge, skills, and technologies (e.g., Scribner & Cole, 1981).

In recent years, researchers who study writing and literacy in out-of-school contexts have drawn on the NLS framework almost to the exclusion of all others. The dominance of this framework has meant that researchers of out-of-school literacy practices have veered away from a focus on the cognitive demands of writing that had, in an earlier era, enabled researchers to trace the strategies and writing processes of authors singly and in collaboration (e.g., Bereiter & Scardamalia, 1987; Flower & Hayes, 1981). This pendulum swing has led to the neglect of fine-grained research on the mental strategies of composing in research on out-of-school writing, which has focused instead on its social and cultural dimensions. But the shift was also generative, honing our understandings of writers' backgrounds and contexts. It became customary within NLS to refer to "literacy events" (e.g., Heath, 1983) and then increasingly to "literacy practices" (e.g., Scribner & Cole, 1981), both emphasizing the social surrounds of texts. While the term *literacy events* signaled everyday or repeated occurrences, the term *literacy practices* came to connote activities surrounded by relationships and infused with vernacular meanings (Barton & Hamilton, 1998; Heath, 1983; Hornberger, 2001; Street, 2001). The theoretical heft of NLS has allowed researchers to document the wide range of literacy practices that flourish in on- and offline domains, home and community settings, and informal and formal spaces (Hull & Schultz, 2002).

The focus on literacy practices by NLS scholars, and the attendant discovery of literacy where it was not expected, in a range of out-of-school contexts, coalesced in a durable interest in everyday people as literate actors engaged in textual meaning-making activities. In fact, as Moje and Luke (2009) point out, research on literacy within the NLS tradition became almost synonymous with research on identity, as scholars explored how textuality fundamentally intersects with senses of self (cf. Gee, 1996). To wit, there was widespread fascination with how "people's identities mediate and are mediated by the texts they read, write, and talk about" (Moje & Luke, 2009, p. 416).

The concept of "identity in practice," introduced by Holland, Lachicotte, Skinner, and Cain (1998; cf. Bartlett & Holland, 2002), elaborates the relationship of identity with agency. According to Holland and her colleagues, people construct their identities within the contexts of "figured worlds" or culturally shared practices. The authors highlight the importance of improvisation as a practice that describes "where—along the margins and interstices of collective cultural and social constructions—how, and with what difficulties human actors, individuals, and groups are able to redirect themselves" (Holland et al., 2001, p. 278) or act with agency. According to these theoretical understandings of identity, people take on identities in relation to context and experience. The identities are not intrinsic or separate from social contexts and interactions; rather, they are embodied and enacted in practice.

With an emphasis on design, a responsiveness to diverse groups of people and contexts, and an attentiveness to the challenges of an increasingly globalized world, a group of scholars known as the New London Group extended the work of the NLS to examine various channels, modes, and modalities, such as audio, visual, gestural, and linguistic resources that they call multiliteracies. Although writing has always been multimodal in that it requires designing space, visual marks, color, and image (cf. Finnegan, 2002; Jewitt, 2005), and many societies have long incorporated multiple modes into their semiotic systems (Canagarajah, 2013), the recent intense proliferation of new digital tools has widened the lens of multimodal composing. This fresh framing of new forms of writing in a digital age and a diverse and interconnected world privileged semiotics rather than linguistics (Kress, 2003) and called attention to how information and ideas are differentially conveyed through different modalities.

In spite of NLS's pervasiveness in nearly all of the research on out-of-school literacy in the past 15 years, important questions and critiques have been raised about the NLS as a theoretical framework. The insights from these critical analyses shed light on recent research and suggest ways to think about the next generation of studies. The work of Latour (e.g., 1996, 2005) in articulating Actor-Network Theory (ANT) and of sociologists such as Lefebvre (1991), as well as new advances in conceptualizing identity, agency, and power, have been particularly important. Brandt and Clinton (2002) were instrumental in raising questions about whether the emphasis on the local in the NLS has exaggerated the importance of local contexts and, as a result, failed to fully take into consideration the technologies of literacy and its global reach. They draw on Latour's explanation of ANT (e.g., Latour, 1996) to argue that literacy "participates in social practices in the form of objects and technologies" (Brandt & Clinton, 2002, p. 338). Literacy is always simultaneously local and global and must be studied and understood as such. According to Latour, human and nonhuman actors/actants are always circulating and in relationship to one another. Brandt and Clinton explain:

> The perspective we are advocating would allow us to acknowledge the heavy hand literacy has had in building networks across time and space—in de-localizing and reframing social life—and in providing centralizing powers by which larger and larger chunks of the social world are organized and connected. (2002, p. 347)

Following Latour (1996), Brandt and Clinton want to replace the concept of "literacy event" with "literacy-in-action" to emphasize how literacy events privilege human action. This would highlight the role literacy itself plays in activity and emphasize that literacy is not only produced in local practice, but is an actor in the local context and its meanings have a life of their own. They claim that NLS puts boundaries around literacies as local practices, making it difficult to trace how they move across global contexts. This consideration is particularly important in research on digital technologies, which cross visible and invisible boundaries (cf. Jacobs, 2006; Kell, 2011).

Several literacy researchers who focus on out-of-school contexts have emphasized the importance of time and place. For instance, Blackburn (2002) uses the term *literacy performances* to bring together ideas from NLS and Butler's (1991) conception of performance. The notion of performance allows Blackburn to analyze literacy events over time and across geographical locations. She illustrates how literacy is performed repeatedly in ways that both confirm and disrupt prior performances. Similarly, Leander and McKim (2003) argue for the need to trace practices across geographical spaces by emphasizing the continuity of online and offline practices, explaining that "multiple space-times are invoked, produced, folded into one another, and coordinated in activity" (p. 224). Their work raises questions about situatedness in descriptions of literacy practices. As Leander and Kim assert:

> Inspired by a Latourian perspective on flow, the study of literacy practices could pull back from a fixation on isolated texts, authors, and isolated textual practices to consider how such texts are related to actual readers, desks and workspaces, writing technologies, classroom rules, clothing, school lunches, calendars, and a whole host of material, symbolic, and human actants that are active in the construction of social space. (2003, p. 227)

These authors emphasize the importance of spatial analysis and the understanding of how identity, geography, and power are consequential in understanding local/global relations.

The tracing of power and agency has been central to several recent studies of writing. For instance, Collins and

Blot (2003) address the danger of relying too much on particularistic accounts of literacy without considering the desire for more general claims. They argue further that an analysis of power is largely absent from most NLS research, and they suggest the importance of macro- and micro-analyses that include power and identity. Echoing this argument, Barton and Hamilton (1998) suggest that ANT (Latour, 1996) offers a way to trace how power works through literacy events through its focus on the flow and concentration of resources across social networks. Latour (1996) is careful to emphasize, however, that ANT is a dynamic concept in contrast to the static nature of the term *network*. This occurs, he argues, through the inclusion of nonhuman artifacts or things in the term *actor* (or *actant*). As Leander and McKim (2003) explain, such an expansive definition of how resources flow across social networks gives researchers a way to look at translations, transformations, and transductions rather than single moments. Leander and McKim also point to the inadequacy of NLS to account for the relationship between local and global contexts. An analysis that simultaneously takes into account local *and* global contexts, while highlighting resources flows and the interplay of power and agency, becomes particularly challenging, yet important, in social media and global exchanges where identities, geographies, and modalities are often shifting.

METHODOLOGICAL FRAMEWORKS

Although recent studies of writing in out-of-school contexts have expanded our conceptual understanding of literacy and exposed a vast repertoire of composing practices and products available for youth in and out of school contexts, scholars have studied this wide range with a familiar set of methods of research. In our examination of the work on out-of-school literacy practices, we discovered that nearly all of the studies used qualitative approaches to capture and analyze composing processes and artifacts. Ethnographic methods and individual case studies emerged as the most common designs, regardless of their focus on digitally mediated or print-based writing.

For example, in her 3-year study of six adolescent English language learners (ELLs) writing in a popular online fan fiction archive, Black (2005) used ethnographic and discourse analytic methods to gain a sense of the fan fiction community as a discursive space. As a participant observer on the website, she gathered data through semistructured interviews via email, instant message (IM) chats, screen captures, and file downloads of participants' texts as well as reader reviews of the participants' texts. Because of geographic distance, she did not make face-to-face contact with her participants, a fact that draws attention to some of the complexities of qualitative Internet research (cf. Hine, 2000; Markham & Baym, 2009).

A smaller number of studies have blended qualitative and quantitative approaches (e.g., Hull, Stornaiuolo, & Sahni, 2010; Lam, 2009). For example, Hull and colleagues (2010) employed mixed methods for data collection and analysis in their multisited, multiyear Kidnet project. To understand how participation in an online social network, Space2Cre8, and offline local programs supported cosmopolitan citizenship among youth in four countries, they collected quantitative data, including Space2Cre8's history-tracking "back-end" archive and participant surveys, as well as observational field notes of program activities, audio and video recordings of group interactions related to Space2Cre8 use, semistructured interviews, and artifacts created by participants.

FINDINGS

Studies of out-of-school writing draw attention to the variation in young people's symbolic forms of expression in and across diverse spaces. Researchers have examined how youth write in a range of nonschool settings, including after-school centers, programs that offer alternatives to incarceration, youth media programs, and community centers

(e.g., Hull & Katz, 2006; Soep, 2006; Vasudevan, Kerr, Hibbert, Fernandez, & Park, 2014). The majority of out-of-school writing research conducted in the last 15 years, however, has focused on an expanding repertoire of writing practices in online spaces. These studies show that young people employ a range of semiotic resources to connect with others and with new affinity groups, and that participation in these social spaces can support identity negotiation and agentive self-authoring. We begin our review by describing the outside-school writing contexts and practices that recent studies have identified. We then turn to two themes salient in the literature on youths' nonschool writing in the 21st century: writing to create local and global connections and writing to author and represent a self.

Range and Variation of Out-of-School Writing Contexts and Practices

In contrast to examinations of school-based writing, which tend to emphasize test performance, instructional methods, learning standards alignment, and discipline-specific practices, researchers interested in young people's nonschool writing have sought to understand the wide range of writing practices in which youth engage across diverse contexts. Examinations of outside-school writing in recent years have tended to focus on the processes and textual products of young people's self-sponsored writing (Britton, 1975; Emig, 1971) in online spaces, including chatrooms (Lam, 2004), fan websites (Steinkuehler, 2007), relay writing forums (Yi, 2008), and social networking sites (Hull & Stornaiuolo, 2014). Researchers have also investigated writing contexts that typically include digital tools and networks, including after-school programs, youth detention centers, and youth media organizations, as active sites of nonschool youth writing (e.g., Brass, 2008; Kinney, 2012; Vasudevan, 2006).

Studies have catalogued a range of composing practices within these varied spaces, including diary writing (Schultz, 2002), tagging (Moje, 2000), posting to social network sites (Davies, 2012), poetry writing (Jocson, 2006), fan fiction writing (Black, 2005), blogging (Mazur & Kozarian, 2010), instant messaging (Haas, Takayoshi, Carr, Hudson, & Pollock, 2011), digital storytelling (Hull & Katz, 2006), and programming (Burke & Kafai, 2010). The variety of practices and genres that flourish outside of school have prompted ongoing critiques of the narrow scope of writing forms valued in schools (cf. Gee & Hayes, 2011). Although we recognize and are concerned that access to new information and communication technologies remains widely variable (Schradie, 2011; Warschauer & Matuchniak, 2010), we note that the range of writing represented in these studies suggests that many youth are finding ways to participate in the proliferation of digital authoring tools and create their own opportunities to compose with and across a range of modes.

Writing to Connect Locally and Globally

Many young people are writing to connect with others in socially oriented, highly collaborative, online spaces. New media tools have presented youth with unprecedented opportunities to participate in and connect with affinity groups (Gee, 2000) through interactions relatively unconstrained by time and space (Hull et al., 2010; Jacobs, 2006; Lewis & Fabos, 2005). Researchers have examined the artifact creation around which many of these interactions occur, as well as the ways in which young composers forge and negotiate relationships with local and global audiences through changed semiotic and textual practices associated with digital tool use (Domingo, 2013; Dowdall, 2009; Guzzetti & Gamboa, 2005).

For example, in their study of interactions through social media between groups of youth in New York City and India, Hull and Stornaiuolo (2014) examined how these young men and women attempted to communicate across transnational spaces and multimodal texts and "negotiate proper distance" in relation to their distant, interactive

audiences. Through discussions, journals, poems, blog posts, private messages, videos, and videotaped commentary shared on the Space2Cre8 social networking site, the students used multiple communicative modes to represent their locally situated and globally relevant stories and adopted a variety of rhetorical stances as they endeavored to locate themselves in time and space relative to unfamiliar interlocutors. For these students, engaging in digital multimodal practices enabled them to playfully experiment with notions of space and time and to design novel representations of their own and others' stories. Although achieving understandings across difference through these creative endeavors proved to be a challenging process, Hull and Stornaiuolo found that "failed" efforts to communicate ultimately facilitated an openness to difference in cultural values, practices, and beliefs among participants.

Writing to Participate in Self-Authorship

A number of studies have focused on how writing can facilitate youths' agentive self-authoring and fluid identity negotiation (e.g., Gilhooly & Lee, 2014; Greenhow & Robelia, 2009; Guzzetti & Gamboa, 2005; Hull & Katz, 2006; Lam, 2000; Yi, 2007). Vasudevan and colleagues (2010), for example, examined how adolescents involved in the Insight Project, a theater project situation within the Alternative to Incarceration Program (ATIP), engaged in authoring across multiple dimensions, including improvisation, focused storytelling, composing scenes and scripts, rehearsals, performing for multiple audiences, and talkbacks (i.e., cast and audience discussion sessions). These authoring opportunities not only provided spaces for participants to compose and perform for a range of audiences, but also offered spaces for reflection, ongoing critical dialogue, and collaboration. Through storytelling, participants were able to lay claim to identities beyond those typically assigned to them as incarcerated youth. Participation in multidimensional self-authoring foregrounded the youths' discursive freedom and critical capacities in ways that invited the young people to see past institutional labels and "in ways that may not have been welcome in other social spaces through which they moved, including schools, homes, and community contexts" (Vasudevan et al., 2010, p. 63).

Leveraging expanded representative forms afforded by digital tools can also help young writers develop empowering narratives of self and rewrite their identities with and for affinity groups (Guzzetti & Gamboa, 2004; Vasudevan, 2006). In her study of the computer-mediated communication of a Chinese immigrant teenager, Lam (2000) offered an early analysis of how youth-authored digital texts might be used to represent and reposition an individual's identity. As an English language learner (ELL) enrolled in remedial and ESL classes at his urban U.S. high school, Almon reported feeling stigmatized as a low-achieving student and worried about his future success owing to his perceived inability to speak English like a native. Through online correspondence with a transnational group of peers, Almon was able to represent and reposition his identity as a composer of English texts. Creating digital texts in his virtual communities enabled the discursive construction of a textual self as well as construction of social networks. It also helped Almon to form a different relationship to English as he gained confidence in his ability to express himself and to overcome his anxiety about the future. The "rewriting" of Almon's textual identity through communication in networked affinity spaces (Gee, 2004) underscores the potential of social sites of digital authorship as tools that can allow marginalized or isolated youth to construct new narratives of self.

A trend among recent studies concerned with youth identity, agency, and composition is a pronounced interest in how second-language learners (and especially English language learners) use digital composition to reinvent, link, and position their national identities (e.g., Gilhooly & Lee, 2014; Lam, 2009; McLean, 2010). In examining the digital, multimodal writing practices of three ethnic Karen brothers who had resettled in the United States with their parents, Gilhooly and Lee (2014) found that the brothers participated in a variety of online literacy spaces that enabled them to connect to the broader Karen diaspora community, sustain ethnic solidarity, express political views

and allegiance, and share their cultural heritage. Drawing on a variety of semiotic resources, the brothers designed photographic collages, music videos, and digital stories to represent their transnational identities and their lived experiences. Gilhooly and Lee found that creating and sharing these online texts served a psychosocial function for the brothers, helping to alleviate the trauma and isolation of resettlement and also connecting them to a network of information and supportive contacts.

Summary

The simultaneous explosion of affordances and tools for digital and multimodal composing has led to a multiplicity of studies in the literacy field. In 2002, Hull and Schultz claimed that writing theory had benefited enormously from and in some ways been led by the conceptual advances derived from studying literacy practices in out-of-school spaces. As the distinctions between school and nonschool spaces rapidly disappear with literacy practices crossing geographical and textual borders, and as the distinctiveness of the category of writing is collapsing, recent literacy research has continued to benefit from and be pushed forward by this research. The studies reviewed here reveal an impressive array of authoring activities in which many youth engage as they traverse their social worlds. These investigations also emphasize the increasing ubiquity of digital, networked tools in outside-school writing and the ways in which the immediately publishable forms of multimodal composition that these tools make possible magnify the social nature of 21st-century writing.

Research suggests that nonschool writing, in its many guises, can shift young people's social participation, helping them to connect with others and express themselves and their experiences to local and global, known and unknown audiences. Symbolic expression across multiple modes, spaces, and genres can engage youth in performing and negotiating past, present, and future identities, and in designing new narratives of self and other. Yet, our review also showed us that such themes are now familiar narratives in the research literature. As important as this work has been for dispelling deficit orientations about youthful abilities and motivations, as well as for opening our eyes to different forms of digitally mediated literacy, how might we productively push beyond research that documents the range of digital writing and its social purposes?

NEW DIRECTIONS

In his discussion of how research has changed in the digital age, Jackson (2013) explains that the compression of time and space afforded by new technologies suggests that researchers should now engage in thin rather than thick description (Geertz, 1973). Researchers can no longer return to sequestered spaces that protect them from their "informants." Instead, across continents and time zones, the researched read scholars' accounts and participate in making meaning of their texts. Using terms reminiscent of the distinction between events and practices, Geertz (1973) describes thin ethnography as what is seen with the naked eye. In contrast, thick description is the result of sociological investigation (Geertz, 1973; Jackson, 2013). In contrast to these traditional anthropological distinctions, Jackson argues for flat ethnography that relies on "thin slices" of ideas and contexts that arise from a variety of perspectives, scales, and registers. A flat ethnography of literacy practices suggests the attempt to capture small moments and a range of texts across time and space, rather than a rich description of a single composing practice located in a particular time and place. We found that a preponderance of the research on out-of-school writing described and valorized specific literacy practices through in-depth ethnography and often thick descriptions. We wonder if this conception of flat ethnography might produce a different kind of research that is suited to studying

writing in the digital age. What might it mean to use the methodology of flat ethnography to document the literacy practices of emerging technologies, tools, and social interactions? Would a method that focuses on thin slices of data collected over time and across geographical space allow researchers to study literacy practices in a digital age from multiple vantages while revealing their complexity?

Most studies of out-of-school writing practices have been solo affairs, focused on providing details of one program or activity, a student or a few students, a certain genre or text type, in a limited time frame. Participants are usually not followed in any depth longitudinally, and few attempts have been made to study development or change over time (cf. Smith, 2014). This means that we have little understanding of the trajectories taken by youth as they navigate digital pathways, geographical spaces, multiple languages and sign systems, and the like over time. We also are missing accounts of out-of-school programs that go beyond evaluation research to consider students' learning and development (Huang, Cho, Mostafavi, & Nam, 2010; Hull, Kenney, Marple, & Forsman-Schneider, 2006; Sebring et al., 2013). Partly, these omissions have to do with the nature of out-of-school activities, which spread themselves over an array of informal contexts or consist of formal programs that are institutionally fragile and short term in duration due to their dependence on external funding. The scarcity of longitudinal studies also reflects the logistical and resource challenges of carrying out long-term studies in general. We wonder how we might document learning and development when there are different conceptions and dimensions of where and when learning occurs? Further, we wonder what design elements and mentorship are needed to support learning and development as young people compose in nonschool spaces?

We recommend a turn toward analyses of how participants and programs develop across out-of-school and in-school contexts, and short of continuous research over time, we suggest "revisits" whereby researchers go back to participants and sites from their previous inquiries to gain insights both on that previous work and on how participants have fared in the intervening years. In part, this is what Jackson suggests by his conception of flat ethnography, though he also suggests holding onto the complexity of the activities and where and when they occur in these periodic returns. Sefton-Green and Rowsell (2015) have recently initiated and offered a set of such revisits among literacy researchers. In their chapter in their volume, for example, Hull and Young (2015) revisited Hull's long-term work with a digital storyteller that led her to a new understanding of that artist's engagement with symbolic creativity. We believe that revisits can also foreground the dramatic shifts that are occurring in writing practices in our digital, mobile, and global world, as well as highlight how people increasingly make meaning across time, contexts, and tools.

In recent years, there has been a growing interest in virtual worlds (Gee, 2007; Gillen, 2009; Steinkuehler, 2007), creative digital media production (Peppler & Kafai, 2007), and digital making (Burke & Kafai, 2010; Maloney, Peppler, Kafai, Resnick, & Rusk, 2008) or the maker movement (e.g., Sefton-Green, 2013). Digital making is the process of using digital tools in creative ways to make new products through methods such as coding and computer programming (Sefton-Green, 2013). Although much of the activities of the maker movement are not about composing per se, its embrace of the concept of "learning by doing" along with its emphasis on the role of materials, tools and new technologies for education in the digital age overlaps with literacy and learning in several important ways. As with much of the current research on out-of-school literacies, this work currently relies on descriptive case studies. These initial case studies raise questions about what it means to compose in a digital communication landscape characterized by new genres, convergence, media mixes, new writer–audience relationships, and broad participation. As compared to the out-of-school literacy research, which is often pointed toward schools in an effort to improve academic achievement through extending the school day, the scholarly writing on the maker movement is often more broadly situated, highlighting composing/making opportunities that will support youth in their development as 21st-century citizens. We anticipate that our understanding of learning and education will similarly

expand if researchers move beyond the school building and the school day to document writing texts and practices (cf. Ito et al., 2013). Similarly, we expect our understanding of what counts as legitimate, critical, powerful, and appropriate texts will continue to evolve. One opportunity, largely missed thus far, is to explore the intersection of writing, aesthetics, and ethics, taking into consideration what is considered to be beautiful, apt, and politically and ethically alert, in the creation of texts and writing spaces (Hull & Nelson, 2009).

Looking toward new possibilities for scholarship on writing out of school, we believe that researchers will increasingly be alert to the ways in which "out of school" and "in school" can both index international contexts and distant and different as well as massive audiences. There is much interest now, through sociolinguistically oriented studies, in understanding the implications of "super diversity" (or the complexity of society due to the interplay of variables such as cultural heritage, linguistic diversity, and legal status) (Arnaut & Spotti, 2014; Vertovec, 2007) for our conceptions of language use (e.g., Blommaert, Collins, & Slembrouck, 2005; Blommaert & Rampton, 2011; Warriner & Wyman, 2013). As our world becomes more connected transnationally, but more complexly divided across multiple, simultaneous, intensive diversities (Appadurai, 2006, 2013), literacy and language practices become pressure points, sensitive locations where the local and global may intersect. This opens up new spaces for research on composing practices and increased understanding of the capacities of youth and adults.

New scholarship on writing in out-of-school contexts might focus on such questions as when and how it is useful to draw boundaries about what is and is not "writing." Similarly, under what circumstances do traditional contextual boundaries such as school and nonschool matter for research on composing? Is it critical to always hold onto complexity in our research on composing, or are there moments when it makes sense to simplify in order to understand? In other words, when is it essential to retain the multilayered, multidimensional, transnational aspects of textual production, and when should we focus on a single aspect of composing? If the world outside school has radically changed, including the nature of communication and space–time relationships, how might school change accordingly, and what schooled literacy practices are crucial to retain?

As we enter an era when more and more people have accepted the notion that important learning (and writing) occur out of school, the notion of in- and out-of school literacy practices may no longer be a useful distinction. Similarly, we wonder whether the term *writing* captures the enormous variety and multiplicity of composing practices among youth and adults. We suggest that school, and school terms, are no longer the arbiters of what to research and where to conduct our studies, which should not rely on school outcomes for their power and importance. This move away from schools and writing will allow us to bring together educators, policy makers, and researchers, along with youth themselves, to imagine new spaces and new forms of learning and composing.

REFERENCES

Appadurai, A. (2006). *Fear of small numbers: An essay on the geography of anger*. Durham, NC: Duke University Press.

Appadurai, A. (2013). *The future as cultural fact: Essays on the global condition*. London: Verso.

Arnaut, K., & Spotti, M. (2014). Super-diversity discourse. In K. Tracy (Ed.), *The international encyclopedia of language and social interaction*. Oxford, UK: Wiley Blackwell.

Bartlett, L., & Holland, D. (2002). Theorizing the space of literacy practices. *Ways of Knowing Journal, 2*(1), 10–22.

Barton, D. (1994). *Literacy: An introduction in the ecology of written language*. Oxford, UK: Blackwell.

Barton, D., & Hamilton, M. (1998). *Local literacies: Reading and writing in one community*. London: Routledge.

Basso, K. (1974). The ethnography of writing. In R. Bauman & J. Sherzer (Eds.), *Explanations in the ethnography of speaking* (pp. 425–432). Cambridge, UK: Cambridge University Press.

Bereiter, C., & Scardamalia, M. (1987). *The psychology of written composition.* Hillsdale, NJ: Erlbaum.

Black, R. (2005). Access and affiliation: The literacy and composition practices of English-language learners in an online fanfiction community. *Journal of Adolescent and Adult Literacy, 49*(2), 118–128.

Blackburn, M. V. (2002). Disrupting the (hetero) normative: Exploring literacy performances and identity work with queer youth. *Journal of Adolescent and Adult Literacy, 46*(4), 312–324.

Blommaert, J., & Rampton, B. (2011). Language and superdiversity. *Diversities, 13*(2), 1–21.

Blommaert, J., Collins, J., & Slembrouck, S. (2005). Polycentricity and interactional regimes in "global neighborhoods." *Ethnography, 6*, 205–235.

Brandt, D., & Clinton, K. (2002). Limits of the local: Expanding perspectives on literacy as a social practice. *Journal of Literacy Research, 34*(3), 337–356.

Brass, J. J. (2008). Local knowledge and digital movie composing in an after-school literacy program. *Journal of Adolescent and Adult Literacy, 51*(6), 464–473.

Britton, J. (1975). *The development of writing abilities (11–18)*. London: Macmillan.

Burke, Q., & Kafai, Y. B. (2010). *Programming and storytelling: Opportunities for learning about coding and composition*. Paper presented at the 9th International Conference on Interaction Design and Children, Barcelona, Spain.

Butler, J. (1991). Imitation and gender insubordination. In D. Fuss (Ed.), *Inside/out: Lesbian theories, gay theories* (pp. 13–31). London: Routledge.

Canagarajah, S. (2013). *Translingual practice: Global Englishes and cosmopolitan relations*. London: Routledge.

Cazden, C. B., John, V. P., & Hymes, D. (1972). *Functions of language in the classroom*. Oxford, UK: Teachers College Press.

Collins, J., & Blot, R. K. (2003). *Literacy and literacies: Texts, power, and identity*. Cambridge, UK: Cambridge University Press.

Davies, J. (2012). Facework on Facebook as a new literacy practice. *Computers and Education, 59*(1), 19–29.

Domingo, M. (2013). Transnational language flows in digital platforms: A study of urban youth and their multimodal text making. *Pedagogies: An International Journal, 9*(1), 7–25.

Dowdall, C. (2009). Impressions, improvisations and compositions: Reframing children's text production in social network sites. *Literacy, 43*(2), 91–99.

Emig, J. (1971). *The composing processes of twelfth graders*. Urbana, IL: National Council of Teachers of English.

Finnegan, R. (2002). *Communicating: The multiple modes of human interconnection*. London: Routledge

Flower, L., & Hayes, J. R. (1981). A cognitive process theory of writing. *College Composition and Communication, 32*(4), 365–387.

Gee, J. P. (1996). *Social linguistics: Ideology in discourses* (2nd ed). London: Falmer Press.

Gee, J. P. (2000). Identity as an analytic lens for research in education. *Review of Research in Education, 25*, 99–125.

Gee, J. P. (2004). *Situated language and learning*. New York: Routledge.

Gee, J. P. (2007). *What video games have to teach us about learning and literacy*. New York: Palgrave Macmillan.

Gee, J. P., & Hayes, E. R. (2011). *Language and learning in the digital age.* New York: Routledge.

Geertz, C. (1973). *The interpretation of cultures*. New York: Basic Books.

Gilhooly, D., & Lee, E. (2014). The role of digital literacy practices on refugee resettlement. *Journal of Adolescent and Adult Literacy, 57*(5), 387–396.

Gillen, J. (2009). Literacy practices in Schome Park: A virtual ethnography. *Journal of Research in Reading, 32*(1), 57–74.

Goody, J., & Watt, I. (1963). The consequences of literacy. *Comparative Studies in Society and History, 5*(3), 304–326.

Greenhow, C., & Robelia, B. (2009). Informal learning and identity formation in online social networks. *Learning, Media and Technology, 34*(2), 119–140.

Guzzetti, B. J., & Gamboa, M. (2004). Zines for social justice: Adolescent girls writing on their own. *Reading Research Quarterly, 39*(4), 408–436.

Guzzetti, B., & Gamboa, M. (2005). Online journaling: The informal writings of two adolescent girls. *Research in the Teaching of English, 40*(2), 168–206.

Haas, C., Takayoshi, P., Carr, B., Hudson, K., & Pollock, R. (2011). Young people's everyday literacies: The language features of instant messaging. *Research in the Teaching of English, 45*(4), 378–404.

Heath, S. B. (1983). *Ways with words*. New York: Cambridge University Press.

Hine, C. (2000). *Virtual ethnography*. Thousand Oaks, CA: SAGE.

Holland, D., Lachicotte, W., Jr., Skinner, D., & Cain, C. (2001). *Identity and agency in cultural worlds*. Cambridge, MA: Harvard University Press.

Hornberger, N. H. (1995). Ethnography in linguistic perspective: Understanding school processes. *Language and Education, 9*(4), 233–248.

Hornberger, N. H. (2001). Afterword: Multilingual literacies, literacy practices and the continua of biliteracy. In K. Jones & M. Martin-Jones (Eds.), *Multilingual literacies: Reading and writing different worlds*. Amsterdam: John Benjamins.

Huang, D., Cho, J., Mostafavi, S., & Nam, H. (2010). *What works? Common practices in high functioning afterschool programs across the nation in math, reading, science, arts, technology, and homework: A study by the National Partnership*. Los Angeles: National Center for Research on Evaluation, Standards, and Student Testing (CRESST).

Hull, G. A., & Young, R. (2015). Life in rhyme: Art, literacy, and survival. In J. Sefton-Green & J. Roswell (Eds.), *Learning and literacy over time: Longitudinal perspectives* (pp. 183–201). New York: Routledge.

Hull, G., & Katz, M.-L. (2006). Crafting an agentive self: Case studies of digital storytelling. *Research in the Teaching of English, 41*(1), 43–81.

Hull, G., Kenney, N., Marple, S., & Forsman-Schneider, A. (2006). *Many versions of masculine: Explorations of boys' identity formation through multimodal composing in an after-school program*. The Robert F. Bowne Foundation's Occasional Papers Series. New York: Robert F. Bowne Foundation.

Hull, G., & Nelson, M. (2009). Literacy, media, and morality: Making the case for an aesthetic turn. In M. Baynham & M. Prinsloo (Eds.), *The future of literacy studies* (pp. 199–227). London: Palgrave Macmillan.

Hull, G., & Schultz, K. (2001). Literacy and learning out of school: A review of theory and research. *Review of Educational Research, 71*, 575–611.

Hull, G., & Schultz, K. (2002). *School's out: Bridging out-of-school literacies with classroom practice*. New York: Teachers College Press.

Hull, G., & Stornaiuolo, A. (2014). Cosmopolitan literacies, social networks, and "proper distance": Striving to understand in a global world. *Curriculum Inquiry, 44*(1), 15–44.

Hull, G., Stornaiuolo, A., & Sahni, U. (2010). Cultural citizenship and cosmopolitan practice: Global youth communicate online. *English Education, 42*(4), 331–367.

Ito, M., Baumer, S., Bittani, M., Boyd, D., Cody, R., Herr-Stephenson, B., et al. (2010). *Hanging out, messing around, and geeking out: Kids living and learning with new media*. Cambridge, MA: MIT Press.

Ito, M., Gutiérrez, K., Livingstone, S., Penuel, W. R., Rhodes, J., Salen, K., et al. (2013). *Connected learning: An*

agenda for research and design. Irvine, CA: Digital Media and Learning Research Hub.

Jackson, J. L., Jr. (2013). *Thin description: Ethnography and the African Hebrew Israelites of Jerusalem*. Cambridge, MA: Harvard University Press.

Jacobs, G. E. (2006). Fast times and digital literacy: Participation roles and portfolio construction within instant messaging. *Journal of Literacy Research, 38*(2), 171–196.

Jewitt, C. (2005). Multimodality, "reading," and "writing" for the 21st century. *Discourse: Studies in the Cultural Politics of Education, 26*(3), 315–331.

Jocson, K. M. (2006). "Bob Dylan and hip hop": Intersecting literacy practices in youth poetry communities. *Written Communication, 23*(3), 231–259.

Kell, C. (2011). Inequalities and crossings: Literacy and the spaces-in-between. *International Journal of Educational Development, 31*(6), 606–613.

Kinney, A. (2012). Loops, lyrics, and literacy: Songwriting as a site of resilience for an urban adolescent. *Journal of Adolescent and Adult Literacy, 55*(5), 395–404.

Kress, G. (2003). *Literacy in the new media age*. London: Routledge.

Kress, G. (2011). English for an era of instability: Aesthetics, ethics, creativity and design. In J. Sefton-Green, P. Thomson, K. Jones, & L. Bresler (Eds.), *The Routledge international handbook of creative learning* (pp. 211–216). London: Routledge.

Kress, G., & van Leeuwen, T. (2001). *Multimodal discourse: The modes and media of contemporary communication*. London: Hodder Education.

Lam, W. S. E. (2000). L2 literacy and the design of the self: A case study of a teenager writing on the internet. *TESOL Quarterly, 34*(3), 457–482.

Lam, W. S. E. (2004). Second language socialization in a bilingual chat room: Global and local considerations. *Language Learning & Technology, 8*(3), 44–65.

Lam, W. S. E. (2009). Multiliteracies on instant messaging in negotiating local, translocal, and transnational affiliations: A case of an adolescent immigrant. *Reading Research Quarterly, 44*(4), 377–397.

Latour, B. (1996). On actor-network-theory—A few clarifications. *Soziale Welt-Zeitschrift fur Sozialwissenschaftliche forschung und praxis, 47*(4), 369.

Latour, B. (2005). *Reassembling the social: An introduction to actor-network-theory*. Oxford, UK: Oxford University Press.

Leander, K. M., & McKim, K. K. (2003). Tracing the everyday "sitings" of adolescents on the internet: A strategic adaptation of ethnography across online and offline spaces. *Education, Communication and Information, 3*(2), 211–240.

Lefebvre, H. (1991). *The production of space* (D. Nicholson-Smith, Trans.). Oxford, UK: Blackwell

Lewis, C., & Fabos, B. (2005). Instant messaging, literacies, and social identities. *Reading Research Quarterly, 40*(4), 470–501.

Maloney, J. H., Peppler, K., Kafai, Y., Resnick, M., & Rusk, N. (2008). Programming by choice: Urban youth learning programming with Scratch. *ACM SIGCSE Bulletin, 40*(1), 367–371.

Markham, A. N., & Baym, N. K. (Eds.). (2009). *Internet inquiry: Conversations about method.* Thousand Oaks, CA: SAGE.

Mazur, E., & Kozarian, L. (2010). Self-presentation and interaction in blogs of adolescents and young emerging adults. *Journal of Adolescent Research, 25*(1), 124–144.

McLean, C. A. (2010). A space called home: An immigrant adolescent's digital Literacy practices. *Journal of Adolescent and Adult Literacy, 54*(1), 13–22.

Mills, K. A. (2010). A review of the "digital turn" in the new literacy studies. *Review of Educational Research, 80*(2), 246–271.

Moje, E. (2000). "To be part of the story": The literacy practices of gangsta adolescents. *Teachers College Record, 102*(3), 651–690.

Moje, E., & Luke, A. (2009). Literacy and identity: Examining the metaphors in history and in contemporary research. *Reading Research Quarterly, 44*(4), 415–437.

Peppler, K. A., & Kafai, Y. B. (2007). From SuperGoo to Scratch: Exploring creative digital media production in informal learning. *Learning, Media and Technology, 32*(2), 149–166.

Prinsloo, M., & Breier, M. (1996). *The social uses of literacy: Theory and practice in contemporary South Africa*. Bertsham, South Africa: SACHED Books.

Schradie, J. (2011). The digital production gap: The digital divide and Web 2.0 collide. *Poetics, 39*(2), 145–168.

Schultz, K. (2002). Looking across space and time: "Reconceptualizing literacy learning in and out of school." *Research in the Teaching of English, 36*(3), 356–390.

Scribner, S., & Cole, M. (1978). Literacy without school: Testing for intellectual effects. *Harvard Educational Review, 48*(4), 448–461.

Scribner, S., & Cole, M. (1981). *The psychology of literacy*. Cambridge, MA: Harvard University Press.

Sebring, P. B., Brown, E. R., Julian, K. M., Ehrlich, S. B., Sporte, S. E., et al. (2013). *Teens, digital media, and the Chicago Public Library*. Chicago: University of Chicago Consortium on Chicago School Research.

Sefton-Green, J. (2013). *Learning at not-school: A review of study, theory, and advocacy for education in non-formal settings*. White paper for the MacArthur Foundation.

Sefton-Green, J., & Rowsell, J. (Eds.). (2015). *Learning and literacy over time: Longitudinal perspectives*. New York: Routledge.

Smith, A. (2014). *Transcontextual writing development among young men*. Unpublished doctoral dissertation. New York University.

Soep, E. (2006). Beyond literacy and voice in youth media production. *McGill Journal of Education, 41*(3), 197–213.

Steinkuehler, C. A. (2007). Massively multiplayer online gaming as a constellation of literacy practices. *E-Learning, 4*(3), 297–318.

Street, B. V. (1984). *Literacy in theory and practice*. Cambridge, UK: Cambridge University Press.

Street, B. V. (1993). (Ed.). *Cross-cultural approaches to literacy*. New York: Cambridge University Press.

Street, B. V. (2001). Literacy "events" and literacy "practices": Theory and practice in the "New Literacy Studies." In K. Jones & M. Martin-Jones (Eds.), *Multilingual literacies: Comparative perspectives on research and practice*. Amsterdam: John Benjamins.

Street, B. V. (2003). What's new in new literacy studies? *Current Issues in Comparative Education, 5*(2), 77–91.

Szwed, J. F. (1981). The ethnography of literacy. In M. F. Whiteman (Ed.), *Writing: The nature, development, and teaching of written communication. Part 1* (pp. 13–23). Hillsdale, NJ: Erlbaum.

Vasudevan, L. (2006). Making known differently: Engaging visual modalities as spaces to author new selves. *E-Learning, 3*(2), 207–216.

Vasudevan, L., Kerr, K. R., Hibbert, M., Fernandez, E., & Park, A. (2014). Cosmopolitan literacies of belonging in an after-school program with court-involved youths. *Journal of Adolescent and Adult Literacy, 57*(7), 538–548.

Vasudevan, L., Stageman, D., Jay, J., Rodriguez, K., Fernandez, E., & Dattatreyan, E. G. (2010). Authoring new narratives with youth at the intersection of the arts and justice. *Perspectives on Urban Education, 7*(1), 54–65.

Vertovec, S. (2007). Super-diversity and its implications. *Ethnic and Racial Studies, 30*, 1024–1054.

Warriner, D. S., & Wyman, L. T. (2013). Experiences of simultaneity in complex linguistic ecologies: Implications for theory, method, and practice. *International Multilingual Research Journal, 7*(1), 1–14.

Warschauer, M., & Matuchniak, T. (2010). New technology and digital worlds: Analyzing evidence of equity in access, use, and outcomes. *Review of Research in Education, 34*(1), 179–225.

Yi, Y. (2007). Engaging literacy: A biliterate student's composing practices beyond school. *Journal of Second Language Writing, 16*, 23–39.

Yi, Y. (2008). Relay writing in an adolescent online community. *Journal of Adolescent and Adult Literacy, 51*(8), 670–680.

CHAPTER 8

The Development of Multileveled Writing Systems of the Brain

Brain Lessons for Writing Instruction

Karin H. James, R. Joanne Jao, and Virginia Berninger

Until recently, most neuroscience research on the brain was based on autopsies of individuals who lost writing skills before death and thus acquired disorders later in development (e.g. Anderson, Damasio, & Damasio, 1990; Basso, Taborelli, & Vignolo, 1978; Brain, 1967). That all changed with the development of technology near the end of the 20th century, when studies then focused on the living brain, initially with adults but increasingly with children and youth. This chapter reviews research on the developing brain as it relates to writing systems. We begin with an evidence-based, conceptual framework for writing systems of the brain grounded in current paradigms in neuroscience, developmental science, learning science, and instructional science. We then provide a brief overview of research methods used for studying the developing brain, followed by illustrative neuroscience findings for writing in early childhood, middle childhood, and adolescence/young adults. Finally, we discuss the significance of these brain findings in reference to five key ideas about how neuroscience can be used to inform educators interested in brain-based pedagogy and brain-based lessons for writing instruction.

MULTIPLE WRITING SYSTEMS IN THE DEVELOPING BRAIN

Despite frequent use of expressions that suggest a separation among language in general and reading and writing, research has shown that reading and writing must be considered parts of language (Berninger & Abbott, 2010). An evidence-based conceptual model of writing systems in the brain (Berninger, 2015; Berninger & Niedo, 2014) includes four language systems—language by ear, language by mouth, language be eye, language by hand—each of which is multileveled (subword, word, multiword syntax and idioms, and text). Moreover, each of the language systems interacts with the other language systems and with sensory/motor, social emotional, cognitive, and attention/executive function systems in the brain. However, which of these systems are interacting with other systems or with specific levels or skills in those other systems depends on the developmental level of the writer and the specific language or writing task.

In interpreting brain research, it is important to consider whether participants were individuals learning to write with or without a struggle or individuals who had acquired and then lost writing skills. For example, *dys*graphia is a word of Greek origin that means *impaired* graph production by hand—letter writing is not legible and automatic. *A*graphia is also a word of Greek origin that means *without* letter production capability because what was once acquired is now lost. This chapter focuses on the developing brain, as related to writing, rather than on acquired writing disorders due to brain injury or disease in adults following earlier normal writing acquisition.

METHODS USED TO STUDY THE DEVELOPING HUMAN BRAIN

For the most part, only noninvasive imaging, such as computer-assisted tomography (CT), *structural* magnetic resonance imaging (MRI), *functional* MRI (fMRI), diffusion tensor imaging (DTI), electroencephalograms (EEGs), and event-related potentials (ERPs), are approved by the U.S. Food and Drug Administration (FDA) for use in research with children. Becoming a critical consumer of brain research requires synthesizing findings not only for specific brain regions but also for the aspect of brain structure or function assessed by a particular imaging tool, none of which assesses all aspects of brain structure or function and which differ in what they do assess. Further, brain research has uncovered an organ that is highly synthesized and dynamic—one that does not emphasize particular regions in isolation, but rather, *systems* in the brain that underlie given functions. These systems are composed of interrelated groups of regions that have feedforward and feedback networks; they influence one another on many different levels. The interactions among regions are influenced by experience, and this is most important for skills acquired as a result of explicit teaching. The underlying brain systems are shaped by interactions among teachers and learners.

Here we give a brief overview of the methods for imaging the brains of children that are discussed in this chapter. Some of these techniques assess brain *structure* (CT, MRI, DTI) and can provide valuable insights into changes in structure that occur over time. Other techniques assess brain *function* (fMRI, functional connectivity, ERPs) and are crucial for understanding how human behavior is produced. These imaging techniques, when coupled with behavioral measures, allow us to understand mechanisms that underlie writing acquisition and therefore add important information to what we can assess by the study of overt behaviors only.

MRI produces structural images of the brain, whereas functional MRI (fMRI) allows for the localization and measurement of functional brain activity via the blood oxygen level dependent (BOLD) signal (Amso & Casey, 2006). This signal provides an indirect measure of neuronal activity (Heeger & Ress, 2002), based on neural activity coupled with local hemodynamic oxygenation, that is, increased oxygen level means increased neuronal activity (Thomas & Tseng, 2008). Regions of the brain that are using more oxygenated hemoglobin are identified through computer data analyses.

Because fMRIs carry no risks, it is a safe measure to use repeatedly with developing populations (with the exception of those with ferromagnetic materials in or on the body). However, to image a brain using fMRI, the participant must stay very still (usually only 5 mm of movement is allowable), which is an obvious limitation for imaging developing children. The reason the child must be absolutely still is that movement results in motor artifact. Thus, typically only children older than 4 years of age can participate in fMRI studies. Depending on the procedure, a 25% attrition rate in the 4- to 5-year-old range occurs, meaning children cannot lie still long enough to complete the procedure; but children in the age 5- to 6-year-old range have a 10% attrition rate. However, the data on children younger than 4 years are virtually unusable unless the children are sedated.

Furthermore, the fMRI data can be used to assess functional connectivity in the developing brain through a

variety of analysis techniques, including correlations, Grainger causality, and psychophysiological interactions (PPI) analyses. These methods have the ability to measure the changing dynamics and functional connections between brain regions over the course of development. This procedure, in its many forms, allows the researcher to observe brain regions that activate together, suggesting that these interactive regions form a functional network. Because we know that human behavior is so complex that it requires the use of many brain systems for any given task, it is important to specify systems, and not just isolated regions, that are required for a given task of interest.

The EEG is an additional imaging tool used to assess cognitive function by recording oscillations in electrical activity from the surface of the scalp. In this method, participants are repeatedly presented with a particular stimulus to reduce random noise and to produce a waveform that reflects the neuronal response to that stimulus (Thomas & Casey, 2003). The averaged waveform is known as an ERP when the responses evoked by stimuli for eliciting specific cognitive processes are time-locked to the onset of the stimulus (Thomas & Casey, 2003; DeBoer, Scott, & Nelson, 2007). Deflections in the ERP waveform, known as components, reflect activity from large neuronal populations and indicate particular aspects of cognitive and sensory processes (DeBoer, Scott, & Nelson, 2007; Taylor & Baldeweg, 2002). Although the temporal resolution of ERP data is accurately measurable within milliseconds, the spatial resolution is less precise due to the recording of electrical potentials at the scalp. Given the temporal resolution of this tool, ERPs can be used, however, to address questions of cognitive functioning in which timing is pertinent. Additionally, ERPs have been successfully used to study development in children (Friedman, 1991), for example, in response to task-relevant and irrelevant stimuli in both passive and active tasks (Taylor & Baldeweg, 2002). Further, EEG and ERP can be used to assess temporal processing in the brain from birth and are therefore useful tools for studying the writing brain early in development.

DEVELOPMENT OF THE WRITING BRAIN

Similar to the ever-changing platforms in our computer technology, the developing brain supporting writing undergoes continual change, in part because of genes that regulate neural migration, neural development and function, and protein production, and in part because of interactions between the brain and environment of the developing child (Berninger, 2015, chap. 7). In a groundbreaking longitudinal study using MRI, Giedd and colleagues (1999) identified neuroanatomical changes in the brain from early to middle childhood to adolescence. Thus, in this chapter the focus is on representative studies at these target developmental times with a focus on writing.

Infancy to Early Childhood

Although writing is not taught to infants and very young children, longitudinal research using EEGs and ERPs has shown that processes known to underlie letter and word perception may have their sources in infancy. For example, ERPs collected at birth showed that auditory pitch processing differentiated children who were and were not at genetic risk for dyslexia, a specific learning disability associated with impaired oral word decoding and reading and written spelling. The ERPs also predicted letter knowledge and phonological skills prior to school age and phoneme duration perception, spelling, and reading speed in second grade (Leppänen et al., 2010). This line of research points to the importance of early screening and intervention to prevent spelling problems, which may be related to problems in differentiating sounds through the ears as well as later differentiating letters processed through the eyes and hands.

The early pitch perception problems may not be restricted to the auditory input mode alone but may reflect a broader problem in pattern analysis. Brem et al. (2010) showed with concordant ERP and fMRI in nonreading kindergarten children that print sensitivity for fast (< 250 milliseconds) processes in posterior occipital-temporal brain regions (where visual processes through the eye are integrated with language through the ear) is associated with learning letter–speech sound correspondences needed in both spelling and word reading. These studies suggest that systems used later for reading are developing very early on and may have significant impact on subsequent reading and writing skills.

Early Childhood

Networks for Visual Word Forms as Well as Graphomotor Planning

It is well established that a network of brain regions is activated when written words and their letters are processed in literate adults (e.g., Cohen et al., 2002). This system of regions includes the left fusiform gyrus, which is sometimes referred to as the "visual word form" area, left superior temporal gyrus/supramarginal gyrus, and left inferior frontal gyrus. However, because the left fusiform gyrus responds differently depending on whether an individual perceives the written word or the written letter (James, James, Jobard, Wong, & Gauthier, 2005), others refer to the "visual word form" area as an orthographic coding area. Of note, consistent with the results for early childhood, the posterior fusiform (near the back of the brain) has been shown in direct recording on the adult brain (not scalp) prior to surgery to process word-like letter strings, whereas the anterior (near the front) fusiform processes single letters, which may in turn be linked to sounds (Nobre, Allison, & McCarthy, 1994), and importantly, to forms that are written (James & Gauthier, 2006).

To investigate why the left anterior fusiform gyrus may be recruited more during single-letter perception than word or letter string perception in young children, several neuroimaging (fMRI) studies were performed by James and colleagues (James, 2010; James & Engelhardt, 2012; Kersey & James, 2013). Their hypothesis was that single letters are the components of the words that are written one at a time—that is, individual letters may have motor plans associated with them that words and groups of letters do not. Having a motor program associated with each word in the language would be inefficient given that the groups of letters would change each time a word was produced. The initial evidence for this hypothesis came from studies that showed that during letter perception, a motor system was also active in addition to the typical letter-sensitive regions (see Figure 8.1) (James & Gauthier, 2006; see also Longcamp, Anton, Roth, & Velay, 2003). Thus, orthographic codes may link with motor codes, and this cross-code link may be involved in single-letter perception.

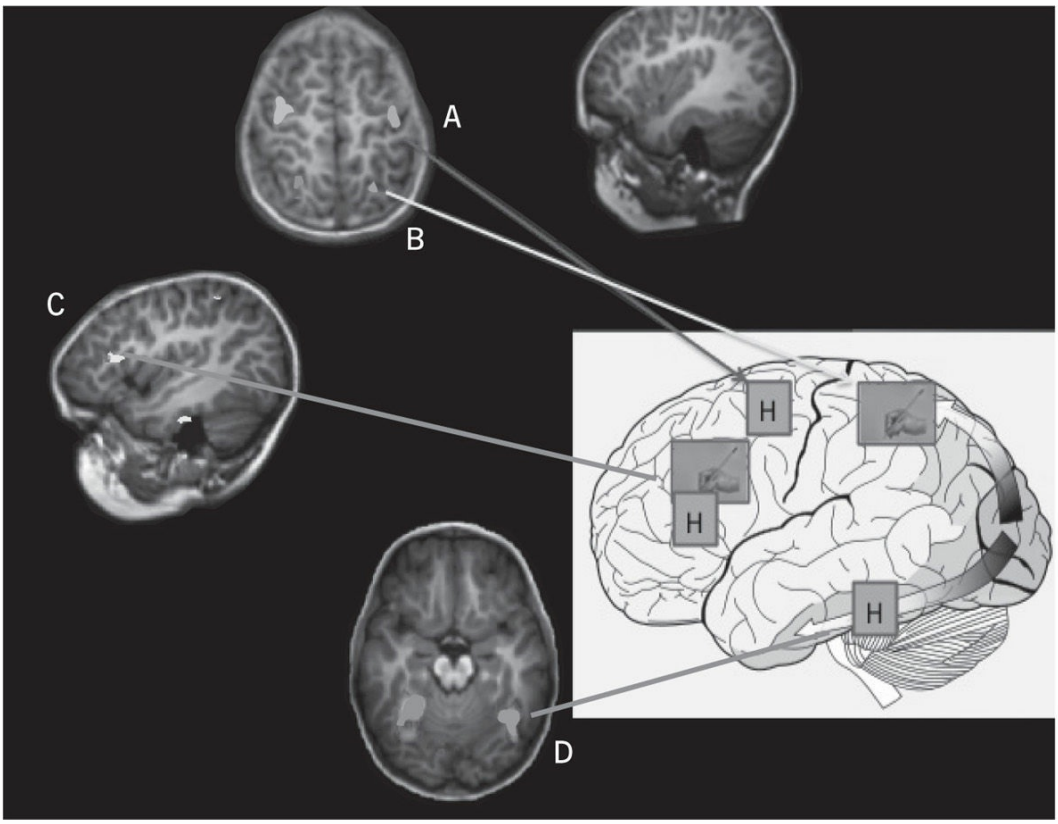


FIGURE 8.1. Brain regions that are more active during letter perception after printing experience than typing experience and visual-auditory practice: A. Precentral Gyrus and Premotor region, B. Inferior Parietal Lobule, C. Inferior Frontal Gyrus and 'Exner's Area', D. Fusiform Gyrus.

Role of Writing Experience in Visual Perception for Children

James (2010) trained two groups of preliterate 4- to 5-year-olds to identify letters of the alphabet and then imaged them before and after training: One group learned them by printing the letters when they were presented visually (copying); and the other group repeated the names of the letters instead of copying them. Children looked at letters, numbers, and simple shapes, while BOLD activation patterns were measured in fusiform gyrus. Prior to the training experience (20 minutes, once a week for 4 weeks, modeled after Longcamp et al., 2003), neural activation did not differentiate among letters, shapes, and numbers. After training, the group that only learned the letters visually without writing did not show any differential activation to letters, shapes, or numbers—the brain did not differentiate among these stimuli. In contrast, the group that learned to print the letters showed significant activation in the left fusiform gyrus to letters, but not to shapes or pseudoletters (forms that follow the same rules of letter but are unfamiliar) and showed significant activation in the left premotor cortex after training (see Figure 8.1). Thus, their brains had become specialized for processing letters, in a way that was similar to the literate adult. This intriguing finding suggests that the role of the left fusiform gyrus in processing and producing letters is not due to visual experience alone, but may be contingent upon motoric production of the letter. Interestingly, the motor cortex was not recruited during the perception of simple shapes, suggesting that the motor cortex is recruited specifically during letter perception. Nonetheless, this study did not compare printing to other forms of motoric practice; perhaps any type of motor practice would facilitate recruitment of the letter processing network.

Various Types of Motor Experience and the Effects on Neural Processing of Letters

In a follow-up study, James and Engelhardt (2012) tested the effects of different types of motor experience on letter processing at the neural level. In this work, they trained children, again, preliterate 4- to 6-year-olds, prior to fMRI scanning. All children learned to produce both letters and simple shapes by three modes—printing them through copying, typing them, and tracing; all children participated in all conditions, but the letters that were used for each condition were counterbalanced. Subsequent to the training episode, neuroimaging was performed during passive visual viewing of all letters learned as well as letters not learned during training. In this within-subjects design, they compared brain activation patterns between the letter experience conditions in the whole brain. Results indicated that printing experience resulted in the largest activation in the fusiform gyrus, parietal cortex, and premotor cortex, which is often reported in adult and child studies of neural networks in reading (e.g., see Booth, 2007). There were different patterns, however, for the different training conditions. In the left fusiform gyrus, printing letters resulted in the highest activation, compared to all the letter and shape conditions, whereas no differences were found in the right fusiform gyrus. In addition, premotor, frontal regions associated with letter processing were more active after printing training than typing or tracing training; the parietal regions were more active after tracing than typing training; and another frontal region was more active after tracing than typing practice (see Figure 8.1).

Therefore, not only was the left fusiform more active after printing practice, but frontal regions associated with motor tasks were also more active after printing practice, and to a lesser extent, tracing practice. These results add to the growing evidence that writing, either copying or tracing, leads to significantly more activation in the network associated with letter perception and reading than does typing or no practice. Thus, writing seems crucial for establishing brain systems used during letter perception and, by extension, reading acquisition; typing may not be an advisable accommodation for students who struggle with handwriting in the early grades who need handwriting instruction.

The premotor activations seen in these studies could be reflecting the recruitment of a premotor region referred to as “Exner’s area” (middle frontal gyrus; see Roux et al., 2009). This region, termed the “graphic motor image center” and first specified as a result of individuals with agraphia having damage to the region, is thought to underlie writing by hand once an individual is proficient. Specifically, Exner’s area is thought to bridge orthography and motor programs that are specific to handwriting. However, recent studies have shown that spelling via typing may also activate regions near Exner’s area as part of a left hemisphere network, including the inferior frontal gyrus, intraparietal sulcus, and inferior temporal/fusiform gyrus, a subset of regions involved in both spelling and reading (Purcell, Napoliello, & Eden, 2011; Purcell, Turkeltaub, Eden, & Rapp, 2011).

Writing Letters versus Observing Others Write Letters

To investigate whether or not active self-production of letter forms was key to the subsequent activation of the letter and reading network, Kersey and James (2013) compared two printing conditions in 7-year-olds: one in which children printed letters themselves, and another in which children watched an experimenter produce the letters. Both groups viewed letters unfolding over time, but only one group produced the letters themselves. The crucial comparison here was whether self-production resulted in the previously identified processing network, or whether any experience of letter production would suffice. In the premotor cortex and in the left fusiform gyrus, actively learned letters resulted in greater neural activity than passively learned letters. Interestingly, in the left fusiform gyrus, passively learned letters did not result in activity that was greater than baseline. Basically, this region acted as if the letters were not learned. Taken together, the results from the fMRI studies during early childhood show that

(1) printing practice recruits the letter/reading processing network more than does seeing/hearing letter names and typing and tracing letters; and (2) learning to write must involve self-production of printing—that is, writing is essential for developing the networks involved in letter processing.

Functional Connectivity in Very Young Writers

Functional connectivity analyses can be used to assess regions of the brain that are coactivated during events that are being investigated. A generalized psychophysiological interactions (gPPI) functional connectivity analysis (see Friston et al., 1997; McLaren, Ries, Xu, & Johnson, 2012) was used to evaluate connectivity using data from 16 right-handed, 4- to 5-year old children. Results from this analysis showed that when printing letters, the left fusiform gyrus was functionally connected to the right middle frontal gyrus, which is associated with working memory and contains Exner's Area, a writing center, the left precentral gyrus (associated with fine motor skills), and the left postcentral gyrus (associated with touch information). Contrasts in connectivity between the printed letters versus typed letters conditions showed that only regions in the left precentral and postcentral gyri were coactivated with the left fusiform more for printing letters rather than typing letters. It is important to keep in mind that for this analysis, children were simply viewing letters that they had learned with the different methods (Vinci-Booher & James, submitted). This analysis suggests that printing letters results in a system of activation connecting the left fusiform, where orthographic codes in letters are first processed, with both touch sensory and motor production regions of the brain.

Collectively, these results show that during the early childhood years (preschool and PreK–K transition to school years), a network is developing in the brain that supports letter writing and perception and the role of forming letters in learning to recognize them in words in learning to read. That is, there is neuroscientific evidence for a writing route to reading as early as the preschool and kindergarten years. Also, results document the value of forming letters (handwriting) over pressing letters (key touch) in learning to perceive the letters.

Middle Childhood

Handwriting

Similar to what James and colleagues found during early childhood for orthographic coding and fine motor planning, the fusiform differentiated fifth graders with and without handwriting problems on an fMRI on–off comparison for writing a familiar letter (Richards et al., 2011). Richards et al. (2009) also found that, during a finger sequencing task that requires sequential motor planning, the same children differed robustly in engaging multiple regions of the brain involved in this task; behavioral measures of printing the alphabet (sequencing component letter strokes), spelling written words (sequencing letters), and written composing (sequencing words) correlated with the same five regions activated during finger sequencing.

Spelling

In a pioneering study linking genes, brains, and endophenotypes, Schulte-Koene and colleagues (see Roeske et al., 2009) studied the relationships among spelling, genes, and brain activity in children with and without dyslexia, which is associated with impaired spelling as well as word decoding (e.g., Roeske et al., 2009). They found that

children with disordered spelling have an abnormal component in ERP signals during an auditory processing task, which assesses ability to discriminate between two acoustic stimuli presented in succession. They found discrimination abnormalities in both an early and a late ERP component when exposed to two similar sounding phonemes such as /ba/ and /da/. Although the earlier time window (beginning after 100 milliseconds post-stimulus onset) has been shown to be abnormal in dyslexia, their group has described abnormalities in a later time window (beginning at about 350 millliseconds post-stimulus onset) that seems to be more specifically related to other language skills besides listening and reading. Their findings also point to genetic variations on two different chromosomes, one involved in switching attention to auditory units over time within single incoming words through the ears, and one involved in regulating energy production (blood oxygenation of glucose), which may be inefficient in those with genetic variants.

McNorgan, Awati, Desroches, and Booth (2014) conducted studies of experience-dependent developmental changes in brain organization for written word learning in children learning to spell and read. McNorgan et al. collected fMRI BOLD, while children ages 8 to 14 made rhyming judgments for sequentially presented word and pseudoword pairs in which these monosyllabic word-level stimuli were presented within the same mode (auditory only or visual only) or crossmodal (audio and visual). Regression analyses of the relationships between pairs with overlapping orthography and phonology and only overlapping phonology replicated prior findings by this group that in planum temporale higher level written word skill was correlated only with cross-modal processing for known words. Such known written words are often referred to as word-specific spelling, which integrates phonological, orthographic, and morphological codes and their connections to semantic representations (vocabulary meaning), and was the persisting developmental difference at fifth grade between those with and without dysgraphia (Berninger & Hayes, 2012). Thus, learning to write and perceive letters during early childhood may affect learning to spell and read words during middle childhood.

Family genetics and brain-imaging research programs at the University of Washington yielded converging evidence for a model of a working memory architecture supporting oral and written language learning containing multiple components: phonological, orthographic, and morphological codes for storing and processing single words and syntax for accumulating words; phonological and orthographic loops; and supervisory attention (focusing, switching, sustaining, monitoring). This model of working memory components also informed the design and interpretation of brain-imaging studies of handwriting, spelling, and composing at the transition of middle childhood to early adolescence. See Berninger and Richards (2012) and Niedo, Abbott, and Berninger (2014) for reviews of the brain and behavioral research evidence for these working memory components; for their applications to writing assessment and instruction for dysgraphia, dyslexia, and oral and written language learning disability (OWL LD); see Silliman and Berninger (2011).

Idea Generation

Berninger et al. (2009) analyzed idea generation during scanning before composing outside the scanner and compared it to the rest condition during scanning. Results showed that typically developing writers recruited a larger network of brain regions, including regions previously associated with specific aspects of cognition, language, and executive functions, working memory, motor planning, and timing. But those with dysgraphia showed a different pattern of activation, including more regions in back than frontal cortical regions as well as different locations within BA 46, a frontal region associated with working memory. The current connectivity work on idea generation is comparing the default network for self-generated thinking at rest and the strategic network for composing on a topic given by the researchers during scanning but written about subsequently outside the scanner.

Systems Approach to the Writing Brain

Recent research on writing at the University of Washington is exploring applications of the paradigm shift in neuroscience to the multilevel connectome of the human brain (e.g., Sporns, 2011, 2012) to the writing brain. Fair et al. (2009) have shown that changes in these neural networks can inform developmental changes in brain–behavior relationships.

Adolescence and Young Adulthood

Handwriting

James and Gauthier (2006) determined psychophysical thresholds for adults given the task of identifying letters presented in visual noise, which varied in amount across trials, on a computer screen. Subsequently, letters were presented near threshold, and participants were required to identify the letters while they wrote a letter or drew a simple shape at the same time. The rationale was that if letter perception invoked a motor plan specific to that letter, then writing a different letter or simple shape would interfere with letter perception, but if the same letter was written and perceived, then no interference would occur. Results from this study demonstrated that letter perception thresholds were raised (worse performance) only when participants wrote a different letter from that perceived, or drew a shape. The results suggested that motor plans specific to individual letters are invoked during letter perception and that letter representations involve both visual information and motor information related to specific letters. As with young children, a network of activation specific to letter processing—left fusiform, premotor cortex, and inferior frontal cortex—was found in adults.

Because literate adults already have mental letter representations, James and Atwood (2009) focused on how novel forms that looked like letters but were not real letters, would be represented after various types of experiences. The research question was whether the representations of novel shapes would invoke the motor system after participants were trained to write the forms. One group of adults practiced writing the novel shapes, while the other group had an equal amount of exposure but only viewed them and practiced saying the names of the forms. Results showed that the letter network—left fusiform and premotor cortex—was active after the writing practice but not the viewing practice.

Multiple Representations of Letters

Rothlein and Rapp (2014) used cutting-edge imaging multivariate pattern analysis–representational similarity analysis (MVPA–RSA) searchlight methods to analyze BOLD, while young adults (all women) viewed single letters to test competing views of whether adult letter representation is modality-specific (linked to motor codes through hand or mouth, speech sounds through ears, or visual codes through eyes), or amodal (abstract and not coded for input or output mode). For adults, who have had years of experience with perceiving and producing letters, there was evidence for neural substrates associated with both modality-specific representations (visual, phonological, and motoric) and abstract letter representations.

Spelling

Booth, Cho, Burman, and Bitan (2007) collected fMRI BOLD as 9- to 15-year-old participants decided if heard

auditory rimes did or did not have the same spelling. Based on increased activation in the left inferior parietal lobes in older students for the nonconflicting versus conflicting sound-spelling relationships, the researchers proposed that adolescents have a more elaborate mapping of phonemes, onset-rimes, and syllables across phonology and orthography. For a review of brain changes over ages in the orthographic, phonological, semantic, and syntactic processing of oral and written language, see Booth (2007).

Handwriting versus Typing

Some adult studies have demonstrated that increased speed of transcription results in better quality of notes as well as recall (Bui, Myerson, & Hale, 2013; Peverly, 2006; Peverly et al., 2007), but the results are mixed as to whether typing or handwriting are better. One study found that typing resulted in better recall of the material (Bui et al., 2013), but another one found that handwriting had an advantage over typing (Mueller & Oppenheimer, 2014). Faster transcription speeds during handwriting increase word production automaticity in both adults and children, which lessens the workload of working memory and results in higher quality writing (Peverly, 2006; Peverly et al., 2007). The relative advantages may depend on level of language—word spelling or text composing—and developmental level of writer; advantages for keyboarding often emerge in adolescence but not for all writing tasks (e.g., Hayes & Berninger, 2009). Clearly, further research is needed on the relative advantages of handwriting and typing for specific writing tasks in adolescents and adults.

FIVE KEY IDEAS FROM BRAIN RESEARCH AND IMPLICATIONS FOR WRITING INSTRUCTION

• **Key Idea 1: In the Information Age, handwriting instruction is necessary for literacy.** Many believe that if children learn to read, they will automatically be able to write. Research by James and colleagues reviewed in this chapter supports the opposite: The act of writing a letter enhances the perception of letter forms, as shown by activation of both premotor and fusiform cortex, which supports reading acquisition. However, brain activation of both the premotor cortex, involved in motor planning and sequential finger movements, and the left fusiform gyrus, involved in orthographic coding of letter forms, also shows that handwriting instruction should help students develop their orthographic loop for integrating letter codes with sequential finger movements during handwriting (Berninger & Richards, 2010, 2012).

Brain Lesson 1: *It is important to teach handwriting, beginning in early childhood and continuing through middle childhood, with attention to both the motor and letter coding processes involved, and integrating handwriting with reading, spelling, and composing* (see Berninger, 2012).

• **Key Idea 2: Teach developing spellers to store, process, and integrate phonology, orthography, and morphology.** Brain research shows common and unique brain activation during tasks requiring storage and processing of phonological word forms (heard and spoken words), orthographic word forms (viewed and written words), and morphological word forms (bases and affixes in both oral and written words) and evidence for cross-code integration of these three word forms in response to spelling instruction (e.g., Richards et al., 2006).

Brain Lesson 2: Even though spell checks flag spelling errors, to choose the correct spelling, developing writers need to learn how to integrate phonological coding of spoken words, orthographic coding of written words, and morphology (bases and affixes) to create word-specific spellings for English, a morphophonemic orthography (see Berninger, 2015, chaps. 4, 5, 6, and companion websites).

• **Key Idea 3: Multicomponent working memory supports the multileveled, multiple-language systems involved in writing.** Brain and behavioral research has shown that a working memory system, which includes these multiple components, supports written language learning (1) storage and processing units for orthographic, phonological, and morphological word forms and syntax for accumulating words; (2) loops that integrate internal codes and output units through hand and mouth; and (3) supervisory attention for focusing, switching, sustaining, and monitoring attention (for review, see Berninger & Richards, 2010; Niedo et al., 2014). A common reference to language, reading, and writing fails to acknowledge the multiple-language systems (by ear, mouth, eye, and hand) involved in the written expression of ideas and the multiple levels (subword, word, syntax, and text) within each of these language systems that affect how they interact with each other (Niedo et al., 2014). Emerging research on the complexities of the human connectome for the writing brain is producing insights into how these multileveled, multiple-language systems work together to support writing acquisition.

Brain Lesson 3: Instructional designers should keep all these working memory components and multiple levels of multiple language systems in mind in designing writing instruction to teach letter production, word spelling, sentence construction, and text generation to create functional writing systems.

• **Key Idea 4: Executive functions for self-regulating the writing process.** A recent review of neuropsychological research evidence based on brain and behavioral studies supports teaching both lower-level executive functions in supervisory attention of working memory (focus attention, switch attention, sustain attention, and self-monitor) and higher-order executive functions for planning (setting goals and making plans to reach them), translating cognitions into language, reviewing, and revising during composing (Berninger, Swanson, & Griffin, 2014). Indeed, the deep structure may not be in the language itself, but rather in the higher-order executive functions that support the bidirectional cognitive-linguistic translation process (Niedo et al., 2014). The inferior frontal gyrus, along with other brain structures connected to it, may play a role in these executive functions for the writing brain (cf., Mesulam, 1990).

Brain Lesson 4: Writing instruction should teach multiple low-level and high-level executive function strategies to help developing writers self-regulate their developing writing skills (Berninger & Niedo, 2014; Arfé, Dockrell, & Berninger, 2014).

• **Key Idea 5: Teaching students to become hybrid writers in the Information Age.**

Brain research reviewed in this chapter clearly shows the advantage of forming letters compared to selecting them with keys early in writing development and even in adults learning novel letters (Longcamp et al., 2003, James & Atwood, 2009). Behavioral research shows the advantage of handwriting over keyboarding in composing texts during middle childhood (Berninger, Abbott, Augsburger, & Garcia, 2009) and in taking notes during class lectures in adolescence and adulthood (Mueller & Oppenheimer, 2014), and the value of handwriting for both note-taking and test-taking (Peverly, 2006; Peverly et al., 2007) during adolescence and young adulthood. Yet, behavioral research has also shown an advantage for keyboarding emerging in early adolescence for students with specific learning disabilities (Alstad, 2014), perhaps because of increased myelination in early adolescence of right–left fibers supporting the bimanual coordination needed for touch typing with a keyboard. Moreover, writing interventions for students with spelling disability during middle childhood and early adolescence, which were designed with all the working memory components in mind during spelling, and combined handwriting during first drafts and keyboarding for revision during composing (MacArthur & Graham, 1987; MacArthur, Schwartz, & Graham, 1991), normalized brain function (Berninger & Richards, 2010).

Brain Lesson 5: The goal of writing instruction in the Information Age should be developing hybrid writers who are adept with multiple writing tools including pens and keyboards (see Berninger, 2012).

CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

The observable output of the brain is action: Developing writers convey internal processes through speech (by mouth), locomotion, limb and eye movements (embodied cognition), and manipulation of objects, including writing tools (pens, pencils, markers, keyboards, styluses, fingers) that produce letters, words, sentences, and text (by hand). Actions influence how sensory information is selected and processed, which, in turn, influence the selection and execution of subsequent actions. At one level, writing can be understood in terms of *action-perception loops*. The specific kind of experience that is needed for individual letters may be different than for words (e.g., James et al., 2005; James & Maouene, 2009) or sentences and text, but developing students will need instruction at the letter as well as these other levels of language in order to externalize their cognition through written words, sentences, and text (Berninger & Winn, 2006). Future research should include more (1) interdisciplinary research on the developing and learning writing brain, and (2) more writing educators and researchers on the interdisciplinary research team to design the research and interpret and disseminate the findings.

ACKNOWLEDGMENTS

Grant No. P50HD071764 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) at the National Institutes of Health to the University of Washington Learning Disabilities Research Center supported, in part, the preparation of this chapter.

REFERENCES

Alstad, Z. (2014, May 28). *Individual differences and group effects for keyboard and stylus in autobiographical compositions and summaries of read source material for students in grades 4 to 9.* Unpublished PhD dissertation, University of Washington, Seattle, WA.

Amso, D., & Casey, B. J. (2006). Beyond what develops when: Neuroimaging may inform how cognition changes with development. *Current Directions in Psychological Science, 15*(1), 24–29.

Anderson, S., Damasio, A., & Damasio, H. (1990). Troubled letters but not numbers. Domain specific cognitive impairments following focal damage in frontal cortex. *Brain, 113*, 749–760.

Arfé, B., Dockrell, J., & Berninger, V. (Eds.). (2014). *Writing development in children with hearing loss, dyslexia, or oral language problems: Implications for assessment and instruction*. New York: Oxford University Press.

Basso, A., Taborelli, A., & Vignolo, L. (1978). Dissociated disorders of speaking and writing in aphasia. *Journal of Neurology, Neurosurgery, and Psychiatry, 41*, 556–563.

Berninger, V. (2012, May/June). Strengthening the mind's eye: The case for continued handwriting instruction in the 21st century (pp. 28–31). *Principal*. National Association of Elementary School Principals. Retrieved from *www.naesp.org.*

Berninger, V. (2013, March). *Educating students in the computer age to be multilingual by hand*. Invited Commentary on "The Handwriting Debate" NASBE Policy Debate (2012, September) for National Association of State Boards of Education (NASBE), Arlington, VA. Retrieved from *www.nasbe.org/wp-*

content/uploads/Commentary-Handwriting-keyboarding-and-brain-development1.pdf.

Berninger, V. W. (2015). *Interdisciplinary frameworks for schools: Best professional practices for serving the needs of all students.* Washington, DC: American Psychological Association.

Berninger, V., & Abbott, D. (2010). Listening comprehension, oral expression, reading comprehension and written expression: Related yet unique language systems in grades 1, 3, 5, and 7. *Journal of Educational Psychology, 102*, 635–651.

Berninger, V., Abbott, R., Augsburger, A., & Garcia, N. (2009). Comparison of pen and keyboard transcription modes in children with and without learning disabilities affecting transcription. *Learning Disability Quarterly, 32*, 123–141.

Berninger, V., & Hayes, J. R. (2012). Longitudinal case studies of twenty children on writing treks in grades 1 to 5. In M. Fayol, D. Alamargot, & V. Berninger (Eds.), *Translation of thought to written text while composing: Advancing theory, knowledge, methods, and applications* (pp. 95–179). New York: Psychology Press/Taylor Francis Group/Routledge.

Berninger, V., & Niedo, J. (2014). Individualizing instruction for students with oral and written language difficulties. In J. Mascolo, D. Flanagan, & V. Alfonso (Eds.) *Essentials of planning, selecting and tailoring intervention: Addressing the needs of unique learners*. New York: Wiley.

Berninger, V., & Richards, T. (2010). Inter-relationships among behavioral markers, genes, brain, and treatment in dyslexia and dysgraphia. *Future Neurology, 5*, 597–617. Group/Routledge.

Berninger, V., & Richards, T. (2012). The writing brain: Coordinating sensory/motor, language, and cognitive systems in working memory architecture. In V. Berninger (Ed.), *Past, present, and future contributions of cognitive writing research to cognitive psychology* (pp. 537–563). New York: Psychology Press.

Berninger, V., Richards, T., Stock, P., Abbott, R., Trivedi, P., Altemeier, L., et al. (2009). fMRI activation related to nature of ideas generated and differences between good and poor writers during idea generation. *British Journal of Educational Psychology Monograph Series II, 6*, 77–93.

Berninger, V., Swanson, H. L., & Griffin, W. (2014). Understanding developmental and learning disabilities within functional-systems frameworks: Building on the contributions of J. P. Das. In T. Papadopoulos, R. Parrilla, & J. Kirby (Eds.), *Cognition, intelligence, and achievement* (pp. 96–114). New York: Elsevier.

Berninger, V., & Winn, W. (2006). Implications of advancements in brain research and technology for writing development, writing instruction, and educational evolution. In C. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 96–114). New York: Guilford Press.

Bitan, T., & Booth, J. (2012). Offline improvement in learning to read a novel orthography depends on direct letter instruction. *Cognitive Science, 36*, 896–918.

Booth, J., Cho, S., Burman, D., & Bitan, T. (2007). The neural correlates of mapping from phonology to orthography in children performing an auditory spelling task. *Developmental Science, 10*, 441–451.

Booth, J. R. (2007). Brain bases of learning and development of language and reading. In D. Coch, G. Dawson, & K. W. Fischer (Eds.), *Human behavior, learning and the developing brain* (pp. 279–300). New York: Guilford Press.

Brain, L. (1967). *Speech disorders: Aphasia, apraxia, and agnosia*. London: Butterworth.

Brem, S., Bach, S., Kucian, K., Guttorm, T., Martin, E., Lyytinen, H., et al. (2010). *Brain sensitivity to print emerges when children learn letter–speech sound correspondences*. Proceedings of the National Academy of Sciences, early edition, pp. 1–6. Retrieved from *www.pnas.org/cgi/doi/10.1073/pnas.0904402107.*

Bui, D. C., Myerson, J., & Hale, S. (2013). Note-taking with computers: Exploring alternative strategies for improved recall. *Journal of Educational Psychology, 105*(2), 299–309.

Cohen, L., Lehéricy, S., Chochon, F., Lemer, C., Rivaud, S., & Dehaene, S. (2002). Language-specific tuning of visual cortex? Functional properties of the visual word form area. *Brain, 125*, 1054–1069.

DeBoer, T., Scott, L. S., & Nelson, C. A. (2007). Methods for acquiring and analyzing infant event-related potentials. In M. de Haan (Ed.), *Infant EEG and event-related potentials* (pp. 5–37). New York: Psychology Press.

Fair, D. A., Cohen, A. L., Power, J. D., Dosenbach, N. U. F., Church, J. A., Miesin, F. M., et al. (2009). Functional brain networks develop from a "local to distributed" organization. *PLOS Computational Biology, 5*(5), e1000381.

Friedman, D. (1991). The endogenous scalp-recorded brain potentials and their relationship to cognitive development. In J. R. Jennings & M. G. H. Coles (Eds.), *Handbook of cognitive psychophysiology: Central and autonomic nervous system approaches* (pp. 621–656). Chichester, UK: Wiley.

Friston, K. J., Buechel, C., Fink, G. R., Morris, J., Rolls, E., & Dolan, R. J. (1997). Psychophysiological and modulatory interactions in neuroimaging. *NeuroImage, 6*, 218–229.

Giedd, J., Blumenthal, J., Jeffries, N., Castellanos, F., Liu, H., Zijdenbos, Z., et al. (1999). Brain development during childhood and adolescence: A longitudinal MRI *study*. *Nature Neuroscience, 2*, 861–863.

Harris, K. R., Graham, S., Mason, L., & Friedlander, B. (2008). *Powerful writing strategies for all students*. Baltimore, MD: Brookes.

Hayes, J. R., & Berninger, V. W. (2009). Relationships between idea generation and transcription: How the act of writing shapes what children write. In R. K. Braverman, K. Lunsford, S. McLeod, S. Null, & A. S. P. Rogers (Eds.). *Traditions of writing research* (pp. 166–180). New York: Taylor & Frances/Routledge.

Heeger, D. J., & Ress, D. (2002). What does fMRI tell us about neuronal activity? *Nature Reviews Neuroscience, 3*, 142–151.

James, K. (2010). Sensori-motor experience leads to changes in visual processing in the developing brain. *Developmental Science, 13*(2), 279–288.

James, K., & Atwood, T. (2009). The role of sensorimotor learning in the perception of letter-like forms: Tracking the causes of neural specialization for letters. *Cognitive Neuropsychology, 26*, 91–110.

James, K. H., & Engelhardt, L. (2012). The effects of handwriting experience on functional brain development in pre-literate children. *Trends in Neuroscience and Education, 1*, 32–42.

James, K. H., & Gauthier, I. (2006). Letter processing automatically recruits a sensory–motor brain network. *Neuropsychologia, 44*, 2937–2949.

James, K., & Gauthier, I. (2009). When writing impairs reading: Letter perception's susceptibility to motor interference. *Journal of Experimental Psychology: General, 138*, 416–431.

James, K., James, T., Jobard, G., Wong, A., & Gauthier, I. (2005). Letter processing in the visual system: Different activation patterns for single letters and strings. *Cognitive, Affective, and Behavioral Neuroscience, 5*, 452–466.

James, K., & Maouene, J. (2009). Auditory verb perception recruits motor systems in the developing brain: An fMRI investigation. *Developmental Science, 12*(6), F26–F34.

Kersey, A. J., & James, K. H. (2013, September 23). Brian activation patterns resulting from learning letter forms through active self-production and passive observation in young children. *Frontiers in Cognitive Science, 4*, 567.

Leppänen, P., Hämaläinen, J., Salminen, H., Eklund, K., Guttorm, T., Lohvansuu, K., et al. (2010). Newborn brain event-related potentials revealing atypical processing of sound frequency and the subsequent association with later literacy skills in children with familial dyslexia. *Cortex, 46*, 1362–1376.

Longcamp, M., Anton, J. L., Roth, M., & Velay, J. L. (2003). Visual presentation of single letters activates a premotor area involved in writing. *Neuroimage, 19*, 1492–1500.

MacArthur, C., & Graham, S. (1987). Learning disabled students' composing with three methods: Handwriting,

dictation, and word processing. *Journal of Special Education, 21*, 2–42.

MacArthur, C., Schwartz, C., & Graham, S. (1991). Effects of a reciprocal peer revision strategy in special education classrooms. *Learning Disability Research and Practice, 6*, 201–210.

McLaren, D. G., Ries, M. L., Xu, G., & Johnson, S. C (2012). A generalized form of context-dependent psychophysiological interactions (gPPI): A comparison to standard approaches. *NeuroImage, 61*, 1277–1286.

McNorgan, C., Awati, N., Desroches, A. & Booth, J. (2014). Multimodal lexical processing in auditory cortex is literacy skill–dependent. *Cerebral Cortex, 24*, 2464–2475.

Mesulam, M. (1990). Large-scale neurocognitive networks and distributed processing for attention, language, and memory. *Annals of Neurology, 28*, 597–613.

Mueller, P., & Oppenheimer, D. (2014). The pen is mightier than the keyboard: Advantages of longhand over laptop note taking. *Psychological Science*. Published online April 23, 2014. Retrieved from *http://pss.sagepub.com/content/early/2014/04/22/0956797614524581*.

Niedo, J., Abbott, R., & Berninger, V. (2014). Predicting levels of reading and writing achievement in typically developing, English-speaking 2nd and 5th graders. *Learning and Individual Differences, 32C*, 54–68.

Nobre, A., Allison, T., & McCarthy, G. (1994). Word recognition in the inferior temporal lobe. *Nature, 372*, 260–263.

Peverly, S. T. (2006). The importance of handwriting speed in adult writing. *Developmental Neuropsychology, 29*, 197–216.

Peverly, S. T., Ramaswamy, V., Brown, C., Sumowski, J., Alidoost, M., & Garner, J. (2007). Skill in lecture note-taking: What predicts? *Journal of Educational Psychology, 99*, 167–180.

Purcell, J. J., Napoliello, E. M., & Eden, G. F. (2011). A combined fMRI study of typed spelling and reading. *NeuroImage, 55*(2), 750–762.

Purcell, J., Turkeltaub, P., Eden, G., & Rapp, B. (2011). Examining the central and peripheral processes of written word production through meta-analysis. *Frontiers in Psychology, 2*, 1–16.

Richards, T., Aylward, E., Raskind, W., Abbott, R., Field, K., Parsons, A., et al. (2006). Converging evidence for triple word form theory in children with dyslexia. *Developmental Neuropsychology, 30*, 547–589.

Richards, T., & Berninger, V. (2013). Brain mapping of language processing using functional MRI connectivity and diffusion tensor imaging. In F. Signorelli & D. Chirchiglia (Eds.), *Brain mapping, and the endeavor to understand the working brain* (pp. 77–93). Open Access. *InTech-open science|open minds*.

Richards, T., Berninger, V., & Fayol, M. (2012). The writing brain of normal child writers and children with writing disabilities: Generating ideas and transcribing them through the orthographic loop. In E. Grigorenko, E. Mambrino, & D. Preiss (Eds.), *Writing: A mosaic of perspectives and views* (pp. 85–105). New York: Psychology Press.

Richards, T., Berninger, V., Stock, P., Altemeier, L., Trivedi, P., & Maravilla, K. (2009). fMRI sequential-finger movement activation differentiating good and poor writers. *Journal of Clinical and Experimental Neuropsychology, 29*, 1–17.

Richards, T., Berninger, V., Stock, P., Altemeier, L., Trivedi, P., & Maravilla, K. (2011). Differences between good and poor child writers on fMRI contrasts for writing newly taught and highly practiced letter forms. *Reading and Writing, 24*(5), 493–516.

Roeske, D., Ludwig, K., Neuhoff, N., Becker, J., Bartling, J., Bruder, J., et al. (2009). First genome-wide association scan on neurophysiological endophenotypes points to trans-regulation effects on SLC2A3 in dyslexic children. *Molecular Psychiatry, 16*, 97–107.

Rothlein, D., & Rapp, B. (2014). The similarity structure of distributed neural responses reveals the multiple

representations of letters. *Neuroimage, 89*, 331–344.
Roux, F. E., Dufor, O., Giussani, C., Wamain, Y., Draper, L., Longcamp, M., et al. (2009). The graphemic/motor frontal area Exner's area revisited. *Annals of Neurology, 66*(4), 537–545.
Silliman, E., & Berninger, V. (2011). Cross-disciplinary dialogue about the nature of oral and written language problems in the context of developmental, academic, and phenotypic profiles. *Topics in Language Disorders, 31*, 6–23.
Smith, S. (2013). Introduction to the NeuroImage Special Issue "Mapping the Connectome." *NeuroImaging, 80*, 1.
Sporns, O. (2011). The human connectome: A complex network. *Annals of the New York Academy of Sciences, 1224*, 109–125.
Sporns, O. (2012). *Discovering the human connectome*. Cambridge, MA: MIT Press.
Tan, L., Spinks, J., Eden, G., Perfetti, C., & Siok, W. (2005). Reading depends on writing, in Chinese. *Proceedings of the National Academy of Sciences, 102*, 8781–8785.
Taylor, M. J., & Baldeweg, T. (2002). Application of EEG, ERP and intracranial recordings to the investigation of cognitive functions in children. *Developmental Science, 5*(3), 318–334.
Thomas, K. M., & Casey, B. J. (2003). Methods for imaging the developing brain. In M. de Haan & M. H. Johnson (Eds.), *The cognitive neuroscience of development* (pp. 19–41). East Sussex, UK: Psychology Press.
Thomas, K. M., & Tseng, A. (2008). Functional MRI methods in developmental cognitive neuroscience. In C. A. Nelson & M. Luciana (Eds.). *Handbook of developmental cognitive neuroscience* (2nd ed., pp. 311–324). Cambridge, MA: MIT Press.
Vinci-Booher, S., & James, K. H. (in preparation). *Functional connectivity of visual and motor systems during letter perception in the pre-school child*. Unpublished manuscript.

CHAPTER 9

From Language to Text

The Development and Learning of Translation

Michel Fayol

Translation is the highly complex process of transforming ideas or cognitive representations into written language (Fayol, Alamargot, & Berninger, 2012). Translation constitutes the interface between the representation(s) of the content to be evoked (e.g., the course of events in a narrative or the set of arguments used to defend a position) and the concrete production of the text (i.e., text generation and the transcription, including spelling and handwriting; Berninger & Swanson, 1994). This chapter is devoted to the study of translation-ability development among children between 4 and 14 years of age and of the constraints they have to manage in order to improve their performance in translation. I begin by elaborating the translation process. Next, I relate the research methods that have been used to study translation and provide results of research on adults and children's translating performances. Finally, I turn to the research and interventions needed to improve the acquisition and use of translation skills in written text production. In all cases, facts and arguments will be based primarily on data first relating to oral narrative

performances and then to written narrative texts as this is the type of text that has been extensively studied among the youngest subjects. As it is now, too few data are available on other types of texts (e.g., descriptive, argumentative) to consider them relevant to an understanding of the translation process.

TRANSLATION: THE NEGLECTED DIMENSION

Models of writing and models of learning how to write have until now mainly considered that the general writing process is composed of three specific processes transforming domain knowledge in a linguistic product: the planning process, the translating process, and the reviewing process (Hayes, 1996; Hayes & Flower, 1980). Regarding the translating process, Berninger and Swanson (1994) have proposed distinguishing between text generation, a linguistic subprocess, and transcription, including spelling management and graphic processing. Empirical studies have focused mainly on planning, revision, handwriting, and spelling (Alamargot & Chanquoy, 2001). By contrast, the translation process, the manifestations of progressive improvements in translation as a result of the writer's expertise, and the possibility of improving translation through interventions have received less attention from cognitivists (Fayol, 1991a).

Translation can be subdivided into two components that occur sequentially, both of which have to do with a general linearization process. First, the preverbal mental model of the situation to be described or the events to be recounted, which have already been selected during planning, must be expanded and organized so that the different dimensions or stages of the situation or the event can actually orient the development of the written text. Various parts of the plan must be developed further and prepared for their successive activation and expression through written language (i.e., elaboration of macropropositions; see van Dijk & Kintsch, 1983). A number of different strategies are conceivable. The simplest strategy involves adding up the facts or characteristics in the order in which they occur and retrieving them from memory (e.g., script-like narration), whereas the most complex strategy consists of elaborating a completely new structure in which blocks of information are progressively deployed as a function of prevailing pragmatic or rhetorical constraints (e.g., following genre-specific discourse schema or text type structures). The writer must select a starting point or origin (i.e., an anchor) that corresponds to a particular point of view (i.e., the beginning of a narrative; the starting point of a description) and determine a path that can be retained in working memory with the least amount of effort (Levelt, 1989). The rest of the information in the text must be situated with respect to that anchor (Costermans & Fayol, 1997).

Second, once preverbal mental organization has been performed (or simply sketched out), it has to be translated and transcribed into language units (i.e., micropropositions): words, sentences and paragraphs. This translation into language requires the activation of a second process of linearization since the preverbal representation contains a large number of different elements (e.g., characters, moments in time, places) included in a multidimensional context. The author must establish and signal the relationships between the successive statements in the text. According to the "nextness" principle (Ochs, 1979), unless otherwise indicated, two linguistic items that are close "on the text/discourse surface" are strongly related to each other. However, this is not always the case because the order of occurrence in the text does not systematically correspond to the order of the events or the arrangement of the entities referred to. Two consecutive statements in discourse may pertain to successive states or events that are strongly or weakly related to each other in the mental model of the situation being described. Hence, a system of marks is needed to signal the strength and/or nature of the link between adjacent statements. Several sets of specific marks are used to control the application of the "nextness" principle: the article system; the noun/pronoun system; the verbal tenses paradigm and the punctuation/connectives paradigm (Fayol, 1997).

METHODS FOR STUDYING THE TRANSLATION COMPONENT OF PRODUCTION

Research into translation has been conducted following two collections of methods (Berninger, Rijlaarsdam, & Fayol, 2012). The first collection consists of studies ranging from the examination of texts in search of their linguistic markers, together with the positions, relations, and temporal characteristics of those marks (pauses, speech rates), to analysis of self-talking and verbal protocols, and even to the results of brain-imaging research descriptions. Researchers have attempted to describe and to model translation by inferring from the written compositions or verbal protocols the mental operations involved in translation (e.g., Bereiter & Scardamalia, 1987; Hayes & Flower, 1980; Schilperoord, 1996). In order to better understand the dynamics of translating, it is necessary to describe and study the processes involved in written composition, analyze how people keep in mind the global objective (Hermann & Grabowski, 1995) and how the processes shift from one dimension (e.g., spelling) to another (e.g., syntactic choice or idea selection), and successfully orchestrate (e.g., activate and deactivate) these mental operations in a limited-capacity cognitive system (Fayol, 1999; Levy & Ransdell, 1995; McCutchen, 2000). Variations in pauses and writing rates (or writing durations) provide objective cues to follow the online management of translation. Modulations in pause durations and in writing rates may be interpreted in terms of differences in processing load: The longer the pause, the slower the writing rate, the heavier the load (Foulin, 1998; Schilperoord, 1996).

The data collected from text analysis has led to correlational studies that make it possible to group together or dissociate the effects of variables. Correlations have been reported between variations in authors' pauses and variables related to different levels of text production: discourse breaks, idea units, and syntactic structures, but rarely in word characteristics (Fayol & Lété, 2012). For example, when collecting think-aloud protocols, Kaufer, Hayes, and Flower (1986) observed that writers produced texts in a discontinuous manner: They wrote bursts of six to seven words and then stopped to think about what to write next (pause bursts) or to evaluate what had been already written (revision bursts) (Hayes, 2012). Pause and revision bursts indicate momentary "hitches" in the translation process. The most frequent approach to studying translation has been to analyze the markers (e.g., punctuation marks) and their distribution in texts as a function of a variety of constraints (instructions, situations, etc.).

The use of verbal protocols is sometimes problematic, unlike in the case of the higher-level components study of composing. In adults, translation activity mobilizes largely automated processes, so it is difficult or even impossible to be aware of (and verbalize) the processes. For children, the fact that attention has focused on elaborating and commenting on the verbal message means that other translating and composing dimensions in general have been neglected. The ability of children to formulate their mental operations has also constituted a major obstacle.

The second collection of methods has consisted of designing experiments in which the variables of interest are controlled as precisely as possible (e.g., Olive, Kellogg, & Piolat, 2002). Experiments are particularly suited to studying the production of words and sentences or to testing causal relations between some variables (e.g., strategies) and their expected impacts (e.g., improving text quality) on the basis of the effects of controlled training (Graham, McKeown, Kiuhara, & Harris, 2012). Experiments have made it possible to identify the variables that influence the production of isolated words and simple sentences (Bock & Levelt, 1994; Bonin & Fayol, 2000). Albeit less frequently, experiments have provided evidence to support contentions about selected translation functions: Preplanning helps to reduce the time and the load devoted to planning online, and thus helps to focus on other writing processes, for example, translation (Kellogg, 1988).

ADULTS' TRANSLATING PERFORMANCES WHILE PRODUCING WRITTEN NARRATIVES

The two-stage translation processes described in the chapter opening have been supported by research observations with adults. When composing narratives, adults must deal with several main constraints and subprocesses that affect translation (Alamargot & Chanquoy, 2001, Chapter 2). First, adults refer to and elaborate a multidimensional mental model (like a perceptual one) corresponding to a real or fictional coherent situation (Johnson-Laird, 1983). Second, due to the specific properties of language, oral or written, they have to linearize information at different levels [episodes (mental model), abstract propositions (semantic), paragraphs (rhetoric dimension), series of sentences, clauses, and words] to produce a cohesive text enabling the reader to mentally follow/reconstruct the unfolding sequence of events. To make their narrative discourse intelligible, adult writers have to establish its foundation anchor: who are the characters, where are they, what are they doing, and why (Gernsbacher, 1997). Then, each new clause maps onto previous information and also introduces new information by means of different arguments (e.g., agents, patients, beneficiary, etc.). Cohesion cues are necessary to ensure coherence at different levels and dimensions of the text (or discourse): references to the same agent, patient, object (using pronouns, definite articles, and noun repetitions), time lapse (temporal marks), place or position (spatial marks), and causal chain (causal devices).

Chanquoy, Foulin, and Fayol (1990) have studied the effects of familiarity with the content, the type of text, and the syntactic complexity on the online management of composing short text endings from oral text beginnings. Their study directly informs adult translation processes. The main results were that, overall, the more predictable the endings, the shorter the initial and the between-clause pause durations, and the faster the writing rate. More recently, Maggio, Lété, Chenu, Jisa, and Fayol (2012) studied translation by examining how words are processed while they are inserted into written texts. They investigated the extent to which words are produced in serial and/or in parallel by examining the length of time that the process lasts when words have just been produced ($n - 1$) and when words are yet to be produced ($n + 1$). The different variables (i.e., sublexical, such as consistency and syllable frequency, and lexical, such as frequency and length) have a distributed effect on the online processing of words: Some characteristics are taken into account before the transcription occurs, some others are considered during the transcription, and lastly some more occur after word transcription. Such a fine-grained management of word production still has to be coordinated with the processing of higher- (sentences, paragraphs, ideas) and lower- (handwriting or typing) level dimensions in the dynamics of translation.

CHILDREN'S ACQUISITION OF TRANSLATION PROCESSES DURING COMPOSING

Generally, adults are successful in managing the intricate translation processes and constraints. Things are not as fluid for children, even when they produce narrative discourses.

Translation Differences between Children and Adults

Narrative text production has been the object of extensive research carried out on children of different ages, in comprehension and production. It is important to distinguish between the different processing operations taking place during children's translation as compared to adults' translation processes. Three aspects of children's translation processes have been studied, and each will be elaborated in the following paragraphs (Alamargot & Fayol, 2009; Fayol, Foulin, Maggio, & Lété, 2012): (1) retrieving and elaborating the representation of the

sequences of events (building a mental model) and their relations; (2) linearizing and formulating the content of the mental model by using a schema, that is, a more specifically linguistic dimension, which draws on the lexical–syntactical aspects of written production and includes a conventional (rhetorical) dimension linked to the structure of narrative texts (by opposition to argumentative, expository, and descriptive texts); and (3) transcribing words by using spelling and graphic production, a dimension having to do with the mechanics of production, for example, oral and then written production.

Translation: Retrieving and Elaborating the Situation

The mental model representation of situations and events was extensively studied in the 1980s–1990s. In the situation model, actions are assumed to be organized in relation to goals pursued by their agents while engaged in overcoming the obstacles preventing them from attaining their goals (Schank & Abelson, 1977). Chains of events are linked together by temporal, causal, or other types of connections underlying the verbal form of the narratives (Trabasso, Secco, & van den Broek, 1985). The main characteristics of a mental model representation are thus already present in 6-year-old children's narratives (Applebee, 1978). Children also differentiate between script-like narratives (as in a simple report of events) and narrative productions encompassing a plot (Hudson & Shapiro, 1991). The mental representation of situations and events could thus be used in both oral and written translation.

Linearization through Using Narrative Schema

The rhetorical dimension of narratives is not limited to a mere listing of characters, places, objects, and events. Narratives are also represented inside a built-in cognitive schema that is a set of hierarchically organized story grammar components (i.e., episodes) that can both facilitate and constrain translation. A typical narrative schema includes setting, initiating event, internal response, attempts, consequences, and reactions with temporal and causal relationships (Stein & Glenn, 1979). Such a schema helps children to linearize, that is, match a series of events or actions and a sequence of propositions, as evidenced by the "knowledge-telling "strategy: Children retrieve information about events following the narrative schema and transcribe them as one goes along, making translation more fluent (Bereiter & Scardamalia, 1987; McCutchen, 1986, 1987).

The Mechanics of Translation

To ensure coherence and cohesion while translating, children have to coordinate considerations and decisions at both a global level (the genre), determined by the context and the function the text serves, and a more local level through several subsystems of linguistics markers used to conjoin or tie meanings across sentences (Halliday & Hasan, 1976). In order to compose texts, they have to acquire a number of translation skills, the development of which has been studied. The first occurrence of characters or objects is generally preceded by an indefinite article (e.g., a woman entered). Subsequent references use definitive determiners, articles (e.g., the woman/this woman), pronouns (e.g., she), and demonstrative adjectives (e.g., this woman). Another linguistic dimension of narrative texts corresponds to the marking of continuity or discontinuity among the events. Relations between the sequences of events differ in their nature and degree: from the parallel unfolding of two activities (e.g., the woman was walking/a bus was passing) to a causal connection (e.g., the arrow was thrown/the man fell). Different markers indicate the degree and nature of the connections, the acquisition of which is more or less well documented: conjunctions (e.g., *and, by, so*) (Cain & Nash, 2011); punctuation marks (Fayol, 1997); and verbal forms (e.g., preterite; past

progressive) allowing the reader to distinguish between foregrounded and backgrounded actions (e.g., the man walked versus was walking/a car was arriving versus arrived) (Fayol, Hickmann, Bonnotte, & Gombert, 1993).

Children's Oral-Language Translation Management

Only a few data are available regarding the translation management of oral narratives and its evolution between 4- and 7- or 8-year-old children (Hidi & Hildyard, 1983; Simon, 1973). While translating, children would have difficulties managing linguistic markers to achieve coherence, especially the use of connectives (Peterson & McCabe, 1983) and the system of references to different characters and events, that is, the use of nouns, pronouns, and articles as anaphoric units (Karmiloff-Smith, 1981). In oral language, there is some evidence that young children (< 5 years of age) first use reference markers (e.g., articles, pronouns) when they are directly linked to the current real situation (i.e., deictic marks) before moving to an intralinguistic use of these referring devices (i.e., using deictic in a linguistic context). In a latter stage, they can orally link successive utterances or sentences by introducing and semantically managing reference units across the texts (Hickmann, 1991).

Despite the more frequent and long pauses observed in children, the pattern of pauses was similar among children and adults as to the location of major pauses (Redford, 2013). A lot remains to be done to better understand how children manage the translation process when they produce oral narratives.

Children's Translation Management of Written Narratives

The findings in children's oral translation encourage people to expect 6-year-olds to achieve written performances close to adult text productions. Paradoxically, written narrative texts gathered among 6- to 8-year-old children often show a level of organization equivalent to the level observed by Applebee (1978) in oral productions among children between 4 and 5 years of age, as if children had regressed (Hidi & Hildyard, 1983; Simon, 1973). Furthermore, there is a clear improvement in written text characteristics between the ages of 6 and 10. How is it possible to have such a strange evolution—children moving from rather well-organized, coherent, and cohesive narratives in the oral modality to sketchy, allusive, and most of the time unorganized written narratives? One possibility is that they encounter difficulties managing the translation process while subjected to the multilevel requirements of the written modality. The difficulties arise during the translation process for different reasons: (1) the specific pragmatic conditions of written communication and their direct impact on translation; and/or (2) the material characteristics and newly learned properties of written language and of the linguistic code that have an indirect effect on translation.

Pragmatic Conditions of Written Communication

The first difficulty regarding children's translation during composing has to do with the pragmatic conditions specific to written language, respectively. Spoken language is fast and temporary; takes place in real time; and is frequently interrupted and socially situated. It is associated with a great repertoire of intonation patterns and nonlinguistic features. The linguistic interactions taking place in everyday life allow the speaker to determine quickly whether or not the listener has understood, liked what was said, or if he or she reacted in a certain way to it. Written language imposes different constraints on translation than what is encountered in oral language. While producing written text, the author of the message has to self-regulate his or her own production and has to imagine to whom and for what purpose the message is conveyed. Children have to discover these new constraints and take

them into account in order to adapt their translation. They have to make their narratives more explicit, introducing more specific information according to what the audience already knows, and use linguistic markers to prevent ambiguities.

The specific constraints regarding written text production have a strong impact on the management of translation. For example, there are different distinctive patterns in word choices between speaking and writing language (Hayes, 1988). Because of different time pressures in natural conversation, people rely on the most accessible items to control the floor. Written translation requires the use of less frequent words. Children have thus to acquire a larger and more precise vocabulary to deal with written translation. The likelihood of a given syntactic structure is influenced by a wide variety of contextual factors, including discourse type, topic, or density of information (Roland, Dick, & Elman, 2007). Again, children have to learn new syntactic structures to better adapt the form of their message to the constraints of written translation. Because of the audience effect, that is, the presence of interlocutors during interaction, the existence of nonverbal and contextual cues in face-to-face interactions impact on the choice of topics, pronouns, and other linguistic markers such as connectives. Audience adaptation is also required in writing, but, considering the physical absence of the reader, the writer cannot so precisely and rapidly match his or her discourse to the audience's needs or preferences. However, children learn to use some new linguistic marks (e.g. punctuation marks) to help the reader to better signal the relationships between successive statements.

Few data are available regarding the way children operate the transition from oral to written lexicon and syntactic forms (Myhill, 2008), and thus learn "how not to write the way they talk" (Myhill, 2009). From first to twelfth grade, sentences and clauses become longer and more complex (e.g., including more embedded structures). Analyzing narrative and argumentative texts in a group of eighth and tenth graders, Myhill reported that besides an increase in word length (taken as a proxy for complexity in word choice) considered as a function of text quality, there was a decrease in clause coordination and an increase in subordination and the use of complex connectives. However, it is a rather simplistic view to consider that syntactic maturity increases with age. Moreover, the most important changes were that these adolescents better managed thematic continuity.

Children can also take into account symbols that were hitherto unknown to them such as punctuation marks. They have to discover these marks and learn to use them adequately. Kress (1982) has reported that young children have yet to discover that punctuation markers are the boundaries between sentences. At the very beginning of their apprenticeship, they tend to use them as markers between what adults consider to be a textual unit or a paragraph.

Until now little research has focused on translation in children's writing and the relationship between syntactic construction and transcription in text production at both sentence and text level (Berninger, Nagy, & Beers, 2011). The same situation prevails regarding how children could be helped to move from a here-and-now perspective to a more there-and-away-based verbal translation during composing. Limpo and Alves (2013b) reported that, with 10- and 11-year-old children, strategic training was efficient and transferred into composition quality of texts but that sentence combining enhanced sentence production without clearly transferring to translation skills.

Material Characteristics and Newly Learned Properties of Written Language

The second difficulty comes with the material characteristics of translation in written production. When they first go to school and learn to write, children produce oral language smoothly and automatically. In order to become fluent writers, they have to learn and automatize handwriting and spelling (i.e., two transcription processes) so that they will become (almost) as efficient in writing as they are in speaking. The cost of these two transcription processes has a heavy impact on translation (McCutchen, 2006).

In order to become fluent writers, children have to learn and integrate letter forms, letter names, and written shapes (Berninger, 2000; Medwell & Way, 2008). They first have to memorize letter forms and then retrieve those shapes from memory before being able to transcribe them. They also have to learn and control the corresponding motor skills of handwriting. As a consequence, learning to write letters fluently and automatically is not an easy task for children. Children who laboriously form letters during text production often forget what they are trying to communicate through the writing process: They are literally lost in translation (Graham, Harris, & Fink, 2000). No study has investigated in detail what constituent of translation is negatively affected by such an overload: Is it ideas, syntax, or spelling?

Correlational studies have provided evidence that automaticity of letter writing is the single best predictor of length and quality of written composition in the primary years (Graham, Berninger, Abbott, Abbott, & Whitaker, 1997). Moreover, training the accuracy and automaticity of handwriting transfers to composition writing performance, especially regarding length of the texts, a proxy for translation efficiency (Berninger et al., 1997; Graham, Harris, & Fink, 2000).

Spelling is another difficulty related to transcription. To become fluent writers, children must learn a new code that has systematic relations with the oral code, though with varying degrees of regularity (Sprenger-Charolles, 2004). English and French are morphophonemic: That is, the spelling of words depends on both the sound and meaning of the units that make up the words. As a consequence, children or adults cannot rely exclusively on phonographic regularities (Jaffré & Fayol, 2005). They must make use of lexical, morphological, and morphosyntactic information (Berninger & Fayol, 2008). A handful of studies have shown that spelling performance explains part of the variance in composition performance (Juel, 1988) and that interventions focused on spelling improved children's writing fluency, that is, a proxy for translation efficiency (Graham, Harris, & Chorzempa, 2002).

Overall, transcription processes—handwriting and spelling—in children, especially first to fifth graders, are not fluent enough to facilitate translation. The lack of fluency has a negative impact on both writing speed and resources in attention and memory, imposing strong constraints on content processing, limiting the quantity of information activated in long-term memory and afterwards maintained in working-memory, and making it difficult to easily translate content into language (Fayol, 1999; McCutchen, 2000).

PROMOTING TRANSLATION RESEARCH WITH CHILDREN AND ADOLESCENTS

A comparison of the specific conditions involved in oral versus written text reveals three major issues that might help to understand children's slow course of learning translation, the difficulty experienced in implementing translation during composing, and the ways interventions could help children improve their acquisition and management of translation. The issues relate to (1) children's knowledge of specific subject domains and their linguistic abilities, (2) their capabilities or translation skills, and (3) their aptitude to become strategic in translation. All of these issues are liable to more or less profoundly affect the translation component. Research on the three factors should provide findings that could improve children's translation knowledge, skills, and strategies, and furthermore lead to improve text quality and length.

Developing New Knowledge and Acquiring Expertise to Prepare for Translation

First, new knowledge and expertise specific to writing must be acquired. Translation draws on three types of

knowledge: knowledge related to the content being evoked (e.g., topic of the text, organization of the events); linguistic knowledge (lexical, syntactic, and rhetorical dimensions); and procedural knowledge related to transcription (i.e., handwriting, spelling). Domain knowledge impacts text quality through translation: The higher the level of familiarity with the topic, the better is the text's quality; the shorter the pauses, the lighter the cognitive load (Kellogg, 2001; McCutchen, 1986, 1987). These results are due to the fact that topic knowledge is easily accessed and at least partially ordered, making linearization of the content more fluent. Improving content knowledge is thus important to prepare for translation. However, text production involves more than content knowledge. Several new kinds of knowledge are required: handwriting fluency, punctuation marks, and spelling.

Another major element relates to punctuation, namely, a system of marks that children discover at the same time they learn to read. Punctuation marks enable authors to segment the to-be-produced text into parts of content that are sent to the translation process. Children acquire this system only very gradually, starting with the period (and the related punctuation marks: "!" and "?") and capital letters, before moving on to the comma (Hall, 2009). We know little about how acquisition continues thereafter. The first utilizations do not correspond to the boundaries between sentences but instead to boundaries between blocks of information (i.e., content) closely associated in time or space. During the translation process, at this early stage of development, blocks of related information are matched with blocks of clauses (Fayol, 1991b, 1997). Later, the marks become more diversified and children gradually learn to respect the constraints that govern the use of standard punctuation observed in adults: For example, a weak mark such as the comma never occupies a position that corresponds to that of a stronger marker (e.g., paragraph break) (Fayol, 1997; Heurley, 1997). The subsequent development of punctuation is probably associated with the practice of reading and the complexity of texts requiring numerous, hierarchically ordered marks. Unfortunately, little is known about the ways these punctuation marks are processed or how they can be trained.

Yet another type of new learning relates to spelling, from phonography to the memory retention of the orthographic forms of frequent words and the acquisition of regular orthographic features. Here again, learning to spell is a long, slow task that is initiated at the same time that children learn to read and write. Numerous errors are observed both in lexical orthography and in the management of agreements, and these errors mobilize attention and memory, hindering and slowing the translation process (Abbott, Berninger, & Fayol, 2010). Systematic interventions have been shown to bring about an improvement (Berninger, Vaughan, Abbott, Begay, Coleman, et al., 2002).

Children's Translation Skill or Capacity

Second, to improve translation skills, some types of knowledge and the conditions under which they are mobilized have to be extended, in particular because of the complexity and length of the written productions (use of references, establishing connections, verbal forms). The use of an anaphora makes it possible to refer to items previously evoked in the text. Although children use definite articles and other deictic expressions at a very early stage, the introduction of multiple characters, the need to monitor these characters, and changes of role (e.g., when the agent becomes the patient) cause problems that have been clearly identified at the level of comprehension but have been less well described in the field of text translation. The acquisition and use of the systems of anaphoric markers raise the question of the relations between the representation of the content (e.g., who is doing what to whom) and the management of anaphoric marks: Is using such a pronoun or article relevant, and is it nonambiguous for the reader? Several studies reported that children with poor comprehension skills (e.g., in interpreting anaphora or definite articles) also exhibit difficulties in the production of narratives (Cragg & Nation, 2006; Ehrlich & Remond, 1997). It has also been documented that anaphoric interpretation can be trained efficiently (Bianco et al., 2012). Training in

the interpretation of anaphora could impact translation, but the question remains to be explored.

The use of connectors is another area in which written texts introduce additional difficulties. Children use these connectors at a very early age in their oral narratives (French & Nelson, 1985). However, the diversity and presence of these markers differ greatly in their written productions (De Weck, 1991). Experimental research in which the content of narratives had been carefully controlled has made it possible to show that it is the specifics of the content, rather than the verbal capabilities of the participants, that are responsible for the use of connectors: When the event sequences recounted are chronological–causal in nature, productions include the relevant connectors, and no development is observed. Here again, the relations with reading performances suggest that poor readers are once more those whose productions are characterized by the omissions of markers or those who are slow to develop. And here again, training is efficient (Bianco et al., 2012).

When children move from oral to written language, they are thus challenged with major changes in the fields of the translation components: lexical knowledge, syntax, and text organization. Moreover, the different levels of the translation process (i.e., lexicon, syntax, text structure) are relatively independent from one another, as are the other dimensions of text production (Whitaker, Berninger, Johnson, & Swanson, 1994). As we have mentioned above, a less frequent and more precise lexicon is mobilized during writing. The same applies to syntax: Sentence forms are more standardized and contain more embeddings in written than in spoken language. Text organizations are difficult to learn and use (Fayol, 1991a; Fitzgerald, 1984). We only have a limited understanding of how children, and then adults, acquire lexical and syntactic forms. Although the exercise of reading is often mentioned as a direct cause of learning these forms, the specific mechanisms that are mobilized to achieve this result remain a mystery (Abbott et al., 2010; Ahmed et al., 2014). The teaching of grammar appears to be at best of only limited effectiveness (Jones, Myhill, & Bailey, 2013). Only research into syntactic priming has offered any prospect of explanations and interventions, and then only of a restricted scope (Bock, Dell, Chang, & Onishi, 2007). Priming effects could be extended to the acquisition of rhetorical forms (i.e., text structures; Fitzgerald & Spiegel, 1983). However, the lexicon and complex syntactic forms, as well as text structures, can also be explicitly taught. Improving the quantity and depth of the lexicon, the variety of syntactic choice, and the knowledge of text structures is expected to facilitate translation because the corresponding improvements facilitate the availability of the linguistic tools that enable matching the sequence of ideas and linguistic dimensions.

Becoming Strategic in Translation

Third, the management of written translation is potentially quite different from the one observed in oral production: In writing production, speed can be easily modulated (and even temporarily interrupted); some steps can be delayed or anticipated; and others can be reviewed and modified. These possibilities open avenues for strategies and strategic regulations. However, most children do not spontaneously discover these strategies. They need to learn them and to be trained to use them. Moreover, their management loads on the working memory and executive functions. Children must keep their objectives in mind while they are dealing with subgoals or subparts of their translation until they go back to the main line of thought. In addition, learning a new strategy does not guarantee its efficiency (Bereiter & Scardamalia, 1983)

To learn any writing strategy and to use it efficiently, one must be able to adopt a metacognitive attitude and to master metacognitive skills, enabling one to evaluate the overall quality of a text and not just to detect errors and problems (Graham, 2006; Limpo & Alves, 2013a). It is also necessary to have easy access to alternative lexical, syntactic, and rhetorical forms that can be readily mobilized during the translation process, in response to shortcomings observed in the text produced so far pertaining to the communicative requirements of translation.

Last, the management of strategies also requires exploitation of working memory capacities and executive functions that control, direct, or coordinate other cognitive processes, enabling the writer to simultaneously keep in mind the goals and ideas produced so far as well as to plan what to translate. Research provides evidence that the capacity to adopt a metacognitive attitude toward a text as well as the availability of extended lexical and syntactic knowledge have an impact on processing speed. We know that these components can be developed and that they constitute a major constraint on the development and management of the translation process during WTP in children. However, the precise mechanisms of their impact remain largely unknown (Gathercole, Pickering, Ambridge, & Wearing, 2004; Kail & Ferrer, 2007; Lee, Bull, & Ho, 2013).

Summary

To recap, in order to improve translation skills in children, one must consider three important issues. These issues have both research and pedagogical relevance. First, to be able to write fluently, without spelling errors, children need to acquire and automatize new knowledge, mainly procedural knowledge, to match easily the flow of ideas with the rhythm of written language, which is the *sine qua non* condition for fluent translation. Second, children need to improve their repertory of lexical, syntactic, and textual tools to make language correspond more closely to ideas. Reading is an avenue to explore in the pursuit of that purpose. However, researchers have attended to the issues of whether improving reading abilities is sufficient to improve translation skills and whether direct instruction is needed to improve reading abilities that would transfer into translation skills. We also have to evaluate the impact of such instruction. Third, children have to move from a passive attitude —composing as ideas come to mind—to an active attitude, that is, accepting constraints (e.g., slow handwriting) and conditions (e.g., revision) as opportunities to improve both the product and the process of translation.

CONCLUSION

Overall, the translation component of composing models is the one component that has received the least attention from researchers. Descriptions of adult performance in translation and of ways that learning to translate is facilitated are limited to a small number of dimensions (e.g., translation involving syntactic complexity or anaphora). However, despite the precise nature of certain results, the cost of managing and, above all, the cost of coordinating translation with the other processes have yet to be addressed. Considerable work therefore remains to be done in order to model translation more precisely and to establish its relations with the other components of the writing process. Furthermore, apart from the work related to sentence combining, which only addresses the question of syntax and even that, at relatively advanced ages, almost no research has been conducted into the implicit and/or explicit learning of several dimensions of the translation process (e.g., of text structures or of the use of verbal forms) and their short-term and long-term impact on writing performance. Research on what and how to teach translation, and what children and adolescents learn from such interventions, is a crucial topic for the future.

ACKNOWLEDGMENT

I am grateful to Professor Céline Beaudet from the University of Sherbrooke, Canada, for her editorial assistance during the translation process of this chapter.

REFERENCES

Abbott, R., Berninger, V., & Fayol, M. (2010). Longitudinal relationships of levels of language in writing and between writing and reading in grades 1 to 7. *Journal of Educational Psychology, 102*, 281–298.

Ahmed, Y., Wagner, R. K., & Lopez, D. (2014). Developmental relations between reading and writing at the word, sentence, and text levels: A latent change score analysis. *Journal of Educational Psychology, 106*, 419–434.

Alamargot, D., & Chanquoy, L. (2001). *Through the models of writing*. Dordrecht, The Netherlands: Kluwer.

Alamargot, D., & Fayol, M. (2009). Modelling the development of written composition. In R. Beard, D. Myhill, M. Nystrand, & J. Riley (Eds), *Handbook of writing development* (pp. 23–47). London: Sage.

Applebee, A. N. (1978). *The child's concept of story: Age two to seventeen*. Chicago: University of Chicago Press.

Bereiter, C., & Scardamalia, M. (1983). Levels of inquiry in writing research. In P. Mosenthal, S. Walmsley, & L. Tamor (Eds.), *Research on writing: Principles and method* (pp. 3–25). New York: Longman.

Bereiter, C., & Scardamalia, M. (1987). *The psychology of written composition*. Hillsdale, NJ: Erlbaum.

Berninger, V. W. (2000). Development of language by hand and its connections with language by ear, mouth, and eye. *Topics in Language Disorders, 20*, 65–84.

Berninger, V. W. (2009). Highlights of programmatic, interdisciplinary research on writing. *Learning Disabilities Research and Practice, 24*(2), 69–80.

Berninger, V. W., & Fayol, M. (2008). Why spelling is important and how to teach it effectively. *Encyclopedia of language and literacy development* (pp. 1–13). London, Ontario: Canadian Language and Literacy Research Network.

Berninger, V. W., Nagy, W., & Beers, S. (2011). Child writers' construction and reconstruction of single sentences and construction of multiple sentence texts: Contribution of syntax and transcription to translation. *Reading and Writing, 24*, 151–182.

Berninger, V. W., Rijlaarsdam, G., & Fayol, M. (2012). Mapping research questions about translation to methods, measures, and models. In M. Fayol, D. Alamargot, & V. Berninger, V. (Eds.), *Translation of thoughts to written text while composing: Advancing theory, knowledge, methods, and applications* (pp. 27–67). New York: Psychology Press.

Berninger, V. W., & Swanson, H. L. (1994). Modifying Hayes and Flower's model of skilled writing to explain beginning and developing writing. In E. Butterfield (Ed.), *Children's writing: Toward a process theory of the development of skilled writing* (pp. 57–81). Greenwich, CT: JAI Press.

Berninger, V. W., Vaughan, K., Abbott, R., Abbott, S., Brooks, A., Rogan, L., et al. (1997). Treatment of handwriting fluency problems in beginning writing: Transfer from handwriting to composition. *Journal of Educational Psychology, 89*, 652–666.

Berninger, V. W., Vaughan, K., Abbott, R. D., Begay, K., Coleman, K. B., Curtin, G., et al. (2002). Teaching spelling and composition alone or together: Implications for the simple view of writing. *Journal of Educational Psychology, 94*, 291–304.

Bianco, M., Pellenq, C., Lambert, E., Bressoux, P., Lima, L., & Doyen, A-L. (2012). Impact of early code-skill and oral-comprehension training on reading achievement in first grade. *Journal of Research in Reading, 35*(4), 427–455.

Bock, K., Dell, G. S., Chang, F., & Onishi, K. H. (2007). Persistent structural priming from language comprehension to language production. *Cognition, 104*, 437–458.

Bock, K., & Levelt, W. J. M. (1994). Grammatical encoding. In M. A. Gernsbacher (Ed.), *Handbook of psycholinguistics* (pp. 945–984). New York: Academic Press.

Bonin, P., & Fayol, M. (2000). Writing words from pictures: what representations are activated and when? *Memory and Cognition, 28*, 677–689.

Bourdin, B., & Fayol, M. (2002). Even in adults, written production is still more costly than oral production. *International Journal of Psychology, 37*, 219–222.

Bower, G. H., & Morrow, D. G. (1990). Mental models in narrative comprehension. *Science, 247*, 44–48.

Cain, K., & Nash, H. M. (2011). The influence of connectives on young readers'processing and comprehension of text. *Journal of Educational Psychology, 103*(2), 429–441.

Chanquoy, L., Foulin, J. N., & Fayol, M. (1990). The temporal management of short text writing by children and adults. *European Bulletin of Cognitive Psychology, 10*, 513–540.

Costermans J., & Fayol, M. (Eds.). (1997). *Processing interclausal relationships. Studies in the production and comprehension of texts*. Mahwah, NJ: Erlbaum.

Cragg, L., & Nation, K. (2006). Exploring written narrative in children with poor reading comprehension. *Educational Psychology, 26*, 55–72.

De Weck, G. (1991). *La cohésion dans les narrations d'enfants*. Neuchâtel, Paris: Delachaux et Niestlé.

Ehrlich, M.-F., & Remond, M. (1997). Skilled and less skilled comprehenders: French children's processing of anaphoric devices in written texts. *British Journal of Developmental Psychology, 15*, 291–309.

Fayol, M. (1991a). Text typologies: a cognitive approach. In G. Denhière & J. P. Rossi (Eds.), *Text and text processing*. Amsterdam: North Holland.

Fayol, M. (1991b). Stories: A psycholinguistic and ontogenetic approach to the acquisition of narrative abilities. In G. Pieraut le Bonniec & M. Dolitsky (Eds.), *From basic language to discourse basis processing* (pp. 229–243). Amsterdam: John Benjamins.

Fayol, M. (1997). On acquiring and using punctuation: A study in written French. In J. Costermans & M. Fayol (Eds.), *Processing interclausal relationships* (pp. 157–178). Mahwah, NJ: Erlbaum.

Fayol, M. (1999). From on-line management problems to strategies in written composition. In M. Torrance & G. Jeffery (Ed.), *The cognitive demands of writing*. Amsterdam: Amsterdam University Press.

Fayol, M. (2012). Cognitive processes of children and adults in translating thoughts into written language in real time. In V. W. Berninger (Ed.), *Past, present, and future contributions of cognitive writing research to cognitive psychology* (pp. 27–39). New York: Psychology Press.

Fayol, M., Alamargot, D., & Berninger, V. (2012). *Translation of thought to written text while composing*. New York: Psychology Press.

Fayol, M., Foulin, J.-N., Maggio, S., & Lété, B. (2012). Towards a dynamic approach of how children and adults manage text production. In E. Grigorenko, E. Mambrino, & D. D. Preiss (Eds.), *Handbook of writing: A mosaic of perspectives* (pp. 141–158). New York: Psychology Press.

Fayol, M., Hickmann, M., Bonnotte, I., & Gombert, J. E. (1993). French verbal inflections and narrative context: A developmental perspective. *Journal of Psycholinguistic Research, 22*, 453–478.

Fayol, M., & Lété, B. (2012). Contributions of online studies to understanding translation from ideas to written text. In M. Fayol, D. Alamargot, & V. Berninger, V. (2012), *Translation of thoughts to written text while composing: Advancing theory, knowledge, methods, and applications* (pp. 289–313). New York: Psychology Press.

Fitzgerald, J. (1984). The relationship between reading ability and expectations for story structures. *Discourse Processes, 7*, 21–41.

Fitzgerald, J., & Spiegel, D. L. (1983). Enhancing children's reading comprehension through instruction in narrative structure. *Journal of Reading Behavior, 15*, 1–17.

Foulin, J.-N. (1998). To what extent does pause location predict pause duration in adults' and children's writing?

Cahiers de Psychologie Cognitive/Current Psychology of Cognition, 17, 601–620.

French, L. A., & Nelson, K. (1985). *Children's acquisition of relational terms: Some ifs, ors, and buts*. New York: Springer Verlag.

Gathercole, S. E., Pickering, S. J., Ambridge, B., & Wearing, H. (2004). The structure of working memory from 4 to 15 years of age. *Developmental Psychology*, *40*(2), 177–190.

Gernsbacher, M. A. (1997). Two decades of structure building. *Discourse Processes, 23*, 265–304.

Graham, S. (2006). Strategy instruction and the teaching of writing: a meta-analysis. In C. MacArthur, N. L. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 187–207). New York: Guilford Press.

Graham, S., Berninger, V. W., Abbott, R. D., Abbott, S. P., & Whitaker, D. (1997). Role of mechanics in composing of elementary school students: A new methodological approach. *Journal of Educational Psychology, 89*, 170–182.

Graham, S., & Harris, K. R. (2000). The role of self-regulation and transcription skills in writing and writing development. *Educational Psychologist, 35*, 3–12.

Graham, S., Harris, K. R., & Chorzempa, B. F. (2002). Contribution of spelling instruction to the spelling, writing, and reading of poor readers. *Journal of Educational Psychology, 92*, 669–686.

Graham, S., Harris, K. R., & Fink, B. (2000). Is handwriting causally related to learning to write? Treatment of handwriting problems in beginning writers. *Journal of Educational Psychology, 92*, 620–633.

Graham, S., McKeown, D., Kiuhara, S., & Harris, K. R. (2012). A meta-analysis of writing instruction for students in the elementary grades. *Journal of Educational Psychology, 104*, 879–896.

Hall, N. (2009). Developing an understanding of punctuation. In R. Beard, D. Myhill, M. Nystrand, & J. Riley (Eds.), *Handbook of Writing Development* (pp. 271–283). London: Sage.

Halliday, M. A. K., & Hasan, R. (1976). *Cohesion in English*. London: Longmans.

Hayes, D. P. (1988). Speaking and writing: Distinct patterns of word choice. *Journal of Memory and Language, 27*, 572–585.

Hayes, J. R. (1996). A new framework for understanding cognition and affect in writing. In C. M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences and applications* (pp. 1–27). Mahwah, NJ: Erlbaum.

Hayes, J. R. (2012). Evidence from language bursts, revision, and transcription for translation and its relation to other writing processes. In M. Fayol, D. Alamargot, & V. W. Berninger (Eds.), *Translation of thought to written text while composing*. New York: Psychology Press.

Hayes, J. R., & Flower, L. S. (1980). Identifying the organization of writing processes. In L. W. Gregg & E. R. Steinberg (Eds.), *Cognitive processes in writing* (pp. 3–30). Hillsdale, NJ: Erlbaum.

Hermann, T., & Grabowski, J. (1995). Pre-terminal levels of process in oral and written language production. In U. M. Quasthoff (Ed.), *Aspects of oral communication* (pp. 67–85). Berlin: de Gruyter.

Heurley, L. (1997). Processing units in written texts: Paragraphs or information blocks? In J. Costermans & M. Fayol (Eds.), *Processing interclausal relationships processing* (pp. 179–200). Mahwah, NJ: Erlbaum.

Hickmann, M. (1991). The development of discourse cohesion: Some functional and cross-linguistic issues. In G. Pieraut Le Bonniec & M. Dolitsky (Eds.), *From basic language to discourse basis processing* (pp. 157–185). Amsterdam: John Benjamins.

Hidi, S., & Hildyard, A. (1983). The comparison of oral and written productions of two discourse types. *Discourse Processes, 6*, 91–105.

Hudson, J., & Shapiro, L. R. (1991). From knowing to telling: The development of children's script, stories, and personal narratives. In A. McCabe & C. Peterson (Eds.), *Developing narrative structure processing* (pp. 89–136).

Hillsdale, NJ: Erlbaum.

Jaffré, J.-P., & Fayol, M. (2005). Orthography and literacy in French. In R. M. Joshi & P. G. Aaron (Eds.), *Handbook of orthography and literacy* (pp. 81–103). Mahwah, NJ: Erlbaum.

Johnson-Laird, P. N. (1983). *Mental models*. Cambridge, MA: Cambridge University Press.

Jones, S., Myhill, D., & Bailey, T. (2013). Grammar for writing? An investigation of the effects of contextualised grammar teaching on students'writing. *Reading and Writing, 26*, 1241–1263.

Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children from first to fourth grades. *Journal of Educational Psychology, 80*, 437–447.

Kail, R. V., & Ferrer, E. (2007). Processing speed in childhood and adolescence: Longitudinal models for examining developmental change. *Child Development, 78*(6), 1760–1770.

Karmiloff-Smith, A. (1981). The grammatical marking of thematic structure in the development of language production. In W. Deutsch (Ed.), *The child's construction of language* (pp. 121–147). London: Academic Press.

Kaufer, D. S., Hayes, J. R., & Flower, L. S. (1986). Composing written sentences. *Research in the Teaching of English, 20*, 121–140.

Kellogg, R. T. (1988). Attentional overload and writing performance: Effects of rough draft and outline strategies. *Journal of Experimental Psychology: Learning, Memory and Cognition, 14*, 355–365.

Kellogg, R. T. (2001). Competition for working memory among writing processes. *American Journal of Psychology, 114*(2), 175–191.

Kress, G. (1982). *Learning to write*. London: Routledge.

Lee, K., Bull, R., & Ho, R. M. H. (2013). Developmental changes in executive functioning. *Child Development, 84*(6), 1933–1953.

Levelt, W. J. M. (1989). *Speaking: From intention to articulation*. Cambridge, MA: MIT Press.

Levy, C. M., & Ransdell, S. E. (1996). *The science of writing*. Mahwah, NJ: Erlbaum.

Limpo, T., & Alves, R. A. (2013a). Modeling writing development: Contribution of transcription and self-regulation to Portuguese students' text generation quality. *Journal of Educational Psychology, 105*(2), 401–413.

Limpo, T., & Alves, R. A. (2013b). Teaching planning or sentence-combining strategies: Effective SRSD interventions at different levels of written composition. *Contemporary Educational Psychology, 38*, 328–341.

Maggio, S., Lété, B., Chenu, F., Jisa, H., & Fayol, M. (2012). Tracking the mind during writing: Immediacy, delayed, and anticipatory effects on pauses and writing rate. *Reading and Writing, 25*, 2131–2151.

McCutchen, D. (1986). Domain knowledge and linguistic knowledge in the development of writing ability. *Journal of Memory and Language, 25*, 431–444.

McCutchen, D. (1987). Children's discourse skill: Form and modality requirements of schooled writing. *Discourse Processes, 10*, 267–286.

McCutchen, D. (2000). Knowledge, processing, and working memory: Implications for a theory of writing. *Educational Psychologist, 35*, 13–23.

McCutchen, D. (2006). Cognitive factors in the development of children's writing. In C. MacArthur, N. L. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 115–130). New York: Guilford Press.

Medwell, J., & Way, D. (2008). Handwriting—A forgotten language skill. *Language and Education, 22*(1), 34–47.

Mehta, P. D., Foorman, B. R., Branum-Martin, L., & Taylor, W. P. (2005). Literacy as a unidimensional multilevel construct: Validation, sources of influence, and implications in a longitudinal study in Grades 1 to 4. *Scientific Studies of Reading, 9*(2), 85–116.

Myhill, D. (2008). Towards a linguistic model of sentence development in writing. *Language and Education, 22*(5), 271–288.

Myhill, D. (2009). From talking to writing: Linguistic development in writing. *British Journal of Educational Psychology. Monograph Series II*: Teaching and Learning Writing (pp. 27–44).

Noordman, L. G. M., & Vonk, W. (1997). The different functions of a conjunction in constructing a representation of the discourse. In J. Costermans & M. Fayol (Eds.), *Processing interclausal relationships processing* (pp. 75–94). Mahwah, NJ: Erlbaum.

Ochs, E. (1979). Planned and unplanned discourse. In T. Givon (Ed.), *Syntax and semantics (XII): Discourse and Syntax*. New York: Academic Press.

Olive, T., Kellogg, R. T., & Piolat, A. (2002). The triple-task technique for studying the process of writing. In T. Olive & C. M. Levy (Eds), *Contemporary tools and techniques for studying writing* (pp. 31–58). Dordrecht, The Netherlands: Kluwer.

Peterson, C., & McCabe, A. (1983). *Developmental psycholinguistics: Three ways of looking at a child's narrative*. New York: Plenum.

Redford, M. A. (2013). A comparative analysis of pausing in child and adult storytelling. *Applied Psycholinguistics, 34*, 569–589.

Roland, D., Dick, F., & Elman, J. L. (2007). Frequency of basic English grammatical structures: A corpus analysis. *Journal of Memory and Language, 57*, 348–379.

Schank, R. C., & Abelson, R. (1977). *Scripts, plans, goals, and understanding*. Hillsdale, NJ: Erlbaum.

Schilperoord, J. (1996). *It's about time: Temporal aspects of cognitive processes in text production*. Amsterdam: Rodopi.

Simon, J. (1973). *The written language of children*. Paris: P.U.F.

Sprenger-Charolles, L. (2004). Linguistic processes in reading and spelling: The case of alphabetic writing systems: English, French, German, and Spanish. In T. Nunes & P. Bryant (Eds.), *Handbook of children's literacy* (pp. 43–66). Dordrecht, The Netherlands: Kluwer.

Stein, N. L., & Glenn, C. G. (1979). An analysis of story comprehension in elementary school children. In R. O. Freedle (Ed.), *New directions in discourse processing* (pp. 53–120). Norwood, NJ: Ablex.

Trabasso, T., Secco, T., & van den Broek, P. (1985). Causal cohesion and story coherence. In H. Mandl, N. Stein, & T. Trabasso (Eds.), *Learning and comprehension of text processing* (pp. 83–111). Hillsdale, NJ: Erlbaum.

van Dijk, T. A., & Kintsch, W. (1983). *Strategies of discourse comprehension*. New York: Academic Press.

Wagner, R. K., Puranik, C. S., Foorman, B., Foster, E., Wilson, L. G., Tschinkel, E., & Kantor, P. T. (2011). Modeling the development of written language. *Reading and Writing, 24*, 203–220.

Whitaker, D., Berninger, V., Johnston, J., & Swanson, H. L. (1994). Intraindividual differences in levels of language in intermediate grade writers: Implications for the translating process. *Learning and Individual Differences, 6*, 107–130.

CHAPTER 10

From Text to Language and Back

The Emergence of Written Language

Liliana Tolchinsky

The study of written language development is a well-established domain of inquiry in cognitive psychology. Researchers of different perspectives concur that the desired outcome of this development is the ability to produce cohesive and coherent texts, adequate for different communicative purposes. Another point of agreement is that writing is a multidimensional endeavor. Whenever writers compose texts (think, for example, of writing a story), they must work on a number of dimensions simultaneously: the content to be conveyed, its overall discursive organization, the syntactic organization of each sentence, ways to link sentences among them, and the choice of the right words to build the sentences. Thus, becoming a skilled writer encompasses mastery of all levels of linguistic knowledge: phonological, morphosyntactic, lexical, pragmatic, and discursive (Alamargot & Chanquoy, 2001). Simultaneous work on discourse, syntax, and the lexicon is inevitable and common to any kind of linguistic production being spoken or written. An additional demand of written text production is that, in contrast to speech production, writers must also take care of the right letters to build the words and the appropriate graphic layout to display the text. All in all, learning to write is considered a complex task, and, there is a long developmental journey to attain a proficient use of writing as a means of linguistic expression.

In spite of a basic agreement on the desired outcome and on the multidimensionality of the task, there are two divergent views about written language development. The views differ in how they conceive of the emergence of writing, the direction of development, the relative weight of the multiple dimensions involved in text production, and the role the acquisition of the written language plays in linguistic development. For the sake of simplicity, I identify one of these views as *additive–cumulative* as opposed to a *mutually enhancing–interactive* perspective.

The goal of this chapter is to show that (1) written language emerges from discerning the graphic characteristics and linguistic affordances of texts and not from learning the rules to pair graphic elements to speech sounds, and that (2) development is neither unidirectional, from (spoken) language to text, but from text to language and back, nor additive–cumulative in nature. Written language development does not progress from learning to trace letters to combining letters into words and words into sentences and eventually constructing a piece of discourse. Rather, there is a constant interaction between the different dimensions involved in text production from the earliest phases of development. Moreover, learning to write is not an ability added to linguistic development; rather, it is an integral and transforming part of this development. It is crucial for native speakers to become proficient language users (Berman, 2004).

In the following I present the main distinguishing features of the two approaches that are shaping research in the domain, the *mutually enhancing–interactive* and the *additive–cumulative*. For the sake of persuasion, I emphasize the differences more than the commonalities between the approaches. Next, I refer to the milestones in early writing development as they appear from empirical research in the field and suggest further lines of research.

THE GREAT DIVIDE

The expression *written language* has two complementary meanings: on the one hand, it refers to the graphic representation of language by means of a writing system; on the other hand, it connotes the discourse modes and registers that characterize the written modality, the *language to be written* in terms of Blanche-Benveniste (1982). The different reliance on each of the two meanings or aspects of written language is the main distinguishing feature between the two theoretical frameworks that shape research in the domain of early written language development.

Additive–Cumulative Views

Written language is conceived first and foremost as a transcriptional system—a system for transcribing spoken language into the written modality. Writing development would consist of the gradual mastery of written language units, starting with smaller and proceeding to progressively larger ones. In other words, writing development is regarded as the ability to generate written language at the word, sentence, and text levels, and to progress in this order (e.g., Berninger et al., 2002; Berninger & Winn, 2006).

Consubstantial to this view is that development takes place in a bottom-up fashion, with skills such as handwriting and spelling supporting the emergence of ideational and discursive processes. In the psychological models supporting this view (Berninger & Swanson, 1994; Hayes & Berninger, 2010), handwriting and spelling are considered low-level skills, whereas ideational and discourse processes are considered to be high-level cognitive processes. Moreover, any variation in the processing cost of a given component would impact the use of other components (McCutchen, 1996). In principle, the impact in variation of the processing cost can be in either direction, with low-level components (handwriting or spelling) affecting high-level processes (planning content, creating a text) or vice versa. However, only one of the directions is privileged in this view of written language development: it is the lack of automaticity of handwriting or spelling that is assumed to interfere with content generation and writing fluency. Thus, lower-level components are not only mastered prior to higher-level components but also constrain the full developmental process of text construction (Abbott, Berninger, & Fayol, 2010).

Accordingly, the study of text production is postponed until children master the transcriptional aspects of writing. Preschoolers and kindergartners are asked to write letters or words, and only after second or third grade (7- and 8-year-olds) are participants asked to write texts (e.g., Berninger et al., 1992; Berninger & Swanson, 1994; Juel, Griffith, & Gough, 1986).

One of the main purposes in the additive–cumulative perspective is to identify the abilities that children need to master to become proficient writers. For this purpose a diversity of linguistic skills, such as vocabulary knowledge, morphological awareness, or phonological awareness, and cognitive abilities, such as working memory, nonverbal IQ, or visual discrimination, are examined as possible predictors of writing achievements. However, for preschoolers and first graders, writing achievement is indexed as word writing (Levin, Ravid, & Rapaport, 2001; Molfese et al., 2011) and rarely as text writing (Puranik & Al Otaiba, 2012).

Finally, another underlying assumption within this view is that the linguistic dimensions—overall discursive organization, syntactic organization of sentences, sentence linkage, and adequate lexical choices—are part and parcel of children's spoken language knowledge. Freed from the burden of transcription, it is further assumed that this knowledge will translate into writing. Written language is seen as a device for translating knowledge, not for constituting knowledge (Galbraith, 2009).

A well-known model of reading and writing development, the simple view of writing, illustrates this perspective (Juel et al., 1986). The model proposes that writing ability involves two main processes: spelling and ideation (organization and generation of ideas). Spelling fulfills in writing the same role as decoding does on reading comprehension (Gough & Tunmer, 1986). Both decoding and spelling rely on the same sources: knowledge of sound-spelling correspondences, together with lexical knowledge—measured in the context of a spelling task—and exposure to print (Juel et al., 1986). The model predicts that spelling determines to a large extent writing ability during the early years of writing development, while ideation becomes progressively more important, once spelling has become automatized. The study strongly emphasizes the extreme importance of phonemic awareness in literacy acquisition. "Children will not acquire spelling–sound correspondence knowledge until a prerequisite amount of phonemic awareness has been attained. Without such phonemic awareness, exposure to print does little to foster spelling-sound knowledge" (Juel et al., 1986, p. 254).

The simple view offers clear, testable predictions but puts phonological awareness at the center of reading and writing acquisition, disregarding the task environment as well as other higher-level processes such as text planning and editing. These processes are not considered to form part of emerging written language.

Methodological Approach

The bulk of studies within this paradigm have relied on experimental research with the goal of finding the abilities that young children need to master in order to become proficient writers. Abilities such as phonological awareness, knowledge of vocabulary, knowledge of letters, writing fluency, and rapid automatized naming (RAN), a task that measures how quickly individuals can name aloud objects, pictures, colors, or graphic symbols, were measured as candidates for predicting ability to write. Numerous correlational studies were carried out in order to detect the concurrent and longitudinal predictors for writing. Currently, structural equation models (embracing factor analysis, path analysis, and regression) are applied to determine the best explanatory model for such a complex construct as writing ability. With few exceptions (Salas, 2014; Puranik & Al Otaiba, 2012; Wagner et al., 2011), when the modeling is applied to preschoolers or first graders the outcome variable (writing) is indexed by word writing rather than by text writing. Moreover, when text writing is considered, studies tend to focus on microstructural rather than macrostructural features of text composition. Microstructural characteristics of a text refer not only to transcriptional/notational aspects such as spelling, punctuation, and capitalization, but also to vocabulary choices, syntactic complexity, use of connectivity devices, and so on (Puranik, Lombardino, & Altmann, 2008; Salas, 2014; Wagner et al., 2011). Macrostructural features refer to the larger configuration and organization of the text, the number and type of functional components included in the text, its overall coherence, richness of content, and/or communicative effectiveness. Microstructural aspects of text composition are easier to operationalize and quantify, whereas macrostructural features of preschoolers writings are difficult to assess. Thus, recent studies on early writing development seem to overwhelmingly favor this type of approach (e.g., Puranik & Al Otaiba, 2012; Puranik et al., 2008; Salas, 2014; Wagner et al., 2011).

Educational Implications

Studies in the additive–cumulative perspective use empirical evidence not only to discover predictors of success and failure in writing but also to recommend teaching approaches and effective strategies for preventing writing difficulties. In particular, these studies seek to train directly and explicitly the abilities that were found to be related to writing achievements: knowledge of letters (Foulin, 2005; De Jong & van der Leij, 1999); morphological awareness (Nunes, Bryant, & Olson, 2003) and especially phonemic awareness (Vukelich & Christie, 2009), handwriting and spelling (Graham, Berninger, Abbott, Abbott, & Whitaker, 1997). Although the specific programs for each ability advise integration with other activities—apart from training the particular skill—greater emphasis is put on detailed and specific didactic work on the skills considered foundational than on a global approach to writing activities.

Mutually Enhancing–Interactive Views

Written language is conceived first and foremost as a discourse mode, and the writing system is viewed as a system for encoding meaning and representing—rather than transcribing—language. Written language development is seen as the acquisition of a repertoire of discourse modes socioculturally bounded (Blanche-Benveniste, 1982; Berman &

Nir-Sagiv, 2007; Dyson, 1983). From this perspective, the study of written language development should consider both children's increasing command of the transcriptional aspects of writing and the discursive aspects of text composing because they are not acquired sequentially—first the transcriptional abilities and later on the linguistic and rhetorical abilities involved in composing. On the contrary, they influence each other. At any point of development, researchers must take into account the ideas that children develop about the functioning of the writing system and about the language to be written (Ferreiro, 1986, 1988; Ravid & Tolchinsky, 2002; Schickedanz & Casbergue, 2004) because there is not a unidirectional development. Rather, relationships across levels may vary throughout development. There might be dissociation between performance on microstructural and macrostructural features of written composition (Berman & Nir-Sagiv, 2007).

The bulk of research from the mutually enhancing–interactive perspective involved student writing of texts in different discourse modes, and not just writing letters or words. The idea is to find out what children know about texts at any point in development without waiting for them to gain full command of spelling (Pontecorvo & Zucchermaglio, 1988; Sandbank, 2001). Work in this line of thought has shown that prior to attaining conventional spelling 4- to 5-year-olds have knowledge about the type of discourse that is expected from a story book as opposed to a newspaper (Ferreiro & Teberosky, 1979). It has also been shown that when 4- to 5-year-olds who do not yet know how to spell are asked to dictate to adult stories that are meant to be written, they use linguistic forms typical of writing, and they avoid resorting to conversational or other spoken language resources (Blanche-Benveniste, 1982).

Most of the abilities that are considered precursors of writing from the additive–cumulative perspective, for example, phonological awareness and morphological awareness, are considered here to be concomitant to learning to read and write in an alphabetic system. Although researchers have focused primarily on the contribution of phonological awareness to reading and writing acquisition (e.g., Bradley & Bryant, 1985; Byrne & Fielding-Barnsley, 1990), there is strong evidence that the relationship between phonological awareness and reading is not unidirectional but reciprocal (e.g., Cataldo & Ellis, 1988; Stanovich, 1986; Vernon & Ferreiro, 1999). Illiterate adults showed poor phonological awareness at the phoneme level but demonstrated phonemic awareness once they received literacy instruction in an alphabetic system (Morais, Cary, Alegria, & Bertelson, 1979). Explicit instruction in phonological awareness skills is very effective in promoting early reading, and, conversely, instruction in early reading appears to strengthen phonological awareness, in particular, phonemic awareness (Snow, Burns, & Griffin, 1998). Similarly, for morphological awareness, studies in Hebrew have shown that kindergarten children who were more advanced in morphology progressed more in word writing from kindergarten to first grade, and those who were more advanced in word writing in kindergarten showed greater improvements in derivational morphology from kindergarten to first grade (Levin et al., 2001). Children acquire a working knowledge of the alphabetic system through reading and writing. Their efforts to spell encourage them to think actively about the parts of a word (Ferreiro, 2002) and about letter–sounds relations (Neuman, Copple, & Bredekamp, 1998).

A comparable reciprocal influence was found between writing, phonological awareness, and knowledge of letters. Knowledge of letter names boosts word writing indirectly through its influence on children's grasp of letter-to-sound correspondences and on their phonemic awareness (Foulin, 2005; Share, 1995). There is converging evidence showing that a combination of phonemic awareness and letter–sound correspondence training strongly benefits children's understanding of the alphabetic principle (Adams, 1990; Byrne & Fielding-Barnsley, 1989).

In this view, a qualitative gap is established between the mechanics of writing, including handwriting and drawing of letters, and the use of graphic forms to produce texts. It is the conceptualization beyond the graphic marks that should be examined. "We are not talking about copying because copying is drawing letters and not writing . . . We are neither talking about the hand that grabs the pencil nor about writing as a final product, we are talking about

what sits between one thing and another: a subject that thinks" (Ferreiro, 1987, p. 103). In the case of letters, for instance, it is crucial to understand what representational meaning children attribute to letters throughout development and how they use them. It has been shown that kindergartners may use the letters they know from their name for writing many other words (Tolchinsky, 2003) but not for writing a text (Puranik & Lonigan, 2011; Sulzby, 1986)—a selective use that may indicate a qualitative distinction between word writing and text writing.

By separating the transcriptional from the discursive aspects of written language it was possible to show that before mastering the alphabetic code children are aware of many linguistic features of written language (Pontecorvo & Zuchermaglio, 1989). At the same time, full developments of the various aspects of oral language, such as complex grammar, definitional vocabulary, and listening comprehension, that have been shown to have substantial predictive relations with later conventional literacy skills (Lonigan & Shanahan, 2008) are enhanced by children's experience with written language. In this sense, written language functions as a device for constituting knowledge (Galbraith, 2009), not just for translating knowledge already existent in the spoken modality.

Methodological Approach

Researchers have relied primarily on qualitative forms of research using observational data gathered in kindergarten or preschool classrooms and looking at the way children explore books, compose texts, and discuss the relationship between text and pictures (Tolchinsky, 2003). Because of their focus on the social and meaning-based aspects of literacy, researchers in this line of work are very much concerned with the ecological validity of the tasks used for gathering information about children's developing knowledge on written language. Even children who have not yet started formal instruction in literacy are asked to compose phone messages, food recipes, birthday cards, letters to the parents, and so on. The writing tasks should fulfill some function beyond teaching to write. The different categories and stages of early writing are obtained from observing how kindergartners and preschoolers plan, write, and read back different types of texts (Dyson, 1983; Strickland & Morrow, 2000; Sulzby, 1986).

More structured interviews have also been used (e.g., Ferreiro & Teberosky, 1979/1982; Ferreiro, 1986, 1994). Children from 3 to 6 years of age were asked to sort written materials, to match pictures to written labels, to create blanks in written sentences as well as to write words, sentences, and stories. Both the graphic characteristics of the written product and the verbal explanations given by children while writing and after having written down were observed. The purpose is to discover what children know about the writing system, as well as their knowledge of the function and social uses of writing and of the particular features of written discourse, rather than identifying the abilities that may predict their achievements.

Educational Implications

The guiding principle vis-à-vis teaching is to create a print-rich environment and purposeful occasions to make children actively participate in writing activities. At a very early age, children's knowledge about writing should be taken into account and built upon. Careful attention is paid to teachers' strategies to enhance motivation and interest for literacy-related activities and to enable children to explore different functions and uses of writing. For every stage, specific intervention strategies are suggested (Strickland & Morrow, 2000). The use of writing should form part of daily school activities, and multiple types of texts should be integrated into these activities, from writing their own name and the names of the rest of the children to writing prescriptions when playing at being doctors, letters, poetry, songs, or newspaper stories. Written representation should be included in any project or classroom activity without any limit concerning the letters or the text to be used. The criterion is the interest of the theme or project and

the need to write, not the particular difficulty of a sound combination.

Besides the referential communicative aspect, there is also the need (and the interest) to use and expand a child's concern for writing *as a domain of knowledge* (Tolchinsky, 2003). Dictation, comparison of words, sentences and texts, and rules of spelling are *as such* meaningful activities that help children to discover regularities and to look for an explanation for these regularities. Therefore, producing texts on their own way must be accompanied by reading activities and by the specific intervention of many aspects of the writing process. The principal source of knowledge for understanding writing is writing itself. It is by using writing that children will learn to master it.

DEVELOPMENTAL MILESTONES

Like any learning process, the development of written language goes through a number of phases from emergence to mastery (Berman, 2004). As we shall see next, the path toward skillful use of writing as a means of linguistic expression appears to support the mutually enhancing–interactive views in relation to the point of emergence and direction of written language development as well as views on the contribution of low-level abilities to proficient text production. In contrast to what additive–cumulative views suggest, written language learning does not emerge from children's work on letters and sounds. Rather, learning of the elements of a writing system is preceded by children's exploration of the superordinate graphic features of written texts and the linguistic activities they afford. With respect to the direction of written language development, we shall see that throughout development there is an interaction between children's learning the particularities of the writing system and written language as a discourse style. When children learn to write letters and some words, they adapt their use to different communicative purposes, establishing a qualitative gap between putting letters on paper and composing a text. Moreover, in contrast to additive–cumulative views, learning to spell words and to write sentences does not lead children to produce well-structured texts in a bottom-up direction. Mastering text construction requires the integration of bottom-up and top-down processes such as mental representations of text structure and genre specific constraints.

Discerning the Graphic Characteristics and Linguistic Affordances of Texts

The human child is driven to leave a trace. If in doubt, try to put a small child near some crayons and you will see that in a few minutes any smooth surface will be filled with their traces. Apart from developing a drive to leave traces and a precocious responsiveness to writing instruments, toddlers show an early awareness of the presence of written marks in the environment—on books, advertisements, cans, t-shirts and other surfaces. Unfortunately, no empirical study has looked at the concomitance of these processes, that is, on the extent to which realizing the properties of writing instruments, the permanence of the traces, and the presence of written marks occur simultaneously. But from further developments it is evident that both the created traces and the printed materials afford looking at and producing different kinds of linguistic behaviors—naming, asking questions, describing, and telling in a certain cadence. All these are linguistic behaviors that literate adults perform for printed messages.

Affordances of printed materials lead to differentiating writing from drawing and to an increasing awareness of the relationship between writing symbols and oral language (Gibson & Levin, 1975; Graham & Winetraub, 1996; Traweek & Berninger, 1997). Informal observations revealed that 2-year-olds produce different kinds of markings for the two requests to draw and to write (Sulzby, 1986). More structured observations led to a similar conclusion. When drawing, toddlers made continuous circular movements, whereas when writing, they followed a direction and lifted the pencil at regular intervals to create blank spaces (Karmiloff-Smith, 1992).

Moreover, children growing up in literate communities develop hypotheses about the nature, purpose, and function of written language in a predictable order (Ferreiro & Teberosky, 1979; Tolchinsky, 2003), with universal features of writing (such as linearity or discreteness of symbols) developmentally preceding and setting the bases for the learning of language-specific traits (directionality, letter forms, etc.). Puranik and Lonigan (2011) found support for such a developmental trend in a study with over 300 English-speaking children ages 3 to 5. All 3-year-olds in the sample had acquired most of the universal writing features, while specific-language features could only be found in the writing samples of 4- and 5-year-olds. Different writing tasks have been used to test the influence of task type in determining the conventionality of writing forms used by preschoolers. Results show that for writing letters or writing their own name, children use the more advanced writing forms (e.g., invented spelling instead of scribbling). Finally, although improvement over time was attested for all writing tasks, significant differences were only found for word and subword tasks (writing letters, child's name, and consonant–vowel–consonant words); performance on sentence- and, especially, text-level tasks did not improve with time (Puranik & Lonigan, 2011).

The study confirms the salience of the global visual pattern of writing, somehow extracted by the child from the environmental print rather than resulting from a direct instructional strategy. Adults teach letters and how to write proper names and real words, not scribbling in ways that look like writing but it is not. Two other findings of the study are particularly useful to shed light on early writing development: the special role played by own-name writing and by letter knowledge in early development and the qualitative gap that exists between writing letters and words, on the one hand, and producing texts, on the other.

Singling Out Meaningful Wholes: Own Name and Letters

After the pioneer study by Hildreth in the early 1930s (Hildreth, 1936), dozens of studies on early writing development in different languages have shown that own-name writing is always closer to correct spelling than children's writing of any other word, sentence, or text. In the different languages that were explored, whenever children are required to write their own name along with other words or sentences, the child's name always shows a higher level of development in any of the features being considered (Bloodgood, 1999; Ferreiro & Teberosky, 1979; Tolchinsky Landsmann & Levin, 1987).

On the one hand we see here a direct influence of instruction and social practices. In literate communities, both parents and teachers tend to teach children how to write their own name before any other word. On the other hand, the above might be related to the strong affective meaning attached to one's own name. Names constitute the first clearly meaningful text, resistant to being forgotten and stable in pronunciation. If a 3- or 4-year-old is told that a set of letters is his or her name, he or she will remember it when presented with the same set at a later date, whereas for any other word this is not usually the case (Tolchinsky, 1993).

Children may at times acquire the letters from other words they have learned, but most frequently the child's name is the source and point of identification for the letters. This behavior, which has been reported time and again in many different languages, may also indicate that children come to identify one or more written words as prototypical exemplars of written texts, that is, texts that are meaningful and well written. The letters included in these words acquire a special status. In the words of a Spanish child: "*sirven para escribir*"—literally, "[they] serve for [to] write." The child's underlying reasoning seems to be that they are part of meaningful texts that can be trusted to produce other texts.

The letters, their names and the sounds they stand for, are also meaningful pieces of knowledge children get from their environment. It is not surprising then that letter knowledge has been found to be a powerful preschool predictor of learning to spell across spelling and educational systems (Cardoso-Martins, 1995; De Jong & van der Leij, 1999;

Levin & Ehri, 2009; Lonigan, Burgess, & Anthony, 2000; Tolchinsky, Levin, Aram, & McBride-Chang, 2011). One of the properties of letter names, their iconicity, helps children to grasp the fact that letters stand for sounds. Iconicity refers to the property of letter names to contain the phoneme that the letter represents. For example, the English name of s, /ɛs/, contains /s/. All letter-name systems that we know of are iconic (Treiman & Kessler, 2003) and therefore are useful in helping children to learn letter-to-sound correspondences.

In sum, learning to write their own names and the names and sounds of letters constitutes a turning point in children's understanding of written language. Children's selective use of these elements indicates that they establish a relevant difference between writing letters and words, and creating texts.

Minding the Gap between Transcribing and Composing

A recurrent finding in studies on early writing development concerns the influence of the writing situation in determining the degree of conventionality of writing forms used by preschoolers (Sulzby, Barnhart, & Hieshima, 1989). Different studies have shown that children who used letters for writing their own name, or other words, and solved successfully letter–knowledge tasks did not use letters when asked to describe a picture (Puranik & Lonigan, 2011) or to write a story (Borzone de Manrique & Signorini, 1998). These findings are subject to several different interpretations. For example, they are taken to support the contention that development does not proceed in a stage-like manner, but rather children have at their disposal a repertoire of forms that differ across writing situations but are stable within a type of writing situation, for instance, for writing a story (Sulzby, 1986). Another interpretation—one that would be consistent with an additive–cumulative view—is that writing texts is more difficult than writing letters or words (Puranik & Lonigan, 2011). In the same line, a third interpretation posits that children are so occupied with spelling and handwriting that they cannot cope with the cognitive demands of text writing (McCutchen, 1996).

From the mutually enhancing–interactive stance, the findings reflect children's realization that there is a qualitative gap between writing words and producing a text. They know that, in order to produce a text, it is not enough to put letters on paper. Texts obey other constraints. Three observable behaviors support this interpretation. First, children produce more graphic output for writing texts than for writing words. Second, the graphic organization of the written marks changes, imitating the graphic layout of different text types. Third, children who are clearly aware of the difference between writing and drawing may draw a picture to complete the scribbling they have produced when asked to write a story. To accept the alternative claim—that it is because of the difficulties imposed by transcription that children cannot produce texts—it must be demonstrated that improvement and automatization of spelling and handwriting cause an improvement in text structure and in other linguistic features of text. As we shall see next, studies have shown that improving spelling and handwriting increases text productivity but rarely better text structuring.

Bridging the Gap between Transcribing and Composing

With age/schooling, preschoolers gain increasing command of spelling and handwriting. Nevertheless, gains in transcription are not met by gains in text composition. There seems to be a qualitative gap between writing letters and words and composing texts to fulfil different communicative purposes. To bridge the gap, the text macrostructural features must gain control over local decisions such as lexical choices, grammatical constructions, and even spelling.

Early Genre Distinctions

Preschoolers distinguish between the modes of discourse to be expected from different printed materials. If 4- to 5-year-olds hear a food recipe from a story book or a typical fairy tale from a newspaper, they react with surprise and deny that those texts are written there. They are also able to produce graphic distinctions when creating different types of texts. Sandbank (2001) found that children's written output when retelling *Hansel and Gretel* looked very different from their outputs describing the witch's house. The narratives were written in long lines of one graphic sign after another with hardly any internal spacing between them, except for the name of the protagonists, which sometimes appeared with blanks on both sides. The description, on the other hand, looked very similar to a list of isolated words. Indeed, when asked to read what they had written, they interpreted the long lines using full utterances, parts of the tale. When interpreting the description, however, they named the different elements in the house saying that there were "chocolate, candies and cookies." A similar graphic differentiation was found when comparing the graphic layout preschoolers produce for shopping lists with the ones produced for news, advertisements, and poetry (Pontecorvo & Zucchermaglio, 1989). Long before gaining a full command of the phonographic conventions of the written system, they produce a graphic layout of their text that imitates the formal features of different discourse genres. When looking at the graphic elements children use, it turned that, although some of them use their incipient knowledge of letters or word writing, many others resort to pseudoletters and other unconventional forms. For writing a story—that is, a piece of connected discourse—children often use lower-order systems such as scribbling or letter strings (Sulzby, 1989, p. 70). There is a hint, which requires more systematic research, that children try to get a long piece of writing similar to what they see adults writing. Actually, when children were asked to show "how grown-ups write," they scribbled (Sulzby, 1986, p. 70).

The findings suggest that children approach text writing by reproducing the graphic layout and by producing longer pieces of writing than when listing words. The question is whether just gaining a better command of word spelling will fill the qualitative gap between transcribing and composing. Two sorts of evidence may help to address this question: (1) the characteristics of the texts that children produce once they have attained a certain command of spelling and handwriting and (2) the changes brought to text writing after automatizing and improving spelling and handwriting are obtained in intervention studies.

Features of Early Text Writing and the Contributing Role of Spelling

Most descriptions of early text writing come from observational data in the context of preschool activities. Many preschool teachers dare to ask children to write a text earlier and more frequently than researchers in the additive–cumulative perspectives do. From these descriptions, it is possible to follow the changes in the graphic elements and graphic layout of the texts as well as in the linguistic activities that very young children perform before and after writing. There are vivid documentations of the transition from the unbroken, wavy scribble produced by 2-year-olds to the tracing of separate marks, to the incorporation of longer strings of identifiable letters, initially randomly ordered and later on showing letter-to-sound correspondences (Dyson, 1983; Schickedanz & Casbergue, 2004; Vukelich & Christie, 2009). At the same time, children start including punctuation marks, initially at the end of text and later on within the text (Ferreiro & Pontecorvo, 1999). Children also organize their texts imitating familiar forms of writing such as lists, letters, stories, and messages. Parallel to the graphic changes, young children seem to be increasingly aware of the representational meaning of writing (Sandbank, 2002). This is shown in their announcing of the message they want to write; in their reading back of their own writing, which usually expresses what they wanted to write more than what they actually wrote; and in their talks with others to plan and revise their

own writing.

To my knowledge, there are no studies that have approached this early period of text production systematically, attempting to tap the relationship between graphic and representational aspects in a precise way. One of the few studies that explored early text writing was carried out with somewhat older children, from 5 to 7 years of age (kindergarten, mid- and end-first grade, mid-second grade) both in English and Spanish (Salas, 2014) and focused on the microstructural level of analysis. All children were administered the same task: a 5-minute writing activity in which they had to tell recent personal events. This study showed that all the observed features improve with age/school level—conventional spelling and word segmentation, punctuation, use of connectives, syntactic complexity measured in terms of subordination and number of words per clause, and lexical diversity. Spelling was not found to have a direct impact on the text-level writing features (including syntactic complexity, vocabulary density, use of connectives, punctuation, etc.) in both English and Spanish first and second-grade text composition. Moreover, no differences in text-level writing features were detected in spite of the differences between the orthographic systems—Spanish is highly transparent, whereas English is much more opaque (Salas, 2014). Children learn to spell earlier and more easily in transparent than in opaque orthographies because in transparent orthographies there is a more regular correspondence between sounds and letters (Seymour, Aro, & Erskine, 2003). Research in transparent orthographies does not reveal, however, a direct impact of spelling on writing quality. Studies in Finnish (Mäki, Voeten, Vauras, & Poskiparta, 2001), Turkish (Babayiğit & Stainthorp, 2011) and German (Landerl & Wimmer, 2008) have shown a nonreliable relationship between word-level spelling and the quality of writing outcomes. Gains in transcription are not met by gains in higher-level text composition: Discourse genre is paramount.

Whenever macrostructural features were targeted, no crucial changes were detected with school level during the primary school years. Rather, the development of macrostructural features appears to be a protracted development highly dependent on the discourse genre. By midchildhood, around 9 years of age, children are capable of composing canonical narratives, including all the functional components of a narrative: a setting, the initiating episode, the conflict, and the resolution completed with evaluative elements that express the motives and mental states of the characters. For nonnarrative texts, however, it takes until adolescence to integrate the appropriate functional components within a unified piece of discourse (Berman & Nir-Sagiv, 2007).

A study on the production of expository texts in primary school (Fuller, 1995) looked at the larger configuration and organization of the text from first grade to ninth grade. This study identified three variants of overall text organization. However, the three variants represented different ways for juxtaposing clauses about a topic more than a cohesive composition about a topic. For the first variant, characterized as a structure *in chain*, the child produced a first statement in response to the writing prompt that provided the topic of the next sentence, which in turn provided the theme for the next one. For the second variant, characterized as a structure *in wheel*, the child produced a series of sentences all on the same subject, but without any concern for connecting between sentences. Children who used the third strategy, called *topic development*, produced a number of sentences referring to the same topic but, again, with no interclausal cohesion and without structuring the text into components fulfilling different purposes. The three strategies were responsible for at least 90% of the written texts of first to ninth grade (Hayes, 2011, 2012). The overall organization of texts did not improve fundamentally throughout primary school and beyond. Children's level of spelling was not measured in Fuller's study (Hayes, 2011, 2012). It is reasonable to assume, however, that children's command of spelling improved throughout primary school. However, the supposed improvement in spelling does not seem to have affected children's command of expository text structure.

Additional evidence for the protractedness of the process of macrostructural organization stems from a comprehensive study on the development of text construction abilities (Berman & Nir-Sagiv, 2007). In this study,

participants from fourth grade of primary school (9-year-olds) up to adolescence and adults were asked to produce personal narratives and expository texts about the topic of conflicts at school. Both local linguistic expression—lexical complexity and level of abstractness, syntactic complexity—and overall text organization were explored. The study showed that, across the board, participants used longer, less frequent, and more abstract words, more subordination, passive voice, and heavier noun phrases in expository texts than in narrative texts. Nevertheless, expository texts were much harder to construct at the global level of overall discourse organization than narratives.

The kind of overall organization and integration of information required for constructing an expository text was not attained until adolescence. With age and schooling, there was an increase in lexical and grammatical knowledge; however, the linguistic achievements were not enough to construct a well-formed text. It seems that neither increase in command of spelling nor the increment in lexical complexity or grammatical complexity that develops with school level accounts for a qualitative change in the global organization of the text. To produce well-formed texts, children need to acquire the appropriate mental representation of a particular mode of discourse (Berman & Nir-Sagiv, 2007). That is why, with a similar command of lexical and grammatical knowledge (and probably of spelling), well-formedness is attained earlier in some genres than in others. The construction of texts requires integration of structural components such as *events* in narrative, *claims* in argumentative texts, or topic categories in expository texts within a unified piece of discourse. Children learn to integrate events within a narrative plot earlier than to integrate different kinds of claims in an argumentative text or subtopics into generalization about a topic in expository texts. Moreover, narratives are supported by a familiar schema, whereas for expository and argumentative texts writers need to organize content as they generate their arguments (Andriessen & Coirier, 1999). The gap between transcription and composing is bridged when overall text organization guides lexical choices and grammatical constructions, when language usage is guided by text construction.

From Text to Language and Back

Three conclusions can be drawn from the developmental picture just outlined in relation to the main distinguishing features between additive–cumulative and mutually enhancing–interactive views. Regarding the emergence of written language, it is possible to conclude that word spelling—that is, children's work on phonographic correspondences—is far from being the emergent point of written language. Rather, children's work on the elements of writing has been preceded by a long exploration of the superordinate features of writing, and the graphic and linguistic features of texts. Whenever kindergartners and preschoolers are given the opportunity—at home or at school—they are prone to explore mark-making (Dyson, 1983; Strickland & Morrow, 2000) and different ways of text production. Very early children who grow in a literate environment show that they understand that writing carries meaning and affords linguistic activities such as naming, describing, and telling stories. The information they get from the environment—own-name writing, letters, environmental print—is used in their own productions and adapted to different communicative situations. However, most of what we know about early text writing comes from rich but unsystematic studies. The link between early writing knowledge and later writing performance is still an open question. Although there is some evidence that what kindergartners know about writing predicts their success in spelling in first grade (Levin et al., 2001; Tolchinsky, Liberman, & Alonso Cortes, 2015), none of these studies has focused on text writing.

In relation to the direction of written language development, a second conclusion to be drawn from the developmental picture is that a qualitative gap exists between learning to put words and sentences on paper and producing cohesive and coherent texts. After learning to spell words and to write sentences, children do not move smoothly to producing well-structured texts that serve different purposes. Neither gains in spelling nor sophisticated

uses of vocabulary and grammar seem to account for the ability to produce good texts. On the contrary, the process of text construction is an intricate process requiring the integration of bottom-up and top-down processes (Berman & Nir-Sagiv, 2007; Karmiloff-Smith, 1992), with spelling, lexical, and grammatical knowledge as well as elements of content (events, claims, facts) at the lower levels, and mental representations of text structure and genre specific constraints (task-schemata) at the higher levels of text composing.

FUTURE RESEARCH

Research on the emergence of written language development faces two challenges related to the points of disagreements in the two perspectives we have discussed. Future research should approach the study of preconventional writing in a more systematic fashion, so as to gain a deeper understanding of the development of transcriptional and discourse features and, more importantly, of the relationship between these two aspects of written language prior to formal instruction on reading and spelling. Once this condition has been met, we will be able to assess in a more reliable way the impact of the incipient knowledge of writing on the successful learning of spelling and text construction.

The second challenge consists in taking seriously the discursive nature of text production. There is strong evidence that transcriptional factors are related to the amount of writing (Abbott et al., 2010; Berninger et al., 1992; Graham et al., 1997). But whenever microstructural and macrostructural features of discourse are evaluated, the contribution of transcriptional factors is far from established. Text quality usually shows high correlation with text length but not necessarily with text well-formedness (Berman & Nir-Sagiv, 2007). Moreover, and more importantly, there is no systematic evidence about the role of ideational and discursive factors in the development of text construction beyond the transcriptional aspects. Research that has focused on the development of text construction has not taken into account either spelling or handwriting. Conversely, research that has focused on transcriptional components has not accounted for the development of overall text organization/macrostructural features. Thus, future research should be targeted to determine the relative weight of the different components—transcriptional, ideational, and discursive—on text construction throughout development.

There are critical educational implications to sorting out the importance of early writing and the extent to which the ability to compose good texts results from the ability to spell words, then to write sentences, in a cumulative fashion or from activating simultaneously higher-level abilities. Solving the two issues—the importance of early writing and the role of written discourse in learning to write—will provide research-based evidence for teachers to decide whether they should invest in writing activities from very early on because these activities are not only enjoyable and valuable in and of themselves, but they also enhance further learning. Moreover, it should be helpful for teachers to decide whether to devote time and energy to practicing word spelling and handwriting or to mobilize the high-level cognitive processes involved in building a written text.

ACKNOWLEDGMENTS

This chapter was written while I enjoyed an I + D grant (EDU2012-36577) from the Spanish Ministry of Economy and Competition. Special thanks to Nayme Salas for her help in preparation of this chapter.

REFERENCES

Abbott, R. D., Berninger, V. W., & Fayol, M. (2010). Longitudinal relationships of levels of language in writing and between writing and reading in grades 1 to 7. *Journal of Educational Psychology, 102*(2), 281–298.

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print.* Cambridge, MA: MIT Press.

Alamargot, D., & Chanquoy, L. (2001). *Through the models of writing: With commentaries by Ronald T. Kellogg & John R. Hayes* (Vol. 9). Dordrecht, The Netherlands: Kluwer.

Andriessen, J., & Coirier, P. (Eds.). (1999). *Foundations of argumentative text processing*. Amsterdam: Amsterdam University Press.

Babayiğit, S., & Stainthorp, R. (2011). Modeling the relationships between cognitive–linguistic skills and literacy skills: New insights from a transparent orthography. *Journal of Educational Psychology, 103*(1), 169–189.

Berman, R. A. (2004). Between emergence and mastery: The long developmental route of language acquisition. In R. A. Berman (Ed.), *Language development across childhood and adolescence* (pp. 9–34). Amsterdam: John Benjamins.

Berman, R. A., & Nir-Sagiv, B. (2007). Comparing narrative and expository text construction across adolescence: A developmental paradox. *Discourse Processes, 43*(2), 79–120.

Berninger, V., Whitaker, D., Feng, Y., Swanson, H. L., & Abbott, R. (1996). Assessment of planning, translating, and revising in junior high writers. *Journal of School Psychology, 34*, 23–52.

Berninger, V., & Winn, W. (2006). Implications of advancements in brain research and technology for writing development, writing instruction, and educational evolution. In C. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 96–114). New York: Guilford Press.

Berninger, V., Yates, C., Cartwright, A., Rutberg, J., Remy, E., & Abbott, R. (1992). Lower-level developmental skills in beginning writing. *Reading and Writing: An Interdisciplinary Journal, 4*(3), 257–280.

Berninger, V. W., & Swanson, H. L. (1994). Modifying Hayes and Flower's model of skilled writing to explain beginning and developing writing. *Advances in Cognition and Educational Practice, 2*, 57–81.

Berninger, V. W., Vaughan, K., Abbott, R. D., Begay, K., Coleman, K. B., Curtin, G., et al. (2002). Teaching spelling and composition alone and together: Implications for the simple view of writing. *Journal of Educational Psychology, 94*(2), 291–304.

Blanche-Benveniste, C. (1982). La escritura del lenguaje dominguero. In E. Ferreiro (Ed.), *Nuevas perspectivas sobre los procesos de lectura y escritura* (pp. 195–212). Buenos Aires: Siglo XXI.

Bloodgood, J. (1999). What's in a name? Children's name writing and literacy acquisition. *Reading Research Quarterly, 34*, 342–367.

Borzone de Manrique, A. M., & Signorini, A. (1998). Emergent writing forms in Spanish. *Reading and Writing: An Interdisciplinary Journal, 10*(6), 499–517.

Bradley, L., & Bryant, P. E. (1985). *Rhyme and reason in reading and spelling*. Ann Arbor: University of Michigan Press.

Byrne, B., & Fielding-Barnsley, R. (1989). Phonemic awareness and letter knowledge in the child's acquisitions of the alphabetic principle. *Journal of Educational Psychology, 80*(1), 313–321.

Byrne, B., & Fielding-Barnsley, R. (1990). Acquiring the alphabetic principle: A case for teaching recognition of phoneme identity. *Journal of Educational Psychology, 82*, 805–812.

Cardoso-Martins, C. (1995). Sensitivity to rhymes, syllables, and phonemes in literacy acquisition in Portuguese. *Reading Research Quarterly, 30*, 808–828.

Cataldo, S., & Ellis, N. (1988). Interactions in the development of spelling, reading and phonological skills. *Journal of Research in Reading, 11*(2), 86–109.

Chan, L., & Louie, L. (1992). Developmental trend of Chinese preschool children in drawing and writing. *Journal of*

Research in Childhood Education, 6, 93–99.

Chanquoy, L., & Alamargot, D. (2002). Mémoire de travail et rédaction de textes: Evolution des modèles et bilan des premiers travaux. *L'Année psychologique, 102*(2), 363–398.

Clay, M. (2001). *Change over time in children's literacy development*. Portsmouth, NH: Heinemann.

De Jong, P. F., & van der Leij, A. (1999). Specific contributions of phonological abilities to early reading acquisition: Results from a Dutch latent variable longitudinal study. *Journal of Educational Psychology, 91*, 450–476.

Dyson, A. H. (1983). The role of oral language in early writing processes. *Research in the Teaching of English, 17*, 1–30

Dyson, A. H. (1987). Individual differences in beginning composing: An orchestral vision of learning to compose. *Written Communication, 4*(4), 411–442.

Ferreiro, E. (1986). The interplay between information and assimilation in beginning literacy. In W. Teale & E. Sulzby (Eds.), *Emergent literacy* (pp. 15–49). Norwood, NJ: Ablex.

Ferreiro, E. (1987) Os processos construtivos de apropriaçao da escrita. In E. Ferreiro & M. Gómez Palacio (Eds.), *Os processos de leitura e escrita. Novas perspectivas*. Porto Alegre, Brazil: Artmed.

Ferreiro, E. (1988) L'ecriture avant la lettre. In H. Sinclair (Ed.), *La production de notations chez le jeune enfant* (pp. 7–70). Paris: Presses Universitaires de France.

Ferreiro, E. (1994). Literacy development: Construction and reconstruction. In D. Tirosh (Ed.), *Implicit and explicit knowledge: An educational approach* (pp. 169–180). Norwood, NJ: Ablex.

Ferreiro, E. (2002) Escritura y oralidad: unidades, niveles de análisis y conciencia metalingüística. In E. Ferreiro (Ed.), *Relaciones de (in)dependencia entre oralidad y escritura* (pp. 151–171). Barcelona: Gedisa.

Ferreiro, E., & Pontecorvo, C. (1999). Managing the written text: the beginning of punctuation in children's writing. *Learning and Instruction, 9*, 543–564.

Ferreiro, E., & Teberosky, A. (1979) *Los sistemas de escritura en el desarrollo del niño*. Siglo XXI. Translated *Literacy before schooling* (1982). Portsmouth, NH: Heinemann.

Foulin, J. N. (2005). Why is letter-name knowledge such a good predictor of learning to read? *Reading and Writing: An Interdisciplinary Journal, 18*(2), 129–155.

Fuller, D. F. (1995). *Development of topic-comment algorithms and test structures in written compositions of students in grades one through nine*. Unpublished doctoral dissertation. Seattle: University of Washington.

Galbraith, D. (2009). Writing about what we know: Generating ideas in writing. In R. Beard, D. Myhill, M. Nystrand, & J. Riley (Eds.), *The SAGE handbook of writing development* (pp. 48–65). London: SAGE Publications.

Gibson, E., & Levin, H. (1975). *The psychology of reading.* Cambridge. MA: MIT Press.

Gough, P. B., & Tunmer, W. E. (1986). Decoding, reading and reading disability. *Remedial and Special Education, 7*, 6–10.

Graham, S., Berninger, V. W., Abbott, R. D., Abbott, S. P., & Whitaker, D. (1997). Role of mechanics in composing of elementary school students: A new methodological approach. *Journal of Educational Psychology, 89*(1), 170–182.

Graham, S., & Weintraub, N. (1996). A review of handwriting research: Progress and prospects from 1980 to 1994. *Educational Psychology Review, 8*(1), 7–87.

Gillon, G. (2004). *Phonological awareness. From research to practice*. New York: Guilford Press.

Hayes, J. R. (2011). Kinds of knowledge-telling: Modeling early writing development. *Journal of Writing Research, 3*(2), 73–92.

Hayes, J. R. (2012). Modeling and remodeling writing. *Written Communication, 29*(3), 369–388.

Hayes, J. R., & Berninger, V. W. (2010). Relationships between idea generation and transcription: How act of writing shapes what children write. In C. Brazerman, R. Krut, K. Lunsford, S. McLeod, S. Null, P. Rogers, et al. (Eds.), *Traditions of writing research* (pp. 166–180). New York: Routledge

Hayes, J. R., & Flower, L. S. (1980). Identifying the organization of writing processes. In L. W. Gregg & E. R. Steinberg (Eds.), *Cognitive Processes in Writing* (pp. 3–29). Hillsdale, NJ: Erlbaum.

Hildreth, G. (1936). Developmental sequences in name writing. *Child Development, 7*(4), 291–303.

Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children from first through fourth grades. *Journal of educational Psychology, 80*(4), 437–447.

Juel, C., Griffith, P. L., & Gough, P. B. (1986). Acquisition of literacy: A longitudinal study of children in first and second grade. *Journal of EducationalPsychology, 78*(4), 243–255.

Karmiloff-Smith, A. (1992). *Beyond modularity: A developmental perspective on cognitive science*. Cambridge, MA: MIT Press/Bradford.

Levin, I. (2007). The role of Hebrew letter names in early literacy: The case of multi-phonemic acrophonic names. *Journal of Experimental Child Psychology, 98*, 193–216.

Levin, I., & Ehri, L. C. (2009). Young children's ability to read and spell their own and classmates' names: The role of letter knowledge. *Scientific Studies of Reading, 13*, 1–25.

Levin, I., Ravid, D., & Rapaport, S. (2001). Morphology and spelling among Hebrew-speaking children: From kindergarten to first grade. *Journal of Child Language, 28*, 741–772.

Landerl, K., & Wimmer, H. (2008). Development of word reading fluency and spelling in a consistent orthography: An 8-year follow-up. *Journal of Educational Psychology, 100*(1), 150–161.

Lonigan, C. J., Burgess, S. R., & Anthony, J. L. (2000). Development of early literacy and early reading skills in preschool children: Evidence from a latent-variable longitudinal study. *Developmental Psychology, 36*, 596–613.

Lonigan, C. J., & Shanahan, T. (2008). *Developing early literacy: Report of the National Early Literacy Panel*. Washington, DC: National Institute for Literacy.

Mäki, H. S., Voeten, M. J., Vauras, M. M., & Poskiparta, E. H. (2001). Predicting writing skill development with word recognition and preschool readiness skills. *Reading and Writing: An Interdisciplinary Journal, 14*(7–8), 643–672.

Malvern, D., Richards, B. J., Chipere, N., & Duran, P. (2004). *Lexical diversity and language development*. New York: Palgrave Macmillan.

McCutchen, D. (1996). A capacity theory of writing: Working memory in composition. *Educational Psychology Review, 8*(3), 299–325.

Molfese, V., Beswick, J., Jacobi-Vessels, J., Armstrong, N., Culver, B., White, J., et al. (2011). Evidence of alphabetic knowledge in writing: Connections to letter and word identification skills in preschool and kindergarten. *Reading and Writing: An Interdisciplinary Journal, 24*, 133–150.

Morais, J., Cary, L., Alegria, J., & Bertelson, P. (1979). Does awareness of speech as a sequence of pones arise spontaneously? *Cognition, 7*, 323–331.

Neuman, S. B., Copple, C., & Bredekamp, S. (1998). *Learning to read and write. Developmentally appropriate practices for young children*. International Reading Association and National Association for the Education of Young Children. Washington, DC: NAEYC.

Nunes, T., Bryant, P., & Olson, J. M. (2003). Learning morphological and phonological spelling rules: an intervention study. *Reading and Writing: An interdisciplinary Journal, 63*, 141–170.

Olive, T., Alves, R. A., & Castro, S. L. (2009). Cognitive processes in writing during pause and execution periods.

European Journal of Cognitive Psychology, 21(5), 758–785.

Pontecorvo, C., & Zucchermaglio, C. (1988). Modes of differentiation in children's writing construction. *European Journal of Psychology of Education, 3*(4), 371–384.

Pontecorvo, C., & Zucchermaglio, C. (1989), From oral to written language: Preschool children dictating stories. *Journal of Literacy Research, 21*, 109–126.

Puranik, C. S., & Al Otaiba, S. (2012). Examining the contribution of handwriting and spelling to written expression in kindergarten children. *Reading and Writing: An Interdisciplinary Journal, 25*(7), 1523–1546.

Puranik, C. S., Lombardino, L. J., & Altmann, L. J. (2008). Assessing the microstructure of written language using a retelling paradigm. *American Journal of Speech–Language Pathology, 17*(2), 107–120.

Puranik, C. S., & Lonigan, C. S. (2011). From scribbles to scrabble: preschool children's developing knowledge of written language. *Reading and Writing: An Interdisciplinary Journal, 24*, 567–589.

Ravid, D., & Tolchinsky, L. (2002) Developing linguistic literacy: A comprehensive model. *Journal of Child Language, 29*(2), 417–447.

Salas, N. (2014) *Early development of text writing in two contrasting orthographies: English and Spanish*. Unpublished. Unpublished Doctoral Dissertation, Bangor University.

Salas, N., & Tolchinsky, L. (submitted). *Hunting for the links between word level writing skills and text level quality*. Unpublished manuscript.

Sandbank, A. (2001). On the interplay of genre and writing conventions in early text writing. In L. Tolchinsky (Ed.), *Developmental aspects in learning to write* (pp. 55–76). Dodrecht, The Netherlands: Kluwer.

Schickedanz, J., & Casbergue, R. (2004) *Writing in preschool: Learning to orchestrate meaning and marks*. Newark, DE: International Reading Association.

Seymour, P. H., Aro, M., & Erskine, J. M. (2003). Foundation literacy acquisition in European orthographies. *British Journal of Psychology, 94*(2), 143–174.

Share, D. L. (1995). Phonological recoding and self-teaching: Sine qua non of reading acquisition. *Cognition, 55*, 151–218.

Snow, C. E., Burns, M. S., & Griffin, P. (Eds.). (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy Press.

Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21*(4), 360–406.

Strickland, D., & Morrow, L. (2000). *Beginning reading and writing*. Newark, DE: International Reading Association and New York: Teachers College Press, Columbia University.

Sulzby, E. (1985). Kindergartners as writers and readers. In M. Farr (Ed.), *Advances in writing research: Vol. 1: Children's early writing development* (pp. 127–199). Norwood, NJ: Ablex.

Sulzby, E. (1986). Writing and reading: Signs of oral and written language organization in the young child. In W. H. Teale & E. Sulzby (Eds.), *Emergent literacy: Writing and reading* (pp. 50–89). Norwood, NJ: Ablex.

Sulzby, E. (1989). Assessment of writing and of children's language while writing. In L. Morrow & J. Smith (Eds.), *The role of assessment and measurement in early literacy instruction* (pp. 83–109). Englewood Cliffs, NJ: Prentice-Hall.

Sulzby, E., Barnhart, J., & Hieshima, J. (1989). Forms of writing and rereading from writing: A preliminary report. In J. Mason (Ed.), *Reading and writing connections* (pp. 31–63). Needham Heights, MA: Allyn & Bacon.

Tolchinsky, L. (2003). *The cradle of culture and what children know about writing and numbers before being taught*. Mahwah, NJ: Erlbaum.

Tolchinsky, L., Levin, I., Aram, D., & McBride-Chang, C. (2011). Building literacy in alphabetic, abjad and

morphosyllabic systems. *Reading and Writing: An Interdisciplinary Journal, 25*, 1573–1598.
Tolchinsky, L., Liberman, G., & Alonso Cortes, M. D. (2015). Explaining first graders achievements in spelling and word separation in shallow orthographies. *Journal of Writing Research, 6*(3), 279–316.
Tolchinsky Landsmann, L., & Levin, I. (1987). Writing in four- to six-year-olds: representation of semantic and phonetic similarities and differences. *Journal of Child Language, 14*, 127–144.
Traweek, D., & Berninger, V. (1997). Comparison of beginning literacy programs: Alternative paths to the same learning outcome. *Learning Disability Quarterly, 20*, 160–168.
Treiman, R., & Kessler, B. (2003). The role of letter names in the acquisition of literacy. In R. V. Kail (Ed.), *Advances in child development and behavior* (Vol. 31, pp. 105–135). San Diego, CA: Academic Press.
Vernon, S. A., & Ferreiro, E. (1999). Writing development: A neglected variable in the consideration of phonological awareness. *Harvard Educational Review, 69*, 395–415.
Vukelich, C., & Christie, J. F. (2009). *Building a foundation for preschool literacy: Effective instruction for children's reading and writing development*. Newark, DE: International Reading Association.
Wagner, R. K., Puranik, C. S., Foorman, B., Foster, E., Wilson, L. G., Tschinkel, E., et al. (2011). Modeling the development of written language. *Reading and Writing: An Interdisciplinary Journal, 24*(2), 203–220.

CHAPTER 11

Self-Efficacy Beliefs and Motivation in Writing Development

Roger H. Bruning and Douglas F. Kauffman

Few factors have been shown to be more consistently tied to human performance than *self-efficacy*, the confidence individuals have for performing successfully in a given domain (Bandura, 1977, 1997). Unlike more general traits and qualities (e.g., temperament, self-concept), efficacy judgments vary "across realms of activity, under different levels of task demands within a given activity domain, and under different situation circumstances" (Bandura, 1997, p. 42). What this means is that self-efficacy judgments not only may differ widely from one activity to another for a given individual (e.g., students' confidence for writing an argument against using standardized test scores to evaluate teachers vs. writing about their own test-taking experiences), but even for the same activity performed in one context versus another (e.g., reading their composition to younger students instead of classmates). As Bandura (1997) has pointed out, successful performance reflects not only skill levels, but also the confidence individuals have for performing in specific domains and contexts. In school settings, for instance, students' self-efficacy judgments will affect both whether they attempt specific tasks and their continuing engagement when they encounter difficulties.

The present chapter is about self-efficacy for writing, a topic that has attracted considerable interest for more than three decades. During this period, writing researchers also have built an extensive research base about the nature of the writing process (e.g., Flower & Hayes, 1981; Hayes, 1996, 2006), writing development (e.g., Bereiter & Scardamalia, 1987; Kellogg, 2008; McCutchen, 2011), motivation to write (e.g., Hidi & Boscolo, 2006; Lipstein & Renninger, 2007a, 2007b; Troia, Shankland, & Wolbers, 2012) and how to provide effective writing instruction (e.g., Graham, McKeown, Kiuhara, & Harris, 2012; Graham & Perin, 2007; Harris, Graham, & Mason, 2006;

Nolan, 2007). Today, however, a growing need for students to write well adds greater urgency to research on methods for developing writing self-efficacy.

In the sections that follow, we first describe sources of self-efficacy, as proposed initially by Bandura, and following the lead of Pajares, Johnson, and Usher (2007), relate these sources specifically to writing. We then examine research on self-efficacy and writing, research that has shown writing self-efficacy's relationships not only to such variables as interest and gender, but to writing-related instructional conditions. We contend, however, that knowledge about writing self-efficacy must be extended further. For example, there is need for finer-grained analyses of how contextual factors and the linguistic, cognitive, and metacognitive challenges writers encounter affect writing self-efficacy (e.g., see Bruning, Dempsey, Kauffman, McKim, & Zumbrunn, 2013; Usher & Pajares, 2008). And although we understand that writers' domain knowledge and interests influence writing quality (e.g., Benton, Corkill, Sharp, Downey, & Khramtsova, 1995; Hidi, Ainley, Berndorff, & Del Favero, 2007; Lipstein & Renninger, 2007a, 2007b), we know much less about how they affect writing self-efficacy.

We argue in this chapter that developing writing self-efficacy should be advanced as an explicit goal for writing instruction. Many writers young and old struggle with writing, and we recognize that their challenges are at least as much related to affective and confidence matters as to cognitive and linguistic factors. Thus, building self-efficacy for any of writing's forms and contexts (e.g., writing to express feelings, record observations, explain, persuade, or complete an assignment) likely will have a positive impact on writing development. And since the general conditions for building self-efficacy have been clearly articulated (e.g., Bandura, 1997; Pajares et al., 2007) teachers can confidently seek improvements in writing self-efficacy as a writing instruction goal. As outlined early on by Bandura (1977) and elaborated in his later publications (e.g., Bandura, 1997), these conditions include mastery and vicarious experiences, social persuasion, and identification of physiological and emotional states.

SOURCES OF SELF-EFFICACY

The most potent source of self-efficacy in any domain, Bandura (1997) has argued, is *mastery experience*, successful performance in the domain. In Bandura's view, the primary reason for the consistently strong relationship between mastery and self-efficacy is the quality of information individuals receive by performing successfully. That is, of all the potential sources of information about our capabilities, actual performance typically is the most trustworthy. In a study of elementary, middle, and high school students, for instance, Pajares et al. (2007) found that compared to other potential sources of writing self-efficacy—vicarious experiences, social persuasion, and identifying physiological and emotional states—mastery experiences with writing accounted for the largest variance in students' writing self-efficacy and competence, leading them to conclude that writing successfully is the most basic route to developing writing self-efficacy.

A second well-studied source of self-efficacy is *vicarious experience*—observing others' performances and assessing one's capabilities in relationship to what is observed. Though perhaps less consistent than mastery in affecting self-efficacy judgments (see Bandura, 1997), vicarious experiences nonetheless exert a potent influence on behavioral and self-efficacy development. Skilled models can supply knowledge about what is required for successful performance and how to perform domain-related skills, as well as information about a setting's relevant dimensions and strategies for overcoming difficulties.

Many factors affect the potency of vicarious experience (see Bandura, 1997), including the expertise of individuals performing target behaviors and the degree to which observers identify with them. Models judged to be similar to oneself in a domain (e.g., classmates, teammates), for instance, typically impact observers more than those

with whom they identify with less. Also, models demonstrating ability to cope—that is, showing how they overcome difficulties by persistence or efficacious thinking—are more effective than those exhibiting only mastery of target behaviors (Zimmerman & Kitsantas, 1999, 2002).

Teacher modeling is an explicit feature of the most highly developed and systematically evaluated instructional approach for developing writing skills and self-regulation strategies—self-regulated strategy development (SRSD; Graham, 2006; Graham et al., 2012; Harris, Graham, MacArthur, Reid, & Mason, 2011). Specific examples of modeling in SRSD range from teachers posing story ideas to demonstrating how to plan, revise, and overcome setbacks. Of course, teachers using any form of writing instruction can model activities ranging from goal setting to evaluating the likely success of differing rhetorical strategies.

Social persuasion—the third major source of self-efficacy—refers to others expressing beliefs that an individual can perform successfully. These expressions can include suggestions, encouragement, and interpretations of performance. Social persuasion, though highly important to any attempt to build self-efficacy, is perhaps best viewed as "a useful adjunct to more powerful efficacy-promoting influences" (Bandura, 1997, p. 104). Several factors can strengthen social persuasion's effects on self-efficacy, however. For instance, feedback on current performance is more effective than focusing on distant goals. Social persuasion also involves more than just "pep talks" (Bandura, 1997, p. 106). Long-term communication patterns in which teachers and others repeatedly show their beliefs in learners' personal agency are much better. Teachers also can encourage student writing development through written comments, of course, especially by making specific suggestions for writing improvement and explaining their reactions (Beach & Friedrich, 2006).

A fourth self-efficacy source is identifying and labeling *physiological and emotional states* tied to activities in a domain. For instance, it is common for students to feel anxious as they begin a challenging writing task. The problem is that such feelings can easily be taken as a sign of likely poor performance or failure. These feelings can then easily feed forward, causing more stress and lowering self-efficacy. The need to manage anxiety reactions like these has led to a long history of clinical use of such techniques as progressive relaxation and guided imagery to treat issues ranging from test anxiety to personality disorders (e.g., see Hayes-Skelton, Roemer, Orsillo, & Borkovec, 2013).

Although writing anxiety seldom reaches the level of a psychological disorder, there is little doubt that its complex challenges can lead to negative physiological or emotional reactions with significant consequences for writing development and self-efficacy (see Bruning & Horn, 2000). Attention to writing anxiety emerged early on in research showing the relationships between writing apprehension and weaker writing skills (e.g., Daly & Miller, 1975; Daly, 1978), as well as its effects on academic decisions, such as students with greater writing apprehension tending to select majors perceived to require less writing (Daly & Shamo, 1978).

WRITING SELF-EFFICACY RESEARCH

We now turn to a closer examination of research on writing self-efficacy. Our goal here is to complement previous reviews of writing self-efficacy research (e.g., Klassen, 2002; Pajares & Valiante, 2006) by highlighting work illustrating two general research approaches. We identify key issues explored in selected studies, methods used to study writing self-efficacy, and important findings. We focus first on correlational research exploring relationships of writing self-efficacy to a variety of variables and then on studies in which the effects of instructional conditions on writing self-efficacy have been investigated experimentally.

Correlational Studies of Writing Self-Efficacy

Two studies reported by McCarthy, Meier, and Rinderer (1985) often are cited as the first or among the first to empirically test Bandura's theory of self-efficacy in relation to writing performance. McCarthy and colleagues focused on the judgments of first-year college students of whether they could demonstrate the specific skills required in a writing course in which they were enrolled (e.g., Can you write an essay without run-on sentences?). These judgments then were compared to actual student performance in writing course-related essays. In both studies, students with higher writing self-efficacy generally wrote more highly-rated essays.

Building on McCarthy et al.'s work, Shell and his colleagues (Shell, Murphy, & Bruning, 1989; Shell, Colvin, & Bruning, 1995) examined two dimensions of writing self-efficacy—self-efficacy for writing *tasks* and writing *skills*. Their writing task measure focused on student judgments about their likely success in selected writing activities (e.g., writing a letter or essay). The second measure, targeted at skills (e.g., writing a sentence with proper punctuation and grammar), was more closely aligned with McCarthy and colleagues' original work. In their first study, Shell and colleagues (1989) found that college students' writing skills self-efficacy predicted writing performance (an essay about a successful teacher's qualities), while writing task self-efficacy did not. Shell and colleagues (1995) next conducted a cross-sectional developmental study of fourth, seventh, and tenth graders in which students also wrote short essays and completed task and skills self-efficacy scales. Writing skills self-efficacy again predicted writing performance, but did not change across grade levels. Writing task self-efficacy did increase, however, implying that age-related efficacy changes may relate more to the range of writing tasks students believe they can successfully perform than to changes in basic writing skills.

At about this same time, Zimmerman and Bandura (1994) published a highly influential study of self-efficacy for self-regulation of writing. Their basic question was whether college students' self-efficacy for *regulating* writing's activities would predict writing attainment beyond what could be predicted from students' verbal ability. Participants were college students in composition classes at a highly selective university. Each student completed a writing self-efficacy measure at the beginning of the term that broadly sampled multiple dimensions of writing self-regulation, ranging from perceived ability to get writing activities underway to ability to correct grammatical errors in what they wrote. Students also rated how certain they were that they could achieve given grades in their writing course and indicated goals for course grades and likely satisfaction levels for specific grades they might receive.

Zimmerman and Bandura's findings, analyzed in a causal modeling framework, showed that students' self-efficacy for regulating writing activities influenced both the standards students set and their academic self-efficacy. These in turn affected the grades sought and actual grades received. Interestingly, the effects of students' perceived ability to manage the writing process considerably outpaced those for verbal aptitude (SAT scores), highlighting how important self-efficacy for managing the writing process is to success in college-level writing.

Beginning in the 1990s and continuing to Pajares's untimely death in 2009, research on writing self-efficacy by Pajares and his colleagues (e.g., Pajares, 2007; Pajares, Britner, & Valiante, 2000; Pajares & Johnson, 1994, 1996; Pajares, Miller, & Johnson, 1999; Pajares & Valiante, 1997, 1999, 2001, 2006) led the way in illuminating multiple factors related to writing self-efficacy. For instance, an early study by Pajares and Johnson (1994) highlighted the need to closely match writing self-efficacy and writing performance and to consider such variables as writing apprehension in writing self-efficacy research.

Subsequent studies by Pajares and associates extended knowledge about writing self-efficacy in several areas, including how best to measure it. Pajares, Hartley, and Valiante (2001), for instance, examined the response format of writing self-efficacy assessments in a study of middle school students, comparing the 0–100 rating format recommended by Bandura (1997, 2006) to a Likert-type format with fewer rating choices. Results showed that,

although both scales were reliable and produced the two-factor structure of basic and advanced composition skills found in earlier research, scores on the 0–100 scale correlated more highly with writing grades and teacher ratings of student writing ability. These findings thus provided empirical support for Bandura's advocacy for the 0–100 scale, as well as showing that middle school students can make valid writing self-efficacy judgments on such a scale.

Pajares and colleagues' work also significantly advanced understanding of relationships between gender and writing self-efficacy. In an early study, for instance, Pajares and Johnson (1996) had ninth-grade students write a 30-minute essay and then related their performance to writing self-efficacy and apprehension, as well as their scores on a statewide writing assessment. Although girls and boys did not differ in either writing aptitude or performance, girls reported lower writing self-efficacy. A study of elementary students by Pajares, Miller, and Johnson (1999) also showed differences between girls' and boys' reported writing self-efficacy and performance. In this instance, however, girls and boys indicated equal self-efficacy for writing at the same time that girls were actually producing higher-quality writing. Interestingly, when boys and girls were asked to directly compare their writing, girls judged themselves to be better writers than boys. Thus, how one asks about writing self-efficacy can affect self-efficacy judgments.

A subsequent study by Pajares and Valiante (2001) shed additional light on these earlier observations by testing whether observed gender differences in writing self-efficacy might more appropriately be attributed to *gender orientation*, the extent to which students identified themselves with stereotypically male or female characteristics in American society. Initial analyses showed strong gender effects on writing self-efficacy favoring girls, but when student feminine orientation beliefs were entered into the analyses, virtually all gender differences in writing motivation and achievement disappeared. Pajares and Valiante thus concluded that observed differences in writing motivation and achievement may not be due to gender per se but to gender orientation, especially beliefs in writing as a female activity. As discussed by Pajares, Valiante, and Cheong (2007), these results provide an important perspective for interpreting continuing findings of gender-related differences in writing self-efficacy and performance (see, for instance, Bruning et al., 2013; National Center for Education Statistics, 2012).

One of Pajares's final contributions (Pajares, 2007) was a detailed analysis of his *Writing Self-Efficacy Scale* (WSES), which has been used in multiple studies. In this study, Pajares assessed writing self-efficacy for more than 1,200 fourth through eleventh graders using the WSES, which was given along with several other writing motivation and outcome measures. Findings at all grades showed the predicted two-factor structure for the WSES, reflecting self-efficacy for basic writing skills and advanced composition tasks. These two factors also showed high reliability and consistent correlations with other writing beliefs measures (e.g., writing self-concept) and writing achievement at all grade levels, thus providing support for its use in writing self-efficacy research generally aimed at understanding student perspectives on writing, evaluating writing instruction outcomes, and tracking student writing development.

Writing Self-Efficacy as an Outcome Variable

Experimental investigations in which writing goals and feedback are varied represent a second important focus of writing self-efficacy research to date. In two influential studies, for instance, Schunk and Swartz (1993) studied how goals and feedback affected the writing quality and self-efficacy of elementary students. In the first, fifth graders were taught a strategy for writing four kinds of paragraphs—descriptive (e.g., describing objects, persons), informative (conveying information), narrative story (telling a story), and narrative descriptive (telling how to do something). The strategy included such skills as writing good topic and supportive sentences. Students rated their self-efficacy for performing these skills both before and after instruction, in which they were randomly assigned to

one of four conditions: *product goal*, in which students were reminded of their goal of writing each kind of paragraph; *process goal*, in which they were coached to attend to the strategies used for writing each paragraph; *process goal plus progress feedback*, in which teachers also gave individual feedback to students three to four times per session about their learning strategy use; or to a *control* condition, where students were simply encouraged to do their best. Students received instruction in small groups over a 20-day period. The process plus feedback condition had the highest skill levels, strategy use, and self-efficacy, and both the process goal and process goal plus feedback conditions produced better writing skills than the product goal condition. Schunk and Swartz's second experiment, with fourth graders, extended the first by assessing whether the process goals condition also encouraged transfer of writing strategies. A delayed measure of writing skill, given 6 weeks later, showed all goal conditions performing better than the control condition, while writing self-efficacy in the process goal plus feedback condition was significantly higher than for the control. Thus, a relatively short intervention combining process goals with feedback on progress was seen to move students toward self-regulation of their writing and improve three major writing development outcomes—writing strategy use, skill acquisition, and self-efficacy.

Zimmerman and Kitsantas (1999, 2002), building on Schunk and Zimmerman's social cognitive model of skill acquisition (e.g., Schunk & Zimmerman, 1997; Zimmerman, 2000), tested how writers' expertise might impact how writing goals affect writing processes and outcomes. Their key assumptions were that novice writers would benefit from early focus on specific writing processes (e.g., learning to write meaningful sentences), but that asking them to pay attention to both processes and outcomes would be counterproductive because of cognitive load issues. These researchers further theorized, however, that as writing skills became more automatic, writers could usefully shift their attention to outcomes.

In their initial study, Zimmerman and Kitsantas (1999) had female high school students work on a task requiring them to rewrite "kernel sentences" into more polished ones by eliminating words and grouping ideas. Students were assigned to one of three experimental conditions. In the *outcome goal* condition, they were told only to use a minimal number of words as they rewrote the sentences. In a *process goal* condition, students were told to focus on carrying out key strategies (e.g., eliminating repetitive words). Finally, in a *shifting goal* condition, students were asked to concentrate first on the strategies until they mastered them, but then to shift their goal to rewriting using a minimal number of words. A final control group simply practiced rewriting the assigned sentence sets. Additionally, some students in each condition recorded their activities (i.e., the steps they carried out) while others did not.

The study generated several interesting findings. Self-recording produced both higher writing self-efficacy and quality, as well as greater student interest. Moreover, compared to students in the process and shifting goal groups, students in the practice-only control group not only had lower writing and self-efficacy scores, but lower self-satisfaction and task interest. These results were among the first to experimentally show how initially adopting writing process goals and delaying attention to outcomes can result in both better writing and higher writing self-efficacy.

In a 2002 follow-up, Zimmerman and Kitsantas utilized essentially the same writing task, but changed their focus to study the influences of students' observing models and receiving feedback on their revisions. This study's goal was to obtain a better understanding of how college-age writers shifted from reliance on modeling and feedback to becoming more self-regulated and adaptable. Three modeling conditions were compared. Some students saw a *coping model* making revising errors but then correcting them. Others saw a *mastery model* performing flawlessly in revising. A third group of students *did not observe anyone* revising, but only saw the training problems. As in the earlier study, some students received feedback, while others did not.

Findings showed that those observing the coping model had the strongest writing revision skills and self-efficacy, followed by mastery model and no-model groups. Students receiving feedback had better revisions and higher self-

efficacy than those who did not. Positive modeling and feedback effects also were observed on student satisfaction and interest in revising. Thus, although both modeling and feedback can improve writing skills and self-efficacy, coping models seem to be most beneficial because they convey strategies for making practice more effective.

In summarizing this and related work, Zimmerman and Kitsantas (2007), Schunk (2003), and Schunk and Zimmerman (2007) emphasized the importance of writers' self-regulatory processes, especially the ability to plan, initiate, and sustain one's own efforts. Writing self-efficacy, in their judgment, is not just an outcome of writing successfully, but of writers monitoring how well they are managing the writing process. Models are important because they help writers recognize a writing task's features and goals. Seeing models use coping strategies, however, can also help writers see the importance of self-monitoring and correcting mistakes. Instruction for improving writing performance and self-efficacy therefore should begin by modeling strategies and drawing attention to process goals, and offer students the chance to practice on their own. Later, as writing strategies become automatic, outcome goals likely will be better.

NEW DIRECTIONS FOR WRITING SELF-EFFICACY RESEARCH AND INSTRUCTION

Throughout the history of writing self-efficacy research, researchers in the field have called for greater emphasis on writing self-efficacy. Already in their pioneering work, for instance, McCarthy and colleagues (1985) argued that writing self-efficacy measures should be extended to a wider range of writing purposes and processes. Schunk and Swartz (1993) suggested studying writing over longer periods in order to better understand how goals and feedback affect writing self-efficacy. And as Pajares (2007) stated, "self-efficacy beliefs and writing competency work in tandem, and improving one requires improving the other" (p. 246). In other words, both writing instruction and research seem likely to benefit from a strong, explicit focus on self-efficacy. But what might this entail?

Certainly, we already know a great deal about writing and writing instruction generally, with several decades of research giving us rich insights into the writing process and ways to improve writing. We know, for instance, that higher-scoring students on the National Assessment of Educational Progress (NAEP) writing assessments report writing more frequently for "authentic" purposes and audiences, as well as interacting more with their teachers about writing (Applebee & Langer, 2011). Multiple meta-analyses by Graham, Harris, and their associates (e.g., Cutler & Graham, 2008; Graham & Harris, 2003; Graham et al., 2012; Graham & Perin, 2007) have shown us that writing collaboratively, observing models of good writing, and acquiring strategies for planning, summarizing, and editing are reliable ways to improve student writing. These instructional approaches are explicit design features of Harris and Graham's widely used SRSD writing instructional model (e.g., Harris et al., 2006; Mason, Harris, & Graham, 2011) and are also emphasized in many other influential approaches to teaching writing (e.g., Applebee & Langer, 2013; Atwell, 1998; Calkins, 1986; Graves, 1994; National Writing Project & Nagin, 2003).

Although such information is encouraging, the data bearing more generally on writing instruction are much less so, at least for American schools. For instance, a survey by Lacina and Collins Block (2012) showed that such proven techniques as collaborative writing, observing writing models, and inquiry activities were being used relatively infrequently in the middle school classrooms they surveyed. In Applebee and Langer's (2011) survey, middle and high school teachers reported only small amounts of writing typically occurring in language arts and other classes (e.g., science, social studies). Only about a fifth of writing assignments required more than a paragraph, leading Applebee and Langer to judge writing instructional time to be "distressingly low" (p. 16). Also, recent U.S. writing assessment results are far from reassuring, with nearly three-fourths of eighth and eleventh graders' writing on the most recent NAEP assessment judged to be at either basic or below basic levels (National Center for

Education Statistics, 2012).

Although we obviously would not argue that simply focusing more on writing self-efficacy will end problems of subpar writing performance, we believe that greater emphasis on writing self-efficacy can be an important step forward for writing instruction. As Bandura (1997) stated, "Educational practices should be gauged not only by the skills and knowledge they impart for present use, but also by what they do to children's beliefs about their capabilities" (p. 176). From our perspective, writing instruction should be evaluated both in terms of writing outcomes and the extent to which writers see themselves as successful and resourceful.

Our assumption is that writers—both novice and more expert—make multiple self-efficacy judgments in the course of any writing-related experience (e.g., when they receive a writing assignment, discuss writing-related ideas with others, search for and use writing resources). We believe that these judgments impact their emotions and decision making. What we propose specifically are steps to better understand how conditions occurring within the writing process affect writing self-efficacy development. For instance, we currently know relatively little about how such factors as writing goals, audiences, social contexts for writing, writing task design, and resources for writing affect writing self-efficacy. To obtain this information, we would argue that finer-grained analyses of writing process-writing efficacy relationships are needed—ones driven by close examination of writings' linguistic, cognitive, and metacognitive challenges (e.g., Bruning et al., 2013)—as well as research designs that tie dimensions of the writing experience more explicitly to writers' self-efficacy judgments and engagement patterns.

In the following section, we describe three potential emphases for future study of writing self-efficacy. The first is research relating "conditions of writing" to writing self-efficacy. Among these conditions are writing contexts (e.g., interactions with other writers, prewriting activities, availability of coaching, and other supports) and writing task features (e.g., goals, genre, audience, types of writing prompts). Second, we propose research examining potential ties between *teachers'* writing histories, writing self-efficacy, and outcome expectancies for using writing instructionally and their writing-related classroom practices. Building teachers' self-efficacy and understanding of writing's instructional functions almost certainly will become more important as writing receives greater emphasis. Third, we propose that adopting new measurement and methodological approaches can significantly advance writing self-efficacy research.

Research Investigating the Effects of "Basic Conditions of Writing" on Writing Self-Efficacy

Like all learning and instructional activities, student writing experiences can be analyzed from the standpoint of how well they incorporate learning conditions known to be consistently associated with successful learning. Among these are seeing models of successful performance (e.g., Raedts Rijlaarsdam, Van Waes, & Daems, 2007), having practice opportunities, receiving timely and appropriate feedback (e.g., Schunk & Swartz, 1993), and learning in supportive contexts. Unfortunately, much writing currently required in schools and colleges seems framed with scant attention to such learning basics, especially for more advanced students (Boscolo & Hidi, 2007). Writing often occurs under less-than-ideal conditions, with students grappling with poorly understood content, having few or no opportunities to revise, and receiving inadequate feedback. In our view, much can be learned by close analysis of writing conditions, studying how writing self-efficacy and performance are affected by them, and testing promising supports. Following are illustrations of such research.

Effects of Collaborative Writing Contexts

In their 2007 article on adolescent-level writing instruction, Graham and Perin called for research examining specific

features of writing instruction shown to positively affect student writing performance. Prominent among these features was collaborative writing, including participating in group-based prewriting activities. Although collaborative writing activities are used in some classrooms, in many others they are not (e.g., Lacina & Collins Block, 2012). For countless student writers, writing is an individual activity, and for those with less-than-successful writing histories, "going it alone" seems almost guaranteed to provide insufficient support and introduce anxiety. In contrast, well-managed collaborative approaches to writing would seem to have considerable potential for strengthening writing self-efficacy by offering models for decision making, exposure to new perspectives on writing, and greater chances for successful performance. Research testing how specific features of collaborative contexts might affect writing self-efficacy is needed.

Effects of Framing Conditions for Writing Tasks

Another potentially productive area for "conditions of writing" research, we believe, is studying writing self-efficacy as a function of such framing conditions as writing prompt features and expected audience. Although there currently are promising theoretical and empirical bases for relating variables like these to writing quality (e.g., see Epting, Gallena, Hicks, Palmer, & Weisberg, 2013; Magnifico, 2010; Nelson, 2007), we currently know little about how they impact writing self-efficacy. For instance, are some ways of presenting writing tasks (e.g., by promoting their task value, Johnson & Sinatra, 2013) more facilitative of writing self-efficacy than others? If writing-related self-efficacy judgments are probed as writers move through subtasks of a complex writing activity (e.g., "I can summarize these articles for use in my paper"), are certain activities pivotal in affecting writers' performance and self-efficacy? And to what extent is writing self-efficacy influenced by student judgments of whether a particular writing assignment has utility for them (e.g., expecting that it will be shared with an expert)? Studies targeting variables like these can provide insights into the mechanisms shaping both moment-to-moment and long-term writing self-efficacy judgments.

Effects of Writer Knowledge and Interests

As any teacher knows, student interest in writing often varies greatly by writing task, topic, and purpose. Also, it is well known that topic-related interest and knowledge significantly influence writing quality and engagement (e.g., Benton et al., 1995; Boscolo & Hidi, 2007; De Bernardi & Antolini, 2007; Lipstein & Renninger, 2007b; Lee, Lee, & Bong, 2014; Proske & Kapp, 2013), but again we know much less about the impact of these variables on writing self-efficacy. One promising focus for self-efficacy research therefore may be the transition from high school to college, a point at which the nature of writing tasks can change dramatically and generate significant challenges for many writers (K. Ganson, 2014, personal communication; Kellogg & Whiteford, 2009; Lavelle & Zuercher, 2001). College writing not only often requires struggling to understand and integrate unfamiliar content, but successfully reflecting favored genres and reasoning styles of academic fields.

Unless students are well prepared for writing challenges like these, they have significant potential to negatively impact writing self-efficacy. To successfully complete many writing assignments, writers not only need to choose relevant sources, but must mobilize an array of cognitive, linguistic, and self-regulatory activities to comprehend, summarize, and communicate that information (McCutchen, 2011). Research focused on writing self-efficacy can further our understanding of how students' domain-related knowledge and interests interact with both the structure and scope of writing assignments and the resources students have available.

Roles of Teacher Writing Self-Efficacy and Outcome Expectancies

We see studies of teachers' writing self-efficacy and outcome expectancies for student writing activities as a second productive area for future research. Teacher self-efficacy research dating back many years (e.g., Hoy & Woolfolk, 1993) has shown its ties to such variables as successful classroom management, teacher goals, and student autonomy, with recent studies (e.g., Holzberger, Philipp, & Kunter, 2013) revealing reciprocal effects between teacher effectiveness and self-efficacy. As writing instruction moves beyond its traditional home in the language arts (e.g., Council of Chief State School Officers & the National Governors Association, 2010; Troia & Olinghouse, 2013), greater responsibility for providing rich and rewarding writing experiences inevitably will fall to content-area teachers. But will they be successful? We would posit that these teachers' past and current writing experiences along with their self-efficacy as writers and as teachers of writing likely will be keys to their success.

No doubt it is overly optimistic to expect all content-area teachers to be immediately effective in using writing in their instruction, especially since many report little or no preparation for teaching writing in their teacher education programs (e.g., see Kiuhara, Graham, & Hawken, 2009). A reasonable starting point, therefore, would be careful analyses of teachers' writing histories, skills, and self-efficacy for writing and teaching writing. Are they themselves currently writing and, if so, and what kinds of writing do they do? Have they developed identities of themselves as writers (Calkins, 1986; Graves, 1994)? Are they efficacious about using writing in their classrooms? What kinds of feedback do they see as effective and how will they offer it?

We also need to better understand what benefits teachers and future teachers expect from classroom uses of writing. Stated in terms of Bandura's (1997) motivational framework, what are teachers' *outcome expectancies* for a greater emphasis on writing? As Bandura and others have pointed out, motivated behaviors—in this case teachers taking steps to make writing a regular part of their students' experiences—requires both self-efficacy for carrying them out *and* expecting them to produce desired outcomes. Thus, building strong writing-based programs, especially in the content areas, will require understanding both teachers' and students' writing self-efficacy and the learning and motivational outcomes they expect from writing.

Adopting New Approaches to Conducting Writing Self-Efficacy Research

As described earlier, writing self-efficacy research to date typically has utilized measures designed either for classroom use or for tapping outcomes of efficacy-related experimental interventions. Both categories of research have greatly extended our knowledge about self-efficacy's role in writing and conditions affecting its development. The time is now right, however, for a new generation of applied, instructionally oriented research in which writing tasks and efficacy measures clearly operationalize the principle that self-efficacy measures be tied to task demands and domains.

While reasonably close alignment of writing tasks and writing self-efficacy measures has been achieved in some classroom and experimental studies (e.g., Zimmerman & Bandura, 1994; Zimmerman & Kitsantas, 2002; Schunk & Swartz, 1993; Schunk & Zimmerman, 2007), technologies now available can provide multiple ways to relate specific writing task features and contexts—such as prompts, audience, and writing resources—to writing self-efficacy. For instance, a well-designed writing environment in which writers generate both interim and final writing products can provide insights into how initial writer judgments of self-efficacy, interest, and outcome expectancies flow into later ones. Related technologies can also vary access to writing supports such as coaching, modeling, or seeing other students' decisions (e.g., see Dempsey, PytlikZillig, & Bruning, 2009; Roscoe & McNamara, 2013), which likewise can be studied for their effects on writing self-efficacy.

For a writing assignment carried out in such an environment, for instance, self-efficacy judgments might be probed at the point at which the writing task is assigned (e.g., as a single, multifaceted "term paper" or as a cluster of related short papers to be combined into a final paper), with regard to the contexts in which ideas are generated or writing produced (e.g., as an individual vs. a collaborative activity), and with respect to the provision of modeling. From studies like these, we can obtain information useful for better managing the writing process to improve writing quality, self-efficacy, enjoyment, and student learning. Technology-based writing environments also can allow us to study how the availability of such affordances as pictures, illustrations, videos, and graphical displays affect writing self-efficacy. They further can let us vary writers' audiences, resource selection, and modes of feedback. Probing self-efficacy judgments for writers who have contrasting levels of access to such features should be highly valuable for improving the design of both writing assignments and instruction.

SUMMARY AND CONCLUSIONS

Many years of research have shown writing self-efficacy's relationships to both writing processes and outcomes. We know it to vary as a function of such variables as writing skill and gender, as well as with conditions such as writing goals and feedback. In this chapter, we take the position that advancing writing self-efficacy as a goal for writing instruction can help us help writers become more motivated and resilient.

Although we generally have solid foundational knowledge about writing self-efficacy and its importance to writing performance, we know much less about how it is affected by specific features of writing contexts and students' writing experiences. Among potentially strong influences on writing self-efficacy are writing's goals and purposes; the social, cognitive, and linguistic contexts for writing; the form and frequency of writing feedback, and interactions of writers' knowledge and interests with writing tasks and genres. As writing is increasingly utilized in content-area instruction, we also need to know more about how teachers' writing skills and self-efficacy, identities as writers, comfort with teaching writing, and outcomes expected for writing affect their teaching practices. Finally, we need to deploy a new generation of process-focused research approaches for studying writing self-efficacy to learn more about how specific variations in writing contexts (e.g., in levels of peer interaction, availability of writing resources) can help us not only develop writers who are more skilled, but who see themselves as confident and capable writers.

REFERENCES

Applebee, A., & Langer, J. (2011). A snapshot of writing instruction in middle and high schools. *English Journal, 100*, 14–27.

Atwell, N. (1998). *In the middle: New understandings about writing, reading and learning* (2nd ed.). Portsmouth, NH: Boynton/Cook.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*, 191–215.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: Freeman.

Bandura, A. (2006). Guide to constructing self-efficacy scales. In F. Pajares & T. Urdan (Eds.), *Self-efficacy beliefs of adolescents* (pp. 307–327). Greenwich, CT: Information Age.

Beach, R., & Friedrich, T. (2006). Response to writing. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 222–234). New York: Guilford Press.

Benton, S., Corkill, A., Sharp, J., Downey, R., & Khramtsova, I. (1995). Knowledge, interest, and narrative writing. *Journal of Educational Psychology, 87*, 66–79.

Bereiter, C., & Scardamalia, M. (1987). *The psychology of written composition.* Mahwah, NJ: Erlbaum.

Boscolo, P., & Hidi, S. (2007). The multiple meanings of motivation to write. In P. Boscolo & S. Hidi (Eds.), *Studies in writing, Vol. 19. Writing and motivation* (pp. 1–14). Oxford, UK: Elsevier.

Bruning, R., Dempsey, M., Kauffman, D. F., McKim, C., & Zumbrunn, S. (2013). Examining dimensions of self-efficacy for writing. *Journal of Educational Psychology, 105*, 25–38.

Bruning, R., & Horn, C. (2000). Developing motivation to write. *Educational Psychologist, 35*, 25–37.

Calkins, L. (1986). *The art of teaching writing.* Portsmouth, NH: Heinemann.

Council of Chief State School Officers (CCSSO) & the National Governors Association (NGA). (2010). *Common Core State Standards for mathematics and for English language arts and for literacy in history/social studies, science, and technical subjects.* Washington, DC: Authors. Available at *www.corestandards.org/the-standards.*

Cutler, L., & Graham, S. (2008). Primary grade writing instruction: A national survey. *Journal of Educational Psychology, 100*, 907–919

Daly, J. (1978). Writing apprehension and writing competency. *Journal of Educational Research, 71*, 10–14.

Daly, J., & Miller, M. (1975). The empirical development of an instrument to measure writing apprehension. *Research in the Teaching of English, 9*, 242–248.

Daly, J., & Shamo, W. (1978). Academic decisions as a function of writing apprehension. *Research in the Teaching of English, 12*, 119–126.

De Bernardi, B., & Antolini, E. (2007). Fostering students' willingness and interest in argumentative writing: An intervention study. In G. Rijlaarsdam (Series Ed.) and P. Boscolo & S. Hidi (Vol. Eds.), *Studies in writing: Vol. 19. Writing and motivation* (pp. 183–201). Oxford, UK: Elsevier.

Dempsey, M., PytlikZillig, L., & Bruning, R. (2009). Helping preservice teachers learn to assess writing: Practice and feedback in a web-based environment. *Assessing Writing, 14*, 38–61.

Epting, L., Gallena, E., Hicks, S., Palmer, E., & Weisberg, T. (2013). Read and think before you write: Prewriting time and level of print exposure as factors in writing and revision. *Journal of Writing Research, 4*, 239–259.

Flower, L., & Hayes, J. (1981). A cognitive process theory of writing. *College Composition and Communication, 32*, 365–387.

Ganson, K. (2014). *Transitioning from high school to college: A retrospective analysis of students' writing experiences*. Unpublished data.

Graham, S. (2006). Strategy instruction and the teaching of writing: A meta-analysis. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of research on writing* (pp. 187–207). New York: Guilford Press.

Graham, S., & Harris, K. R. (2003). Students with learning disabilities and the process of writing: A meta-analysis of SRSD studies. In H. Swanson, K. Harris, & S. Graham (Eds.), *Handbook of learning disabilities* (pp. 323–344). New York: Guilford Press.

Graham, S., McKeown, D., Kiuhara, S., & Harris, K. R. (2012). A meta-analysis of writing instruction for students in the elementary grades. *Journal of Educational Psychology, 104*, 879–896.

Graham, S., & Perin, D. (2007). A meta-analysis of writing instruction for adolescent students. *Journal of Educational Psychology, 99*, 445–476.

Graves, D. H. (1994). *A fresh look at writing.* Portsmouth, NH: Heinemann.

Harris, K. R., Graham, S., & Mason, L. (2006). Self-regulated strategy development for 2nd-grade students who struggle with writing. *American Educational Research Journal, 43*, 295–340.

Harris, K. R., Graham, S., MacArthur, C., Reid, R., & Mason, L. (2011). Self-regulated learning processes and

children's writing. In B. Zimmerman & D. Schunk (Eds.), *Handbook of self-regulation of learning and performance* (pp. 187–202). London: Routledge.

Hayes, J. R. (1996). A new framework for understanding cognition and affect in writing. In C. M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences, and applications* (pp. 1–27). Mahwah, NJ: Erlbaum.

Hayes, J. R. (2006). New directions in writing theory. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 28–40). New York: Guilford Press.

Hayes-Skelton, S., Roemer, L., Orsillo, S., & Borkovec, T. (2013). A contemporary view of applied relaxation for generalized anxiety disorder. *Cognitive Behaviour Therapy, 42*, 292–302.

Hidi, S., Ainley, M., Berndorff, D., & Del Favero, L. (2007). The role of interest and self-efficacy in science related expository writing. In G. Rijlaarsdam (Series Ed.) and P. Boscolo & S. Hidi (Vol. Eds.), *Studies in writing, Vol. 19, Writing and motivation* (pp. 203–217). Oxford, UK: Elsevier.

Hidi, S., & Boscolo, P. (2006). Motivation and writing. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 144–157). New York: Guilford Press.

Holzberger, D., Philipp, A., & Kunter, M. (2013). How teachers' self-efficacy is related to instructional quality: A longitudinal analysis. *Journal of Educational Psychology, 105*, 774–786.

Hoy, W. K., & Woolfolk, A. (1993). Teachers' sense of efficacy and the organizational health of of schools. *The Elementary School Journal, 93*, 356–372.

Johnson, M. L., & Sinatra, G. M. (2013). Use of task-value instructional inductions for facilitating engagement and conceptual change. *Contemporary Educational Psychology, 38*, 51–63.

Kellogg, R. (2008). Training writing skills: A cognitive developmental perspective. *Journal of Writing Research, 1*, 1–26.

Kellogg, R., & Whiteford, A. (2009). Training advanced writing skills: The case for deliberate practice. *Educational Psychologist, 44*(4), 250–266.

Kiuhara, S., Graham, S., & Hawken, L. (2009). Teaching writing to high school students: A national survey. *Journal of Educational Psychology, 101*, 136–160.

Klassen, R. (2002). Writing in early adolescence: A review of the role of self-efficacy beliefs. *Educational Psychology Review, 14*, 173–203.

Lacina, J., & Collins Block, C. (2012). Progressive writing instruction: Empowering school leaders and teachers. *Voices from the middle, 19*, 10–17.

Lavelle, E., & Zuercher, N. (2001). The writing approaches of university students. *Higher Education, 42*, 373–391.

Lee, W., Lee, M.-J., & Bong, M. (2014). Testing interest and self-efficacy as predictors of academic self-regulation and achievement. *Contemporary Educational Psychology, 29*, 86–99.

Lipstein, R., & Renninger, K. (2007a). Interest for writing: How teachers can make a difference. *English Journal, 96*, 79–85.

Lipstein, R., & Renninger, K. (2007b). "Putting things into words": The development of 12–15- year-old students' interest for writing. In G. Rijlaarsdam (Series Ed.) and P. Boscolo & S. Hidi (Vol. Eds.), *Studies in Writing, Vol. 19, Writing and motivation* (pp. 113–140). Oxford: Elsevier.

Magnifico, A. (2010). Writing for whom: Cognition, motivation, and a writer's audience. *Educational Psychologist, 45*, 167–184.

Mason, L., Harris, K. R., & Graham, S. (2011). Self-regulated strategy development for students with writing difficulties. *Theory into Practice, 50*, 20–27.

McCarthy, P., Meier, S., & Rinderer, R. (1985). Self-efficacy and writing: A different view of self-evaluation.

College Composition and Communication, 36, 465–471.

McCutchen, D. (2011). From novice to expert: Implications of language skills and writing-relevant knowledge for memory during the development of writing skill. *Journal of Writing Research, 3,* 51–68.

National Center for Education Statistics (2012). *The nation's report card: Writing 2011(NCES 2012–470)*. Washington, DC: Institute of Education Sciences, U.S. Department of Education.

National Writing Project & Nagin, C. (2003). *Because writing matters: Improving student writing in our schools.* San Francisco: Jossey Bass.

Nelson, N. (2007) Why write? A consideration of rhetorical purpose. In G. Rijlaarsdam (Series Ed.) and P. Boscolo & S. Hidi (Volume Eds.), *Studies in Writing. Vol. 19. Writing and motivation* (pp. 17–30). Oxford, UK: Elsevier.

Nolan, S. (2007). The role of literate communities in the development of children's interest in writing. In G. Rijlaarsdam (Series Ed.) and P. Boscolo & S. Hidi (Vol. Eds.), *Studies in Writing: Vol. 19. Writing and motivation* (pp. 241–255). Oxford, UK: Elsevier.

Pajares, F. (2007). Empirical properties of a scale to assess writing self-efficacy in school contexts. *Measurement and Evaluation in Counseling and Development, 29,* 239–249.

Pajares, F., Britner, S. L., & Valiante, G. (2000). Relation between achievement goals and self-beliefs of middle school students in writing and science. *Contemporary Educational Psychology, 25,* 406–422.

Pajares, F., Hartley, J., & Valiante, G. (2001). Response format in writing self-efficacy assessment: Greater discrimination increases prediction. *Measurement and Evaluation in Counseling and Development, 33,* 214–221.

Pajares, F., & Johnson, M. (1994). Confidence and competence in writing: The role of writing self-efficacy, outcome expectancy, and apprehension. *Research in the Teaching of English, 28,* 313–331.

Pajares, F., & Johnson, M. (1996). Self-efficacy beliefs in the writing of high school students: A path analysis. *Psychology in the Schools, 33,* 163–175.

Pajares, F., Johnson, M., & Usher, E. (2007). Sources of self-efficacy beliefs of elementary, middle, and high school students. *Research in the Teaching of English, 42,* 104–120.

Pajares, F., Miller, M., & Johnson, M. (1999). Gender differences in writing self-beliefs of elementary school students. *Journal of Educational Psychology, 91,* 50–61.

Pajares, F., & Valiante, G. (1997). Influence of self-efficacy on elementary students' writing. *Journal of Educational Research, 90,* 353–360.

Pajares, F., & Valiante, G. (1999). Grade level and gender differences in the writing self-beliefs of middle school students. *Contemporary Educational Psychology, 24,* 290–405.

Pajares, F., & Valiante, G. (2001). Gender differences in writing motivation and achievement of middle school students: A function of gender orientation? *Contemporary Educational Psychology, 26,* 366–381.

Pajares, F., & Valiante, G. (2006). Self-efficacy beliefs and motivation in writing development. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 158–170). New York: Guilford Press.

Pajares, F., Valiante, G., & Cheong, Y. (2007). Writing self-efficacy and its relation to gender, writing motivation and writing competence: A developmental perspective. In P. Boscolo & S. Hidi (Eds.), *Studies in writing: Vol. 19. Writing and motivation* (pp. 141–159). Oxford, UK: Elsevier.

Proske, A., & Kapp, F. (2013). Fostering topic knowledge: Essential for academic writing. *Reading and Writing, 26,* 1337–1352.

Raedts, M., Rijlaarsdam, G., Van Waes, L., & Daems, F. (2007). Observational learning through video-based models: Impact on students' accuracy of self-efficacy beliefs, task knowledge and writing performances. In P. Boscolo & S. Hidi (Eds.), *Studies in writing: Vol. 19. Writing and motivation* (pp. 219–238). Oxford, UK: Elsevier.

Roscoe, R. D., & McNamara, D. S. (2013). Writing Pal: Feasibility of an intelligent writing strategy tutor in the high school classroom. *Journal of Educational Psychology, 105*, 1010–1025.

Schunk, D. (2003). Self-efficacy for reading and writing: Influence of modeling, goal setting, and self-evaluation. *Reading and Writing Quarterly, 19*, 159–172.

Schunk, D., & Swartz, C. (1993). Goals and progress feedback: Effects on self-efficacy and writing achievement. *Contemporary Educational Psychology, 18*, 337–354.

Schunk, D., & Zimmerman, B. (1997). Social origins of self-regulatory competence. *Educational Psychologist, 32*, 195–208.

Schunk, D., & Zimmerman, B. (2007). Influencing children's self-efficacy and self-regulation of reading and writing through modeling. *Reading and Writing Quarterly, 23*, 7–25.

Shell, D., Colvin, C., & Bruning, R. (1995). Developmental and ability differences in self-efficacy, causal attribution, and outcome expectancy mechanisms in reading and writing achievement. *Journal of Educational Psychology, 87*, 386–398.

Shell, D., Murphy, C., & Bruning, R. (1989). Self-efficacy and outcome expectancy mechanisms in reading and writing achievement. *Journal of Educational Psychology, 81*, 91–100.

Troia, G., & Olinghouse, N. (2013). The Common Core State Standards and evidence-based educational practices: The case of writing. *School Psychology Review, 42*, 343–357.

Troia, G., Shankland, R., & Wolbers, K. (2012). Motivation research in writing: Theoretical and empirical considerations. *Reading and Writing Quarterly, 28*, 5–28.

Usher, E. L., & Pajares, F. (2008). Sources of self-efficacy in school: Critical review of the literature and future directions. *Review of Educational Research, 78*, 751–796.

Zimmerman, B. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13–39). San Diego, CA: Academic Press.

Zimmerman, B., & Bandura, A. (1994). Impact of self-regulatory influences on writing course attainment. *American Educational Research Journal, 31*, 845–862.

Zimmerman, B., & Kitsantas, A. (1999). Acquiring writing revision skill: Shifting from process to outcome self-regulatory goals. *Journal of Educational Psychology, 91*, 241–250.

Zimmerman, B., & Kitsantas, A. (2002). Acquiring writing revision and self-regulatory skill through observation and emulation. *Journal of Educational Psychology, 94*, 660–668.

Zimmerman, B., & Kitsantas, A. (2007). A writer's discipline: The development of self-regulatory skill. In P. Boscolo & S. Hidi (Eds.), *Studies in writing*: Vol. 19. *Writing and motivation* (pp. 51–69). Oxford, UK: Elsevier.

CHAPTER 12

Self-Regulation and Writing

Meta-Analysis of the Self-Regulation Processes in Zimmerman and Risemberg's Model

Tanya Santangelo, Karen R. Harris, and Steve Graham

Historians often distinguish between prehistory and history, with history defined by the invention of writing over 5000 years ago (Harris, Graham, Brindle, & Sandmel, 2009). Clearly, writing is a critical part of humanity's story. While at one time writing was used primarily for recordkeeping, today writing is critical to communication, self-expression, learning, and more. Approximately 85% of the world's population writes (Swedlow, 1999). Despite the importance of writing, two issues are readily apparent. First, far too many students and adults today struggle with writing, and second, relatively little research has been conducted on writing, including self-regulation and writing.

Learning to write is critical in today's world, yet the majority of our students are not developing the writing abilities they need to use writing as a powerful tool for learning and for showing what they know. Data from the National Center for Education Statistics (2012) reveal that less than a third of students in the United States have mastered the skills necessary for proficient, or grade-level appropriate writing on the National Assessment of Educational Progress. The vast majority of students in the United States have scored at the basic level or below, which denotes only partial mastery of the writing skills needed at each grade. A deteriorating attitude toward writing across the grades has also been reported. The problems don't end at grade 12. Almost one in five first-year college students require a remedial writing class. The National Commission on Writing for America's Families, Schools, and Colleges, in its fourth report to Congress, *Writing and School Reform* (2007), has emphasized the importance of keeping writing at the center of school reform.

Unlike reading and math, where far more is known, we know too little about how writing develops over time (Fitzgerald & Shanahan, 2000; Harris, Santangelo, & Graham, 2010; Shanahan, Chapter 13, this volume). Research in writing is further hampered by a lack of theoretical models of children's writing, as most models represent adult writing. In this chapter, we focus on self-regulation and writing. Because a review of the research base indicated very little research on writing development (see also Chapter 13, this volume; Graham, 2006), and even less specifically regarding development of self-regulation in writing, we focus here on a first step: getting a picture of what we know about self-regulation in writing based on an important model of writing.

Thus, in this chapter we first note early and influential models of writing. This discussion provides the larger picture in which to frame our focus on the one model of writing that centers explicitly and solely on self-regulation and writing (although other models include self-regulation to some extent either implicitly or explicitly). Zimmerman and Risemberg (1997) proposed a model in which environmental, behavioral, and personal (covert) forms of self-regulation were identified, resulting in ten self-regulatory processes critical to effective writing. Thus, after briefly looking at major models of writing influencing research today, we report a meta-analysis of true and quasi-experimental studies investigating the impact of teaching students to use the self-regulation processes for writing outlined by Zimmerman and Risemberg. Finally, we discuss the implications of the results of this meta-analysis for future research in writing and self-regulation, including developmental research.

EARLY MODELS OF WRITING

Rohman (1965) presented an early model consisting of three linear stages in the writing process; this linear model of writing, however, was disputed in the 1970s (Harris et al., 2009; Nystrand, 2006; Sitko, 1998). Emig (1971) was one of the first to establish the complex and reciprocal nature of the writing process in her study of the composing processes of 12th-grade students. It was not until the 1980s, however, that empirical research on writing began to accrue and impact education. While de Beaugrande (1984), for example, posited a more complex model of writing, the two models of writing with cognitive focus that most greatly impacted research and education beginning in the 1980s were those of Hayes and Flower (1980, later revised by Hayes, 1996) and Bereiter and Scardamalia (1987).

Hayes and Flower

Hayes and Flower (1980) delineated the recursive nature of the writing process and identified subprocesses for each of the three major processes in writing: planning, translating, and reviewing. Hayes and Flower provided critical tenets of the writing process that continue to impact research and instruction today. First, writing is a goal-directed, problem-solving activity that involves both major goals and subgoals. Second, a variety of mental operations are implemented to reach the skillful author's goals and subgoals. Third, the process of writing is not linear, but rather involves the complex interplay of interwoven or nested activities. And fourth, skilled writers must deal with a great many demands at once, including those related to planning, writing, revising, and mechanics (Hayes & Flower, 1980).

Although we do not attempt to provide a detailed explanation of Hayes and Flower's (1980) model here, their model included three basic components: task environment, cognitive processes, and the writer's long term memory. Task environment involved factors that were external to the writer, but that influenced the writing task, including attributes of the writing assignment and text produced so far. Cognitive processes referred to the mental operations employed during writing and was broken into three important subprocesses: planning, translating, and reviewing. Further, the writer was seen as monitoring this complex process; self-regulation is addressed in several ways in their model. In long-term memory, the writer held knowledge about the topic, the intended audience, the genre, and general plans or formulas for accomplishing varying writing tasks.

Bereiter and Scardamalia

Bereiter and Scardamalia (1987) initially focused on explaining critical developmental differences between novice and expert writers, and on detailing the processes used by both. They proposed that writing consisted of four main processes: (1) a mental representation of the task, (2) problem analysis and goal setting, (3) problem translation, and (4) resultant knowledge telling. Writing was seen as a recursive problem-solving process, allowing expert writers to think and write more effectively on a topic. Further, two forms of strategies were used to improve writing: rhetorical and self-regulatory. Novice writers were described as engaging in simple "knowledge telling," whereas more developed or expert writers used a process described as "knowledge transforming." These terms and understandings are still used today.

Although we also do not attempt a detailed explanation of this model here, Bereiter and Scardamalia's (1987) model also included important aspects of self-regulation in writing. The knowledge-transforming approach to writing involves planning text content in accordance with rhetorical (e.g., considerations of style, effect on reader), communicative (e.g., major points to be made, scope and breadth of content), and pragmatic (e.g., space, time for writing) constraints. The writer develops a mental representation of the assignment and then engages in problem analysis and goal setting to determine what to say (content planning), as well as how to say it and who to say it to (rhetorical process planning).

ZIMMERMAN AND RISEMBERG: FOCUS ON FORMS OF SELF-REGULATION

In 1997, Zimmerman and Risemberg reviewed the models proposed by Hayes and Flower (1980), Bereiter and Scardamalia (1987), and others. Zimmerman and Risemberg argued that although these models included the task environment and self-regulatory strategies, they emphasized the role of cognitive processes in students' writing competence, as opposed to writer performance and its self-regulated development. They further argued that

"explanations focusing on writing performance and its self-regulated development need to include the role of social, motivational, and behavioral processes as well as cognitive ones" (p. 75). Working from social cognitive theory and self-regulation theory (Zimmerman, 1989), they proposed a model of writing composed of three fundamental forms of self-regulation: environmental, behavioral, and personal and covert; each of these was further divided into specific self-regulation processes (see Table 12.1). The authors argued that these triadic forms of self-regulation interact reciprocally via a cyclic feedback loop that allows writers to self-monitor and self-react to feedback about the effectiveness of specific self-regulatory techniques or processes.

TABLE 12.1. Three Classes and Ten Processes in Zimmerman and Risemberg's (1997) Self-Regulation Model of Writing

I. **Environmental**. Processes: (1) *environmental structuring* (selecting, organizing, and creating effective writing settings and conditions) and (2) *self-selected models, tutors, or books* that serve as sources of writing knowledge and skills. Many writers indicate the influence of models of writing at stages in their development. For example, they may seek to learn from an identified text or a particular writer's style.

II. **Behavioral.** Processes: (3) *self-monitoring* one's own performance (i.e., overtly charting the number of pages written, sections completed, or incremental goals met), (4) *self-consequenting* based on one's own performance (such as rewards for meeting goals or punishments for failing to meet goals), and (5) *self-verbalizations* used to enhance the process of writing (saying dialogue aloud as one composes or reading text aloud to assist in evaluation).

III. **Personal/Covert.** Processes: (6) *time planning and management* (estimating and budgeting time needed for writing), (7) *goal setting* (specifying long and short term outcomes while writing, goals for the quality and characteristics of the written product, and so on), (8) *self-evaluative standards* for one's own writing (setting and adhering to specific standards of personal satisfaction regarding one's writing, such as setting criteria for judging an effective concluding paragraph), (9) *use of cognitive strategies* (rule-governed methods for organizing, producing, and transforming written text), and (10) *use of mental imagery* to recall or create a vivid image of a setting, activity, or character to facilitate effective written description.

Zimmerman and Risemberg's (1997) model of self-regulated writing represented a significant contribution to the field when it was introduced and it remains influential today. In their seminal article, empirical evidence of relationships between each of the ten self-regulatory processes and writing achievement was narratively summarized. Based on their selective review of the literature, Zimmerman and Risemberg concluded that the model —as a whole—was supported by research. The level of support for each self-regulation process, however, varied. At that time, some processes, such as cognitive strategies, had been investigated in multiple studies, whereas others, such as environmental structuring, had received scant research attention. Additionally, although some of the studies cited by Zimmerman and Risemberg to support their model involved high-quality experimental designs (e.g., see Odom et al., 2005), many did not. In other words, there was much yet to learn.

Nearly two decades have passed since Zimmerman and Risemberg's (1997) article was published; a considerable amount of research has been conducted during that time, yet no syntheses of the research related to their model were found. Therefore, we systematically synthesized the findings from true and quasi-experimental studies that have investigated the impact of teaching students to use the self-regulation processes in Zimmerman and Risemberg's model of writing. We selected meta-analysis as our method of review because it allowed us to determine and statistically compare the effects of specific practices (e.g., Dignath, 2011). Although other meta-analyses have examined the impact of various writing instruction practices (e.g., Graham, McKeown, Kiuhara, & Harris, 2012; Graham & Perin, 2007), ours is the first one focused specifically on synthesizing experimental research related to teaching students how to self-regulate the writing process.

SYNTHESIZING THE RESEARCH RELATED TO SELF-REGULATION AND WRITING

The overarching question that guided our review was the following: Which of the ten self-regulatory processes proposed by Zimmerman and Risemberg (1997) in their model are supported by empirical research that tests whether applying or teaching it results in general improvements in students' writing? If application of a self-regulation process by students repeatedly resulted in significant improvement in the quality of students' writing, it would support the importance of the process to both writing and to the process within Zimmerman and Risemberg's model. The same logic applies to repeated demonstrations that teaching a self-regulation process significantly enhances the quality of students' writing. These tests represent a stringent evaluation of the importance of each self-regulation process to the model, as they establish a strong link between the self-regulation process and writing through the use of experimental research methodology.

METHODS

Selection and Location of Studies

Studies had to meet the following criteria to be included in our meta-analysis: (1) used a true or quasi-experimental research design (but did not use students as their own controls); (2) involved K–12 students in regular school settings (i.e., not special schools for students with disabilities); (3) included an intervention condition targeting at least one self-regulatory process described by Zimmerman and Risemberg (1997); (4) included a posttest measure of writing quality (quasi-experiments that did not provide comparable pretest data were excluded because they did not allow us to account for potential pretest differences resulting from nonrandom assignment); (5) was written in English; and (6) contained the statistics needed to compute a weighted effect size (ES) (or the statistics were obtainable from the authors).

To identify potentially relevant studies, we conducted searches in multiple electronic databases (e.g., EBSCO, ERIC, PsychINFO, ProQuest Dissertations and Theses), hand searched relevant journals (e.g., *Elementary School Journal, Journal of Educational Psychology, Learning Disability Quarterly, Reading and Writing)*, and examined the reference lists from previous reviews of writing instruction and assessment. If a document looked promising based on the abstract or title, it was obtained and evaluated. The reference list of each obtained document was also examined for other potentially includable studies.

Coding

Each study was independently coded by the first and third authors for: (1) publication type (i.e., peer-reviewed journal article, dissertation/thesis, or other); (2) grade level; (3) type of student (i.e., full range of literacy skills found in a general education classroom, significant literacy difficulties, average literacy skills, or above average literacy skills); (4) number of participants; (5) genre (i.e., narrative, persuasive, or expository); and (6) targeted self-regulation process. In addition, a brief written description of the intervention and control conditions was developed, and the necessary statistics for computing an ES were recorded. Across the studies and variables, interrater reliability for coding (calculated as the percentage of exact agreement) was greater than 95%. The few disagreements found were resolved through discussion.

Calculating ESs

The ES for each study was calculated as Cohen's *d* (also known as the standardized mean difference) by subtracting the mean (*M*) score of the control group at posttest from the *M* score of the treatment group at posttest and then dividing by the pooled standard deviation (*SD*) of the two groups (Lipsey & Wilson, 2001). For quasi-experiments, pretest differences between the treatment and control conditions were first adjusted by subtracting the *M* pretest score for each group from their *M* posttest score. All ESs were adjusted for small sample size bias (Hedges *g*; Hedges, 1982). For this review, we focused solely on ESs for writing quality because our goal was to explore how teaching self-regulation impacted students' overall writing performance. When a study utilized a holistic writing quality measure, we calculated the ES using this score. For studies that only included analytic writing quality measures, we calculated an ES for each assessed area and averaged them.

To accommodate for the different types of data structures, as well as inconsistencies in the information provided by authors, some adjustments and estimations were necessitated to calculate ESs (for detailed descriptions, see Bornstein, Hedges, Higgins, & Rothstein, 2009; Cooper, Hedges, & Valentine, 2009; and Schmidt & Hunter, 2015). For example, with some studies, it was necessary to estimate the posttest ES from covariate-adjusted posttest *M*s. In a few other instances, because the pre- and posttest measures were not identical, we had to calculate separate ESs for each measure and then obtain an adjusted ES by subtracting the pretest ES from the posttest ES. When necessary, we also estimated missing *M*s and *SD*s, using the available statistics. Prior to calculating some ESs, it was necessary to average the performance of two or more groups in each condition (e.g., grade levels) using the procedure recommended by Nouri and Greenberg (Cortina & Nouri, 2000).

Quasi-experiments that used an incorrect level of analysis (e.g., intact classrooms were assigned to conditions, but data were analyzed at the individual student level) were adjusted for clustering effects using the intraclass correlation (ICC) estimation formula recommended by Hedges (2007) (assuming equal cluster sizes, when necessary). Following the precedent established in previous writing meta-analysis (e.g., Graham et al., 2012), ICCs were imputed by adjusting reading comprehension estimates (Hedges & Hedberg, 2007) to reflect writing quality based on the data from Rock's (2007) large—though single-grade—study of writing.

Statistical Analysis of ESs

We made an a priori decision to only calculate an average weighted ES for a specific self-regulation procedure if its effectiveness was examined in at least four independent experiments. This threshold is consistent with the minimum criteria used in other meta-analyses (e.g., Graham & Perin, 2007) and represents a liberal, exploratory approach aimed at optimizing what can be learned from the available evidence (Pressley, Graham, & Harris, 2006). Recognizing the inherent limitations of drawing conclusions from a small number of studies, we computed a fail-safe N for each average weighted ES (i.e., the number of missing/additional studies needed to reverse a statistically significant finding) to provide information about the stability of the obtained results (Schmidt & Hunter, 2015).

We employed a weighted random-effects model in our analyses (Cooper et al., 2009). For each self-regulation category with at least four studies, we calculated an average weighted ES (weighted to account for sample size by multiplying each ES by its inverse variance), along with the corresponding confidence interval and level of statistical significance. As is commonly done with meta-analyses, we calculated the *Q* statistic to determine if ES variability exceeded what would be expected due to sampling error alone (Bornstein et al., 2009). However, since *Q* is underpowered when the analysis includes a small number of ESs (which was the case in our review), we used I^2 as a second measure of homogeneity because it is less sensitive to sample size. Finally, we examined the ES distributions to identify any outliers that could potentially distort the analysis. Five effects were Winsorized to ensure they did not exert a disproportionate influence for magnitude of effect (Eissa, 2009; Scott, 2009) or sample

size (Hacker et al., 2011; Harris et al., 2012; Thibodeau, 1963).

Final Sample of Included Studies

The final sample for this meta-analysis comprised 78 papers, published between 1963 and 2014. It included 79 independent experiments and yielded 87 ESs. Because of space constraints, the full list of references is not included in this chapter; however, citations for each coded study can be found in Tables 12.3 and 12.4, and the full reference list is available from the first author. Thirty-five of the 79 studies used a true random design, whereas 49 were quasi-experimental. Forty-nine were peer-reviewed journal articles, 25 were dissertations, and seven were other types of documents (e.g., conference paper, book chapter, unpublished manuscript). Altogether, the data set included 8,104 students in grades K–12. The majority of studies used a sample (or disaggregated subsample) made up of either of students representing the full range of literacy skills found in a typical general education classroom (k = 45) or students who experienced significant difficulty with literacy (k = 30). Far fewer focused specifically on students with average (k = 7) or above-average (k = 4) literacy skills. Of the studies included in our meta-analysis, six were described in Zimmerman and Risemberg's (1997) narrative review.

Results

Which Self-Regulation Processes Have Been Examined in at Least Four Studies?

Five of the ten self-regulatory processes described by Zimmerman and Risemberg (1997) were examined in at least four experiments that met our inclusion criteria: (1) *self-selected models, tutors, or books*; (2) *goal setting*; (3) *self-evaluative standards*; (4) *cognitive strategies* (which we divided into three more specific, and mutually exclusive, categories—cognitive strategies instruction; prewriting; and cognitive strategies instruction with versus without additional self-regulation), and (5) *mental imagery*. A summary of the findings for each self-regulation process is presented in Table 12.2. Information about the studies included in each category can be found in Tables 12.3 and 12.4.

TABLE 12.2. Summary of Findings

1. Self-selected models, tutors, or books
Category[a]: environmental restructuring
number of studies = 7
ES = 0.30***; CI = 0.19 – 0.42; Q = 5.31; I^2 = 0.00 37; Fail-safe N[b] = 37

2. Goal setting
Category[a]: personal
number of studies = 8
ES = 0.73***; CI = 0.54 – 0.93; Q = 13.28; I^2 = 47.29; Fail-safe N[b] = 107

3. Self-evaluative standards
Category[a]: personal
number of studies =12
ES = 0.51***; CI = 0.27 – 0.75; Q = 44.66***; I^2 = 75.37; Fail-safe N[b] = 204

4. Cognitive strategies instruction
Category[a]: personal
number of studies = 38

ES = 1.06***; CI = 0.82 – 1.29; Q = 245.19***; I^2 = 84.91; Fail-safe N[b] = 4138

4a. Prewriting
Category[a]: personal
number of studies = 13
ES = 0.55***; CI = 0.39 – 0.72; Q = 11.09; I^2 = 27.31; Fail-safe N[b] = 123

4b. Cognitive strategies instruction with additional self-regulation
Category[a]: personal
number of studies = 6
ES = 0.50**; CI = 0.16 – 0.83; Q = 7.27; I^2 = 31.18; Fail-safe N[b] = 15

5. Mental imagery
Category[a]: personal
number of studies = 4
ES = 0.76***; CI = 0.48 – 1.04; Q = 3.61; I^2 = 16.82; Fail-safe N[b] = 24

Note. ES, average weighted effect size for writing quality; CI, confidence interval.
[a]Corresponding triadic category in Zimmerman and Risemberg's (1997) model.
[b]Number of missing/additional studies needed to change this statistically significant finding.
$p < .05$; ** $p < .01$; *** $p \leq .001$.

TABLE 12.3. Summary of Studies[a] Examining Self-Selected Models, Tutors, or Books; Goal Setting; Self-Evaluative Standards; Prewriting; and Mental Imagery

Self-selected models, tutors, or books
Gaske (1991)[b]
Pub.: Dissertation
Grade: 4–5
Students: With and without disabilities, with significant literacy difficulties
N = 30
Description of conditions: As part of the prewriting stage in the writing process approach, students used predictable books as models to help construct their own text versus writing process approach without the use of models.
Genre: Narrative
Effect size for writing quality = 0.80

Knudson (1989)[b]
Pub.: Peer-reviewed journal
Grade: 4, 6, 8
Students: With above-average literacy skills
N = 46
Description of conditions: Students examined model pieces of writing to help construct their own text versus free writing.
Genre: Expository
Effect size for writing quality = 0.26

Knudson (1991)[b]
Pub.: Peer-reviewed journal
Grade: 4, 6, 8
Students: Represented the full-range of literacy skills
N = 76
Description of conditions: Students examined model pieces of writing to help construct their own text versus free

writing.
Genre: Persuasive
Effect size for writing quality = 0.24

A. E. Thibodeau (1963)
Pub.: Dissertation
Grade: 6
Students: Represented the full-range of literacy skills
N = 408
Description of conditions: Students examined model pieces of writing to help construct their own text versus existing language arts instruction.
Genre: Narrative
Effect size for writing quality = 0.44

Reedy (1964)
Pub.: Dissertation
Grade: 9
Students: Represented the full-range of literacy skills
N = 410
Description of conditions: Students examined the organizational patterns in model compositions to help organize their own text versus instruction on patterns of communication.
Genre: Expository
Effect size for writing quality = 0.26

Vinson (1980, Exp. 1)
Pub.: Dissertation
Grade: 9
Students: Represented the full-range of literacy skills
N = 118
Description of conditions: Students examined model pieces of writing for specific text features they can use in their own writing versus writing instruction and practice, without the use of models.
Genre: Expository
Effect size for writing quality = 0.18

Caplan & Keech (1980)
Pub.: Other
Grade: 12
Students: Represented the full-range of literacy skills
N = 129
Description of conditions: Students examined model pieces of writing to learn techniques for "showing" rather than "telling" versus existing writing instruction.
Genre: Narrative, persuasive
Effect size for writing quality = 0.12

Goal setting
Graham & Harris (2006)[b]
Pub.: Other
Grade: 4
Students: With and without disabilities, with significant literacy difficulties
N = 22
Description of conditions: Students established specific goals for revising versus a general revising goal to improve their text.
Genre: Narrative
Effect size for writing quality = 0.28

Schunk & Swartz (1993.2)[b, c] †
Pub.: Peer-reviewed journal
Grade: 4
Students: Represented the full-range of literacy skills
N = 20
Description of conditions: Students given a goal to write a specific type of paragraph versus a general goal to do their best.
Genre: Narrative, expository
Effect size for writing quality = 1.08

Ferretti et al. (2000)[b]
Pub.: Peer-reviewed journal
Grade: 4, 6
Students: Represented the full-range of literacy skills; with and without disabilities, with significant literacy difficulties
N = 124
Description of conditions: Students given a goal of writing persuasive text that included specific argumentative elements versus a general goal to write persuasive text.
Genre: Persuasive
Effect size for writing quality = 0.38

Ferretti et al. (2009)[b]
Pub.: Peer-reviewed journal
Grade: 4, 6
Students: Represented the full-range of literacy skills; with and without disabilities, with significant literacy difficulties
N = 96
Description of conditions: Students given a goal of writing persuasive text that included specific argumentative elements versus a general goal to write persuasive text.
Genre: Persuasive
Effect size for writing quality = 1.11

Midgette et al. (2008)[b]
Pub.: Peer-reviewed journal
Grade: 5
Students: Represented the full-range of literacy skills
N = 74
Description of conditions: Students given a specific revising goal to improve the reasons and evidence in their text versus a general revising goal to improve their text
Genre: Persuasive
Effect size for writing quality = 0.58

Schunk & Swartz (1993.1)[b, c] †
Pub.: Peer-reviewed journal
Grade: 5
Students: Represented the full-range of literacy skills
N = 30
Description of conditions: Students given a goal to write a specific type of paragraph versus a general goal to do their best.
Genre: Expository
Effect size for writing quality = 1.49

Graham et al. (1995)[b]
Pub.: Peer-reviewed journal
Grade: 5–6

Students: With and without disabilities, with significant literacy difficulties
N = 43
Description of conditions: Students given a specific revising goal to add three pieces of information versus a general revising goal to improve their text.
Genre: Narrative
Effect size for writing quality = 0.75

Page-Voth & Graham (1999)[b]
Pub.: Peer-reviewed journal
Grade: 7–8
Students: With and without disabilities, with significant literacy difficulties
N = 20
Description of conditions: Students given a goal to include common elements of persuasive text versus provided with general feedback about their compositions.
Genre: Narrative, expository
Effect size for writing quality = 1.13

Self-evaluative standards
Paquette (2009)
Pub.: Peer-reviewed journal
Grade: 2, 4
Students: Represented the full-range of literacy skills
N = 85
Description of conditions: Cross-age tutors were used to teach students how to self-evaluate with a rubric and revise their writing versus no intervention.
Genre: Not specified
Effect size for writing quality = 0.70

Andrade et al. (2008)
Pub.: Peer-reviewed journal
Grade: 2, 4
Students: Represented the full-range of literacy skills
N = 85
Description of conditions: Cross-age tutors were used to teach students how to self-evaluate with a rubric and revise their writing versus no intervention.
Genre: Not specified
Effect size for writing quality = 0.85

Guastello (2001)
Pub.: Other
Grade: 4
Students: Represented the full-range of literacy skills
N = 167
Description of conditions: Students taught to use a rubric to self-evaluate and revise their writing versus writing practice without a rubric.
Genre: Narrative, expository
Effect size for writing quality = 1.22

Young (2000)
Pub.: Dissertation
Grade: 4
Students: Represented the full-range of literacy skills
N = 161
Description of conditions: Students taught to use a rubric to self-evaluate their writing versus writing practice with teacher feedback.
Genre: Narrative, expository

Effect size for writing quality = 0.82

Ross et al. (1999)
Pub.: Peer-reviewed journal
Grade: 4–6
Students: Represented the full-range of literacy skills
N = 296
Description of conditions: As part of whole language instruction, students generated and were taught to use a rubric to self-evaluate their writing versus whole language only.
Genre: Narrative
Effect size for writing quality = 0.17

Fitzgerald & Markham (1987)[b, c †v]
Pub.: Peer-reviewed journal
Grade: 6
Students: Represented the full-range of literacy skills
N = 30
Description of conditions: Students taught a general problem-solving strategy that guided self-evaluation and revision their writing versus read and discussed literature.
Genre: Narrative
Effect size for writing quality = 0.31

Olson (1990)
Pub.: Peer-reviewed journal
Grade: 6
Students: Represented the full-range of literacy skills
N = 42
Description of conditions: Following general writing and revision instruction, students self-evaluated and revised their writing versus general writing instruction only.
Genre: Narrative
Effect size for writing quality = 0.18

Wolter (1975)
Pub.: Dissertation
Grade: 6
Students: Represented the full-range of literacy skills
N = 18
Description of conditions: Students taught how to self-evaluate their writing using a structured scoring form versus students given encouragement to improve their writing.
Genre: Narrative
Effect size for writing quality = 0.75

Reynolds et al. (1988, Exp. 1)
Pub.: Peer-reviewed journal
Grade: 6–8
Students: With and without disabilities, with significant literacy difficulties
N = 53
Description of conditions: Students taught to use two strategies that guided self-evaluation and revision versus no intervention.
Genre: Narrative
Effect size for writing quality = 0.15

Andrade & Boulay (2003)
Pub.: Peer-reviewed journal
Grade: 7–8

Students: Represented the full range of literacy skills
N = 107
Description of conditions: Students taught to use a rubric to self-evaluate and revise drafts versus students given a rubric, but not provided with any self-evaluation instruction.
Genre: Expository
Effect size for writing quality = 0.00

Wise (1992)
Pub.: Dissertation
Grade: 8
Students: With average literacy skills
N = 87
Description of conditions: Students taught how to use a strategy that guided self-evaluation and revision versus students encouraged to revise their writing.
Genre: Persuasive
Effect size for writing quality = 0.62

Duke (2003)[b]
Pub.: Dissertation
Grade: 10–12
Students: Represented the full-range of literacy skills
N = 164
Description of conditions: Students provided with a rubric and taught how to use it for self-evaluation with a cognitive strategies approach versus students provided with a rubric and given an overview of the criteria.
Genre: Expository
Effect size for writing quality = 0.29

Prewriting
Moore & Caldwell (1993)[b]
Pub.: Peer-reviewed journal
Grade: 2–3
Students: Represented the full-range of literacy skills
N = 63
Description of conditions: Before writing, students generated ideas using drama techniques or storyboarding versus using a traditional class discussion format.
Genre: N
Effect size for writing quality = 0.88

Norris et al. (1997)[b]
Pub.: Peer-reviewed journal
Grade: 3
Students: Represented the full-range of literacy skills
N = 119
Description of conditions: Before writing, students generated ideas by drawing versus students wrote without prewriting.
Genre: Narrative
Effect size for writing quality = 0.56

Kurtz (1987, Exp. 1)
Pub.: Dissertation
Grade: 3–6
Students: With and without disabilities, with significant literacy difficulties
N = 12
Description of conditions: Students taught a strategy to generate and organize ideas prior to writing versus writing practice and feedback, without prewriting.

Genre: Narrative
Effect size for writing quality = 0.87

Loader (1989)
Pub.: Dissertation
Grade: 4
Students: With average literacy skills
N = 47
Description of conditions: Students taught to organize their ideas using a semantic organizer versus in list form.
Genre: Expository
Effect size for writing quality = 0.44

McNulty (1980)
Pub.: Dissertation
Grade: 4
Students: Represented the full-range of literacy skills
N = 160
Description of conditions: Student brainstormed and discussed ideas prior to writing versus brainstorming only.
Genre: Narrative
Effect size for writing quality = 0.43

Doan (2008)[b]
Pub.: Dissertation
Grade: 4–5
Students: Represented the full-range of literacy skills
N = 32
Description of conditions: Students taught to use the internet to gather information prior to writing versus writing practice.
Genre: Expository
Effect size for writing quality = 0.79

Brodney et al. (1999, Exp. 1)[b]
Pub.: Peer-reviewed journal
Grade: 5
Students: Represented the full-range of literacy skills
N = 51
Description of conditions: After watching a video, students were provided with additional topical reading material and prompted to organize their ideas prior to writing versus students wrote after watching a video, without supplemental reading or prewriting.
Genre: Expository
Effect size for writing quality = 0.95

Brodney et al. (1999, Exp. 2)[b]
Pub.: Peer-reviewed journal
Grade: 5
Students: Represented the full-range of literacy skills
N = 49
Description of conditions: After watching a video, students were prompted to organize their ideas prior to writing versus students wrote after watching a video, without prewriting.
Genre: Expository
Effect size for writing quality = 0.17

Reece & Cumming (1996.4)[b]
Pub.: Other
Grade: 5–6

Students: Represented the full-range of literacy skills
N = 20
Description of conditions: Students learned to compose using dictation and were taught to plan and organize their ideas prior to writing versus students learned to compose using dictation, without prewriting.
Genre: Expository
Effect size for writing quality = 0.86

A. L. Thibodeau (1963)
Pub.: Dissertation
Grade: 6
Students: Represented the full-range of literacy skills
N = 500
Description of conditions: Students completed a series of thinking and planning activities prior to writing versus existing writing instruction focused on mechanics and usage.
Genre: Narrative
Effect size for writing quality = 0.38

Blair (2003)
Pub.: Dissertation
Grade: 7–8
Students: With and without disabilities, with significant literacy difficulties
N = 18
Description of conditions: As part of daily writing practice, students used story webs to organize their ideas prior to writing versus daily writing practice, without story webbing.
Genre: Expository
Effect size for writing quality = 0.01

Vinson (1980, Exp. 2)
Pub.: Dissertation
Grade: 9
Students: Represented the full-range of literacy skills
N = 109
Description of conditions: Before writing, students worked collaboratively to brainstorm and record ideas versus writing instruction and practice, without prewriting.
Genre: Expository
Effect size for writing quality = 0.58

Bulgren et al. (2009)[b]
Pub.: Peer-reviewed journal
Grade: 9–12
Students: Represented the full-range of literacy skills
N = 36
Description of conditions: Students taught to use a Question Exploration routine and graphic organizer to take notes that would be used to write an essay versusgeneral writing instruction, without emphasis on prewriting.
Genre: Expository
Effect size for writing quality = 1.37

Mental imagery
Jampole et al. (1994)[b] †
Pub.: Peer-reviewed journal
Grade: 3–4
Students: With above-average literacy skills
N = 87
Description of conditions: Students learned to use mental imagery to enhance sensory descriptions versusstudents listened to and discussed short stories and practiced writing.

Genre: Narrative
Effect size for writing quality = 0.84

Fortner (1986)
Pub.: Peer-reviewed journal
Grade: 3–6
Students: With and without disabilities, with significant literacy difficulties
N = 49
Description of conditions: Students participated in New Directions in Creativity program and collaborative brainstorming to enhance their creative ideas versusexisting language arts instruction.
Genre: Narrative
Effect size for writing quality = 1.03

Jampole et al. (1991)[b, c]
Pub.: Peer-reviewed journal
Grade: 4–5
Students: With above-average literacy skills
N = 37
Description of conditions: Students learned to use mental imagery to enhance sensory descriptions versusstudents listened to and discussed short stories.
Genre: Narrative
Effect size for writing quality = 0.82

Stoddard (1982)
Pub.: Dissertation
Grade: 5–6
Students: With above-average literacy skills
N = 120
Description of conditions: Students participated in New Directions in Creativity program and sentence-combining instruction versus no intervention.
Genre: Narrative
Effect size for writing quality = 0.23

Note. Exp., experiment.

Within each category, studies are listed by grade level, in ascending order.

[a]Separate studies within a publication designated with .1, .2, etc. Experiments within a study are designated as Exp. 1, Exp. 2, etc.

[b]True random experiment.

[c]Study included in Zimmerman and Risemberg (1997).

TABLE 12.4. Summary of Studies[a] Examining the Use of Cognitive Strategies Instruction

Cognitive strategies instruction
Harris et al. (2006, Exp. 1)[b]
Pub.: Peer-reviewed journal
Grade: 2
Students: With and without disabilities, with significant literacy difficulties
N = 42
Description of conditions: Students taught POW + TREE and POW + WWW strategies versus existing process writing instruction.
Genre: Narrative, persuasive
Strategy: Planning, drafting[d]
Effect size for writing quality = 1.89

Lane et al. (2011)[b]
Pub.: Peer-reviewed journal
Grade: 2
Students: With and without disabilities, with significant literacy difficulties
N = 44
Description of conditions: Students taught POW + TREE and POW + WWW strategies versus no intervention.
Genre: Narrative, persuasive
Strategy: Planning, drafting[d]
Effect size for writing quality = 0.68

Harris et al. (2014)
Pub.: Peer-reviewed journal
Grade: 2–3
Students: With and without disabilities, with significant literacy difficulties
N = 51
Description of conditions: Students taught POW + TREE strategy versus existing process and skill writing instruction.
Genre: Narrative
Strategy: Planning, drafting[d]
Effect size for writing quality = 0.87

Harris, Lane, Driscoll et al. (2012)
Pub.: Peer-reviewed journal
Grade: 2–3
Students: Represented the full-range of literacy skills
N = 56
Description of conditions: Students taught POW + WWW strategy or POW + TREE strategy versus performance in non-instructed genre.
Genre: Narrative, persuasive
Strategy: Planning, drafting[d]
Effect size for writing quality = 1.17

Harris, Lane, Graham et al. (2012)[b]
Pub.: Peer-reviewed journal
Grade: 2–3
Students: Represented the full-range of literacy skills
N = 262
Description of conditions: Students taught POW + WWW or POW + TREE strategy versus performance in non-instructed genre.
Genre: Narrative, persuasive
Strategy: Planning, drafting[d]
Effect size for writing quality = 1.47

Graham et al. (2005, Exp. 1)[b]
Pub.: Peer-reviewed journal
Grade: 3
Students: With and without disabilities, with significant literacy difficulties
N = 48
Description of conditions: Students taught POW + TREE and POW + WWW strategies versus existing process writing instruction.
Genre: Narrative, persuasive
Strategy: Planning, drafting[d]
Effect size for writing quality = 1.78

Tracy et al. (2009)

Pub.: Peer-reviewed journal
Grade: 3
Students: Represented the full-range of literacy skills
N = 127
Description of conditions: Students taught POW + WWW strategy versus existing skill-focused writing instruction.
Genre: Narrative
Strategy: Planning, drafting[d]
Effect size for writing quality = 0.25

Curry (1997)
Pub.: Dissertation
Grade: 4
Students: With and without disabilities, with significant literacy difficulties
N = 48
Description of conditions: Students taught brainstorming and WWW strategy versus existing skill-focused writing instruction.
Genre: Narrative
Strategy: Planning, drafting[d]
Effect size for writing quality = 0.57

Glaser & Brunstein (2007, Exp. 1)
Pub.: Peer-reviewed journal
Grade: 4
Students: Represented the full-range of literacy skills
N = 79
Description of conditions: Students taught three strategies versus existing writing instruction.
Genre: Narrative
Strategy: Planning, drafting[d]
Effect size for writing quality = 1.19

Kiuhara et al. (2011)[b]
Pub.: Other
Grade: 4
Students: Represented the full-range of literacy skills
N = 227
Description of conditions: Students taught COUNT and Plan FAST strategies versus existing process and skill-focused writing instruction.
Genre: Narrative
Strategy: Planning, drafting[d]
Effect size for writing quality = 1.12

Walser (2000)[b]
Pub.: Dissertation
Grade: 4
Students: With above average literacy skills; with average literacy skills
N = 41
Description of conditions: Students taught a strategy versus text structure instruction and writing practice.
Genre: Narrative
Strategy: Planning, drafting, revising
Effect size for writing quality = 0.67

Warrington (1999)
Pub.: Dissertation
Grade: 4

Students: Represented the full-range of literacy skills
N = 92
Description of conditions: Students taught semantic web strategy versus existing process writing instruction.
Genre: Narrative
Strategy: Planning
Effect size for writing quality = 0.52

Englert et al. (1991)
Pub.: Peer-reviewed journal
Grade: 4–5
Students: With above average literacy skills; with and without disabilities, with significant literacy difficulties
N = 174
Description of conditions: Students taught POWER set of strategies versus existing process writing instruction.
Genre: Expository
Strategy: Planning, drafting, revising, editing
Effect size for writing quality = 0.50

Troia & Graham (2002)[b]
Pub.: Peer-reviewed journal
Grade: 4–5
Students: With and without disabilities, with significant literacy difficulties
N = 20
Description of conditions: Students taught STOP + LIST strategy versus process writing instruction.
Genre: Narrative
Strategy: Planning, drafting
Effect size for writing quality = 0.83

MacArthur et al. (1991)
Pub.: Peer-reviewed journal
Grade: 4–6
Students: With and without disabilities, with significant literacy difficulties
N = 29
Description of conditions: Students taught a reciprocal peer strategy versus existing process writing instruction.
Genre: Narrative
Strategy: Revising, editing[d]
Effect size for writing quality = 1.33

Anderson (1997)[b]
Pub.: Dissertation
Grade: 5
Students: Represented the full-range of literacy skills; with and without disabilities, with significant literacy difficulties
N = 45
Description of conditions: Students taught WWW strategy *versus* grammar instruction.
Genre: Narrative
Strategy: Planning, drafting[d]
Effect size for writing quality = 1.49

Garcia-Sanchez & Fidalgo-Renondo (2006)[b]
Pub.: Peer-reviewed journal
Grade: 5–6
Students: With and without disabilities, with significant literacy difficulties
N = 121
Description of conditions: Students taught POD + THE VOWELS and RED strategies using SRSD or strategies using the social cognitive model of sequential skill acquisition versus existing skill-focused writing instruction.

Genre: Expository
Strategy: Planning, drafting, revising[d]
Effect size for writing quality = 2.24

Sawyer et al. (1992, Exp. 1)[c]
Pub.: Peer-reviewed journal
Grade: 5–6
Students: With and without disabilities, with significant literacy difficulties
N = 21
Description of conditions: Students taught WWW strategy versus writing practice.
Genre: Narrative
Strategy: Planning, drafting[d]
Effect size for writing quality = 0.63

De La Paz & Graham (1997)[b]
Pub.: Peer-reviewed journal
Grade: 5–7
Students: With and without disabilities, with significant literacy difficulties
N = 21
Description of conditions: Students taught STOP + DARE strategy versus text structure instruction and writing practice.
Genre: Persuasive
Strategy: Planning, drafting[d]
Effect size for writing quality = 0.92

Fitzgerald & Markham (1987)[b]
Pub.: Peer-reviewed journal
Grade: 6
Students: Represented the full-range of literacy skills
N = 30
Description of conditions: Students taught a revising strategy versus read and discussed literature.
Genre: Narrative
Strategy: Revising
Effect size for writing quality = 0.31

Meltzer (2006)
Pub.: Dissertation
Grade: 6
Students: With above average literacy skills; with and without disabilities, with significant literacy difficulties
N = 64
Description of conditions: Students taught a co-constructed strategy or STOP + DARE strategy versus process writing instruction.
Genre: Persuasive
Strategy: Planning, drafting[d]
Effect size for writing quality = 0.74

Scardamalia et al. (1984)
Pub.: Peer-reviewed journal
Grade: 6
Students: Represented the full-range of literacy skills
N = 62
Description of conditions: Students taught strategies for self-reflection versus practice with planning and taking notes.
Genre: Persuasive, expository
Strategy: Planning, drafting[d]

Effect size for writing quality = 0.65

Torrance et al. (2007)
Pub.: Peer-reviewed journal
Grade: 6
Students: Represented the full-range of literacy skills
N = 95
Description of conditions: Students taught two strategies versus existing skill-focused writing instruction.
Genre: Expository
Strategy: Planning, revising[d]
Effect size for writing quality = 3.19

Welch (1992)
Pub.: Peer-reviewed journal
Grade: 6
Students: With and without disabilities, with significant literacy difficulties
N = 18
Description of conditions: Students taught PLEASE and COPS strategies versus existing skill-focused writing instruction.
Genre: Expository
Strategy: Planning, drafting, editing
Effect size for writing quality = 1.72

Wong et al. (2008)
Pub.: Peer-reviewed journal
Grade: 6
Students: With average literacy skills
N = 55
Description of conditions: Students taught CHAIR strategy versus less explicit CHAIR writing procedure.
Genre: Persuasive
Strategy: Planning, drafting[d]
Effect size for writing quality = 0.41

Reynolds et al. (1988, Exp. 2)
Pub.: Peer-reviewed journal
Grade: 6–8
Students: With and without disabilities, with significant literacy difficulties
N = 53
Description of conditions: Students taught Evaluative and Directive Phrases and COPS strategies versus no intervention.
Genre: Expository
Strategy: Revising, editing
Effect size for writing quality = 0.16

Welch & Jenson (1990)
Pub.: Peer-reviewed journal
Grade: 6–8
Students: With and without disabilities, with significant literacy difficulties
N = 114
Description of conditions: Students taught PLEASE and COPS strategies versus existing skill-focused writing instruction.
Genre: Expository
Strategy: Planning, drafting, editing
Effect size for writing quality = 0.72

Gamelin (1996)
Pub.: Dissertation
Grade: 7
Students: Represented the full-range of literacy skills
N = 52
Description of conditions: Students taught POWER set of strategies and COPS strategy versus existing process writing instruction.
Genre: Expository
Strategy: Planning, drafting, revising, editing
Effect size for writing quality = 0.98

Hacker et al. (2011)
Pub.: Other
Grade: 7
Students: Represented the full-range of literacy skills
N = 508
Description of conditions: Students taught DARE strategy versus existing writing instruction.
Genre: Persuasive
Strategy: Planning, drafting[d]
Effect size for writing quality = 0.18

Jones (2001)
Pub.: Dissertation
Grade: 7
Students: With and without disabilities, with significant literacy difficulties
N = 20
Description of conditions: Students taught TREE strategy versus existing writing instruction.
Genre: Persuasive
Strategy: Planning, drafting[d]
Effect size for writing quality = 0.73

Yeh (1998)
Pub.: Peer-reviewed journal
Grade: 7
Students: Represented the full-range of literacy skills
N = 110
Description of conditions: As part of the process writing approach, students taught two heuristic strategies versus process writing instruction only.
Genre: Persuasive
Strategy: Planning
Effect size for writing quality = 0.14

De La Paz & Graham (2002)
Pub.: Peer-reviewed journal
Grade: 7–8
Students: Represented the full-range of literacy skills
N = 58
Description of conditions: Students taught PLAN+WRITE strategy versus existing skill-focused writing instruction.
Genre: Expository
Strategy: Planning, drafting[d]
Effect size for writing quality = 2.63

Mason et al. (2013)
Pub.: Peer-reviewed journal

Grade: 7–8
Students: With and without disabilities, with significant literacy difficulties
N = 84
Description of conditions: Students taught POW+TREE strategy versus no intervention.
Genre: Persuasive, quick writing
Strategy: Planning, drafting[d]
Effect size for writing quality = 0.85

De La Paz (2005)
Pub.: Peer-reviewed journal
Grade: 8
Students: Represented the full-range of literacy skills
N = 132
Description of conditions: Students taught historical reasoning and STOP + DARE strategies *versus* existing reading and writing instruction in social studies class.
Genre: Persuasive
Strategy: Planning, drafting[d]
Effect size for writing quality = 1.30

Simmons et al. (1994)
Pub.: Other
Grade: 8
Students: Represented the full-range of literacy skills
N = 101
Description of conditions: Students taught genre-specific strategies versus general writing strategy and text structure instruction.
Genre: Narrative
Strategy: Persuasive, revising
Effect size for writing quality = 0.40

Eissa (2009)[b]
Pub.: Peer-reviewed journal
Grade: 9
Students: With and without disabilities, with significant literacy difficulties
N = 77
Description of conditions: Students taught DARE strategy versus existing writing instruction.
Genre: Persuasive
Strategy: Planning, drafting[d]
Effect size for writing quality = 4.14

Scott (2009)[b]
Pub.: Dissertation
Grade: 9–10
Students: With and without disabilities, with significant literacy difficulties
N = 56
Description of conditions: Students taught POW + TREE strategy *versus* no intervention.
Genre: Persuasive
Strategy: Planning, drafting[d]
Effect size for writing quality = 0.58

Bryson & Scardamalia (1996)[b]
Pub.: Peer-reviewed journal
Grade: 10
Students: Represented the full-range of literacy skills; with and without disabilities, with significant literacy difficulties

N = 31
Description of conditions: Students taught strategies for self-reflection versus text structure instruction.
Genre: Persuasive
Strategy: Planning, drafting
Effect size for writing quality = 1.24

Adding self-regulation to cognitive strategies instruction
Harris et al. (2006, Exp. 2)[b]
Pub.: Peer-reviewed journal
Grade: 2
Students: With and without disabilities, with significant literacy difficulties
N = 43
Description of conditions: Strategy instruction with versus without peer collaboration focused on goal setting, self-evaluating, and self-monitoring.
Genre: Narrative, persuasive
Strategy: Planning, drafting[d]
Effect size for writing quality = 0.32

Graham et al. (2005, Exp. 2)[b]
Pub.: Peer-reviewed journal
Grade: 3
Students: With and without disabilities, with significant literacy difficulties
N = 48
Description of conditions: Strategy instruction with versus without peer collaboration focused on goal setting, self-evaluating, and self-monitoring.
Genre: Narrative, persuasive
Strategy: Planning, drafting[d]
Effect size for writing quality = 0.13

Kurtz (1987, Exp. 2)
Pub.: Dissertation
Grade: 3–6
Students: With and without disabilities, with significant literacy difficulties
N = 12
Description of conditions: Strategy instruction with versus without instruction in self-evaluating.
Genre: Narrative
Strategy: Planning
Effect size for writing quality = 1.09

Brunstein & Glaser (2011)[b]
Pub.: Peer-reviewed journal
Grade: 4
Students: Represented the full-range of literacy skills
N = 117
Description of conditions: Strategy instruction with versus without instruction in goal setting, self-evaluating, and self-monitoring.
Genre: Narrative
Strategy: Planning, drafting[d]
Effect size for writing quality = 0.86

Glaser & Brunstein (2007, Exp. 2)
Pub.: Peer-reviewed journal
Grade: 4
Students: Represented the full-range of literacy skills
N = 75

Description of conditions: Strategy instruction with versus without instruction in goal setting, self-evaluating, and self-monitoring.
Genre: Narrative
Strategy: Planning, drafting[d]
Effect size for writing quality = 0.87

Sawyer et al. (1992, Exp. 2)[c]
Pub.: Peer-reviewed journal
Grade: 5–6
Students: With and without disabilities, with significant literacy difficulties
N = 22
Description of conditions: Strategy instruction with versus without instruction in goal setting, self-evaluating, and self-monitoring.
Genre: Narrative
Strategy: Planning[d]
Effect size for writing quality = 0.02

Note. J, peer-reviewed journal; D, dissertation; O, other; F, students represented the full-range of literacy skills; S, students (with and without disabilities) with significant literacy difficulties; A, students with average literacy skills; H, students with above average literacy skills; N, narrative; P, persuasive; E = expository; QW, quick writing; P = planning; D, drafting; R, revising; E, editing; ES, effect size for writing quality; NS, not specified. Within each category, studies are listed by grade level, in ascending order.

[a]Separate studies within a publication designated with .1, .2, etc. Experiments within a study are designated as Exp. 1, Exp. 2, etc.

[b]True random experiment.

[c]Study included in Zimmerman and Risemberg (1997).

[d]Strategy taught using the self-regulated strategy development model.

Which Self-Regulation Processes Are Supported by the Empirical Evidence?

Self-Selected Models, Tutors, or Books

We located seven studies that examined the impact of having students use models, tutors, or books to enhance their writing. Although the name of this category denotes "self-selection," the description and supporting research provided by Zimmerman and Risemberg (1997) suggests variability in how that is enacted. Because our focus was on K–12 students, we included studies that examined the impact of models selected either by students (i.e., self-selected) or by the teacher. Together, these studies included 1,217 students in grades 4, 5, 6, 8, 9, and 12; most represented the full range of literacy skills found in a general education classroom. The intervention conditions involved students analyzing and seeking to emulate different types of text materials, such as published books, teacher-constructed samples, or peer-written compositions. In some studies, the focus was on teaching about general characteristics and features of good writing, whereas in others it was more specific (e.g., a particular linguistic technique). All of the comparison conditions involved writing instruction/practice without models. In all seven studies, the use of model texts improved the quality of students' writing. The average weighted ES of 0.30 was statistically significant, and 37 missing studies would be needed to reverse that finding. The *Q* test was not significant, and I^2 indicated that the variance was entirely attributable to within-study factors.

Goal Setting

The impact of goal setting was examined in eight studies that included a total of 429 students in grades 4–8. Students representing the full range of literacy skills and students with literacy difficulties were included in this sample. In five studies, the intervention involved goals related to drafting text (e.g., include at least three reasons to support your point of view and at least two likely refutations), whereas the other three targeted revising (e.g., add three new ideas to your essay). In all but one study, the goals were established by teachers. All of the comparison conditions involved generic goals or feedback (e.g., write a good persuasive essay). Goal setting had a positive impact on students' writing quality in all eight studies. The average weighted ES was 0.73, and changing this statistically significant finding would require 107 missing studies. The *Q* test was not significant, but I^2 indicated moderate inconsistency, with 47% of the variance resulting from between-study factors.

Self-Evaluative Standards

Self-evaluation was examined in 12 studies that included 1326 students in grades 2–8 and 10–12, most of whom represented the full range of literacy skills. In 11 of the experiments, students' self-evaluation and revision processes were guided by the use of standards (e.g., rubric or scoring guide) and/or a strategy. The comparison conditions varied: Seven involved writing instruction/practice without self-evaluation; three involved no (or an unrelated) intervention; and two involved providing students with rubrics, but not instruction regarding how to use them. Eleven studies reported a positive effect. One experiment that compared self-evaluation with instruction versus without instruction found no difference between these two conditions. The average weighted ES of 0.51 was statistically significant, and 204 missing studies would be needed to reverse that finding. The effects in this category were quite heterogeneous, as evidenced by the significant *Q* test and I^2 value indicating that 75% of the variance was due to between-study factors.

Cognitive Strategy Instruction

As noted previously, we divided cognitive strategies into three mutually exclusive sets of studies. The impact of cognitive strategies instruction, the first of these three, was examined in 38 studies that included 3,268 students in grades 2–10. All of the intervention conditions involved students learning to use general and/or genre-specific cognitive strategies to guide the composing process. The self-regulated strategy development (SRSD) model (e.g., Graham & Harris, 2005; Harris et al., 2009) was used in 25 of the 38 experiments. Most comparison conditions involved writing instruction/practice without cognitive strategies (e.g., process writing approach, skill-focused instruction) (k = 30). However, one consisted of less explicit strategy instruction, and a few involved no (or an unrelated) intervention (k = 7). Teaching students to use cognitive strategies enhanced writing quality in all 38 studies. The average weighted ES was 1.06, with 4,138 missing studies needed to reverse the statistical significance. Both the significant *Q* test and I^2 value (84.91) indicated considerable heterogeneity among the analyzed effects. Although we did not conduct moderator analysis as part of our review, results from previous meta-analysis suggest that the instructional model used to teach cognitive strategies is likely a contributory factor to this variance. Specifically, SRSD has been shown to produce significantly greater effects than non-SRSD interventions. For example, Graham et al. (2012) found the average weighted ES for SRSD was 1.14, compared with 0.59 for all other instructional approaches.

The second subcategory of cognitive strategies was prewriting. *Prewriting* was addressed in 13 studies that

included 1,216 students in grades 2–12, most of whom represented the full range of literacy skills. In the intervention conditions, students generated, gathered, and/or organized writing content in a variety of ways, such as through drawing, using different types of graphic organizers, watching videos, and reading relevant materials. In the control conditions, students either wrote without prewriting (k = 9) or generated ideas using less structured formats (k = 3). All 12 studies showed a positive effect, and the average weighted ES of 0.55 was statistically significant. Reversing this finding would require 123 missing studies. The Q test was not significant, and I^2 indicated that between-study factors accounted for 27% of the variance.

Six studies addressed the difference between *cognitive strategies instruction with and without additional self-regulation procedures* (i.e., goal setting, self-evaluation, and self-monitoring), the third subcategory of cognitive strategies. They included 317 students in grades 2–6. Four studies focused on students with literacy difficulties, and two included students representing the full range of literacy skills. A positive effect was reported in all six studies, and the average weighted ES was 0.50. Fifteen missing studies would need to be located to reverse this statistically significant finding. The Q test was not significant, and I^2 indicated that 31% of the variance was due to between study factors.

Mental Imagery

Four studies that included 293 students in grades 3–6 examined the impact of teaching students to use mental imagery during the writing process. Three studies focused on students with average literacy skills, and one included students with literacy difficulties. In the intervention conditions, students learned to use mental imagery to promote general creativity (k = 2) or enhance sensory descriptions (k = 2). In three studies, the comparison condition was another type of literacy instruction, whereas one study used a no-intervention control. All four studies showed positive effects. The average weighted ES of 0.76 was statistically significant, with 24 missing studies needed to reverse that finding. The Q test was not significant, and the I^2 value of 16.82 indicated that the majority of variance was due to within-study factors.

Conclusion and Discussion

Overall, the results of our meta-analysis suggest that teaching students how to self-regulate the writing process improves the quality of their compositions. All five self-regulation processes that had been examined in at least four studies produced a statistically significant and practically meaningful average weighted ES. According to Cohen's basic guidelines for interpreting ESs, the effect for using models, tutors or books (0.30) is small; the effects for self-evaluative standards (0.51), goal setting (0.73), and mental imagery (0.76) are moderate; and the effect for cognitive strategies instruction (1.06) is large. The effects for both subcategories related to cognitive strategies—prewriting (0.55) and adding additional self-regulation to cognitive strategies instruction (0.50)—are moderate. All of these effects are considered "substantively important" using the standards developed by the Institute of Education Sciences (2014).

With regard to Zimmerman and Risemberg's (1997) model, our findings are likely best interpreted as offering strong—though notably incomplete—support. Although we found positive effects for these five self-regulation processes, we were unable to calculate the impact of the other five (i.e., environmental structuring, self-monitoring, self-consequenting, self-verbalization, and time planning and management), due to a lack of available research. Interestingly, environmental structuring and self-consequenting were the two self-regulation processes Zimmerman and Risemberg indicated as having the least amount of empirical support, and the category with the most cited

studies, cognitive strategies, was also the largest in our review. Thus, the pattern of research addressing these processes appears to have remained relatively consistent over time. It is also worth mentioning that although we were unable to locate at least four studies that specifically examined five of the ten self-regulation processes (such that we could compute an average weighted ES), they were often included as part of cognitive strategies instruction (e.g., as part of SRSD instruction, students learn to use self-instructions). Further, several of the five processes for which we did find sufficient studies are also often incorporated in cognitive strategies instruction. For example, with SRSD, students frequently learned how to structure their writing environment, analyze model texts, use self-speech, self-monitor their writing performance, graph their performance, and review performance graphs as one means of self-reinforcement (a form of self-consequenting).

RECOMMENDATIONS FOR FUTURE RESEARCH

One set of recommendations for future research follows simply from these conclusions: We need more research on the role of environmental structuring, self-monitoring, self-consequenting, self-verbalization, and time planning and management in terms of writing performance. Although our meta-analysis indicates that we have some research related to models, tutors or books; self-evaluation; goal setting; mental imagery; and cognitive strategies instruction, we clearly need to know more about these five self-regulation processes. For example, some grade levels have been given scant attention, thus far, and little research has been done on these varying self-regulation processes across genres, which may be important.

Of particular importance is the lack of developmental research on writing. Presently, there are few longitudinal studies examining writing development over time, and the studies that are available do not focus on self-regulation and writing for the most part (cf. Berninger & Abbott, 2010). When self-regulation has been studied, it has mostly involved cross-sectional studies of planning and revising (e.g., Limpo, Alves, & Fidalgo, 2013), showing that these skills become more sophisticated as students move from the elementary grades to secondary school. Without instruction, however, planning and revising behaviors do not consistently contribute to predicting how well students' write until they move into the secondary grades (Graham, 2006).

This lack of developmental research has far-reaching implications for both research and practice. Developmental research is needed to inform instructional/intervention research as well as policy. For example, given the challenges with writing faced by students and adults, the importance of writing is well recognized in the new Common Core State Standards (CCSS, 2012) in the United States. Unfortunately, the developers of the CCSS in writing did not have a strong research base to rely on in the development of standards for writing instruction. Without developmental and instructional research to indicate what writing skills, knowledge, and processes should be mastered and when, the writing benchmarks in CCSS represent educated guesses (Graham & Harris, 2013).

Finally, we focused on one model of writing that emphasizes the role of self-regulation processes in writing development: Zimmerman and Risemberg's (1997). Future research on the development and impact of self-regulation in writing should address either other models or an integration across writing models.

ACKNOWLEDGMENTS

During the writing of this chapter, Karen R. Harris and Steve Graham served as Professorial Fellows in the Faculty of Education at Australian Catholic University in Brisbane, Australia, as well as on the faculty of Arizona State University.

REFERENCES

Bereiter, C., & Scardamalia, M. (1987). *The psychology of written composition*. Hillsdale, NJ: Erlbaum.

Berninger, V., & Abbott, R. (2010). Longitudinal relationships of levels of language in writing and between writing and reading in grades 1 to 7. *Journal of Educational Psychology, 102,* 281–298.

Bornstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2009). *Introduction to meta-analysis*. West Sussex, UK: Wiley.

CCSS. (2010). Common Core State Standards: National Governors Association and Council of Chief School Officers. Retrieved from: *http://www.corestandards.org/ELA-Literacy*.

Cooper, H., Hedges, L. V., & Valentine, J. C. (2009). *The handbook of research syntheses and meta-analysis* (2nd ed.). New York: Russell Sage.

Cortina, J. M., & Nouri, H. (2000). *Effect size for ANOVA designs* (Sage University Paper Series on Quantitative Applications in the Social Sciences, 07-129). Thousand Oaks, CA: Sage.

de Beaugrande, R. (1984). *Text production: Toward a science of composition*. Norwood, NJ: Ablex.

Dignath, C. (2011). Assessing students' acquisition of self-regulated learning skills using meta-analysis. In B. J. Zimmerman & D. H. Schunk (Eds.), *Handbook of self-regulation of learning and performance* (pp. 376–390). New York: Routledge.

Eissa, M. A. (2009). The effectiveness of a program based on self-regulated strategy development on the writing skills of writing-disabled secondary school students. *Electronic Journal of Research in Educational Psychology, 7*, 5–25.

Emig, J. (1971). *The composing processes of twelfth graders.* Urbana, IL: National Council of Teachers of English.

Fitzgerald, J., & Shanahan, T. (2000). Reading and writing relations and their development. *Educational Psychologist, 35*(1), 39–50.

Graham, S. (2006). Writing. In P. Alexander & P. Winne (Eds.), *Handbook of educational psychology* (pp. 457–478). Mahwah, NJ: Erlbaum.

Graham, S., & Harris, K. R., (2005). *Writing better: Effective strategies for teaching students with learning difficulties.* Baltimore, MD: Brookes.

Graham, S., & Harris, K. R. (2013). Common Core State Standards, writing, and students with LD. *Learning Disabilities Research and Practice, 28*, 28–37.

Graham, S., McKeown, D., Kiuhara, S., & Harris, K. R., (2012). A meta-analysis of writing instruction for students in the elementary grades. *Journal of Educational Psychology, 104*, 879–896.

Graham, S., & Perin, D. (2007). A meta-analysis of writing instruction for adolescent students. *Journal of Educational Psychology, 99*, 445–476.

Hacker, D., Dole, J., Ferguson, M., Adamson, S., Roundy, L., & Scarpulla, L. (2011). *The short-term and long-term writing gains using self-regulated strategy development in middle school*. Unpublished manuscript.

Harris, K. R., Graham, S., Brindle, M., & Sandmel, K. (2009). Metacognition and children's writing. In D. Hacker, J. Dunlosky, & A. Graesser (Eds.), *Handbook of metacognition in education* (pp. 131–153). Mahwah, NJ: Erlbaum.

Harris, K. R., Lane, K. L., Graham, S., Driscoll, S., Sandmel, K., Brindle, M., et al. (2012). Practice-based professional development for self-regulated strategies development in writing: A randomized controlled study. *Journal of Teacher Education, 63*, 103–119.

Harris, K., Santangelo, T., & Graham, S. (2010). Metacognition and strategy instruction in writing. In H. S. Waters

& W. Schneider (Eds.), *Metacognition, strategy use, and instruction* (pp. 226–256). New York: Guilford Press.

Hayes, J. (1996). A new framework for understanding cognition and affect in writing. In M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences, and applications* (pp. 1–27). Mahwah, NJ: Erlbaum.

Hayes, J., & Flower, L. (1980). Identifying the organization of writing processes. In L. Gregg & E. Steinberg (Eds.), *Cognitive processes in writing* (pp. 3–30). Hillsdale, NJ: Erlbaum.

Hedges, L. V. (1982). Estimation of effect size from a series of independent experiments. *Psychological Bulletin, 92*, 490–499.

Hedges, L. V. (2007). Effect sizes in cluster-randomized designs. *Journal of Educational and Behavioral Statistics, 32*, 341–370.

Hedges, L. V., & Hedberg, E. C. (2007). Intraclass correlation values for planning group-randomized trials in education. *Educational Evaluation and Policy Analysis, 29*, 60–87.

Institute of Education Sciences. (2014). *What Works Clearinghouse procedures and standards handbook* (Version 3.0). Washington, DC: Author.

Intersegmental Committee of the Academic Senates (ICAS). (2002). *A statement of competencies of students entering California's public colleges and universities*. Sacramento, CA: Author.

Limpo, T., Alves, R., & Fidalgo, R. (2013). Children's high-level writing skills: Development of planning and revising and their contribution to writing quality. *British Journal of Educational Psychology, 84*, 177–193.

Lipsey, M. W., & Wilson, D. B. (2001). *Practical meta-analysis*. Thousand Oaks, CA: Sage.

National Center for Education Statistics (2012). *The nation's report Card: Writing 2011*. Washington, DC: Institute of Education Sciences, U.S. Department of Education. Retrieved from *http://nces.ed.gov/nationsreportcard/pdf/main2011/2012470.pdf*.

National Commission on Writing (2007). *Writing and school reform.* New York: College Entrance Examination Board.

Nystrand, M. (2006). The social and historical context for writing research. In C. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 11–27). New York: Guilford Press.

Odom, S. L., Brantlinger, E., Gersten, R., Horner, R. H., Thompson, B., & Harris, K. R. (2005). Research in special education: Scientific methods and evidence-based practices. *Exceptional Children, 71*, 137–148.

Pressley, M., Graham, S., & Harris, K. R., (2006). The state of educational intervention research. *British Journal of Educational Psychology, 76*, 1–19.

Rock, J. L. (2007). *The impact of short-term use of criterion on writing skills in ninth grade* (Research Rep. No. RR-07-07). Princeton, NJ: Educational Testing Service.

Rohman, G. (1995). Pre-writing: The stage of discovery in the writing process. *College Composition and Communication, 16*, 106–112.

Schmidt, F. L., & Hunter, J. E. (2015). *Methods of meta-analysis: Correcting error and bias in research findings* (3rd ed.). Thousand Oaks, CA: Sage.

Scott, T. D. (2009). *The effectiveness of the response-to-intervention process for at-risk high school students.* Unpublished doctoral dissertation.

Sitko, B. M. (1998). Knowing how to write: Metacognition in writing instruction. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), *Metacognition in educational theory and practice* (pp. 93–116). Hillsdale, NJ: Erlbaum.

Swedlow, J. (1999). The power of writing. *National Geographic, 196*, 110–132.

Thibodeau, A. L. (1963). *A study of the effects of elaborative thinking and vocabulary enrichment exercises on written composition* (Doctoral dissertation). Retrieved from ProQuest (64-4041).

Zimmerman, B. (1989). A social cognitive view of self-regulated learning. *Journal of Educational Psychology, 81*, 329–339.

Zimmerman, B. J., & Risemberg, R. (1997). Becoming a self-regulated writer: A social cognitive perspective. *Contemporary Educational Psychology, 22*, 73–122.

CHAPTER 13

Relationships between Reading and Writing Development

Timothy Shanahan

The relationships of reading and writing have long been the subject of empirical research, and there are several existing literature reviews (Berninger, Abbott, Abbott, Graham, & Richards, 2002; Berninger, Cartwright, Yates, Swanson, & Abbott, 1994; Fitzgerald & Shanahan, 2000; Nelson & Calfee, 1998; Stotsky, 1983; Shanahan & Tierney, 1990; Tierney & Shanahan, 1991), the most recent appearing in 2006 (Shanahan, 2006). The purpose of this chapter is to update the most recent of those reviews given advances in the field and to answer five questions about reading-writing relations:

1. What theoretical models provide relevant frameworks for research into reading–writing relationships?
2. What questions have been posed, and what research methods have been used to answer them?
3. What are the major findings and how strong is the research support?
4. What future research is needed?
5. What are the implications for instruction?

Some research summarized in past reviews will be used, but only research not included in the 2006 review will be examined comprehensively; taking account of recent research findings, and positioning them in the context of past studies while avoiding repetitive discussion of work sufficiently covered in past reviews.

An important aspect of reading–writing relationships is the developmental nature of the relationships (Shanahan, 1984). The nature of reading and writing relationships has been found to change qualitatively over time. Although the developmental nature of these relationships has not attracted sufficient empirical attention, this issue will be accorded particular attention throughout this review.

THEORETICAL MODELS

Three basic theoretical models have been used to guide research on reading–writing relationships. The first model explores the shared knowledge and cognitive substrata (e.g., visual, phonological, and semantic systems, short-term and long-term memory, words, sentences, text) that underlie reading and writing abilities (Ellis, 1985, 1987; Fitzgerald, 1990; Fitzgerald, 1992; Just & Daneman, 1992; McCutchen, 2000; Swanson & Berninger, 1996). The basic idea is to try to discern the cognitive similarities and differences of reading and writing, and their reliance on shared bases of information and skill. Metaphorically, the shared cognition model conceptualizes reading and

writing as two buckets drawing water from a common well or two buildings built on a common foundation.

According to Fitzgerald and Shanahan (2000), readers and writers rely on four common knowledge bases. The first knowledge base—domain or content knowledge—has received the least research attention. Although the role of knowledge is especially obvious in writing (Flower & Hayes, 1984; Hillocks, 1986)—as writing has to be about something—research has not often pursued the role of knowledge in composition, and when it has, the measured relationship has been attenuated (Langer, 1986). The role of domain knowledge in reading has received greater attention, and "prior knowledge" has been found to be an important influence on reading comprehension (Spivey, 1997), undergirding the ability to infer, organize, and remember information. Cognition appears to rely on a single universe of substantive content knowledge that can be drawn upon for various functional purposes, including reading and writing. As with basic processes of memory, domain knowledge serves as a kind of generalizable foundation, available within both reading and writing.

A second knowledge base drawn on by both reading and writing is metaknowledge about written language, including pragmatics. "Metaknowledge refers to several subcategories of knowledge, including knowing about the functions and purposes of reading and writing; knowing that readers and writers interact; monitoring one's own meaning-making . . ." (Fitzgerald & Shanahan, 2000, p. 40).

A third substrate underlying reading and writing deals with knowledge of text attributes, including graphophonics (which encompasses phonological sensitivity, grapheme knowledge, and morphology). It also includes understanding of the syntactic ordering of words and how to interpret punctuation and text organization (e.g., relations between graphics and text, directionality, structural organization, formatting features).

Finally, the shared knowledge underlying reading and writing encompasses procedural knowledge, including knowing how to access, use, and generate information intentionally during reading and writing, and cognitive strategies such as prediction, questioning, and summarizing.

A second theoretical model used to think about reading–writing relationships is sociocognitive in nature (Booth, 1983; Rubin, 1984). The sociocognitive model conceptualizes reading and writing in terms of "reader–writer" relations. If cognitive models conceptualize reading–writing relations as taking place in the mind of literate persons, the relationship in sociocognitive models takes place in the transactional space *between* readers and writers. Reading and writing are fundamentally about communication, and people engage in identifiable processes to communicate effectively. Writing is obviously about interpersonal communication when the text takes the form of a letter or note, but the great insight of the sociocognitive models is that all acts of literacy are fundamentally communicative. Metaphorically, sociocognitive models describe reading–writing relations as a kind of conversation, and the key variables include insights about and awareness of the conversational partners and their purposes.

The third theoretical model treats reading and writing as separate processes that can be combined to accomplish a goal or solve a problem (Hayes, 1987; Langer & Applebee, 1987). For example, reading and writing can be used together to facilitate student learning of content; reading and writing can be used as study skills, and more learning may accrue if they are joined or if they are combined in particular ways. Writers, when trying to produce high quality texts—such as writing a report from sources—must alternate between reading and writing to accomplish the goal effectively. Metaphorically, in the combined-use model, reading and writing are tools that can be used together much as a carpenter might use a spirit level and sabre saw alternately when building something.

Despite the clear differences in variables and purposes distinguishing the three models, it should be noted that each has something to contribute to instruction. For each model there are studies aimed at foundational issues (i.e., describing the nature of the particular reading–writing relationships) and at exploiting the connections instructionally to enhance some aspect of learning or proficiency.

RESEARCH QUESTIONS AND RESEARCH METHODS

Each of the three theoretical models describes singular ways reading and writing are connected, and each entails distinctive research purposes. Consequently, investigations of the models have employed somewhat different combinations of empirical research methods.

Cognitive models hypothesize common substrata underlying reading and writing. Research studies attempt to identify cognitive commonalities that connect reading and writing and the strength of the relationships among cognitive variables (see MacArthur & Graham, Chapter 2, this volume). Initially, cognitive studies emphasized bivariate correlations; correlating one characteristic writing variable with one characteristic reading variable. These studies usually reported small-to-moderate correlations between the variables under investigation. However, since the 1980s, multivariate statistical analyses have been more typical. Multivariate investigations construct complex models of reading and writing and consider the connections across these models using multiple regression, canonical correlations, structural path analysis, hierarchical linear modeling, or latent change score modeling. The studies have identified patterns of relationship across complex representations of reading and writing and help answer questions such as "What direction are the relationships?" and "Does reading affect writing more than writing affects reading?" These cognitive investigations have been the ones most likely to take a developmental stance. Specifically, they have considered how reading–writing relationships differ across time or how they change with development. The purpose of these studies is less to evaluate how the strength of the relationships may change, but in identifying how the nature of the relationships may change. For example, one study found that reading–writing relationships could best be characterized as being about decoding–spelling connections early on, but that later they were more bound up in issues of reading comprehension and text structure (Shanahan, 1984).

Recently, cognitive studies of reading–writing relationships have become more longitudinal in design (Abbott, Berninger, & Fayol, 2010; Costa et al., 2013; Mehta, Foorman, Branum-Martin, & Taylor, 2005; Garcia, Abbott, & Berninger, 2010; Pinto, Bigozzi, Gamannossi, & Vezzani, 2012). In the past, most such studies have relied on cross-panel designs; researchers have looked at grade-level differences by examining separate samples of students—making it necessary to consider other explanations than development for explaining the observed differences.

Finally, cognitive research sometimes uses experimental research methods. Cognitive studies often try to improve student performance with a particular reading or writing variable, and then the impact of the improvement is evaluated cross-modally. For example, students might be taught to write more varied and complex sentences, and the outcome of the instruction would then be measured in terms of writing quality and reading comprehension (O'Hare, 1973). If instruction in a particular variable influenced reading and writing proficiency simultaneously, it would represent a reading–writing connection. Experimental studies may pursue even less specifically targeted interventions, but would still attempt to attribute the contiguous improvements in reading and writing to a common instructional source (Tierney & Shanahan, 1991).

Sociocognitive studies of author–reader relationships ask about whether readers think about authors and use cross-modal awareness as the basis of text interpretation; they also query the extent to which writers think about their readers and when they do that during the composing process (Bazerman, Chapter 1, this volume; Beach, Newell, & VanDerHeide, Chapter 6, this volume). Sociocognitive studies usually have depended on self-reports, including "think alouds" and interviews. More recently, there have been experimental sociocognitive studies, manipulating writers' awareness of audience to examine the impact on composition quality. Sociocognitive studies have considered the developmental nature of the communicative process, such as how children's perceptions of authors while reading differ across age levels (Shanahan, 1992).

Functional analyses aimed at studying how reading and writing can be used together usually ask questions about the impact of combining reading and writing on some outcome other than reading and writing achievement. Although *any* problem-solving or goal-directed outcome could be the focus of research, studies have most often examined two academic outcomes: learning information from text and the writing of reports based on multiple information sources. Combinations of reading and writing have been studied experimentally; a particular way of combining reading and writing is undertaken by one group and the group's performance is then compared with a control group left to their own devices. Descriptive studies of functional combinations of reading and writing are also available. In descriptive studies, students are observed closely while carrying out functional tasks such as writing a research paper (Tierney, Soter, O'Flahavan, & McGinley, 1989), and then the various ways students move back and forth between reading and writing are described and linked to how successfully the task was accomplished.

AN APPRAISAL OF RESEARCH RESULTS

Cognitive Relationships

Studies have often shown substantial correlations between measures of linguistic features in reading and writing, including phonemic, orthographic, morphological, lexical, syntactic, and discourse features (Abbott & Berninger, 1993; Ahmed et al., 2014; Berninger, 2000; Shanahan, 1984; Shanahan & Lomax, 1986, 1988). These studies have provided an increasingly lucid picture of the cognitive changes that take place in the relationships across development. Studies show that phonological and orthographic knowledge are closely linked (Abbott & Berninger, 1993; Ahmed, Wagner, & Lopez, 2014; Berninger & Abbott, 2010; Shanahan, 1984; Vaessen & Blomert, 2013), and handwriting is also implicated in spelling ability (Abbott & Berninger, 1993; Abbott et al., 2010; Berninger et al., 1997; Hayes & Berninger, 2010), but only for younger children (Berninger et al., 1994). Phonological awareness and knowledge of letter–sound correspondences have an early impact on word reading skills, but their influence on spelling and writing have been found to persist throughout the elementary grades (Abbott & Berninger, 1993; Berninger, Abbott, et al., 1998; Berninger, Vaughn, et al., 1998; Vaessen & Blomert, 2013), and the role of spelling ability in both writing fluency and reading achievement also persists (Berninger & Abbott, 2010; Graham, Berninger, Abbott, Abbott, & Whittaker, 1997). Spelling also has an influence on reading comprehension across a wide range of ages (Abbott et al., 2010; Berninger & Abbott, 2010; Berninger et al., 2002; Shanahan, 1984), as do the vocabulary and discourse features of writing, including cohesion and text organization (Babayiğit & Stainthorp, 2010; Berninger, Abbott, Nagy, & Carlisle, 2010; Cox, Shanahan, & Sulzby, 1990; Cox, Shanahan, & Tinzman, 1991; Garcia et al., 2010; Shanahan, 1984). More recent studies have also shown the importance of executive functioning (e.g., metacognitive planning) and working memory in reading and writing (Altemeier, Abbott, & Berninger, 2008; Berninger & Abbott, 2010; Garcia et al., 2010).

In the early studies, the amount of linguistic variance shared across reading and writing rarely exceeded 50% (Fitzgerald & Shanahan, 2000), but in more recent studies with multiple measures of each linguistic characteristic, the variance sharing estimates have been even higher, with 72–85% shared variance for word factors and about 65% for text level factors (Berninger et al., 2002). These estimated increases are likely due to better specification of the measurement models, obtained through the use of multiple indicators of the variables. The pattern of higher measurable relations among the word recognition–word production variables than among the text comprehension–text composition variables has been identified consistently across a wide range of age groups and studies (Ahmed et al., 2014; Berninger & Abbott, 2010; Berninger, 2002; Juel, 1988; Shanahan, 1984). Word recognition and spelling appear to be more closely linked for normal developing children; low-literacy adults show much less use of

phonological strategies—particularly for spelling (Greenberg, Ehri, & Perin, 2002).

Various connections between reading and writing appear to be bidirectional (Ahmed et al., 2014; Berninger & Abbott, 2010; Berninger et al., 2002; Diamond, Gerde, & Powell, 2008; Shanahan & Lomax, 1986, 1988). This means that the word recognition abilities of reading can influence the spelling (and fluency) of composition and that learning to spell influences children's word recognition. Similar bidirectional patterns of growth were evident in the other linguistic features as well.

That so much linguistic knowledge underlies reading and writing, and that the use of knowledge in one area of language can facilitate performance in another is not to say the relationships are symmetrical. Reading and writing may each draw on a common base of knowledge of linguistic features, but how this is done may differ across reading and writing in important ways. For example, students who are reading or writing about restaurants—and who know something about restaurants—might vary in their ability to draw on this knowledge across reading and writing (since in reading the author provides the stimulus for the reader to draw on prior knowledge while in writing the writer must self-stimulate memories). With language features, such as phonemic and orthographic knowledge, different numbers and types of paths have been traced from sounds to letters and letters to sounds. For example, when a reader comes across the word *notion*, the potential underlying phonemic representations of the second consonant would include /t/ and /sh/, but the writer working from sound-to-letters would choose from the *s*, *sh*, *ch*, and *ti* paths; asymmetrical choices that reveal reading and writing to be more than inverse versions of each other (Cronnell, 1970; Ehri, 1997; Reed, 1981).

Langer (1986) conducted an analysis of the connections between strategies or procedural actions used during comparable reading and writing activities and found similar levels of correlation to what has been evident with linguistic connections. In the Langer study, students thought aloud during and after various reading and writing activities. As with linguistic knowledge, a lack of symmetry was evident across reading and writing in procedural action. The reason for differences in knowledge use is likely bound up in the different purposes of reading and writing, and in differences in their starting places: Writers can begin with a blank page and few constraints, whereas readers have to follow the author's lead and accept any interpretive constraints set by the author.

The asymmetry that exists between reading and writing has important practical implications. That reading and writing are not just reverse images of each other is one reason students must receive instruction in *both* reading and writing. The teaching of either alone would be insufficient because of the unique properties of each. Accordingly, researchers have considered whether reading or writing is the more potent basis for instruction. Earlier path analytic research studies (Shanahan & Lomax, 1986; Shanahan, 1988) indicated that reading-to-writing models were more powerful than writing-to-reading models, but that bidirectional models were even more powerful.

More recent research has challenged this view (Ahmed et al., 2014). In a longitudinal study (following students from grade 1 through grade 4) using latent change score analysis, the results "were that reading-to-writing models were superior to writing-to-reading and bidirectional models. . . . Our findings suggest that reading exerts a relatively larger influence on writing factors than the influence of writing on reading factors" (p. 430). In other words, Ahmed and colleagues found a consistent application of reading knowledge to writing but less frequent application of writing knowledge to reading. One exception to the reading-to-writing pattern in this study was that students appeared to apply sentence-composing knowledge during reading comprehension.

Ahmed and colleagues' study (2014), because of its longitudinal design, also provides worthwhile information about the developmental nature of reading–writing relationships. In grade 1, the relations were strongest at the word level and moderate at text-discourse and sentence levels. As in past studies, decoding and spelling formed a common literacy factor early on—in this case, with decoding improvements preceding spelling growth. Again, consistent with past research, as children progressed through the grades, sentence and text-discourse factors became more

characteristic of the reading–writing relationship; however, in this case, the overall degree of relationship was found to lessen over time. “This may reflect that the relation between reading and writing decreases as a function of the complexity of language” (p. 431). It will take future intervention research to determine whether cross-modal sharing of the more complex aspects of language can be increased through instruction. Such instruction may not be required initially because the mutual reliance on letters and sounds is so obvious; but as language features become more complex or subtle, explicit instruction may be a key instigator to such sharing.

Another important shift in the cognitive research has been an expansion of the types of students studied. Recent investigations, for example, have focused more heavily on children and adults with learning problems. Historically, most reading–writing relationship research has been based on data drawn from regular classrooms and usually included the full performance range drawn from normal populations. The burgeoning and high-quality work of Virginia W. Berninger and her colleagues has helped to redress the imbalance. Their work has examined learning-disabled populations, but has avoided the problems of constrained variance such subjects usually present through the careful identification of a large and varied population of research subjects and the estimation of parameters based on multiple measures. One of the most important and remarkable insights from Berninger’s work is that the patterns of reading–writing relationships tend not to differ much from the patterns identified in wider ranging populations.

Of course, the neglect of special learners with regard to reading–writing relationships is due in part to the relative dearth of work on writing disabilities. Although there is a large literature devoted to the etiology, identification, and remediation of various types of reading problems, no literature comparable in size and scope has yet been created in the area of writing. If students struggle in reading lessons, they are likely to receive additional instruction, but no similar educational response is yet in place for writing. An important exception is a longitudinal study that followed students who were learning disabled in reading and/or writing (Costa et al., 2013) and found big differences in the co-occurrence of reading and writing disability at different stages of development, despite the extensive cognitive connections between reading and writing. For example, they found that only 27% of first graders had both reading and writing disability; but the coincidence of disability reached 46% by grade 4. This pattern may seem discrepant with earlier descriptions of reading–writing development. The design of this study does not allow for the nature of the disabilities to be sorted out, and the results could be due to either the increasing likelihood of identification (reading problems may become more evident or of greater concern as students get older) or to the fact that a wider constellation of language skills, any of which may be problematic, are implicated in reading development over time. The authors concluded, “reading and writing are largely separate problems, particularly in the early elementary school grades” (Costa et al., 2013, p. 27). But given the increases in the coincidence of these problems, a combined instructional response that considers both reading and writing may make the best sense.

Reading–writing relationship studies have also started to consider second-language learners. One such study examined reading–writing relationships among English learners in grades 3–6 (Ball, 2003). A series of statistical analyses revealed few differences between either the patterns of literacy development or how reading and writing related to each other for both native English or English-as-a-second-language students. This finding is perhaps not surprising, given that in studies of native English speakers the biggest relationships and changes in relationship have been evident with children in grades 1 and 2 (Shanahan, 1984; Ahmed et al., 2014). However, Ball found sizable differences in the oral-language performance of English speakers and English learners. this is an important finding as the oral-language measures were closely related to higher-level reading comprehension and story construction. This result suggests that greater oral-language development may be needed to allow second-language students to progress at the highest levels of literacy learning. Furthermore, a composite measure of cognitive ability did not reveal differences across groups, and cognitive ability predicted performance comparably on both spelling and word recognition measures—the same pattern evident in native language learners. Thus, reading and writing may be

combined in the same ways for native and second-language populations, though more oral-language support may be needed for the English learners to gain the benefits of it.

A second ELL study suggests a somewhat different pattern of relationship (Atkinson, 1993). It connected various environmental reading variables in L2 (i.e., how much pleasure reading and textbook reading were taking place) to writing achievement in L1 and L2. The reading measures were predictive of reading and writing performance in L1, but were not connected to L2 performance. The authors concluded that acquiring L2 literacy may be different from L1 literacy in terms of particular relationships, and they concluded that print exposure alone would not be sufficient to develop L2 writing skills.

Lastly, studies have started to explore the relationships between reading and writing during the preschool years (Diamond et al., 2008; Hecht & Close, 2002; Pinto et al., 2012; Ritchey, 2008). These preschool studies found early reading and writing skills to be correlated across the modes (though not as closely as are the skills within reading or within writing) and the relationships were, again, bidirectional in nature.

Sociocognitive Relationships

Sociocognitive research on reading–writing relations has been synthesized comprehensively (Tierney & Shanahan, 1991), and there are more recent reviews of audience awareness studies (Schriver, 1997) and author awareness studies (Shanahan, 1998). Past reviews concluded that readers have a sense of authorship which they use to enhance text comprehension and interpretation, writers think about readers while writing (usually during revision), writers can produce better texts when they consider readers' needs, and it is possible to enhance writing quality by increasing writers' awareness of readers. There have been markedly more studies of audience awareness than of author awareness; though enough newer studies of author awareness have been published to challenge at least one earlier conclusion: "These findings suggest that a sense of authorship can be heightened; and once heightened, students tend to read more critically, more flexibly, and with a view to negotiating meanings for themselves" (Tierney & Shanahan, 1991, pp. 261–262).

More recent sociocognitive studies have revealed that readers demonstrate an awareness of author and that author awareness is likely to arise from students' growing social development rather than from reading instruction (Shanahan, 1992). In terms of developmental patterns, younger students (age 7) are less likely to construct authors spontaneously than older students (age 13), and they are also less likely to use awareness of author during text interpretation. Most studies of author awareness have been focused on high school and college students, stages of development at which students should already have a clear purchase on conception of author. For example, Wineburg (1991, 1998), showed the centrality of "sourcing" (thinking about the author of a text) to the reading of historians, but found that high school students were less likely to engage in sourcing when reading historical texts. The specialized nature of author-focused reading is evident in the fact that mathematicians and chemists do not demonstrate similar author referencing during reading (Shanahan, Shanahan & Misischia, 2011). The difference is likely due to the goals of text interpretation in the different disciplines; weighing author bias is particularly central to evaluating historical information. Earlier research did not recognize author awareness as a disciplinary construct. Experimental studies in which students are taught to read like historians have had mixed results (Avishag, 2012; Nokes, Dole, & Hacker, 2007).

Empirical evidence also suggests that author visibility is not always a positive support during reading, in spite of the earlier noted claims. An experimental study manipulated author visibility in statistics texts accomplished through author self-references and the use of first-person writing style (Nolen, 1995). Readers, with texts they comprehended well, welcomed the visible authors and saw them as helpful and supportive to their understanding. However, when

students struggled to understand a text, the visible authors were perceived as obstructive, inept, and manipulative. More importantly, readers were likely to give up and not even attempt to understand the texts, though they hung in there with less visible authors when the reading got tough. In other words, author visibility increased the chances readers would blame an author for text complexity, but they would take more personal responsibility for understanding texts when the author was less apparent.

There continues to be much more research on writers' awareness of audiences than of readers' awareness of authors. The findings from more recent audience awareness studies are very consistent with the older studies. Researchers continue to find that thinking about audience during planning improves writing quality (Green & Sutton, 2003). Audience awareness can be enhanced through assigned audiences (Midgette, Haria, & MacArthur, 2008), reflective prompts (Jucks, Schulte-Löbbert, & Bromme, 2007), or having students work in pairs to identify potential comprehension problems (Boscolo & Ascorti, 2004). These interventions have been found to improve persuasive writing, including greater inclusion of counterarguments (Midgette et al., 2008; Moore & MacArthur, 2012). However, younger students do not seem to benefit from heightened audience awareness as much as older students, probably because they cannot translate this awareness into changes in their compositions (Sato & Matsushima, 2006). One small study of development (Lindgren, Leijten, & Van Waes, 2011) compared 10-year-olds, 14-year-olds, and professional writers. It found that younger writers had only a vague awareness of reader needs, whereas 14-year-olds had a clearer conception of readers but still lacked the writing skills to respond effectively to their needs. The adult professional writers had both a clear conception of reader needs and ways to adapt their writing to address those needs (Lindgren et al., 2011). Even when students could translate heightened audience awareness into writing improvement, it did not carry over to future writing (Moore & MacArthur, 2012).

Combined Use

Studies of the combined use of reading and writing have focused on academic tasks (Shanahan, 2004). Past research has shown that the combined use of reading and writing during studying has a powerful impact on content learning (Bangert-Drowns, Hurley, & Wilkinson, 2004). The combination of reading and writing is most beneficial when students are asked to write extensive essays rather than short-answer responses (Marshall, 1987; Newell, 1984). Writing also seemed to be more helpful when students were trying to learn unfamiliar information (Langer & Applebee, 1987) and different kinds of writing activities led to different learning outcomes. For example, writing prior to reading increased critical response to the text, whereas writing about the ideas in the text after reading led to a more thoughtful consideration of the ideas (Tierney et al. 1989).

Although there have been few recent studies of the combination of reading and writing to stimulate learning, there has been a notable meta-analysis of past research (Graham & Hebert, 2010). Graham and Hebert combined data from 85 studies of writing about text (grades 4–12), and concluded that "students' comprehension of science, social studies, and language arts texts is improved when they write about what they read" (p. 5). The effects of responding to texts through personal reactions, analysis and interpretation, writing summaries, writing notes, and answering questions about texts all showed positive learning outcomes. Writing about text improved comprehension of the content by an average of 16% on standardized measures. In the upper elementary years, summary writing was quite powerful in stimulating learning, presumably because it required students to think through the ideas more thoroughly. On average, the impact of summary writing on learning moved students by 19%. However, for older students, summary writing was only marginally productive. Writing longer analytical pieces was what mattered (by an average of 27% across nine studies). Repeatedly, across these analyses, they found that reading and then writing about the information was more effective in stimulating learning than reading and rereading or reading and

discussing.

The other major emphasis of studies on combining reading and writing has been on discourse synthesis or writing from sources. Initially, the idea was that engaging in writing from sources led to greater interconnections among the ideas presented in the multiple texts. This research was descriptive and detailed how writers move between reading and writing or how ideas are linked (e.g., Spivey & King, 1989). Over the past decade, more attention has been accorded to writing from sources. The growing interest in disciplinary literacy (Shanahan & Shanahan, 2008) has been the impetus for the increased interest. Disciplinary literacy researchers have shown the importance of written argument based on multiple sources in history.

Studies have tried to improve compositions by showing students how to organize their texts or to structure comparisons. The studies highlighted here took a different approach, trying to improve writing by enhancing *reading* behaviors. For example, in one study students were guided through a regimen of how to consider the author, make source attributions, and analyze and critique arguments (De La Paz & Felton, 2010). In another study, the researchers provided a computer-based tutorial and practice environment (Sourcer's Apprentice) that showed students how to source and corroborate information while reading history (Britt & Aglinskas, 2002). A third guided middle school students to summarize text using graphic organizers (Reynolds & Perin, 2009), and a fourth study guided student reading with interactive questions aimed at directing their attention to the aspects of texts that could help them compose successfully (Proske & Kapp, 2013). A fifth taught note-taking skills (Altemeier, Jones, Abbott, & Berninger, 2006). All of these approaches increased the length and quality of writing.

UNANSWERED QUESTIONS

There has been a recent acceleration of reading–writing relationship research during the past few years, especially with regard to cognitive and functional combination studies. Less attention has been accorded to the sociocognitive aspects of the relationship, especially from the reading side. Researchers have exposed the importance of author awareness, and it appears that it is more useful for some kinds of reading than for others. How general the author awareness effect may be needs research attention. Author awareness training in history reading is effective, but such training may enhance other kinds of reading too. Thinking about the readers' comprehension needs during revision improves the quality of writing, but no treatments with generalizable effects have yet been identified. Clearly, longitudinal research into the long-term effects of any of the successful audience awareness treatments would be appropriate.

Cognitive research into reading–writing relationships has grown increasingly ambitious and wide ranging in terms of variables and subjects over the past two decades. The models under study are very sophisticated. What is needed now is greater attention to experimental studies aimed at exploiting the major relationships that have been identified.

Empirical study of functional combinations of literacy has seen renewed interest. It is evident from these studies that using reading and writing together can make students more effective learners in their content subjects and allows them to produce more effective research texts. Few attempts have been made to examine the generalizability of the interventions. Researchers have revealed how writing about text improves achievement and how reading can enhance students' research papers, but it is unknown whether students are more likely to continue to combine reading and writing beyond the studies or whether having combined reading and writing successfully alters future performances in any way. Future research should consider forward transfer of successful reading and writing practices.

Cognitive studies have continued to reveal how reading–writing relationships change over time. These studies

continue to highlight the bidirectionality of the relationships, though they have called into question the strength of the writing-to-reading paths, especially in the upper elementary grades—when text and discourse variables become more important to reading and writing. Future research is needed to determine if instructional context can alter the degree of transfer across reading and writing, though this seems likely. The patterns of relationship described by various studies suggest that, in preschool through grade 2, knowledge of sound–symbol relationships is related to spelling growth (and this influence continues to play a role in spelling at least through grade 5), but that sentence-level (e.g., sentence comprehension, construction, combination) and text-level connections (text comprehension, structure, compositional fluency) emerge later (by grade 4). The relations among larger discourse elements are not as prominent as the word-level relations, however. Students seem to spontaneously use transfer information in both directions, but as attention shifts to larger discourse units, this sharing is more likely to take place from reading-to-writing alone. Instruction might increase student awareness of the benefits of sharing these text and discourse structures as well.

Developmental studies of the sociocognitive relationships suggest that initially readers and writers interact with texts without much consideration of factors that influence oral conversations. Young students may not perceive the social nature of these interactions, but with time—or instruction—they become facile at seeing texts as representing conversational partners. However, even once this insight has been developed, students may not yet have the skills to exploit it or to accommodate to the perceived communicative demands.

There has been little emphasis on studying combined uses of reading and writing from a developmental perspective. However, meta-analyses of studies on writing from sources indicate a varied pattern of effectiveness of various writing responses. Summary writing is most powerful with elementary-level students, while extended written analysis or synthesis offers bigger payoffs for older students. This seems to be because summary writing stimulates younger readers to a more thorough analysis of text than reading alone, but older readers can read text thoroughly without writing about it.

INSTRUCTIONAL IMPLICATIONS

Research shows that students can be taught the cognitive and linguistic skills that underlie reading and writing, and there can be both reading and writing outcomes. It would be wise for teachers to have students explore these skills through reading activities and writing activities. Studies show that students can also be taught to think about readers' comprehension needs during writing, how to read in ways that improve research papers, how to write as a study skill, and how to think about authors effectively during the reading of history; findings that have been replicated with varied instructional methods and sizeable learning outcomes.

Educators should consider two additional research findings. Connor and her colleagues (Connor, Ingebrand, & Dombek, 2013; Connor et al., 2009) observed the integration of reading and writing instruction in 25 primary school classrooms in Reading First schools over a 2-year period. More than 500 first and third graders were assessed in the spring and fall. The observations revealed modest amounts of writing instruction and activity during the literacy block. In first grade, only about 4 minutes per day was devoted to writing activity and instruction in the fall and about 6 minutes in the spring; there was even less writing in third grade. There is little possibility that writing will impact reading if there is no writing. Even with limited amounts of grade 1 writing, the amount of one-to-one writing instruction improved reading comprehension, and impacts were comparable to what has been found in experimental studies with older students (Graham & Hebert, 2010). Unfortunately, neither amount nor type of writing in the grade 3 classrooms determined gains in reading or writing achievement, perhaps because the writing

was so limited. Writing instruction can only impact reading if it is available for students to draw on. Everything that is known about reading–writing relations has been learned in the context of instruction that prioritizes reading over writing. With greater attention to writing instruction, the patterns of relationship might change. Thus, reading knowledge might currently have a big impact on writing achievement (Ahmed et al., 2014), but with more writing knowledge this pattern could be altered.

REFERENCES

Abbott, R. D., & Berninger, V. W. (1993). Structural equation modeling of relationships among developmental skills and writing skills in primary and intermediate grade writers. *Journal of Educational Psychology, 85*, 478–508.

Abbott, R. D., Berninger, V. W., & Fayol, M. (2010). Longitudinal relationships of levels of language in writing and between writing and reading in grades 1 to 7. *Journal of Educational Psychology, 102*, 281–298.

Ahmed, Y., Wagner, R. K., & Lopez, D. (2014). Developmental relations between reading and writing at the word, sentence, and text levels: A latent change score analysis. *Journal of Educational Psychology, 106*, 419–434.

Altemeier, L., Abbott, R. D., & Berninger, V. W. (2008). Executive functions for reading and writing in typical literacy development and dyslexia. *Journal of Clinical and Experimental Neuropsychology, 30*, 588–606.

Altemeier, L., Jones, J., Abbott, R., & Berninger, V. W. (2006). Executive factors in becoming writing-readers and reading-writers: Note-taking and report writing in third and fifth graders. *Developmental Neuropsychology, 29*, 161–173.

Atkinson, D. (1993). Differing reading–writing relationships in L1 and L2 literacy development? *TESOL Quarterly, 2*, 329–333.

Avishag, R. (2012). Reading like a historian: A document-based history curriculum intervention in urban high schools. *Cognition and Instruction, 30*, 86–112.

Babayiğit, S., & Stainthorp, R. (2010). Component processes of early reading, spelling, and narrative writing skills in Turkish: A longitudinal study. *Reading and Writing, 23*, 539–568.

Ball, S. E. (2003). *The relation between reading and writing development in English and ESL students.* Unpublished doctoral dissertation, University of Toronto.

Bangert-Drowns, R. L., Hurley, M. M., & Wilkinson, B. (2004). The effects of school-based writing-to-learn interventions on academic achievement: A meta-analysis. *Review of Educational Research, 74*, 29–58.

Berninger, V. W. (2000). Development of language by hand and its connections with language by ear, mouth, and eye. *Topics in Language Disorders, 20*(4), 65–84.

Berninger, V. W., & Abbott, R. D. (2010). Listening comprehension, oral expression, reading comprehension, and written expression: Related yet unique language systems in grades 1, 3, 5, and 7. *Journal of Educational Psychology, 102*, 635–651.

Berninger, V. W., Abbott, R. D., Abbott, S. P., Graham, S., & Richards, T. (2002). Writing and reading: Connections between language by hand and language by eye. *Journal of Learning Disabilities, 35*, 39–56.

Berninger, V. W., Abbott, R. D., Nagy, W., & Carlisle, J. (2010). Growth in phonological, orthographic, and morphological awareness in grades 1 to 6. *Journal of Psycholinguistic Research, 39*, 141–163.

Berninger, V. W., Abbott, R. D., Rogan, L., Reed, E., Abbott, R., Brooks, A., et al. (1998). Teaching spelling to children with specific learning disabilities: The mind's ear and eye beats the computer or pencil. *Learning Disability Quarterly, 21*, 106–122.

Berninger, V. W., Cartwright, A. C., Yates, C. M., Swanson, H. L., & Abbott, R. D. (1994). Developmental skills

related to writing and reading acquisition in the intermediate grades. *Reading and Writing: An Interdisciplinary Journal, 6*, 161–196.

Berninger, V. W., Vaughan, K., Abbott, R. D., Brooks, A., Abbott, S., Reed, E., et al. (1998). Early intervention for spelling problems: Teaching spelling units of varying size with a multiple connections framework. *Journal of Educational Psychology, 90*, 587–605.

Berninger, V. W., Vaughan, K., Abbott, R. D., Brooks, A., Abbott, S., Rogan, L., (1997). Treatment of handwriting fluency problems in beginning writing: Transfer from handwriting to composition. *Journal of Educational Psychology, 89*, 652–666.

Booth, W. C. (1983). *The rhetoric of fiction* (2nd ed.). Chicago: University of Chicago Press.

Boscolo, P., & Ascorti, K. (2004). Effects of collaborative revision on children's ability to write understandable narrative texts. In L. Allal, L. Chanquoy, & P. Largy (Eds.), *Revision: Cognitive and instructional presses* (pp. 157–170). Boston: Kluwer.

Britt, M. A., & Aglinskas, C. (2002). Improving students' ability to identify and use source information. *Cognition and Instruction, 20*, 485–522.

Connor, C. M., Ingebrand, S., & Dombek, J. (2013). The reading side. In B. Miller, P. McCardle, & R. Long (Eds.), *Teaching reading and writing: Improving instruction and student achievement* (pp. 7–20). Baltimore: Paul H. Brookes.

Connor, C. M., Morrison, F. J., Fishman, B., Ponitz, C. C., Glasney, S., Underwood, P., et al., (2009). The ISI classroom observation system: Examining the literacy instruction provided to individual students. *Educational Researcher, 38*(2), 85–99.

Costa, L.-J., Ahmad, U., Edwards, C., Vanselous, S., Yerby, D. C., & Hooper, S. R. (2013). The writing side. In B. Miller, P. McCardle, & R. Long (Eds.), *Teaching reading and writing: Improving instruction and student achievement* (pp. 21–35). Baltimore: Paul H. Brookes.

Cox, B. E., Shanahan, T., & Sulzby, E. (1990). Good and poor elementary readers' use of cohesion in writing. *Reading Research Quarterly, 25*, 47–65.

Cox, B. E., Shanahan, T., & Tinzman, M. (1991). Children's knowledge of organization, cohesion, and voice. *Research in the Teaching of English, 25*, 179–218.

Cronnell, B. A. (1970). *Spelling-to-sound correspondences for reading vs. sound-to-spelling correspondences* (Tech. Note 2–7–15). Los Alamitos, CA: Southwest Regional Laboratory.

De La Paz, S., & Felton, M. K. (2010). Reading and writing form multiple source documents in history: Effects of strategy instruction with low to average high school writers. *Contemporary Educational Psychology, 35*, 174–192.

Diamond, K. E., Gerde, H. K., & Powell, D. R. (2008). Development in early literacy skills during the pre-kindergarten year in Head Start: Relations between growth in children's writing and understanding of letters. *Early Childhood Research Quarterly, 23*, 467–478.

Ehri, L. (1997). Learning to read and having to spell are one and the same, almost. In C. A. Perfetti & L. Rieten (Eds.), *Learning to spell: Research, theory, and practice* (pp. 237–269). Mahwah, NJ: Erlbaum.

Ellis, A. (1985). The cognitive neuropsychology of developmental (and acquired) dyslexia: A critical survey. *Cognitive Neuropsychology, 2*, 169–205.

Ellis, A. (1987). Review on problems in developing cognitively transmitted cognitive modules. *Mind and Language, 2*, 242–251.

Fitzgerald, J. (1990). Reading and writing as "mind meeting." In T. Shanahan (Ed.), *Reading and writing together: New perspectives for the classroom* (pp. 81–97). Norwood, MA: Chrisopher-Gordon.

Fitzgerald, J. (1992). *Towards knowledge in writing: Illustrations from revision studies.* New York: Springer-Verlag.

Fitzgerald, J., & Shanahan, T. (2000). Reading and writing relations and their development. *Educational Psychologist, 35*, 39–50.

Flower, L., & Hayes, J. R. (1984). Images, plays, and prose: The representation of meaning in writing. *Written Communication, 1*, 120–160.

Garcia, N. P., Abbott, R. D., & Berninger, V. W. (2010). Predicting poor, average, and superior spellers in grades 1 to 6 from phonological, orthographic, and morphological, spelling, or reading composites. *Written Language and Literacy, 13*, 61–98.

Graham, S., Berninger, V. W., Abbott, R. D., Abbott, S., & Whittaker, D. (1997). The role of mechanics in composing of elementary school students: A new methodological approach. *Journal of Educational Psychology, 89*, 170–182.

Graham, S., & Hebert, M. (2010). *Writing to read: Evidence for how writing can improve reading.* New York: Carnegie Corporation.

Green, S., & Sutton, P. (2003). What do children think as they plan their writing? *Literacy, 37*, 2–38.

Greenberg, D., Ehri, L. C., & Perin, D. (2002). Do adult literacy students make the same spelling errors as children matched for word-reading age? *Scientific Studies of Reading, 6*, 221–244.

Hayes, D. A. (1987). The potential for directing study in combined reading and writing activity. *Journal of Reading Behavior, 19*, 333–352.

Hayes, J. R., & Berninger, V. (2010). Relationships between idea generation and transcription: How the act of writing shapes what children write. In C. Bazerman, R. Krut, K. Lunsford, S. McLeod, S. Null, P. Rogers, et al. (Eds.), *Traditions of writing research* (pp. 166–180). New York: Taylor & Francis/Routledge.

Hecht, S., & Close, L. (2002). Emergent literacy skills and training time uniquely predict variability in response to phonemic awareness training in disadvantaged kindergardners. *Journal of Experimental Child Psychology, 82*, 93–115.

Hillocks, G., Jr. (1986). The writer's knowledge: Theory, research, and implications for practice. In A. R. Petrosky & D. Bartholomae (Eds.), *The teaching of writing. Eighty-fifth yearbook of the National Society for the Study of Education* (pp. 71–94). Chicago: National Society for the Study of Education.

Jucks, R., Schulte-Löbbert, P., & Bromme, R. (2007). Supporting experts' written knowledge communication through reflective prompts on the use of specialist concepts. *Journal of Psychology, 215*, 237–247.

Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children from first through fourth grades. *Journal of Educational Psychology, 80*, 437–447.

Just, M., & Daneman, J. (1992). A capacity theory of comprehension: Individual differences in working memory. *Psychological Review, 99*, 122–149.

Langer, J. A. (1986). *Children reading and writing: Structures and strategies.* Norwood, NJ: Ablex.

Langer, J. A., & Applebee, A. N. (1987). *How writing shapes thinking.* Urbana, IL: National Council of Teachers of English.

Lindgren, E., Leijten, M., & Van Waes, L. (2011). Adapting to the reader during writing. *Written Language and Literacy, 14*, 188–223.

Marshall, J. D. (1987). The effects of writing on students' understanding of literary text. *Research in the Teaching of English, 21*, 31–63.

McCutchen, D. (2000). Knowledge, processing, and working memory: Implications for a theory of writing. *Educational Psychologist, 35*, 13–24.

Mehta, P. D., Foorman, B. R., Branum-Martin, L., & Taylor, W. P. (2005). Literacy as a unidimensional multilevel construct: Validation, sources of influence, and implications in a longitudinal study in grades 1 to 4. *Scientific Studies of Reading, 9*, 85–116.

Midgette, E., Haria, P., & MacArthur, C. (2008). The effects of content and audience awareness goals of revision on the persuasive essays of fifth- and eighth-grade students. *Reading and Writing, 21*, 131–151.

Moore, N. S., & MacArthur, C. A. (2012). The effects of being a reader and of observing readers on fifth-grade students' argumentative writing and revising. *Reading and Writing, 25*, 1449–1478.

Nelson, N., & Calfee, R. C. (Eds.). (1998). The reading–writing connection. *Ninety-seventh Yearbook of the National Society for the Study of Education.* Chicago: National Society for the Study of Education.

Newell, G. (1984). Learning from writing in two content areas: A case study/protocol analysis. *Research in Teaching of English, 18*, 205–287.

Nokes, J. D., Dole, J. A., & Hacker, D. J. (2007). Teaching high school students to use heuristics while reading historical texts. *Journal of Educational Psychology, 99*, 492–504.

Nolen, S. B. (1995). Effects of a visible author in statistical texts. *Journal of Educational Psychology, 87*, 47–65.

O'Hare, F. (1973). *Sentence combining: Improving student writing without formal grammar instruction. NCTE Research Report No. 15.* Urbana, IL: National Council of Teachers of English.

Pinto, G., Bigozzi, L., Gamannossi, B., & Vezzani, C. (2012). Emergent literacy and early writing skills. *Journal of Genetic Psychology, 173*, 330–354.

Proske, A., & Kapp, F. (2013). Fostering topic knowledge: Essential for academic writing. *Reading and Writing, 26*, 1337–1352.

Reed, C. (1981). Writing is not the inverse for reading for young children. In C. H. Frederickson & J. Dominick (Eds.), *Writing: The nature, development, and teaching of written communication* (vol. 2, pp. 105–117). Hillsdale, NJ: Erlbaum.

Reynolds, G. A., & Perin, D. (2009). A comparison of text structure and self-regulated writing strategies for composing from sources by middle school students. *Reading Psychology, 30*, 265–300.

Ritchey, K. D. (2008). The building blocks of writing: Learning and writing letters. *Reading and Writing, 21*, 27–47.

Rubin, D. (1984). Social cognition and written communication. *Written Communication, 1*, 211–246.

Sato, K., & Matsushima, K. (2006). Effects of audience awareness on procedural text writing. *Psychological Reports, 99*, 51–73.

Schriver, K. A. (1997). *Dynamics in document design: Creating texts for readers.* New York: Wiley.

Shanahan, C., Shanahan, T., & Misischia, C. (2011). Analysis of expert readers in three disciplines: History, mathematics, and chemistry. *Journal of Literacy Research, 43*, 393–429.

Shanahan, T. (1984). Nature of the reading-writing relation: An exploratory multivariate analysis. *Journal of Educational Psychology, 76*, 466–477.

Shanahan, T. (1992). Reading comprehension as a conversation with an author. In M. Pressley, K. R. Harris, & J. T. Guthrie (Eds.), *Promoting academic competence and literacy in school* (pp. 129–148). San Diego, CA: Academic Press.

Shanahan, T. (1998.) Readers' awareness of author. In R. C. Calfee & N. Spivey (Eds.), *The reading-writing connection. Ninety-seventh Yearbook of the National Society for the Study of Education* (pp. 88–111). Chicago: NSSE.

Shanahan, T. (2004). Overcoming the dominance of communication: Writing to think and to learn. In T. L. Jetton & J. A. Dole (Eds.), *Adolescent literacy research and practice* (pp. 59–74). New York: Guilford Press.

Shanahan, T. (2006). Relations among oral language, reading, and writing development. In C. A. MacArthur, S.

Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 171–183) New York: Guilford Press.

Shanahan, T., & Lomax, R. G. (1986). An analysis and comparison of theoretical models of the reading-writing relationship. *Journal of Educational Psychology, 78*, 116–123.

Shanahan, T., & Lomax, R. G. (1988). A developmental comparison of three theoretical models of reading-writing relationship. *Research in the Teaching of English, 22*, 196–212.

Shanahan, T., & Shanahan, C. (2008). Teaching disciplinary literacy to adolescents: Rethinking content-area literacy. *Harvard Educational Review, 78*, 40–59.

Shanahan, T., & Tierney, R. J. (1990). Reading-writing connections: The relations among three perspectives. In J. Zutell & S. McCormick (Eds.), *Literacy theory and research: Analyses from multiple paradigms. Thirty-ninth Yearbook of the National Reading Conference* (pp. 13–34). Chicago: National Reading Conference.

Spivey, N. N. (1997). *The constructivist metaphor: Reading, writing, and the making of meaning.* San Diego, CA: Academic Press.

Spivey, N. N., & King, J. R. (1989). Readers as writers composing from sources. *Reading Research Quarterly, 24*, 7–26

Stotsky, S. (1983). Research of reading/writing relationships: A synthesis and suggested directions. *Language Arts, 60*, 568–580.

Swanson, H. L., & Berninger, V. (1996). Individual differences in children's writing: A function of working memory or reading or both processes? *Reading and Writing, 8*, 357–383.

Tierney, R. J., & Shanahan, T. (1991). Research on the reading-writing relationship: Interactions, transactions, and outcomes. In R. Barr, M. L. Kamil, P. Mosenthal, & P. D. Pearson (Eds.), *Handbook of reading research* (vol. 2, pp. 246–280). Mahwah, NJ: Erlbaum.

Tierney, R. J., Soter, A., O'Flahavan, J. F., & McGinley, W. (1989). The effects of reading and writing upon thinking critically. *Reading Research Quarterly, 24*, 134–173.

Vaessen, A., & Blomert, L. (2013). The cognitive linkage and divergence of spelling and reading development. *Scientific Studies of Reading, 17*, 89–107.

Wineburg, S. (1998). Reading Abraham Lincoln: An expert/expert study in the interpretation of historical texts. *Cognitive Science, 22*, 319–346.

Wineburg, S. S. (1991). Historical problem solving: A study of the cognitive processes used in the evaluation of documentary and pictorial evidence. *Journal of Educational Psychology, 83*, 73–87.

PART III

INSTRUCTION IN WRITING

CHAPTER 14

Evidence-Based Practice and Writing Instruction

A Review of Reviews

Steve Graham, Karen R. Harris, and Amber B. Chambers

For well over 100 years, scholars have systematically studied the effectiveness of practices for teaching and improving students' writing (e.g., Cook, 1912; Garcia-Sanchez & Caso-Fuertes, 2005; Miller & Ney, 1968). Although the study of instructional practices in writing has never been particularly extensive or deep, there has been enough research on the topic that it has been summarized, dissected, and discussed multiple times during the current and the last century (e.g., see Blount, 1973; Bradock, Lloyd-Jones, & Schoer, 1963; Graham & Perin, 2007a; Hillocks, 1986; Horn, 1919; Meckel, 1963; Scardamalia & Bereiter, 1986). It was commonly assumed that the collective findings from this instructional research and reviews of it enhanced our understanding of writing development and the practice of teaching writing.

Starting in the 1990s with medicine, and then spreading to psychology, business, informational science, education, and other disciplines, the basic idea that research can positively influence practice intensified and gained ground as a result of the evidence-based practice (EBP) movement. The primary assumption underlying the EBP movement was that practitioners in a field should apply the best evidence available to make conscious, informed, and judicious decisions for their clients (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996). In fields such as education (or the teaching of writing), this process involves using evidence to make decisions about assessment, instruction, evaluation, and management. A focus on evidence-based practices was a reaction to the situation where much of what practitioners did in a field was based on tradition and lore, without scientific evidence to validate it.

The idea that high-quality research should be used to inform practitioners' decision making is by its very nature a complex process. In the case of writing, for instance, teachers must weigh the benefits, limitations, and even possible harm that might ensue as a result of implementing or not implementing an EPB. In practice, teachers must contextualize knowledge gained from research with their own knowledge about their students, the context in which they operate, and what they know about how to teach writing. Of course, they must first be familiar with evidence-based practices in writing.

In this chapter, we identify and examine the use of EBPs in the area of writing for students in grades 1 to 12. To identify EBP, we conducted a review of reviews in order to identify studies that would provide evidence on the effectiveness of specific instructional practices in writing. This review included both quantitative (true and quasi-experiments, participants as own-control investigations, and single-subject design studies), as well as qualitative studies (i.e., studies examining the instructional writing practices of exceptional literacy teachers). As part of three other publications (Graham & Harris, in press; Graham, Harris, & Santangelo, in press; Rogers & Graham, 2008), we analyzed and summarized these data to identify EBPs in writing. Before presenting the results of these analyses, we first consider why it is important to identify EPBs and what should count as evidence in identifying them. Then, we summarize EBPs in writing and consider the affordances and caveats of using them in the classroom.

WHY EMPHASIZE EBPS?

There are three primary sources of information practitioners can draw upon to inform their instructional practices in writing (Graham, 2010). One source comes from professional writers. They draw on their own insights and experience as writers to make recommendations to others on how to teach writing or become successful writers. These recommendations range from contradictory suggestions such as "make it up as you go along" from mystery writer Tony Hillerman (Burnham, 1994, p. 89) to novelist Frank Yerry's (Gordon, 2000, p. 46) admonition that

"writing a novel is like building a brick wall; only amateurs believe in inspiration." They have also included more fanciful recommendations from revered writers such as Mark Twain who advised, "When you catch an adjective, kill it" (Winokur, 1999, p. 75), or "Get your facts first, and then you can distort 'em as you please" (p. 114). It must be noted that some professional writers are skeptical of their colleagues' advice on writing. This skepticism was reflected in Somerset Maugham's dictum: "There are three rules for writing the novel. Unfortunately, no one knows what they are" (Winokur, 1999, p. 146). This did not stop Maugham from giving advice to aspiring writers on multiple occasions, however!

A second source of information about writing instruction comes from those who teach it. This includes teachers' judgments about practices they view as effective. Judgments about the effectiveness of a specific practice are formed as teachers apply it in their classroom. It also includes advice from those who study writing teachers in action. Based on their observations, they may recommend that others use specific practices they view as worthy. A notable example of a practice based on the study of teachers in action is writers' workshop (Graves, 1983).

The knowledge developed by teachers is distributed in multiple ways. A practice deemed effective might be shared with colleagues through discussion, demonstration, or in writing. A teacher might also remember and apply a practice that was used by one of their former writing teachers. For those who study teachers in action, similar mechanisms are used to promote a favored practice, as it might be modeled in a college classroom, shared at professional conferences or in workshops, and presented in articles and books.

Although professional writers and writing teachers undoubtedly possess considerable wisdom about teaching writing, caution should be exercised concerning their recommendations. First, as Graham (2010) noted, it is difficult to separate the wheat from the chaff. For example, a professional writer does many things while writing, and these actions may change from one writing task to the next. Writers may decide their success is due to a particular activity or set of activities, but there is no guarantee that their selection is accurate or even useful. Consider, for instance, that many professional writers develop elaborate routines for how they write, ranging from walking before writing to writing with the blackest possible ink on blue paper to writing in a cork-lined bedroom (Burnham, 1994). Although writers who use routines like these surely attributed some of their success to the selected routine (or they would not engage in them repeatedly), the value of some routines, as illustrated by the last two regimens above, are not likely to make others better writers.

Similarly, teachers apply a variety of practices as they teach students to write. As their students' writing improves, they may single out one or more practices as being responsible for the changes they observe. Their choices may be valid, but it is also possible that their choices are incorrect or correct for just some students but not for others. To illustrate, they may have enjoyed a particular activity or been told by others that it is a good way to teach writing. As a result, they give the activity additional valence when considering why their students' writing becomes better. Researchers who study writing teachers in action are not immune to such phenomena and may overestimate the effectiveness of practices that are consistent with their philosophical views on writing and its development.

A second problem in assessing the value of writing practices based on professional opinion or teachers' experiences is that they are often offered with little and sometimes no direct evidence of their effectiveness (Graham, 2010). When evidence is provided, it too often takes the form of testimonials or the presentation of selected students' writing, making it impossible to determine if the evidence is representative or atypical. Smagorinsky (1987) provided a good example of why it is important to collect evidence in a more systematic and representative fashion. He critiqued the work done by Donald Graves involving case studies of 16 children taught using unstructured personal expression in writing. He noted that the observations and conclusions drawn by Graves and associates studying the 16 children and their teachers was based on evidence collected under favorable conditions, without considering contradictory or negative evidence about the efficacy of the approach used to teach

them.

A third issue in assessing the value of teaching procedures based on professional opinion or teachers' experiences is that the recommended method may be based on the actions of a single person (or even a few people). In such cases, there is no way to predict if the practice will be effective with other teachers. For instance, the National Writing Project commonly has teachers share their best writing lessons with each other (a concept we applaud). We feel confident that many of these lessons are effective for the presenting teacher, but we are worried about their portability to other classes and situations. More confidence could be placed in the value of each lesson if multiple teachers were able to present representative and credible evidence that the lesson worked in different situations.

To summarize, developing a writing program based solely on instructional practices gathered through the experiences, insights, or observations of skilled writers, teachers, or experts who observe teachers is a risky proposition. The validity, generalizability, and reliability of recommendations based on such evidence are uncertain. This does not mean that the practices developed and valued by teachers and others should be ignored or set aside. We argue instead that practitioners need to bring a third source of information to bear when teaching writing, contextualizing and integrating it with the teaching practices they have acquired over time, but using this third source to drive and make calculated decisions about what and how to teach. This third source of information involves writing practices shown to be effective repeatedly via scientific testing.

Why do we think that EBPs should play a central role in driving the practice of teaching writing? Basically, EBPs provide a more trustworthy source of information when compared to practices acquired through professional opinion and teachers' experiences. Intervention research studies attempt to isolate the effects of a specific practice or set of practices when testing them, addressing the issue of separating the proverbial wheat from the chaff. Intervention research also systematically collects evidence on whether the instructional practice produced the desired impact, specifying who is tested and using research methods designed to rule out alternative explanations for observed effects. These scientific practices provide direct and compelling evidence on the effectiveness of the target practice(s). Intervention research further addresses issues involving generalizability and reliability, as investigators conduct multiple studies to determine if a positive effect can be replicated across students and situations, while the confidence that can be placed in specific findings can be determined through statistical analyses.

Because intervention studies typically quantify the observed impact of a writing intervention on writing performance, the outcomes from a study can be converted into a common metric (an effect size), making it possible to determine the relative strength (in comparison to the control conditions) and direction (positive or negative) of the writing treatment on students' writing performance. Through meta-analysis (see Lipsey & Wilson, 2001), the effects of multiple studies testing the same writing practice can be aggregated and weighted by study size to determine if the impact of the target writing treatment is statistically greater than no effect.

HOW ARE EBPS IDENTIFIED?

There is no universally agreed upon method for identifying EBPs. Most advocates of the evidence-based approach, however, would agree that a practice needs to show a positive effect on students' performance across multiple investigations (Hjørland, 2011). The gold standard for testing the effectiveness of an instructional practice is randomized control designs (true experiments) in which students are randomly assigned to a writing treatment using the instructional practice and a control condition that does not receive the writing treatment (e.g., they receive an alternative treatment). A true experiment provides mechanisms (e.g., randomization, control group) designed to increase confidence that the writing treatment, as opposed to a rival explanation, is responsible for observed changes

in students' writing. The confidence that can be placed in the resultant findings should be viewed as a matter of degree, however, and not an either/or situation, as other circumstances not controlled by the study may be responsible for the observed changes in writing (it would be extremely difficult to control all other circumstances). Consequently, other approaches to testing the effectiveness of a writing practice, such as quasi-experiments (where students are not randomly assigned to treatment and control conditions), or studies where participants act as their own control (they receive both writing treatments in a counterbalanced order), can also yield a reasonable estimate that the writing treatment was responsible for changes in students' writing performance.

The group designs described above are not the only way of estimating whether a causal connection exists between a writing treatment and observed changes in writing performance. Single-subject design methodology provides an alternative approach for examining the validity of such a connection. With single-subject designs, the effectiveness of a writing practice is examined at the individual, not at the group, level. Each participating student's writing performance is repeatedly assessed before as well as during and/or after instruction to establish a stable baseline and treatment effect (assuming treatment produced a positive effect). The researcher controls when the writing practice is introduced to each student to rule out counter explanations to the findings (e.g., the student's performance improved because of something that happened outside of the intervention period).

It is important to note that mechanisms (e.g. randomization or systematically controlling the introduction of the treatment) used to increase the internal validity of the different types of studies described above (e.g., true experiments, quasi-experiments, and single-subject designs) do not ensure that the findings of a study are generalizable to other students. Repeated replications of the observed findings with other students are needed to establish such generalizability.

Although some argue that findings from qualitative studies should not count as evidence when identifying EBPs (Hjørland, 2011), we argue (e.g., Graham, 2010) that qualitative studies that examine the writing instructional practices of highly effective teachers can support the contention that a practice is evidence-based. The basic reasoning underlying this contention is that instructional practices that are employed across all or most available qualitative studies of exceptional literacy teachers are potentially more important to students' writing success than writing practices that are idiosyncratic to a specific study (Graham & Perin, 2007c). The analysis and synthesis of the findings from qualitative studies examining the writing practices of exceptional teachers must be treated cautiously, though, as it does not specifically establish that a writing practice has a positive effect on students' performance (see the definition of EBPs by Hjørland, 2011, at the start of this section). The information obtained from a synthesis of the findings from qualitative studies of exceptional teachers, when combined with the types of quantitative evidence described above, provides additional support and can expand our thinking about an EBP that was identified using conventional quantitative evidence.

This brings us to another important contention. We believe that using multiple forms of evidence to identify EBPs is advantageous for two reasons. First, this makes it possible to draw a more comprehensive set of instructional recommendations than is possible from concentrating on just one form of evidence (Graham et al., in press. Second, more trust can be placed in an EBP that was supported by evidence from multiple types of research (i.e., group studies, single-subject design investigations, and qualitative studies of exceptional teachers). Conversely, less confidence can be placed in a writing practice that is supported by one type of research and not another (e.g., a practice is supported by single-subject design studies but not true and quasi-experiments).

We would like to make two additional points. First, qualitative research plays other important roles in thinking about EBPs. Among other things, this type of research can be used to help us think more carefully about the context in which EBPs are applied; how teachers apply EBPs in conjunction with their current knowledge and skills in teaching writing; and the importance and role that teachers, students, and parents assign to EBPs.

Second, and most importantly, when EBPs in an area like writing are examined collectively, they can provide teachers with general guidelines about the teaching of writin—in essence, supplying a roadmap for what is important in writing instruction. A primary purpose of this chapter is to create such a map.

METHODS FOR ESTABLISHING EBPS FOR WRITING

To establish EBPs for writing in grades 1 to 12, we drew upon evidence from all five of the different research methods described above: true experiments, quasi-experiments, participants as own controls, single-subject designs, and qualitative studies of exceptional literacy teachers. We did not conduct a new review of the literature to obtain evidence on the effectiveness of specific writing practices. Instead, we drew upon 19 previous reviews designed to identify effective writing practices, starting with Hillocks's seminal meta-analysis in 1986. In effect, we conducted a review of reviews to identify EBPs for writing, but we extended the basic review of review approach by reexamining all of the studies from the previous reviews to identify a set of writing EBPs for grades 1 to 12.

Table 14.1 provides a description of the 19 reviews we examined, including the references, types of research the review examined (e.g., true and quasi-experiments), writing practices tested or studied, writing outcomes examined, type of students participating in the studies reviewed, and whether the quality of individual studies was assessed. Most of the reviews that served as our source of evidence in this chapter involved meta-analysis of true- and quasi-experiments (with two of them including the participant as own-control studies; see Graham, Harris, & Hebert, 2011; Morphy & Graham, 2012), but a number of reviews also included single-subject design studies (e.g., Rogers & Graham, 2008) as well as qualitative studies of the writing practices of exceptional literacy teachers (Graham & Perin, 2007c).

TABLE 14.1. Reviews That Provided Evidence for Identifying Effective Writing Practices

Andrews et al. (2006)
Type of studies: True experiments, quasi-experimental
Practices studied: Sentence combining, grammar
Outcomes: Quality, other outcomes
Student: Full range of students in typical classrooms, struggling writers
Study quality: Assessed study quality, BE

Bangert-Drowns (1993)
Type of studies: True experiments, quasi-experimental
Practice studied: Word processing
Outcomes: Quality, other outcomes
Student: Full range of students in typical classrooms, struggling writers
Study quality: Assessed study quality

Bangert-Drowns, Hurley, & Wilkinson (2004)
Type of studies: True experiments, quasi-experimental
Practice studied: Writing to learn
Outcomes: Content learning
Student: Full range of students in typical classrooms, struggling writers
Study quality: Assessed study quality

Gersten & Baker (2001)
Type of studies: True experiments, quasi-experimental
Practices studied: Creative writing, expository writing, narrative writing
Outcomes: Quality, other outcomes
Student: Struggling writers

Study quality: Not reported

Gillespie & Graham (2014)
Type of studies: True experiments, quasi-experimental
Practices studied: Strategy instruction, dictation, procedural facilitation, prewriting activities, goal setting, process writing
Outcomes: Quality
Student: Struggling writers
Study quality: Assessed study quality

Goldberg et al. (2003)
Type of studies: True experiments, quasi-experimental
Practice studied: Word processing
Outcomes: Quality, other outcomes
Student: Full range of students in typical classrooms, struggling writers
Study quality: Assessed study quality

Graham (2006)
Type of studies: True experiments, quasi-experimental, single-subject design
Practice studied: Strategy instruction
Outcomes: Quality, other outcomes
Student: Full range of students in typical classrooms, struggling writers
Study quality: Not reported

Graham, Bolinger, et al. (2012)
Type of studies: True experiments, quasi-experimental, single-subject design
Practices studied: Time for writing/writing instruction; teaching writing process /strategies, teaching text transcription/sentence skills, establishing a supportive environment
Outcomes: Quality, other outcomes
Student: Full range of students in typical classrooms, struggling writers
Study quality: Assessed study quality, only best evidence studies used in the review

Graham & Harris (2003)
Type of studies: True experiments, quasi-experimental, single-subject design
Practice studied: Strategy instruction
Outcomes: Quality, other outcomes
Student: Full range of students in typical classrooms, struggling writers
Study quality: Not reported

Graham, Harris, & Hebert (2011)
Type of studies: True experiments, quasi-experimental; POC
Practice studied: Formative assessment
Outcomes: Quality, other outcomes
Student: Full range of students in typical classrooms, struggling writers
Study quality: Not reported

Graham, Harris, & McKeown (2013)
Type of studies: True experiments, quasi-experimental, single-subject design
Practice studied: Strategy instruction
Outcomes: Quality, other outcomes
Student: Full range of students in typical classrooms, struggling writers
Study quality: Not reported

Graham & Hebert (2011)
Type of studies: True experiments, quasi-experimental: SOC
Practice studied: Writing to facilitate reading

Outcomes: Reading
Student: Full range of students in typical classrooms, struggling writers
Study quality: Not reported

Graham, McKeown, Kiuhara, & Harris (2012)
Type of studies: True experiments, quasi-experimental
Practice studied: Strategy instruction, adding self-regulation to strategy instruction, text structure instruction, creativity/imagery instruction, teaching transcription skills, grammar instruction, prewriting activities, peer assistance, product goals, assessing writing, word processing, extra writing time, process writing approach, comprehensive writing programs
Outcomes: Quality
Student: Full range of students in typical classrooms, struggling writers
Study quality: Assessed study quality

Graham & Perin (2007a; 2007b)
Type of studies: True experiments, quasi-experimental
Practices studied: Process writing approach, grammar, sentence combining, strategy instruction, summarization, text structure, prewriting, inquiry, procedural facilitation, peer assistance when writing, study of models, product goals, feedback, word processing, extra writing
Outcomes: Quality, content learning (2007a)
Student: Full range of students in typical classrooms, struggling writers
Study quality: Assessed study quality

Graham & Perin (2007c)
Type of studies: single-subject design; qualitative study of the writing practices of exceptional literacy teachers.
Practices studied: Strategy instruction, behavioral reinforcement, grammar instruction, word processing, self-evaluation, direct instruction; practices of exceptional teachers
Outcomes: Quality, other outcomes
Student: Full range of students in typical classrooms, struggling writers
Study quality: Not reported

Hillocks (1986)
Type of studies: True experiments, quasi-experimental
Practices studied: Grammar instruction, sentence combining, models of writing, assessment criteria, inquiry, free writing, modes of instruction
Outcomes: Quality
Student: Full range of students in typical classrooms, struggling writers
Study quality: Not reported

Morphy & Graham (2012)
Type of studies: True experiments, quasi-experimental: participant as own control
Practice studied: Word processing
Outcomes: Quality, other outcomes
Student: Struggling writers
Study quality: Assessed study quality

Rogers & Graham (2008)
Type of studies: single-subject design
Practices studied: Strategy instruction: planning and drafting, grammar/usage, goal setting for productivity, strategy instruction: editing, word processing, reinforcement, prewriting activities, Sentence construction, strategy instruction: paragraph construction, self-monitoring
Outcomes: Quality, elements, production, grammar, errors corrected, complete sentences
Student: Full range of students in typical classrooms, struggling writers
Study quality: Assessed study quality

Sandmel & Graham (2011)
Type of studies: True experiments, quasi-experimental
Practice studied: Process approach to writing
Outcomes: Quality
Student: Full range of students in typical classrooms, struggling writers
Study quality: Assessed study quality

Santangelo & Graham (2013)
Type of studies: True experiments, quasi-experimental
Practices studied: Handwriting and spelling, Instruction
Outcomes: Handwriting, spelling; Quality, Length
Student: Full range of students in typical classrooms, struggling writers
Study quality: Assessed study quality

As can be seen from Table 14.1, the effectiveness of many different writing practices has been tested over time. Many practices, but not all of them, have been tested using different approaches to research (e.g., true experiments, quasi-experiments, single-subject designs). The outcome that was most commonly tested in the studies in these reviews was writing quality (typically measured using holistic or analytic writing scales). Studies included in the reviews included both typically developing writers (i.e., full range of students in classroom) and students experiencing difficulty learning to write (i.e., struggling writers), but struggling writers were included much less often in the accumulated studies.

As noted earlier, we obtained all of the studies included in the 19 reviews presented in Table 14.1. For studies that involved true experiments, quasi-experiments, and participants as own controls, we conducted a new meta-analysis (which is summarized in Graham & Harris, in press). The findings from this new meta-analysis are presented in Table 14.2. This analysis involved students from grade 1 to 12, and the average effect size was weighted by sample size, giving greater weight to studies with more students than studies with fewer participants, as findings from larger studies are more reliable (Lipsey & Wilson, 2001). We did not compute an average-weighted effect size unless there were at least three studies testing the effectiveness of a specific writing practice.

TABLE 14.2. Evidence-Based Writing Practices from True Experiments, Quasi-Experiments, and Participants as Own Controls Studies

Writing interventions / Studies / Effect size / 95% Confidence interval / Grade levels

Students write
Extra writing / 9 / 0.24* / 0.01 to 0.47 / 2–8
Writing about content material—CL / 31 / 0.29*** / 0.15 to 0.44 / 2–12
Writing about material read—RDT / 55 / 0.50*** / 0.37 to 0.62 / 2–12
Writing about material read—NRT / 11 / 0.37*** / 0.23 to 0.51 / 3–12

Supporting students' writing
Process writing approach / 33 / 0.34*** / 0.24 to 0.44 / 1–12
Elementary / 18 / 0.48*** / 0.34 to 0.65 / 1–5
Secondary / 14 / 0.25*** / 0.12 to 0.39 / 6–12
Word processing / 39 / 0.44*** / 0.27 to 0.61 / 1–12
Word processing plus additional supports / 4 / 1.46*** / 0.76 to 2.15 / 1–5
Peer collaboration around process / 8 / 0.74** / 0.32 to 1.16 / 2–12
Setting goals for writing / 9 / 0.80*** / 0.53 to 1.06 / 4–8
Prewriting / 13 / 0.48*** / 0.28 to 0.69 / 2–9
Inquiry / 6 / 0.37* / 0.05 to 0.70 / 3–12

Explicit writing instruction
Writing strategies / 42 / 1.26*** / 0.97 to 1.56 / 2–12
General strategy instruction / 14 0.56*** / 0.38 to 0.74 / 4–10
SRSD instruction / 28 1.59*** / 1.18 to 1.99 / 2–12
Add self-regulation to strategy instruction / 6 / 0.50** / 0.16 to 0.83 / 2–6
Motivation / 3 / 1.07** / 0.46 to 1.68 / 5–12
Creativity and imagery / 4 / 0.76*** / 0.44 to 1.07 / 3–6
Emulate model text / 7 / 0.30*** / 0.19 to 0.42 / 3–12
Sentence combining / 5 / 0.50*** / 0.30 to 0.70 / 4–9
Transcription skills / 8 / 0.55* / 0.08 to 1.02 / 1–3
Vocabulary skills / 3 / 0.78** / 0.27 to 1.29 / 3–8

Writing assessment
Adult feedback / 7 / 0.87*** / 0.62 to 1.11 / 2–6
Peer feedback / 10 / 0.77*** / 0.45 to 1.08 / 2–9
Self-assessment / 13 / 0.51*** / 0.28 to 0.75 / 2–12
Machine feedback / 5 / 0.34* / 0.02 to 0.65 / 6–10

Note. All average-weighted effect sizes are for writing quality except effects for Writing about Content Material (content learning measured) and Writing about Material Read (reading comprehension measured). RDT, researcher-designed reading comprehension measures; NRT, norm-referenced reading measure.
*$p < .05$; **$p < .01$; ***$p < .001$.

With two exceptions, the reported average-weighted effect sizes in Table 14.2 focused on writing quality. We wanted to identify EBPs that would have a positive impact on improving overall writing performance, reasoning that these would be particularly important in designing an effective writing program. The two exceptions were: (1) writing about material presented in class where the outcome was remembering/learning content material; and (2) writing about material read where the outcome was comprehension.

Table 14.2 provides information on how many studies were included in each analysis, if the obtained effect was statistically significant, the confidence interval for the obtained effect, and the grade range of students included in the test of the writing practice. For the process writing approach, we further reported the average-weighted effect at the elementary and secondary grades, as this study characteristic was related to variability in study outcomes and favored this type of instruction with younger students. We also found that studies that applied the self-regulated strategy development model (Harris, Graham, Mason, & Friedlander, 2008) to teach writing strategies produced larger effects than the combined effects for studies that applied other approaches to teach strategies.

To identify writing EBPs based on evidence from single-subject design studies, we drew upon a previous meta-analysis we conducted in 2008 (Rogers & Graham), where an average effect size was reported if the writing practice was tested in four or more studies. The effect statistic used in the Rogers and Graham analysis was percent of nonoverlapping data (PND), calculated as the total number of data points taken during or immediately after instruction that exceeds the highest baseline data point. A writing practice was considered effective if the average PND exceeded 50% (Scruggs & Mastropieri, 1998). The writing outcomes for EBPs based on single-subject design studies in Rogers and Graham were quite varied, as it is only possible to compute a PND for variables that are presented in graph form. Researchers typically present graphs for the variables they are most interested in directly impacting. The variables graphed sometimes involved writing quality, but it more often involved a discrete and easily countable variable. Table 14.3 presents the mean PND for each writing practice by outcome measure, the number of studies as well as the range of PNDs for these studies, and the grade range of students participating in the studies.

TABLE 14.3. Evidence-Based Writing Practices from Single-Subject Design Studies

Strategy instruction: planning/drafting
Studies: 21
Grade range: 2–8
Measure: Elements
M: 96% TX/POST
Range: 67–100% TX/POST

Studies: 18
Grade range: 2–8
Measure: Elements
M: 90% MAINT
Range: 25–100% MAINT

Studies: 4
Grade range: 2–6
Measure: Elements
M: 85% GEN Genre
Range: 67–100% GEN Genre

Studies: 10
Grade range: 2–8
Measure: Production
M: 91% TX/POST
Range: 68–100% TX/POST

Studies: 7
Grade range: 2–8
Measure: Production
M: 86% MAINT
Range: 33–100% MAINT

Studies: 11
Grade range: 2–8
Measure: Quality
M: 72% TX
Range: 48–96% POST

Teaching grammar/usage
Studies: 4
Grade range: 2–6 Grammar
M: 83% TX
Range: 75–88% TX

Goal setting for productivity
Studies: 7
Grade range: 2–12
Measure: Production
M: 79% TX/POST
Range: 26–100% TX

Strategy instruction: editing
Studies: 5
Grade range: 4–12
Measure: Errors corrected

M: 84% POST
Range: 50–100% POST

Word processing
Studies: 4
Grade range: 1–5
Measure: Production
M: 70% TX
Range: 29–100% TX

Reinforcement
Studies: 4
Grade range: 3–6
Measure: Production
M: 96% TX 84–100% TX

Prewriting activities
Studies: 4
Grade range: 3–12
Measure: Quality
M: 52% TX/POST
Range: 13–84% TX/POST

Sentence construction
Studies: 5
Grade range: 6–12
Measure: Complete sentences
M: 86% TX/POST
Range: 78–100% TX/POST

Strategy instruction: paragraph construction
Studies: 4
Grade range: 8–9
Measure: Elements
M: 97% TX/POST
Range: 89–100% TX/POST

Self-monitoring
Studies: 7
Grade range: 2–7
Measure: Production
M: 51% TX
Range: 23–91% TX

Note. TX, scores during treatment; TX/POST, scores during treatment as well as immediately after treatment (less than 3 weeks after treatment ended); MAINT, maintenance (3 or more weeks after treatment ended); GEN, scores for generalization probes.

Finally, we obtained each qualitative study from the reviews in Table 14.1 (e.g., Graham & Perin, 2007c) that examined the writing practices employed by exceptional literacy teachers. We conducted a meta-synthesis of these qualitative studies (this was done as part of Graham et al., in press). A meta-synthesis treats each qualitative study as a case and looks for reoccurring themes across studies. Table 14.4 presents the ten themes or reoccurring patterns of

practice applied in a majority of the qualitative studies of exceptional literacy teachers.

TABLE 14.4. Writing Instructional Practices of Effective Teachers from Qualitative Studies

1. Provide time dedicated to writing and writing instruction, with writing occurring across the curriculum.
2. Involve students in various forms of writing over time.
3. Treat writing as a process, where students plan, draft, revise, edit, and share their work.
4. Keep students engaged and on-task by involving them in thoughtful activities.
5. Teach often to the whole class, in small groups, and with individual students; this includes teaching students how to plan, draft, and revise as well as teaching more basic writing skills.
6. Model, explain, and provide guided assistance when teaching.
7. Provide just enough support so that students can make progress or carry out writing tasks and processes, but encourage students to act in a self-regulated fashion, doing as much as they can on their own.
8. Be enthusiastic about writing and create a positive environment in which students are constantly encouraged to try hard, believe that the skills and strategies they are learning will permit them to write well, and attribute success to effort and the tactics they are learning.
9. Set high expectations for their students, encouraging them to surpass their previous efforts or accomplishments.
10. Adapt writing assignments and instructions to better meet the needs of individual students.

EBPS IN WRITING

Table 14.1 presents EBPs for writing based on evidence from true experiments, quasi-experiments, and participants as own-control studies. Each writing practice had a statistically significant impact on students' performance in three or more studies. Practices involved increasing students' writing; supporting one or more aspects of the writing process (i.e., apply the process approach, use word processing as the writing stylus, have peers collaborate when they write, set goals for writing, ask students to engage in prewriting or inquiry activities and prewriting exercises to gather, organize, and analyze possible writing content); providing instructions to enhance writing skills, strategies, knowledge, and motivation; and providing students with feedback about their writing (i.e., teacher, peer, self, and machine feedback). Each of these practices significantly improved the overall quality of students' writing. In addition, having students write about what they were learning in class or in text improved learning and comprehension.

The writing EBPs presented in Table 14.3 and based on single-subject design studies all exceeded the 50% criteria for an effective PND established by Scruggs and Mastropieri (1998). These EBPs overlap considerably with the ones presented in Table 14.2, providing additional support for teaching writing strategies and sentence skills; using goal setting, word processing, and prewriting activities to support students' writing; encouraging students to obtain feedback through their own efforts (i.e., self-monitor their writing performance); and fostering motivation for writing (i.e., reinforcement).

The ten writing practices applied in a majority of the qualitative studies with exceptional literacy teachers (see Table 14.4) provided additional support and depth for a number of the writing EBPs in Tables 14.2 and 14.3, including the importance of having students write (see practices 1 and 2), the process approach to writing (see practice 3); teaching writing strategies and skills (see practices 5 and 6), setting goals (see practice 9), and facilitating motivation (see practice 4, 8, and 10).

A GENERAL ROADMAP FOR TEACHING WRITING

One of our primary goals in this chapter was to develop a set of general guidelines for teaching writing based on the collective findings in Tables 14.2 to 14.4. To do this, we examined all of the practices identified in these three tables in order to identify principles for teaching writing to students in grades 1 to 12. Our analysis resulted in six evidence-based recommendations.

Recommendation 1: Write

We identified a cluster of EBPs that supported the importance of engaging students in the process of writing. Increasing the amount of time students spend writing enhanced the quality of their text (see Table 14.2), whereas highly effective teachers asked students to write often and for a variety of purposes (practices 1 and 2 in Table 14.4).

Recommendation 2: Create a Supportive Writing Environment

Another cluster of EBPs demonstrated the value of creating a supportive writing environment. Efforts designed to support students' writing included teachers setting clear and specific goals for students' writing (Tables 14.2 and 14.3); students working together as they composed (Table 14.2); and students engaging in prewriting and inquiry activities designed to help them gather, organize, and think about possible writing content (Tables 14.2 and 14.3).

Highly effective teachers also engaged in goal setting, establishing high expectations for their students (Table 14.4, practice 9), but at the same time they provided nuanced support by adapting writing assignments and instruction to meet the needs of individual students (Table 14.4, practice 10). In addition, these teachers created a classroom environment where they were enthusiastic about writing, emphasized the importance of students' effort, provided just enough support so that students could succeed, kept students engaged by using activities that required thoughtful activity, and showed that they believed that their students were capable (Table 14.4, practices 4, 7, and 8). Many of these same supports and classroom characteristics were evident in the studies that tested the process approach to writing (Table 14.2).

Recommendation 3: Teach Writing Skills, Strategies, Knowledge, and Motivation

A third cluster of EBPs centered on teaching designed to enhance students' writing strategies, skills, knowledge, and motivation. Effective instruction included teaching students specific strategies for (1) drafting paragraphs as well as (2) planning, revising, and editing text. Strategy instruction was enhanced when students were taught self-regulation procedures for using writing strategies, and students became better writers when they were taught how to visualize ideas and be more creative (Table 14.2). In addition, highly effective teachers taught students strategies for carrying out the process involved in planning, revising, and editing using modeling, explanation, and guided practice (Table 14.4, practices 5 and 6).

Highly effective teachers not only taught strategies for composing, but they also taught foundational writing skills as well, using whole-class, small-group, and individual instruction where skills were modeled, explained, and practiced (Table 14.4, practices 5 and 6). Teaching transcription skills (handwriting, typing, and spelling), vocabulary for specific types of writing, and sentence constructions skills through sentence combining improved the quality of students' writing (Table 14.2), whereas teaching sentence construction as well as grammar and usage skills through modeling and guided practice improved sentence writing skills and reduced errors in writing, respectively (Table 14.3). Moreover, instructional procedures designed to increase students' knowledge about the characteristics of good writing (i.e., asking students to emulate model text) and to enhance their motivational

disposition (e.g., increasing self-efficacy through self-evaluation) resulted in better writing (Table 14.2).

Recommendation 4: Provide Feedback

Another cluster of EBP centered on feedback. Students' writing improved when teachers provided them with feedback about their writing or progress in learning (Table 14.2). Writing was also enhanced when students were taught to evaluate their own writing or monitored some aspect of what they wrote (Tables 14.2 and 14.3). Giving and receiving feedback from a peer further improved the quality of what students wrote, as did receiving feedback from a computer program (Table 14.2).

Recommendation 5: Use 21st-Century Writing Tools

A fifth cluster of EBPs supported the use of word processing as a stylus for writing. Students become better writers when they compose via word processing and even stronger writers when they compose with word processing programs that include additional software that facilitates one or more aspects of writing, like word choice or planning (Tables 14.2 and 14.3).

Recommendation 6: Use Writing as a Tool to Support Student Learning

A final cluster of EBPs demonstrated the power of using writing as a tool to support student learning. Asking students to write about content material presented in class or text enhanced their learning and comprehension (Table 14.2), whereas highly effective teachers asked students to write for a variety of purposes (Table 14.4, practice 2).

AFFORDANCES AND CAVEATS

Affordances

One advantage of establishing EBPs in writing is that they can provide a general roadmap for teaching writing to students in grades 1 to 12. They demonstrate that students become better writers by writing and that writing about material read or studied in class can facilitate learning and comprehension. They demonstrate the importance of establishing a supportive and motivating environment in which students write and learn to write. They provide direction on which writing skills, processes, knowledge, and motivational attributes can be profitably taught. They show that feedback from others or one's self can result in better writing. They confirm the value of writing with 21st-century writing tools.

For both skilled and novice writing teachers, such a roadmap provides a way of thinking about and structuring classroom writing practices. We believe that teachers who apply such knowledge to their own classrooms will benefit most (as will their students) if they contextualize it with what they know about their students and the experience and practical knowledge they have acquired about how to teach writing, making it work within their own particular context.

In addition to providing a general roadmap to guide teaching practices, the EBPs presented here provide specific instructional procedures that can be applied directly in the classroom to improve students' writing. Although the application of an EBP does not guarantee success, it does have an advantage. Other teachers have used it in different settings, and it made a demonstrable and replicable difference in their students' writing. The skillful teaching of

writing is not easy, and we believe that teachers' use of instructional procedures with a proven track record is likely to increase their success, which will in turn increase their desire and motivation to teach writing.

Caveats

EBPs as a Roadmap

Although current EBPs in writing provide practitioners with a general roadmap for writing instruction, it is important to recognize that it is like an old treasure map with holes in it and smudges obscuring important details. In other words, it is incomplete and lacks precision. This is evident in both large and small ways. The existing map, for instance, tells us little to nothing about how to develop a writer's voice and audience awareness, reduce or eliminate grammatical miscues in students' text, or teach writing to students who are second-language learners (as few instructional studies have been conducted with these students).

The contour lines on our treasure map are also incomplete, as we are still exploring the topography of each of the current EBPs. For instance, we know that word processing can enhance students' writing at all grade levels, but our map does not identify the cliffs, chasms, and changing landscape that shape our journey with this tool. With word processing, this includes issues surrounding typing speed (how fluent does a child's typing need to be for him for her to benefit from word processing?), accessibility (are there enough computers in the class?), and the constant development of new digital writing tools.

In other instances, our survey of the topography of EBPs is uneven. For example, the available evidence reveals that instruction can improve the spelling and handwriting skills of students in the elementary and middle school grades (Santangelo & Graham, 2013), but we do not know if such instruction enhances the overall quality of students' writing beyond the primary grade because such research has not been conducted.

Although our treasure map lays out the general terrain, providing a general sense of what we need to do to find the hoped-for treasure (better writing), it does not lay out a specific pattern of trails and roadways that must be traveled. In other words, we do not know what combination or how much of each of the EBPs identified here is needed. Although there are surely multiple paths to gain the treasure, the available evidence is clear—better results are obtained when teachers bring together multiple EBPs to improve their students' writing (Sadoski, Willson, & Norton, 1997).

It must also be recognized that our treasure map captures a partial representation of one reality (i.e., writing) but intersects only loosely with other realities, such as reading and learning, that should also be considered. We know that writing about material read or content presented in class facilitates comprehension and learning. We also know that increasing how much students write and teaching a variety of writing skills improve students' reading (see Graham & Hebert, 2011). As with the other parts of our map, detail needs to be added, holes must be filled, and topography has to be determined to better consider how writing can facilitate reading, learning, and even other capabilities such as oral language, and how they in turn can facilitate writing.

As our map metaphor demonstrates, relying solely on EBPs to develop a writing program is not enough (we don't think it ever will be). Teachers also need to bring to bear their own knowledge and experience about how to teach writing. This presents a problem in some instances, as too many teachers indicate their preparation to teach writing is minimal to nonexistent (Brindle, 2012). Clearly, we need to do a better job of preparing all teachers if they are to apply EBPs smartly and judiciously.

EBPs as Specific Instructional Practices

As teachers apply specific EBPs presented in this chapter, we encourage them to think of these practices as "potentially" effective. There is no guarantee that a writing practice that was effective in a series of research studies will be effective in all other situations. Frankly, there is never a perfect match between the conditions under which a writing practice was tested by researchers and the conditions in which it is subsequently applied by classroom teachers. The safest course of action, therefore, is to monitor the effects of an EBP when it is applied to be sure it works in this new situation.

Researchers agree that an EBP must be implemented in the classroom with fidelity if it is to be successful. This is important, but the devil is in the details. For some, fidelity means that the practice has to be applied exactly as it was applied by researchers testing it (including using a word-by-word script during instruction). For others, fidelity means that the instructional guidelines and materials provided with EBPs serve as a meta-script to guide what the teacher does, emphasizing that all elements of instruction need to be implemented, but teachers need to adapt them to their context, students, and capabilities (Harris, Graham, & Adkins, 2015). In our experience, teachers are more apt to apply EBPs and use them well when they can bring their professional skills and judgment to bear to make the practice fit their particular situation.

When selecting which EBPs to apply, teachers may be tempted to select those with the largest ES or PND. This would be a mistake, as a higher effect does not mean that a particular practice is better than another specific practice. This would only be the case if the two practices were directly compared, and such a comparison rarely occurred in the research literature. Moreover, the only EBP presented in this chapter that constituted a full writing program was the process approach to writing. Although this approach is effective, it was not particularly powerful and can be enhanced when it is combined with other EBPs (e.g., Danoff, Harris, & Graham, 1993). Thus, we encourage teachers to select and implement EBPs using a roadmap such as the one drawn here, combined with a theoretical model of how writing develops (see Graham et al., in press)

Finally, it is important to note that many of the EBPs in this chapter were not tested extensively (some involved just three studies), did not cover all grade levels, and mostly involved typically developing writers. Again, this emphasizes the importance of teacher judgment and knowledge in the application of these procedures.

CONCLUDING REMARKS

A positive benefit from the scientific study of writing is that researchers have identified a variety of EBPs that teachers can use to help students become more skilled writers. These EBPs not only provide teachers with tools for addressing a specific aspect or writing, but they also provide guidelines that give shape and substance to a writing program as a whole. The idea that high-quality research should inform writing instruction does not mean that teachers' professional judgment and experience are no longer important. Rather, the use of EBPs requires that teachers make complex judgments about the benefits and limitations of these practices, and consider how best to contextualize them, taking into account what they already know about writing, their students, and the context within which they work. This can be facilitated through professional development (see Harris et al., 2012), but additional research is needed to better understand this process.

REFERENCES

Andrews, R., Torgerson, C., Beverton, S., Freeman, A., Locke, T., Low, G., et al. (2006). The effects of grammar teaching on writing development. *British Educational Research Journal*, *32*, 39–55.

Bangert-Drowns, R. (1993). The word processor as an instructional tool: A meta-analysis of word processing in writing instruction. *Review of Educational Research, 63*, 69–93.

Bangert-Drowns, R. L., Hurley, M. M., & Wilkinson, B. (2004). The effects of school-based Writing-to-Learn interventions on academic achievement: A meta-analysis. *Review of Educational Research, 74*, 29–58.

Blount, N. (1973). Research on teaching literature, language, and composition. In R. Travers (Ed.), *Second handbook of research on teaching.* Chicago: Rand McNally.

Bradock, R., Lloyd-Jones, R., & Schoer, L. (1963). *Research in written composition.* Champaign, IL: National Council of Teachers of English.

Brindle, M. (2012). *Examining relationships among teachers' preparation, efficacy, and writing practices*. Unpublished doctoral dissertation, Vanderbilt University, Nashville, TN.

Burnham, S. (1994). *For writers only.* New York: Ballantine.

Cook, W. (1912). Shall we teach spelling by rules? *Journal of Educational Research, 3*, 316–325.

Danoff, B., Harris, K. R., & Graham, S. (1993). Incorporating strategy instruction into the school curriculum: Effects on children's writing. *Journal of Reading Behavior, 25*, 295–322.

Garcia-Sanchez, J., & Caso-Fuertes, A. (2005). Comparison of the effects on writing attitudes and writing self-efficacy of three different training programs in students with learning disabilities. *International Journal of Educational Research, 43*, 272–289.

Gersten, R., & Baker, S. (2001). Teaching expressive writing to students with learning disabilities. *Elementary School Journal, 101*, 251–272.

Gillespie, A., & Graham, S. (2014). A meta-analysis of writing interventions for students with learning disabilities. *Exceptional Children, 80*, 454–473.

Goldberg, A., Russell, M., & Cook, A. (2003). The effect of computers on student writing: A meta-analysis of studies from 1992 to 2002. *Journal of Technology, Learning, and Assessment* 2.

Gordon, W. (2000). *The quotable writer.* New York: McGraw-Hill.

Graham, S. (2006). Strategy instruction and the teaching of writing: A meta-analysis. In C. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 187–207). New York: Guilford Press.

Graham, S. (2010). Teaching writing. P. Hogan (Ed.), *Cambridge encyclopedia of language sciences* (pp. 848–851). Cambridge, UK: Cambridge University Press.

Graham, S., Bolinger, A., Booth Olson, C., D'Aoust, C., MacArthur, C., McCutchen, D., et al. (2012). *Teaching writing in elementary school: A practice guide.* Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.

Graham, S., & Harris, K. R. (in press). Evidence-based writing practices: A meta-analysis of existing meta-analyses. In R. Fidalgo, K. R. Harris, & M. Braaksma (Eds.), *Design principles for teaching effective writing: Theoretical and empirical grounded principles.* Hershey, PA: Brill Editions.

Graham, S., & Harris, K. R. (2003). Students with learning disabilities and the process of writing: A metaanalysis of SRSD studies. In L. Swanson, K. R. Harris, & S. Graham (Eds.), *Handbook of research on learning disabilities* (pp. 383–402). New York: Guilford Press.

Graham, S., & Harris, K. R. (in press). Evidence-based writing practices: A meta-analysis of existing meta-analyses. In R. Fidalgo, K. R. Harris, & M. Braaksma (Eds.), *Design principles for teaching effective writing: Theoretical and empirical grounded principles*. Hershey, PA: Brill Editions.

Graham, S., Harris, K. R., & Hebert, M. (2011). *Informing writing: The benefits of formative assessment*. Washington, DC: Alliance for Excellence in Education.

Graham, S., Harris, K. R., & Hebert, M. (2011). Writing-to-read: A meta-analysis of the impact of writing and

writing instruction on reading. *Harvard Educational Review, 81,* 710– 744.

Graham, S., Harris, K. R., & McKeown, D. (2013). The writing of students with LD and a meta-analysis of SRSD writing intervention studies: Redux. In L. Swanson, K. R. Harris, & S. Graham (Eds.), *Handbook of learning disabilities* (2nd ed., pp. 405–438). New York: Guilford Press.

Graham, S., Harris, K. R., & Santangelo, T. (in press). Research-based writing practices and the Common Core: Meta-nalysis and meta-synthesis. *Elementary School Journal*.

Graham, S., & Hebert, M. (2011). Writing to read: A meta-analysis of the impact of writing and writing instruction on reading. *Harvard Educational Review, 81,* 710–744.

Graham, S., McKeown, D., Kiuhara, S., & Harris, K. R. (2012). A meta-analysis of writing instruction for students in the elementary grades. *Journal of Educational Psychology, 104*, 879–896.

Graham, S., & Perin, D. (2007a). *Writing next: Effective strategies to improve writing of adolescent middle and high school*. Washington, DC: Alliance for Excellence in Education.

Graham, S., & Perin, D. (2007b). A meta-analysis of writing instruction for adolescent students. *Journal of Educational Psychology, 99*, 445–476.

Graham, S., & Perin, D. (2007c). What we know, what we still need to know: Teaching adolescents to write. *Scientific Studies in Reading, 11,* 313–336.

Graves, D. (1983). *Writing: Teachers and children at work.* Exeter, NH: Heinemann.

Harris, K. R., Graham, S., & Atkins, M. (2015). Tier 2, Teacher implemented writing strategies instruction following practice-based professional development. *Contemporary Educational Psychology, 40*, 5–16.

Harris, K. R., Graham, S., Mason, L., & Friedlander, B. (2008). *Powerful writing strategies for all students*. Baltimore, MD: Brookes.

Harris, K. R., Lane, K., Graham, S., Driscoll, S., Sandmel, K., Brindle, M., et al. (2012). Practice-based professional development for strategies instruction in writing: A randomized controlled study. *Journal of Teacher Education, 63*, 103–119.

Hillocks, G. (1986). *Research on written composition: New directions for teaching*. Urbana, IL: National Council of Teachers of English.

Hjørland, B. (2011). Evidence based practice: An analysis based on the philosophy of science. *Journal of the American Society for Information Science and Technology, 62*, 1301–1310.

Horn, E. (1919). Principles of methods in teaching spelling as derived from scientific investigation. In *Eighteenth Yearbook, National Society for the Study of Education.* Bloomington, IN: Public School Publishing.

Lipsey, M., & Wilson, D. (2001). *Practical meta-analysis*. Thousand Oaks, CA: Sage.

Meckel, H. (1963). Research on teaching composition and literature. In N. Gage (Ed.), *Handbook of research on teaching.* Chicago: Rand McNally.

Miller, B., & Ney, J. (1968). The effect of systematic oral exercises on the writing of fourth-grade students. *Research in the Teaching of English, 2,* 44–61.

Morphy, P., & Graham, S. (2012). Word processing programs and weaker writers/readers: A meta-analysis of research findings. *Reading and Writing: An Interdisciplinary Journal, 25*, 641–678.

Rogers, L., & Graham, S. (2008). A meta-analysis of single subject design writing intervention research. *Journal of Educational Psychology, 100*, 879–906.

Sackett, D., Rosenberg, W., Gray, J., Haynes, R., & Richardson, W. (1996). Evidence based medicine: What it is and what it isn't. *British Medical Journal, 312*, 71–72.

Sadoski, M., Willson, V., & Norton, D. (1997). The relative contribution of research-based composition activities to writing improvement in lower and middle grades. *Research in the Teaching of English, 31,* 120–150.

Sandmel, K., & Graham, S. (2011). The process writing approach: A meta-analysis. *Journal of Educational Research, 104*, 396–407.

Santangelo, T., & Graham, S. (2013, February). *Meta-analyses of handwriting and spelling instruction.* Paper presented at the Pacific Coast Research Conference, Mission Beach, CA.

Scardamalia, M., & Bereiter, C. (1986). Written composition. In M. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 778–803). New York: Macmillan.

Scruggs, T., & Mastropieri, M. (1988). Summarizing single-subject research: Issues and applications. *Behavior Modification, 22*, 221–242.

Smagorinsky, P. (1987). Graves revisited: A look at the methods and conclusions of the New Hampshire study. *Written Communication, 4*, 331–342.

Winokur, J. (1999). *Advice to writers.* New York: Pantheon.

CHAPTER 15

New Developments in Genre-Based Literacy Pedagogy

David Rose

It is now over 30 years since genre-based literacy pedagogy of the Sydney School (hereafter simply genre pedagogy) began making an impact on the teaching of writing in Australian schools (Hyon, 1996; Johns, 2002; Martin, 2000; Rose, 2008). Over these decades its practices, pedagogic contexts, and informing theories have expanded considerably, so the research review presented in this chapter is timely. Genre pedagogy has emerged from a series of large-scale action research projects, including at least three phases in its development, through the 1980s and 1990s, and diversifying in the 2000s. Throughout all these phases, a fundamental question has been how schools can more effectively redistribute the semiotic resources of contemporary culture to democratize the outcomes of education. The design of theoretical models and research methods has flowed from this research question, shaped by the findings as the project has unfolded.

The first phase, known as the *Writing Project* and *Language and Social Power* project, was initiated in 1979 by teacher–educator Joan Rothery and discourse analyst J. R. Martin and colleagues in schools and universities in Sydney, with the aim of designing an explicit pedagogy for teaching writing in the primary school. The second phase, known as *Write It Right*, extended the research to the secondary school and workplace contexts, exploring relations between writing and knowledge. The third phase has included the *Reading to Learn* program, exploring relations between reading, writing and classroom pedagogy (Rose, 2014; Rose & Martin, 2012), as well as the *SLATE (Scaffolding Literacy in Tertiary and Academic Environments)* project (Mahboob, 2013) and the *DISKS (Disciplinarity, Knowledge and Schooling)* project (Martin & Maton, 2013).

THEORETICAL MODELS

The research project as a whole has drawn on two complex theories of language and its social contexts, including the model of text-in-context developed within systemic functional linguistic (SFL) theory, and the model of

pedagogic contexts developed in the sociological theory of Basil Bernstein (1990, 2000). On one hand, the research has applied the SFL model of text-in-context to describe the systems of "knowledge genres" that students are expected to read and write in school. On the other, it has adapted Bernstein's theory of pedagogic discourse to describe the "curriculum genres" (Christie, 2002) through which control of the written genres of schooling is acquired and evaluated.

SFL is a large, multidimensional theory of language as social process that provides a number of useful tools for educational research. In particular, SFL recognizes three metafunctions of language: its interpersonal function to enact relations between participants, its ideational function to construe their experience of reality, and a textual function to weave the interpersonal and ideational together as discourse that is meaningful in context. Halliday (e.g., 1978) outlines a model of language and social context as complementary layers of meaning in which each metafunction of language realizes a dimension of social context, in the following proportions:

ideational: field ::
interpersonal: tenor ::
textual: mode.

Martin (1992; Martin & Rose, 2007, 2008) elaborates this model, exploring field as configurations of people and things involved in sequences of activities, oriented to global institutional purposes; tenor as relations of power and solidarity among participants; and mode as the extent to which a text constitutes or merely accompanies what is going on (or how multimodal it is). Unlike Halliday, Martin goes further to stratify context as two levels, with genre specifying the particular combinations of field, tenor, and mode allowed by a given culture, realized by the stages and phases through which a text unfolds.

This model treats a culture as a system of genres, realized through recurrent configurations of meaning (across language and attendant modalities of communication). Social context is thus modeled as genre, in turn realized through field, tenor, and mode (collectively known as register), realized in turn through language (and other modalities of meaning). Alongside the stratal relation between language and context, language itself is organized in three strata, as discourse, realized as grammar, realized as phonology (in speech) or graphology (in writing). Figure 15.1 presents this model as a set of nested circles in which each level is related to the next by realization.

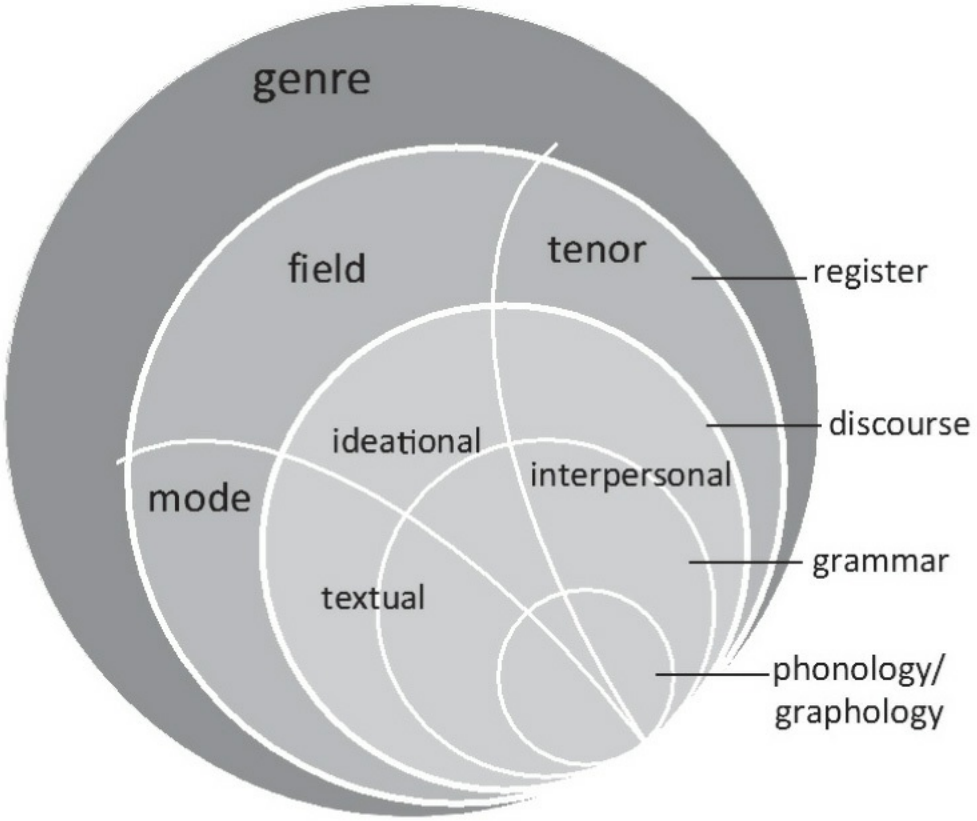


FIGURE 15.1. A stratified model of language and social context.

We can use the SFL model to investigate the complexity of reading and writing tasks, in order to design curriculum genres that provide explicit guidance for each dimension of the tasks. A written text consists of patterns of letters in words (spelling patterns), realizing patterns of words in sentences (grammar patterns), realizing patterns of meanings across texts (discourse patterns), realizing configurations of entities, activities, and social relations (register), realizing global social functions (genre)—in short, an immensely complex task for a novice reader and writer.

In such a model of language as social process, writing and reading are understood as institutional practices, which the school has evolved to elaborate and reproduce. To understand relations between written ways of meaning and pedagogic practices, we turn to Bernstein's sociological theory. Like SFL, Bernstein's model is complex and multidimensional. For the purposes of this review, we draw on just two dimensions: Bernstein's metatheoretical comparison of types of pedagogy and his model of pedagogic discourse.

First, Bernstein contrasts pedagogic theories along two lines:

> whether the theory of instruction privileged relations internal to the individual, [or] relations *between* social groups [and] whether the theory articulated a pedagogic practice emphasising a logic of acquisition or . . . a logic of transmission. . . . In the case of a logic of acquisition . . . the acquirer is active in regulating an *implicit* facilitating practice. In the case of a logic of transmission the emphasis is upon *explicit* effective ordering of the discourse to be acquired, by the transmitter. (1990, pp. 213–214)

In these terms, genre pedagogy has always been both visible and interventionist—with a strong focus on the explicit transmission of knowledge about language with the aim of empowering otherwise disenfranchised groups. It contrasts with theories focused on the psychology or behavior of individuals that construe learning as either passive absorption or personal discovery of knowledge.

Second, Bernstein models pedagogic discourse as an instructional discourse "which creates specialised skills and their relationship to each other," embedded in a regulative discourse "which creates order, relations and identity" (2000, p. 46). Bernstein's "discourse" refers to social activity, for which he also uses the term *practice*, which is used here to avoid confusion with the SFL use of discourse. Bernstein's instructional practice can be interpreted in SFL terms as pedagogic activities (field), pedagogic relations between learners and teachers (tenor), and modalities of learning—spoken, written, visual, manual (mode), together with the knowledge and social values exchanged through these pedagogic activities, relations, and modalities. A configuration of pedagogic activities, relations, modalities, knowledge, and values constitutes a curriculum genre.

In this perspective, it is the social relations enacted over time in pedagogic activities that create "order, relations and identity." It is not only knowledge that learners acquire through pedagogic activities, relations, and modalities, but identities as learners that are more or less successful and more or less included in the community of learning in the school. Differentiation in learner identities is a product of (1) continual evaluation, which positions them on a hierarchy of success and failure, (2) varying degrees of engagement in lesson activities and classroom interactions, and (3) varying control over modalities of learning, particularly reading and writing. By these means, pedagogic practice creates and legitimates an unequal social order and asymmetric social relations.

PHASE 1: THE *WRITING PROJECT* AND *LANGUAGE AND SOCIAL POWER*

In the first phase of genre pedagogy's development, research questions included the kinds of writing that were most valued in the primary school, and how students could be explicitly guided to write them (Painter & Martin, 1986). The primary research methods were to collect and analyze students' texts and to trial teaching activities through action research. Findings for this stage of the research included, on one hand, the key written genres through which school knowledge is acquired and displayed or "knowledge genres"; and on the other hand a curriculum genre through which knowledge genres can be explicitly taught and learned. More specifically, the research method involves comparison between genres, using the criteria provided by the SFL model; comparisons between knowledge genres to identify the nature of writing tasks in school, and comparisons between curriculum genres to identify and refine effective teaching practices.

Being able to name genres and point out their differences is liberating for both teachers and students. When genre pedagogy began, the only such terms available to many teachers were "story" and "essay." In the first stage of the research program, genres commonly written in the primary school were identified and named, along with their social purposes and typical staging (Table 15.1). This type of metalanguage is designed for teachers to be able to explicitly discuss with students the kinds of texts written for various purposes and how they are organized.

TABLE 15.1. Key Genres Described in the First Phase of Research

Stories
Genre: Recount
Purpose: Recounting events
Stages: Orientation; Record of events

Genre: Narrative
Purpose: Resolving a complication
Stages: Orientation; Complication; Resolution

Factual texts
Genre: Description
Purpose: Describing specific things
Stages: Orientation

Genre: Report
Purpose: Classifying and describing general things
Stages: Classification; Description

Genre: Explanation
Purpose: Explaining sequences of events
Stages: Phenomenon; Explanation

Genre: Procedure
Purpose: How to do an activity
Stages: Purpose; Equipment; Steps

Arguments
Genre: Exposition
Purpose: Arguing for a point of view
Stages: Thesis; Arguments; Reiteration

Genre: Discussion
Purpose: Discussing two or more points of view
Stages: Issue; Sides; Resolution

The comparative method can also be usefully applied to analyzing and designing curriculum genres. Joan Rothery and colleagues designed a curriculum genre in which writing could be explicitly modeled, discussed, and guided, dubbed the "teaching to learning cycle" or TLC. Figure 15.2 displays one version (Rothery 1994/2007).

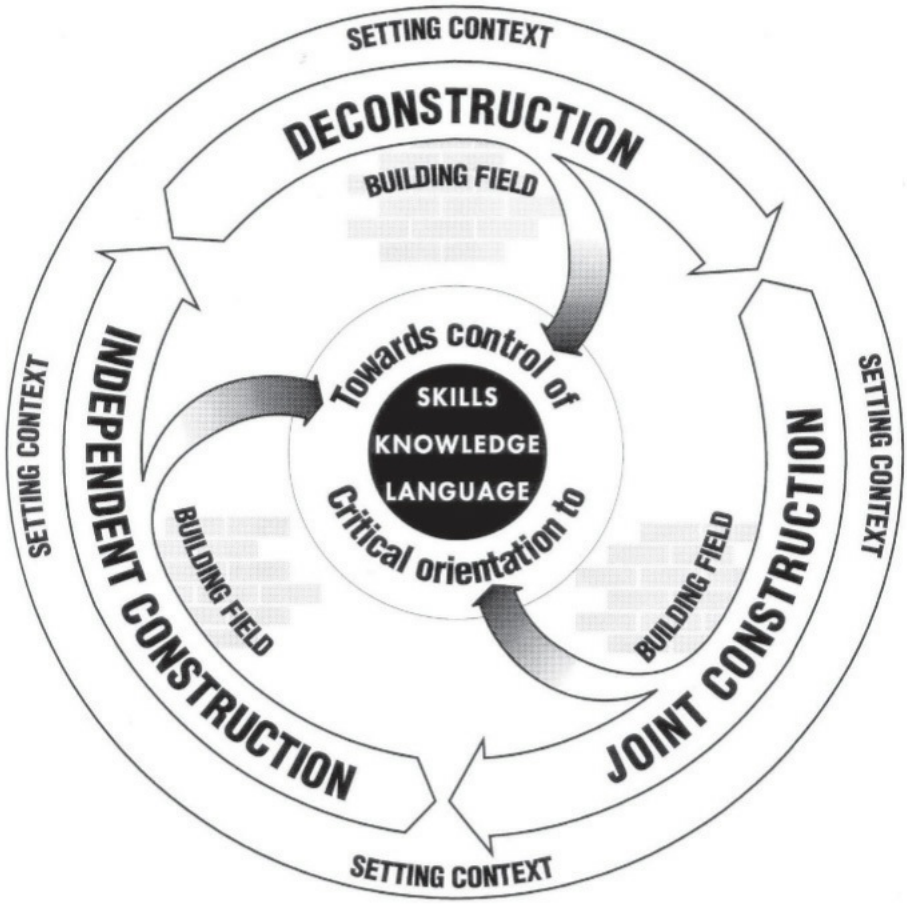


FIGURE 15.2. Genre teaching/learning cycle (Rothery, 1994/2007).

The cycle begins with Deconstruction of one or more model texts of the genre to be written, in which the teacher guides students to identify their organization and key language features, using the metalanguage illustrated in Table 15.1. Deconstruction is followed by the central stage of Joint Construction, in which the teacher guides the class to construct a new text of the genre, following the general patterns of the models. Only after this guided joint practice are students expected to write a text of their own in the Independent Construction stage, using the scaffolds provided in the Deconstruction and Joint Construction stages. Throughout each stage, the field to be written about may be built up through reading, discussion, and note making, and the contexts for using the genre are established. As the inner circle suggests, the goal of the pedagogy is both control of the genre and critical orientation toward texts, through guided practice.

Alongside making the teacher's knowledge and evaluation criteria explicit, genre pedagogy is designed to narrow the gap between students by guiding the whole class to deconstruct and jointly construct the desired genre, before they attempt independent writing tasks. The goal is for all students to be well prepared before they reach high school.

PHASE 2: *WRITE IT RIGHT*

The findings of phase 1 of the genre pedagogy research project thus included the common knowledge genres that

students are expected to write in the primary school, their typical staging and language features, and an effective curriculum genre for guiding whole classes to write them effectively. The implications for writing instruction were borne out by a rapid take-up across Australian primary schools, leading to incorporation of genres in state curricula, and appropriation by educational publishers as teaching materials. Today the genre writing pedagogy is an international movement, increasingly popular, for example, in Scandinavia (Rose & Martin, 2013), Latin America, China (Chen, 2010; Liu, 2010), South Africa (Childs, 2008), Indonesia (Emilia, 2010; Martin & Rose, 2012), and the United States (Schleppegrell, 2013).

The second phase of research was dubbed *Write It Right* by the sponsoring education department of New South Wales (NSW). The research questions for this large-scale project were relations between knowledge acquired and applied in secondary schools and industry workplaces, and the genres in which this knowledge was written and read, alongside effective curriculum genres for teaching it. The method was to collect and analyze both samples of students' writing and the curriculum texts they read across the secondary curriculum, as well as the documents that workers at all levels read and write in workplaces, and to develop teaching materials and work with teachers on refining genre writing pedagogy.

The findings of this project were many, and their implications for embedding literacy in teaching practice continue to unfold. Key publications include collections of papers in Christie (1998), Christie and Martin (1997), Martin and Veel (1998), and work on secondary subject areas, including English (Rothery, 1994/2007) and science (Rose, McInnes, & Korner, 1992/2007). The range of knowledge genres identified in this and subsequent research id described in Martin and Rose (2008), and presented for teachers in Rose (2014).

PHASE 3: *READING TO LEARN*

The third phase of research in genre pedagogy has centered on the teacher education/action research program known as *Reading to Learn* (or R2L). This now international program began in the late 1990s with the research problem of enabling Indigenous Australian school students to read and write at levels appropriate for their age and grade, when they were consistently reported at an average 3 to 8 years behind the literacy levels of their non-Indigenous peers (Rose, Gray, & Cowey, 1999). Working with schools and teachers at all levels of education, R2L expanded its research questions through the 2000s to ask how all children in the junior primary can be enabled to read and write independently, how all students in primary classes can be supported to read and write at the same levels (Rose, 2011a), and how secondary teachers can embed the teaching of skills in reading and writing into their curriculum teaching (Martin & Maton, 2013; Rose & Acevedo, 2006).

The action research method of *Reading to Learn* combines the genre writing pedagogy outlined earlier, with multimodal strategies for teaching reading, at the levels of graphology, grammar, discourse, and register, and closely designed teacher–class interaction cycles (Martin, 2007; Martin & Rose, 2007; Rose, 2004, 2010, 2011b), embedded in curriculum programs informed by the *Write It Right* research, to simultaneously enhance the literacy skills of all students in a class. The methodology assumes that reading is a fundamental mode of learning in school and that a principal function of writing is to demonstrate what has been learned from reading. Moreover, it considers the inequality of skills in reading and writing, between students in every class, to be a fundamental problem of education, and it targets the design of curriculum genres to enable teachers to overcome this problem, particularly by means of teacher-guided whole-class activities.

A fundamental principle of genre pedagogy is that learners should be prepared by teachers before attempting learning tasks. Thus, the genre writing pedagogy prepares students with Deconstruction and Joint Construction

activities, before attempting independent writing. The Reading to Learn methodology extends this principle with three levels of guidance for reading and writing tasks, in Table 15.2.

TABLE 15.2. Three Levels of Guidance in R2L Curriculum Genres

Reading
First level: Preparing for Reading
Second level: Detailed Reading
Third level: Sentence Making

Writing
First level: Joint Construction; Individual Construction
Second level: Joint Rewriting; Individual Rewriting
Third level: Spelling; Sentence Writing

In the first level, teachers prepare students to comprehend challenging texts by giving an oral summary of the field as it unfolds through the genre, in terms that all students can understand. The effect is to reduce the semiotic load of the reading task, as students need not struggle to recognize what is going on as the text is read, but can follow without overload. If the text is read aloud, their load is further reduced, as they need not struggle to decode unfamiliar words. This technique of Preparing for Reading enables the class to work with texts that may be well beyond students' independent reading levels. With short stories or chapters in novels, the whole text may be read, and then discussed, but with denser texts, each paragraph may be briefly prepared, read, and discussed. With factual texts, the teacher may also guide students to identify and mark key information in each paragraph, building their skills in recognizing and comprehending key information.

At this level, students are also guided to write successful texts, by jointly deconstructing the stages and phases of model texts in target genres and jointly constructing new texts organized with the same stages and phases. The analysis of phases within text stages is more detailed than in earlier versions of genre writing pedagogy, as students are guided to appropriate the particular text patterning resources of accomplished authors, as well as the global patterns of the genre. For example, authors may build tension in the Complication stage of a narrative by a series of worsening problems and characters' reactions. Through fine-grained deconstruction of literary models, students learn to recognize and appropriate such types of phasal structuring (for stages and phases of knowledge genres, see Martin & Rose, 2008; Rose, 2006; Rose & Martin, 2012). In Joint Construction, the class imagines a new field for the story (i.e., plot, setting, characters) and follows the stages and phases of the model, substituting this new field. In evaluative texts, phases may include patterns of grounds, conclusions, examples, evidence, and so on, which are also deconstructed in accomplished models and appropriated in Joint Constructions. With factual texts, the information that has been marked in paragraph-by-paragraph reading is written as notes on the board, by students taking turns to scribe and dictate the wordings from the reading texts. The phases of information in the notes are then identified and labeled by the teacher, who then guides the class to construct a new text using the notes.

In Individual Construction, students practice writing new texts with the same stages and phases that have been guided in Joint Construction, before attempting a completely independent writing task. For stories, they imagine a new plot, setting, and characters; for evaluative texts, they argue for an issue they have studied or evaluate a text they have studied; for factual texts, they may use the same notes to write a text of their own.

In the second level, teachers guide students to read passages from the reading text in detail, by preparing them to recognize groups of words in each sentence, and elaborating on their meanings as students identify each word group, using carefully designed cycles of teacher–student interaction, in the activity known as Detailed Reading. At this point, students already have a grasp of the text's overall field through prior Preparing and reading, so they are ready

to focus on finer details. Passages may be chosen for Detailed Reading that are particularly challenging, that encapsulate key information about the field, or that are ideal models of language. The teacher prepares each sentence with a brief synopsis, reads it to the class, and then guides students to identify each chunk of meaning, which they highlight, giving them visual and manual control of the wordings. Guidance consists of a preparation giving the meaning to be identified and the position of the words in the sentence. The students' task is to identify the wording from the meaning and position cues. The whole class is engaged by asking students in turn to identify each wording. As preparations are designed to enable every student to identify wordings successfully, all students are continually affirmed, in contrast to more typical classrooms where only a small minority of students engage actively in dialogue (Nuthall, 2005; Rose & Martin, 2012). As all students have successfully identified the wording, all are ready for the elaboration of its meaning, which may involve defining new words, explaining unfamiliar concepts, or engaging students in relating their own knowledge. Detailed Reading typically runs for 20–30 minutes, by which time every student in the class is able to read the passage with complete fluency and comprehension, no matter what their initial reading levels. So Detailed Reading is a powerful strategy, not only to enable students to read and comprehend challenging texts, but to enable the class to work with texts that may be well beyond students' individual reading capacities.

Following Detailed Reading, students are also guided to use what they have learned from reading by jointly rewriting the text passage that has been read in detail, using the same grammatical patterns for literary or persuasive texts, or the same field for factual texts. As all students now have complete control over the field and language patterns of the reading passage, they are able to focus on the complex task of using them for writing. With stories and evaluative texts, a new field is chosen, which the teacher guides the class to apply using the same grammatical patterns as the original sentences. Typically, each chunk of meaning in each sentence is worked on in turn, which students take turns to scribe. With factual texts, the class first scribes notes of the wordings that have been highlighted during Detailed Reading (as in Joint Construction), and the teacher guides the class to use this detailed information to write new sentences. So with stories and evaluative texts, the language patterns in rewriting derive from the original passage, with new content, whereas with factual texts the content is the same but new language patterns are created. Following Joint Rewriting, students attempt the same task in Individual Rewriting, using a new field with stories and evaluative texts, and the same field with factual texts. Top students find they are able to independently write well beyond their previous competence, allowing the teacher time to provide more support to other students. Joint and Individual Rewriting are powerful techniques for learning to appropriate the language resources of accomplished authors and to control technical, abstract, and literary language.

In the third and most intensive level, teachers guide students to manually manipulate wordings by cutting up sentences from a Detailed Reading passage, and rearranging them, in the activity of Sentence Making. This is typically a group activity in which each group has a set of sentences that the teacher has written on cardboard strips (but may also be used as an individual guided activity for students with additional needs.) The teacher guides the class to cut the strips into word groups, and then individual words, and students in groups mix up the cards, rearrange them into their original orders and into alternative patterns of their choosing. Sentence Making is extremely effective as it gives students total manual control over the meanings and wordings of written language, without the additional load of inventing and writing their own sentences. Once students have control over meanings and wordings through Sentence Making, the teacher guides them to spell individual words by cutting them into their letter patterns and practicing writing the letter patterns and words on individual whiteboards. As students are thoroughly familiar with each word from the perspective of meaning, and they can easily practice and self-correct on the boards, the spelling activity is highly effective. This is the level at which students practice sound–letter correspondences, in the context of meaningful words in meaningful texts, in contrast to decontextualized phonics

and spelling activities. Once they can spell most of the words, they write the whole sentences from memory in Sentence Writing, enabling them to practice fluent meaningful writing, without the load of inventing their own sentences. These intensive strategies thus embed foundation literacy skills in reading and writing curriculum texts, as Detailed Reading and Rewriting embed grammar and vocabulary in learning the curriculum through reading and writing.

These curriculum genres are practiced in daily and weekly programs that vary with the level of schooling. At the start of school, the intensive strategies are used to teach beginning literacy, from the alphabet to reading comprehension and writing, using sentences from reading books that the teacher has read to the class. In the primary school, Preparing and reading each day is followed by Detailed Reading on a short passage, intensive strategies on one or more sentences, and Rewriting of the short passage; Joint and Individual Construction are weekly activities, leading to independent writing of focus genres every 2 to 3 weeks. In the secondary school, teachers use Preparing and reading to teach curriculum content, in place of the ubiquitous teacher talk; Detailed Reading and Rewriting are applied to selected passages at least every week; and Joint Construction is followed by independent writing every 4 to 5 weeks.

EVALUATION

Outcomes of the R2L methodology have been repeatedly evaluated over 15 years. The program began with an action research project with Indigenous students from remote Australian communities, for whom literacy rates were on average 4 to 8 years behind the national Australian averages for their ages (Rose et al., 1999). Within the first year of this project, independent evaluators reported average improvements for junior secondary students at "2.5 [national English] Profile levels" (McRae, Ainsworth, Cumming, Hughes, Mackay, Price, et al., 2000, p. 69). The Australian government's Literacy Profile levels were measured by reading accuracy and comprehension and writing standards. Each Profile level corresponded to expected literacy growth over 1.5 school years. Hence, a growth rate of 2.5 Profile levels in less than one school year approximated growth rates normally expected over 4 years.

A large-scale R2L professional learning program has been run by the Catholic Education Office Melbourne (CEOM) since 2003. Outcomes have been tracked using a combination of measures, including the Developmental Assessment Resource for Teachers (DART) reading assessment (Forster, Mendelovits, & Masters, 1994), running records and writing assessments. Culican (2006, p. 57) reports that the

> approach was highly successful in accelerating the literacy performance of over 95% of the target students underachieving in literacy . . . average literacy gains across all schools and classes, and among students from all backgrounds and ability ranges, was consistently more than a CSF level in improvement within approximately three school terms, or approximately double the expected rate of literacy development. Furthermore, 20% of students made gains of two or more CSF levels, or four times the expected rate of literacy development.

CSF levels (Curriculum and Standards Framework of Victoria) were identical to the national Literacy Profile levels discussed earlier. More recently, CEOM has been calculating outcomes of its R2L programs in terms of effect sizes, using similar measures. Hattie (2009) defines the outcomes of standard pedagogic practice as an effect size of $d = 0.4$. CEOM's R2L 2011 data for primary schools showed a mean effect size of $d = 0.94$, and for secondary schools of $d = 1.03$. As with previous evaluations, these average effect sizes are more than double expected growth

rates.

WRITING ASSESSMENT IN READING TO LEARN

In 2008, a writing assessment was designed to accurately but simply analyze the language resources that each student brings to the writing task (Rose, 2014). Teachers identify these language resources in students' writing using 14 criteria. The criteria are derived from the SFL model of text-in-context outlined earlier, recontextualized to facilitate a simple, practicable text analysis for each piece of writing. At the level of genre, evaluation focuses on the social purpose, stages, and phases of the text. At the level of register, it focuses on the text's field, tenor, and mode. At the level of discourse, lexical, appraisal (evaluative), conjunction, and reference resources are identified. At the level of grammar, the variety and accuracy of grammatical resources are evaluated, and at the level of graphic features, spelling, punctuation, and graphic presentation are marked. The sequence of analysis is thus from the top-down, from genre to register, to discourse features that realize field, tenor, and mode, to grammatical patterns that realize discourse patterns, to graphological features that express these patterns in writing. Questions are used to interrogate each of these criteria, summarized in Table 15.3.

TABLE 15.3. Writing Assessment Criteria

Context	[Quick judgments are made about these context criteria.]
Purpose	*How appropriate and well developed is the genre for the writing purpose?*
Staging	*Does it go through appropriate stages, and how well is each stage developed?*
Phases	*How well organized is the sequence of phases in the text?*
Field	*How well does the writer understand and explain the field in factual texts, construct the plot, settings, and characters in stories, or describe the issues in arguments?*
Tenor	*How well does the writer engage the reader in stories, persuade in arguments, or objectively inform in factual texts?*
Mode	*How highly written is the language for the school stage? Is it too spoken?*
Discourse	[Discourse criteria are marked in the text to give an accurate measure.]
Ideation	*What are the writer's lexical resources? How well is lexis used to construct the field?*
Appraisal	*What are the writer's appraisal resources? How well is appraisal used to engage, persuade, evaluate?*
Conjunction	*Is there a clear logical relation between all sentences?*
Identification	*Is it clear who or what is referred to in each sentence?*
Grammar and graphic features	[Grammar features are judged overall rather than one by one.]
Grammar	*Is there an appropriate variety of sentence and word group structures for the school stage? Are the grammatical conventions of written English used accurately?*
Spelling	*How accurately spelled are core words and noncore words?*
Punctuation	*How appropriately and accurately is punctuation used?*
Presentation	*Are paragraphs used? How legible is the writing? Is the layout clear? Are illustrations/diagrams used appropriately?*

Students' writing samples are compared with analyzed writing exemplars at each school year level, which are moderated against state and national standards, and each criterion is given a score from 0 to 3 against the standard in the exemplar. A score of 0 indicates no evidence of the criterion at the standard for the year level, 1 is present but

weak, 2 is good but could be improved, and 3 is excellent for the year standard. Teachers are asked to assess the writing of students from low-, middle-, and high-achieving groups, in order to compare the growth of each group in the class. Independent writing samples from at least two students in each group are collected at the start of the year and at the end of each school term. Teachers are repeatedly guided to use the assessment in the R2L training and further moderate the assessments with colleagues in their schools. Following initial training and moderation, teachers' assessments are remarkably consistent, with only a few points divergence between independent assessments of the same piece. This consistency is due in part to the design of the assessment, which gives equal weight to each component of the writing task, and in part to teachers' rapid control over the text analysis with guided practice. This practice has the added advantages of giving teachers conscious knowledge of the language features they are working with, in order to design their teaching and discuss language with their students.

The assessment is applied here to analyze the improvement for one low-achieving junior secondary student. Text 1 was produced before R2L teaching, as follows. Appraisals (evaluative items) are marked in **bold** (Martin & Rose, 2007).

> *In this book* ***I like that I could connect with it as it's suitable for my age****. By the end* ***it dragged on a bit to much for my liking.***

This text is the genre known as a "personal response," characterized by expressions of personal feelings and reactions to the text, and often produced by weaker students when asked to evaluate a text (Martin & Rose, 2008). From the interpersonal perspective, of the three evaluations here, two are subjective reactions: *I like that I could connect with it*, but *it dragged on a bit to much for my liking*, and one objective valuation, *it's suitable for my age*. Ideationally, the only lexical items are *this book* and *my age*. The lack of any description of the text and its contents is inadequate for a text response. Textually, references indicate the writer *I, I, my, my*, and the book *this book, it, it's, the end, it*.

In terms of tenor, this response assumes a familiar peer relationship with the reader; in terms of field, it lacks any description of the book; in terms of mode, it is context-dependent speech written down. As this student is soon to enter secondary school, the tenor would be regarded as too familiar for its academic context, the field as inadequate, the mode as far too spoken, and the genre as inappropriate for the task of evaluating a literary text.

Text 2, by the same student following one semester's instruction with R2L, is an "interpretation," which appreciates a novel and interprets its themes (Table 15.4). This is the canonical genre of literature studies in the secondary school. Interpretations typically begin with an Evaluation stage, followed by a Synopsis of elements of the text that carry its themes, and conclude with a Reaffirmation of the evaluation (Rothery, 1994/2007; Martin & Rose, 2008).

TABLE 15.4. Post-R2L interpretation (Text 2)

Evaluation

The Recruit *is a* ***fantastic*** *novel by Robert Muchamore, which was first published in 2004. This* ***realistic*** *narrative is for young teenagers who* ***would easily relate*** *to this story as the characters* ***face problems*** *of today's teenagers.*

Synopsis themes

The main character, James Choke (Adams), ***goes through tragedy and adventure throughout*** *his young life. Through the novel, he* ***has to adjust to his losses*** *in life. He finds out who he* ***really is*** *and discovers* ***a lot of new things*** *in life.*

Plot
After being separated from his sister (Lauren), James had to live in an orphanage. Toward the end of the narrative James becomes a spy and knows what it feels like to belong and make new friends in a whole new environment.

Reaffirmation relevance
The author Robert Muchamore made the novel ***very realistic*** *by making James's life* ***not so easy****. James had a* ***rough*** *life until* ***something amazing*** *happened to him and* ***totally changed*** *his life.* ***Many*** *young teenagers* ***go through the same problems*** *as James does.*

Composition
Throughout this novel the composer has used informal modern language that ***would appeal*** *to a teenage audience. There are swearing, references to popular culture, and references to technology. The third-person narration gives* ***a lot of*** *information to the audience. It describes the characters from an* ***objective perspective****.*

Appeal
Every now and then *the novel* ***made me feel sad and angry,*** *knowing what James had to go through in life. I* ***would have liked*** *if the author mentioned Kerry* ***a bit more. I believe*** *this story is* ***written well*** *and* ***outstanding*** *novel with a* ***believable*** *plot that* ***many*** *young people* ***would enjoy****.*

Note. Appraisals are in **bold**. Marked themes signaling phase shifts are underlined.

Within its staging, the Synopsis includes two paragraphs that identify the novel's themes and synopsize its plot. The Reaffirmation evaluates its relevance for teenage readers, its literary composition, and its appeal to the writer and potential readers. Although genre stages are highly predictable, phases within each stage tend to be more variable, depending on factors such as the field and writers' imagination.

Appraisals are concentrated in the Evaluation and Reaffirmation, including a much wider range of text valuations, reader reactions, and judgments of characters. Sourcing of attitudes is now far more objective, with personal sourcing limited to the final evaluation, and valuations attributed to potential readers: *young teenagers*, *many young people*.

Ideationally, lexical resources construe the texts' themes and their relevance for readers, and the field of literature. Some of these literary resources have clearly been scaffolded by the teacher, but they are used coherently here by the student writer. The novel's plot is condensed as an activity sequence in just two sentences.

Textually, reference to the book now begins by naming it and then presuming it: *a novel*, *this narrative*. Characters are also presented first by naming and then presuming: *his young life, his losses, who he really is.* As well as presenting each phase as separate paragraphs, the shift from phase to phase is also signaled by clause Themes that are made prominent, either by doubling an identity or starting with a time or place, underlined in Table 15.4.

Tenor unfolds subtly through the text, beginning with strong valuation to engage the reader: *a fantastic novel*, then amplified judgment for its themes: *totally changed his life*, and amplified valuation for its relevance: *very realistic*. Although these are all presented objectively, the personalized reactions in the last paragraph enact solidarity with teenage readers. The field here is multilayered, with one field, the novel's plot, projecting a field of personal growth (its themes), and the field of literary appreciation (Rothery, 1994/2007). The mode is now at an appropriate level of written language for the end of primary school, and the genre is masterfully controlled. This student is now well prepared for the writing demands of secondary literature studies.

In practice, teachers make quick judgments about the assessment criteria, described in detail earlier in this chapter. Quick overall judgments are made about genre and register criteria, and discourse features may then be highlighted in part of the text to display the student's resources. Text 1 scored just 10/42, with 0 for most contextual

and discourse criteria, as its two sentences are so far below the standard expected for junior secondary school, although they meet minimum standards for lower-level criteria.Text 2 scored 34/42, with 2–3 for all criteria, as it meets an average to high standard for genre, register, and discourse criteria.

In middle primary (Year 3/4), growth for the low-achieving group is exemplified with writing samples from one student in Texts 3 and 4 (Figure 15.3). The pre-intervention Text 3 on the left is an incomplete recount that borrows elements from the animated movie *Shrek*. The postintervention Text 4 on the right is modeled on a literary description studied in detail by the class. Text 3 scored 9/42, while Text 4 scored 26/42.

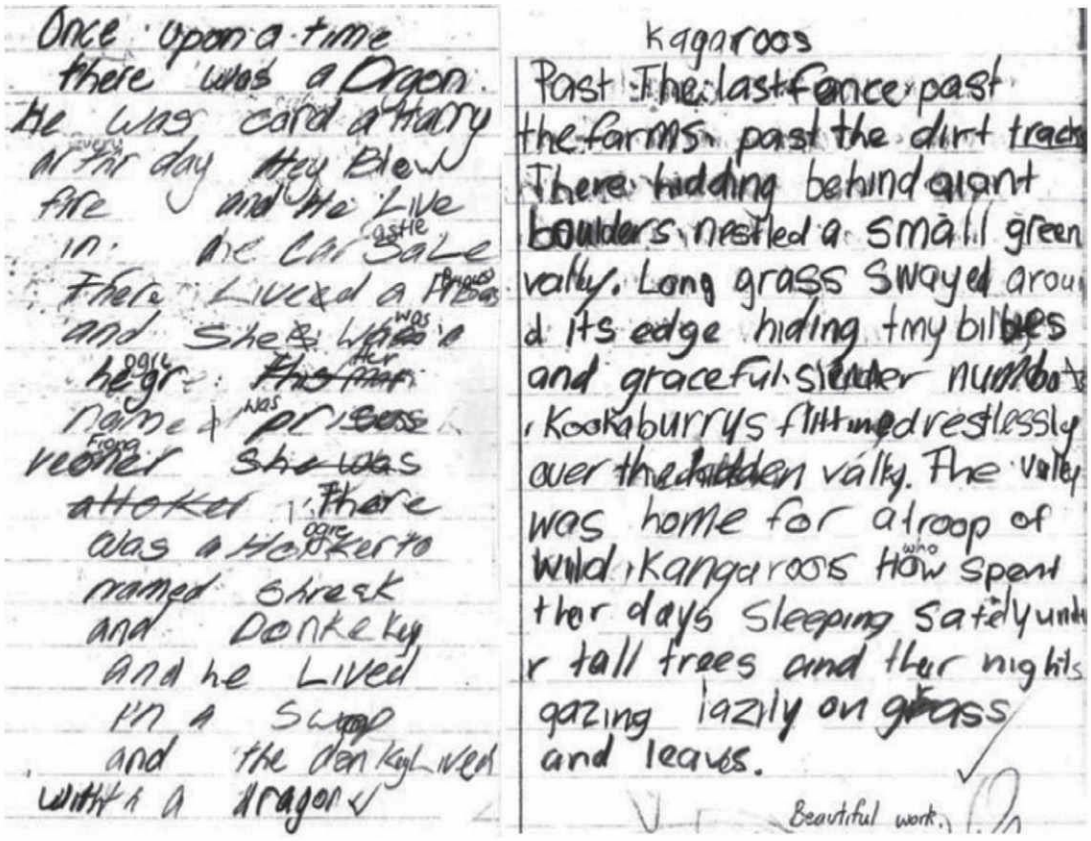


FIGURE 15.3. Pre- and post-R2L teaching for a low-achieving student in middle primary (Texts 3 and 4).

FINDINGS

Texts 1–4 illustrate potential rapid growth in literacy skills using R2L's explicit teaching strategies, informed by systematic knowledge about language-in-context and designed to equally engage all students. These kinds of growth have been replicated again and again by teachers undertaking R2L training programs over 15 years. As teachers are asked to measure their students' literacy before and after R2L teaching, this data forms a useful comparison of literacy outcomes of standard teaching methods, including various standard remedial interventions commonly provided to failing student groups. An example of such a comparison is the following analysis of one R2L training program in which approximately 400 primary and secondary teachers were trained in western NSW in 2010 (Koop & Rose, 2008; Rose, 2011c). The sample thus represents a large set (~400 classes × 20–30 students per class, or ~8,000–12,000 students). The large sample size helps to minimize potential biases.

Figures 15.4 and 15.5 illustrate the gap between low-, middle- and high-achieving student groups, before and after

the intervention. Figure 15.4 charts the mean preintervention scores on the writing measure described earlier for each student group and school stage in Term 1. Figure 15.5 charts the postintervention scores for each student group and school stage, after less than 1 year of R2L teaching. School stages surveyed include kindergarten (K), junior primary (Year 1/2), middle primary (Year 3/4), upper primary (Year 5/6), and junior secondary (Year 7/8). Note that the same students are represented in each cohort in Figures 15.4 and 15.5, before and after the intervention. The data do not show longitudinal growth rates from year to year; rather, these data are only from the year that teachers were being trained in the R2L program.

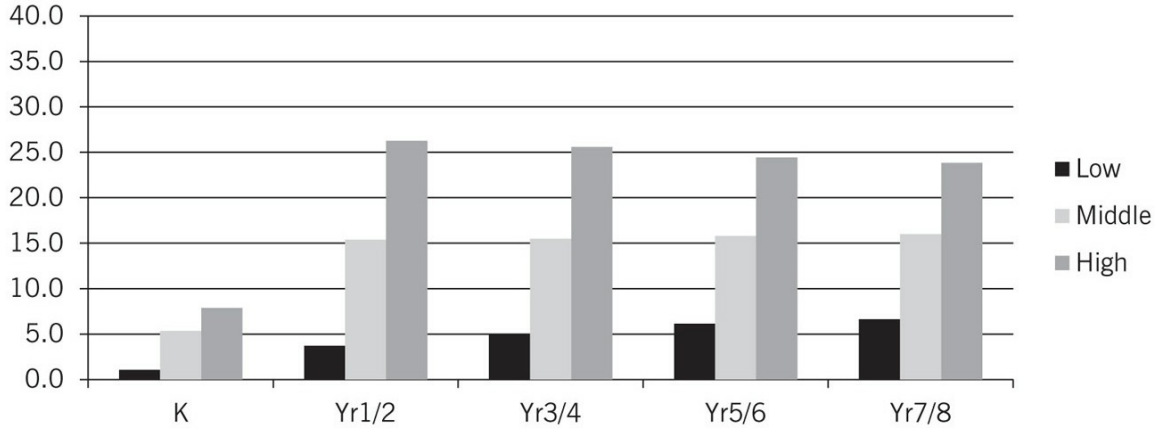


FIGURE 15.4. Preintervention scores show the gap between student groups before R2L teaching.

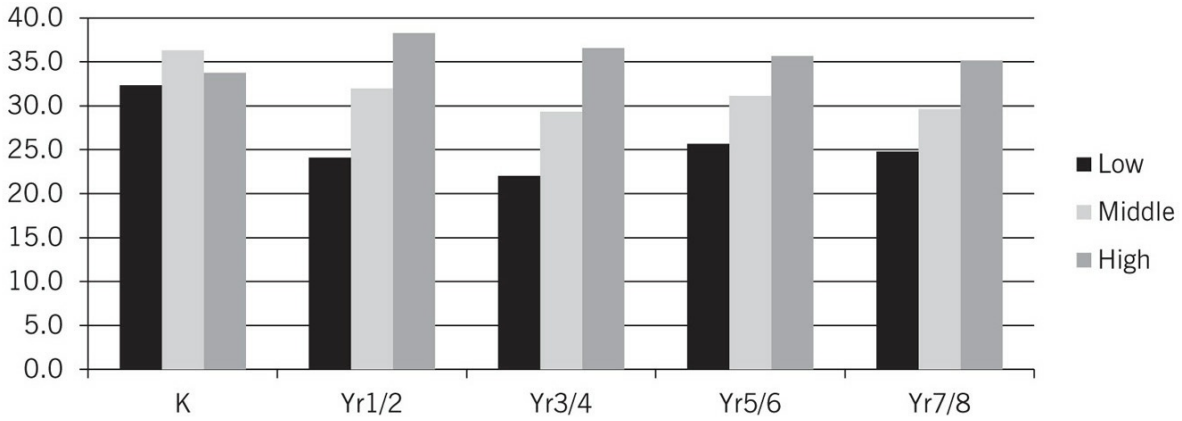


FIGURE 15.5. Postintervention scores show growth and reduction in gap after R2L teaching.

In Figure 15.4, preintervention scores at the start of kindergarten show the gap between low- and high-achieving students at 16% of the total possible score. By the start of Year 1/2, the high group has accelerated to acceptable standards, but the low group is still near zero—the gap between low and high students has tripled to over 50% of the total. This gap then continues throughout the years, decreasing slightly. The low group improves very slowly from Year 1/2 to Year 7/8, but remains in the failing range, the middle group remains steady in the low average range, and the high group remains in a high average range, falling slightly.

Comparing results between Figures 15.4 and 15.5, postintervention scores show that average growth in kindergarten is 70% above preintervention scores; all groups are now scoring in the high range, and the gap between low- and high-achieving groups is halved. In the other year levels, growth is 30 to 40% above the preintervention

scores, and the gap has halved from 50% to around 25%.

IMPLICATIONS

These data provide an unusual opportunity to compare the outcomes of different approaches to pedagogy from a large set of students, classes, and schools. This is not a comparison between teachers, classes, or schools because it is averaged across the whole set of schools and classrooms. What is compared in Figures 15.4 and 15.5 are the outcomes of standard teaching practices in each stage of school, with the outcomes of carefully designed strategies in the R2L intervention. The preintervention scores in each stage represent the outcomes of the preceding 1 to 2 years of standard teaching practices.

Clearly, this research design differs from small-scale projects common in educational research. It may be criticized for lacking the precision of the randomized control experiments borrowed into education from biomedical research; rather, it employs a pre-/postmethodology sometimes known as quasi-experimental. However, it may also be argued that a control equivalent in this research design is the literacy standards that students had achieved before the R2L intervention. The critical factor in this data is the gap between more and less successful students, which the R2L methodology takes as the fundamental problem to be addressed in education.

Figure 15.4 suggests that this gap is present at the start of school, but that standard literacy practices of the early years triple its effects in the first years of school. This exaggerated gap continues throughout the following stages of school, as low-achieving students remain in the failing range, the middle group in the low average range, and the high group within the high average range. In order for the high-achieving group to maintain its position in the high average range, these students must keep developing their literacy skills at a standard average growth rate. However, for low-achieving students to get out of the failing range, up to a passable average range, they must develop their skills at more than double the rate of the high-achieving students. This rarely happens with standard teaching practices. Nor does it happen with targeted interventions such as phonics programs, withdrawal reading programs, leveled readers, leveled reading groups, or special education programs, which may produce incremental but not exponential growth (Hattie, 2009).

Genre pedagogy, and *Reading to Learn* in particular, achieves exponential growth rates because:

- In the infants school, foundation literacy skills are taught explicitly in the context of meaningful, pleasurable shared book reading activities with whole classes, rather than individuated decontextualized activities such as commercial phonics programs (Rose, 2011a).
- In the primary years, skills in learning from reading and writing genres are explicitly taught in the context of reading age-appropriate literature and studying topics across learning areas, in teacher guided whole-class activities, rather than differentiated practice at “instructional levels” (Hattie, 2009).
- In the secondary school, skills in acquiring and demonstrating knowledge through reading and writing are embedded in studying each subject in the curriculum rather than treating knowledge as separate from the texts in which it is written, and leaving reading and writing development to each student’s intuitions (Martin & Maton, 2013).
- Teacher education programs are designed to provide teachers with knowledge about language and pedagogy to independently select and analyze texts in their curriculum programs, and plan and implement detailed lessons that simultaneously enhance the skills of all students in their classes (Rose & Acevedo, 2006; Culican, 2006; Rose, 2011d).

Further research in genre pedagogy is currently being conducted in many contexts, such as schools in developing nations (Dell, 2011; Emilia, 2010), tertiary education (Mahboob, 2013; Millin, 2011; Rose, Rose, Farrington, & Page, 2008), knowledge in school (Martin, 2013; Martin & Maton, 2013), knowledge about language (Schleppegrell, 2013; Rose & Martin, 2012) and teacher education in western Europe (Acevedo & Lövstedt, 2014; Coffin, 2014; Gouveia, 2014; Whittaker, 2014).

Further research is also needed to design genre pedagogy programs appropriate to varying contexts, such as U.S. schools, where literacy debates tend to be unhelpfully polarized between conservative and progressive/constructivist positions. Genre pedagogy subverts such "literacy wars" by giving teachers the knowledge they need to make all students successful, regardless of their backgrounds and curriculum. In this regard, a key area for further research is how to make genre pedagogy a part of preservice teacher training in various national systems. To date, the primary mode of dissemination has been through in-service programs for practicing teachers, as they and their schools have demanded effective literacy pedagogies. In contrast, there has been far less demand from teacher education faculties, except where genre pedagogy has become an official part of state syllabi, obligating universities to provide preservice training. In general, preservice training the world over has been spectacularly unsuccessful in providing graduates with the skills they need to make all their students successful. It is common for teacher–educators to blame schools for subverting the training they provide to teachers, but research is urgently needed in how to recontextualize effective literacy pedagogy as effective teacher education.

REFERENCES

Acevedo, C., & Lövstedt, A.-C. (2014). *Teacher learning for European literacy education: Project outputs from Sweden*. Stockholm Education Administration, The Hague: European Union. Available at *http://tel4ele.eu.*

Bernstein, B. (1990). *Class, codes and control 4: The structuring of pedagogic discourse.* London: Routledge.

Bernstein, B. (2000). *Pedagogy, symbolic control and identity: Theory, research, critique.* London: Taylor & Francis.

Chen, J. (2010). *Sydney school genre-based literacy approach to EAP writing in China.* PhD Thesis, Department of Linguistics, University of Sydney and School of Foreign languages, Sun Yat Sen University.

Childs, M. (2008). *A reading based theory of teaching appropriate for the South African context*. PhD Thesis, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa.

Christie, F. (Ed.). (1999). *Pedagogy and the shaping of consciousness: Linguistic and social processes*. London: Cassell.

Christie, F. (2002). *Classroom discourse analysis*. London: Continuum.

Christie, F. (Ed.) (1998). *Pedagogy and the shaping of consciousness: Linguistic and social processes.* London: Cassell (Open Linguistics Series).

Christie, F., & Martin, J. R. (Eds.). (1997). *Genres and institutions: Social practices in the workplace and school*. London: Cassell.

Christie, F., & Martin, J. R. (Eds.). (2007). *Language, knowledge and pedagogy: Functional linguistic and sociological perspectives.* London: Continuum.

Coffin, C. (2014). *Teacher learning for European literacy education: Final Report Public Part*. The Hague: European Union. Available at *http://tel4ele.eu*.

Culican, S. (2006). *Learning to read: Reading to Learn, A middle years literacy intervention Research Project*, Final Report 2003-4. Catholic Education Office: Melbourne. Available at *www.readingtolearn.com.au*.

Dell, S. (2011). *Reading revolution*. Mail & Guardian Online. Available at *http://mg.co.za/article/2011-04-03-*

reading-revolution.

Emilia, E. (2010). *Teaching writing: Developing critical learners*. Bandung, Indonesia: Rizqi Press.

Forster, M., Mendelovits, J., & Masters, G. (1994). *Developmental Assessment Resource for Teachers (DART)*. Canberra, Australia: Australian Council for Education Research.

Gouveia, C. (2014). *Teacher learning for European literacy education: Project outputs from Portugal*. Lisbon: Instituto de Linguística Teórica e Computacional (ILTEC), The Hague: European Union. Available at *http://tel4ele.eu*.

Halliday, M. A. K. (1978). *Language as a social semiotic: The social interpretation of language and meaning.* London: Edward Arnold.

Halliday, M. A. K. (2004). *An introduction to functional grammar* (2nd ed.). London: Edward Arnold. Originally published 1994.

Hattie, J. A. C. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement.* London: Routledge.

Hyon, S. (1996). Genre in three traditions: Implications for ESL. *TESOL Quarterly, 30*, 693–722.

Johns, A. M. (Ed.). (2002). *Genre in the classroom: Applying theory and research to practice.* Mahwah, NJ: Erlbaum.

Koop, C. & Rose, D. (2008). Reading to learn in Murdi Paaki: Changing outcomes for indigenous students. *Literacy Learning: The Middle Years, 16*(1), 41–46.

Liu, Y. (2010). *Commitment resources as scaffolding strategies in the Reading to Learn program*. PhD Thesis, University of Sydney, Sun Yat Sen University.

Mahboob, A. (Ed.). (2013). Genre-based literacy programmes: Contexualising the SLATE project. *Linguistics and the Human Sciences, 7*, 1–3.

Martin, J. R. (1992). *English text: System and structure.* Amsterdam: John Benjamins.

Martin, J. R. (2000). Grammar meets genre—Reflections on the 'Sydney School.' *Arts: The Journal of the Sydney University Arts Association, 22*, 47–95.

Martin, J. R. (2007). Metadiscourse: Designing interaction in genre-based literacy programs. In R. Whittaker, M. O'Donnell, & A. McCabe (Eds.), *Language and literacy: Functional approaches* (pp. 95–122). London: Continuum.

Martin, J. R. (2013). Embedded literacy: Knowledge as meaning. *Linguistics and Education, 24*(1), 23–37.

Martin, J. R., & Maton, K. (Eds.). (2013). *Cumulative knowledge-building in secondary schooling.* Special Issue of *Linguistics and Education*, 24(1).

Martin, J. R., & Rose, D. (2003). *Working with discourse: Meaning beyond the clause*. (2nd rev. ed. 2007). London: Continuum.

Martin, J. R., & Rose, D. (2007). Interacting with text: The role of dialogue in learning to read and write, *Foreign Languages in China, 4*(5), 66–80.

Martin, J. R., & Rose, D. (2008). *Genre relations: Mapping culture.* London: Equinox.

Martin, J. R., & Rose, D. (2012). Genres and texts: Living in the real world. *Indonesian Journal of SFL, 1*(1), 1–21

Martin, J. R., & Rose, D. (2013). Pedagogic discourse: Contexts of schooling. *RASK International Journal of Language and Communication* (Special issue in honor of Carl Bache), 1–46.

Martin, J. R., & Veel, R. (1998). *Reading science: Critical and functional perspectives on discourses of science.* London: Routledge

Martin, J. R., & White, P. R. R. (2005). *The language of evaluation: Appraisal in English.* London: Palgrave.

McRae, D., Ainsworth, G., Cumming, J., Hughes, P. Mackay, T., Price, K., et al. (2000). *What has worked, and will*

again: The IESIP strategic results projects. Canberra: Australian Curriculum Studies Association.

Millin, T. (2011). *Scaffolding academic literacy with undergraduate social science students at the University of KwaZulu-Natal using the Reading to Learn intervention strategy: An evaluative study*. MSc Dissertation, University of Edinburgh, Moray House School of Education.

Nuthall, G. A. (2005). The cultural myths and realities of classroom teaching and learning: A personal journey. *Teachers College Record, 107*(5), 895–934.

Painter, C., & Martin, J. R. (Eds.). (1986). *Writing to mean: Teaching genres across the curriculum.* Applied Linguistics Association of Australia (Occasional Papers 9).

Rose, D. (2004). Sequencing and pacing of the hidden curriculum: How Indigenous children are left out of the chain. In J. Muller, A. Morais, & B. Davies (Eds.), *Reading Bernstein, researching Bernstein* (pp. 91–1070). London: RoutledgeFalmer.

Rose, D. (2005). Democratising the classroom: A literacy pedagogy for the new generation. *Journal of Education, 37*, 127 –164. Available at *http://dbnweb2.ukzn.ac.za/joe/joe_issues.htm.*

Rose, D. (2006). Reading genre: A new wave of analysis. *Linguistics and the Human Sciences, 2*(2), 185–204.

Rose, D. (2007). Towards a reading based theory of teaching. Plenary paper. In L. Barbara & T. Berber Sardinha (Eds.), *Proceedings of the 33rd International Systemic Functional Congress*, São Paulo, Brazil. Available at *www.pucsp.br/isfc/proceedings*.

Rose, D. (2008). Writing as linguistic mastery: The development of genre-based literacy pedagogy. In R. Beard, D. Myhill, J. Riley, & M. Nystrand (Eds.), *Handbook of writing development* (pp. 151–166). London: Sage.

Rose, D. (2010). Meaning beyond the margins: Learning to interact with books. In S. Dreyfus, S. Hood, & M. Stenglin (Eds.), *Semiotic margins: Reclaiming meaning* (pp. 177–208). London: Continuum.

Rose, D. (2011a). Beating educational inequality with an integrated reading pedagogy. In F. Christie & A. Simpson (Eds.), *Literacy and social responsibility: Multiple perspectives* (pp. 101–115). London: Equinox.

Rose, D. (2011b). Genre in the Sydney School. In J. Gee & M. Handford (Eds.), *The Routledge handbook of discourse analysis* (pp. 209–225). London: Routledge.

Rose, D. (2011c). *Report for Western NSW Region NSW Department of Education and Training Implementation and outcomes of the professional learning program, 2010*. Sydney: Reading to Learn. Available at *www.readingtolearn.com.au.*

Rose, D. (2011d). Learning in linguistic contexts: Integrating SFL theory with literacy teaching. In G. W. Huang (Ed.), *Studies in functional linguistics and discourse analysis III* (pp. 222–240). Beijing: Higher Education Press.

Rose, D. (2014). *Reading to Learn: Accelerating learning and closing the gap*. Sydney: Reading to Learn. Available at *www.readingtolearn.com.au*.

Rose, D., & Acevedo, C. (2006). Closing the gap and accelerating learning in the middle years of schooling. *Australian Journal of Language and Literacy, 14*(2), 32–45.

Rose, D., Gray, B. & Cowey, W. (1999). Scaffolding reading and writing for indigenous children in school. In P. Wignell (Ed.), *Double power: English literacy and Indigenous education* (pp. 23–60). Melbourne: National Language and Literacy Institute of Australia (NLLIA).

Rose, D., & Martin, J. R. (2012). *Learning to Write, Reading to Learn: Genre, knowledge and pedagogy in the Sydney School*. London: Equinox.

Rose, D., & Martin, J. R. 2013. *Skriva, läsa, lära (writing, reading, learning)*. Stockholm: Hallgren & Fallgren.

Rose, D., McInnes, D., & Korner, H. (2007). *Scientific literacy (Write It Right Literacy in industry research project —Stage 1)*. Sydney: NSW AMES 2007. Originally published 1992.

Rose, D., Rose, M., Farrington, S., & Page, S. (2008). Scaffolding literacy for Indigenous health sciences students.

Journal of English for Academic Purposes, 7, 166–180.
Rothery, J. (2007). *Exploring literacy in school English (Write It Right resources for literacy and learning).* Sydney: NSW AMES 2007. (Original work published 1994)
Schleppegrell, M. J. (2013). The role of metalanguage in supporting academic language development. *Language Learning, 63*, 153–170.
Whittaker, R. (2014). *Teacher learning for European literacy education: Project outputs from Spain*. Madrid: Universidad Autónoma de Madrid, The Hague: European Union, Available at *http://tel4ele.eu.*

CHAPTER 16

Writing to Learn

Perry D. Klein, Nina Arcon, and Samanta Baker

Writing to learn (WTL) is the practice of using composition to help students understand and reason about subjects such as science, history, and mathematics. WTL has been the topic of several previous reviews (Ackerman, 1993; Applebee, 1984; Bangert-Drowns, Hurley, & Wilkinson, 2004; Graham & Hebert, 2011; Hebert, Gillepsie, & Graham, 2013; Klein, 1999). In this chapter we provide an overview of the field, including the conceptual basis of recent developments and some illustrative empirical studies. In keeping with the purpose of the volume, we focus on writing in elementary and secondary school settings.

WHAT THEORETICAL MODELS ARE USED TO UNDERSTAND WTL?

In this section, we group theories about WTL into three families, based on their relationship to the writer's mental representation of concepts.

At the Level of Conscious Representations: Information-Processing Models

The first family of models is based on the classical view of cognition as information processing. These models represent cognition as goal-directed strategic problem solving; knowledge is represented by schemata in long-term memory; and cognition occurs through operations in working memory. The most frequently discussed information-processing model of WTL has been Bereiter and Scardamalia's (1987) knowledge-transforming model (cf. Chuy, Scardamalia, & Bereiter, 2012). It is based on a dialectic between rhetorical problem solving and content problem solving. Initially, the writer sets a rhetorical goal; if content cannot be retrieved from long-term memory to support this goal, then the rhetorical goal is translated into a content subgoal. To pursue this subgoal, the writer engages in problem solving in a content space, using operations such as drawing inferences. The product is a content proposition, which serves as input to the rhetorical problem-solving space.

Several other WTL processes based on a classical cognitive architecture have been proposed. For example, the writer could begin with a rhetorical goal for the text, jot down ideas to explore the topic, draw inferences, and then consolidate these inferences to form a new goal for the text (Flower & Hayes, 1981). Or a writer could use multiple

textual sources, recursively selecting, organizing, and integrating content from each to support an original theme (Mateos, Martín, Villalón, & Luna, 2008). Each of these proposals assumes a classical cognitive architecture but identifies different strategies for operating within this architecture. Consequently, more than one could be valid.

Empirically, there is strong evidence that the processes identified in information-processing models contribute to learning during writing: Correlational evidence shows that writers who attend to sources of information, transform this information through cognitive operations (e.g., comparing claim and evidence), and regulate this process through metacognitive operations (e.g., reflecting on what they need to understand) learn more than writers who do not (e.g., Glogger, Schwonke, Holzäpfel, Nückles, & Renkl, 2012; Klein, Boman, & Prince, 2007; Leopold, Sumfleth, & Leutner, 2013). Prompting these cognitive and metacognitive operations contributes to learning during writing (Hübner, Nückles, & Renkl, 2010; Wong, Kuperis, Jamieson, Keller, & Cull-Hewitt, 2002). At the same time, it is likely that strategies for writing to learn vary from task to task. For example, the WTL strategies that lead to comprehension of a text (e.g., Cantrell, Fusaro, & Dougherty, 2000) are probably different from the WTL strategies that contribute to learning to solve math problems (Roelle, Krüger, Jansen, & Berthold, 2012), which in turn are probably different from WTL strategies for interpreting science experiments (Klein, 2000).

Below the Level of Conscious Representations: The Knowledge-Constituting Model

The second family of theories invokes structures and operations that are largely subsymbolic, that, is, below the level of the conscious thought (Britton, 1982; Galbraith, 1992, 2009). The most developed theory in this family is Galbraith's knowledge-constituting model. It is based on a connectionist architecture in which each individual's semantic knowledge is encoded in a network consisting of units that roughly correspond to neurons. These units are linked by connections, which have fixed weights. In the case of writing, the weights in the semantic network comprise the writer's *disposition*, that is, implicit knowledge concerning a given topic.

For any writing activity, the *topic* and *task* are inputs to this system; they produce a unique pattern of activation. The units pass activation among themselves until they settle into a stable state; this state is the *message*. The message then serves as input to a language module, which consists of distributed representations of lexical and syntactic knowledge. This linguistic knowledge comprises an additional set of constraints on the process, which then produces an *utterance*. Next, the utterance is fed back into the distributed semantic network. At this point, it only partially fits the disposition, so further cycles of text production take place. Feedback to the distributed semantic network is inhibitory, so that after an utterance is expressed, then other aspects of the disposition, previously suppressed, can also be expressed. This process then iterates, leading to a gradual convergence between the writer's disposition toward the topic and the content of the text. In addition to the process just described, the model also includes a problem-solving module that allows sentences to be produced by encoding information that is retrieved from episodic memory.

Empirically, the knowledge-constituting model implies that spontaneously writing to a rhetorical goal should result in the discovery of previously implicit knowledge. Consistent with this implication, Ong (2013) found that writers discovered more ideas when they generated content with no planning time than when they did so with extended planning time (but cf. Kieft, Rijalaarsdam, & van den Bergh, 2006). Additionally, in a series of studies, Galbraith and colleagues found that writers who are low self-monitors (i.e., individuals who do not closely attend to social expectations and adjust their behavior to them) discover new ideas during spontaneous writing, and these ideas are accompanied by the creation of a coherent text and a sense of understanding. Conversely, high self-monitors generate more ideas during planning, but this results in less sense of discovery and a text with lower coherence (see Galbraith, 2009, for a review).

Beyond the Level of Individual Representations: Distributed Cognition

A third family of theories includes distributed cognition, activity theory, and situated cognition; these theories construe thinking and learning as the product of a system of persons, social practices, external representations, and tools (see Nardi, 1996, for a comparison among these theories). Distributed cognition, for example, conceives of cognition as the transformation of representations, which usually comprise a mixture of internal and external elements (Hutchins, 1995; Zhang & Patel, 2006). From this point of view, writing is a process in which networks of individuals (authors, collaborators, editors, reviewers) use external tools (e.g., writing software) to transform representations (e.g., source texts, outlines, drafts) through practices such as collaborative writing (Beaufort, 2008; Haas & Witte, 2001). A prominent example of WTL as distributed cognition is the creation of archival science in which multiple individuals are involved in the production of each manuscript, using practices such as peer review, to contribute to a cumulative body of disciplinary knowledge (Cronin, 2004).

WTL in schools can also be conceived as a distributed cognitive process (Klein & Leacock, 2012; Newell, 2006). Classmates may participate as collaborators in prewriting discussion, joint drafting, or peer review. Students depend on external resources, such as Internet sources and writing prompts, which provide content and help to organize the writing process (e.g., Glogger et al., 2012; see Klein & Leacock, 2012, for a review). Empirical research on WTL has not usually been conceived as "distributed cognition"; however, several kinds of findings are consistent with this framework. For example, the Science Writing Heuristic includes group collaboration, external prompts for writing, and sometimes audience feedback; it has proven consistently effective (e.g., Hand, Gunel, & Ulu, 2009). Similarly, some software for Computer Supported Collaborative Learning (CSCL) includes supports for writing in specific text genres and collaboration with peers (e.g., Chen & She, 2012).

Summary: Theories of WTL

Because these three theories focus on different levels of analysis (symbolic, subsymbolic, and distributed), they are not mutually exclusive (Klein & Leacock, 2012). As the foregoing discussion illustrates, each has some empirical support. Having said this, the classical cognitive model appears to have the strongest support, in the form of experimental research and mediational analysis, demonstrating the role of cognitive operations and strategies as mediators of learning (e.g., Glogger et al., 2012). The following sections provide further examples of empirical research relevant to these theories.

RESEARCH QUESTIONS, METHODS, AND FINDINGS

This section focuses on three main practices in WTL and the questions associated with each. However, first, we comment on the more basic question: Does writing contribute to learning? The question, stated in this simple form, is somewhat problematic. If someone were to ask, "Does reading contribute to learning?" The answer would be something like, "Yes, but it depends on . . .," followed by a long string of qualifiers about the moderating effects of texts, students' skills and strategies, instruction, and support. An answer to the question about writing to learn similarly requires extensive qualification. Part of this issue involves the activities to which writing is compared: reading, discussion, the creation of a graphic representation, and so on.

With these caveats, several meta-analyses have shown that writing contributes significantly to learning. Bangert-Drowns et al. (2004) found that writing-intensive units of study, in comparison to units of study that are not writing-intensive, resulted in significantly greater learning with small effect sizes. This was true of students up to the fifth

grade, secondary students, and tertiary students, but not middle school students. In a meta-analysis of experimental and quasi-experimental writing studies, Graham and Perin (2007) similarly found that writing produced small but significant effects on learning. This was true across subject areas and for the two grade ranges that were compared (grades 4–6 versus 7–12). Recently, Graham and Hebert (2011) conducted a meta-analysis of studies that compared the effect of writing about reading, with other conditions such as talk or rereading only. The effect of writing was significantly greater than other activities and was medium in size. Effects were larger for middle school students than for secondary students.

What Characteristics of Writing Tasks Contribute to Learning?

One frequently investigated question has been, "What characteristics of writing tasks contribute to learning?" Researchers typically use an experimental or quasi-experimental method, which includes a posttest of topic knowledge. Additionally, researchers may collect data on the cognitive and writing processes that mediate between the writing task characteristics and the dependent variables (e.g., Glogger et al., 2012; Leopold et al., 2013; Newell & Winograd, 1995). During the 1970s through the 1990s, a common type of question was, "Does the genre of the writing task affect learning?" So we will organize this section largely in terms of genre.

Argumentation

It is thought that argument writing encourages students to consider competing ideas, evaluate them using evidence, and draw reasoned conclusions. In a meta-analysis on the effects of writing on reading comprehension, Graham and Hebert (2011) found that extended writing, in comparison to nonwriting activities such as oral discussion, significantly contributed to learning, with small to medium effect sizes; of these extended writing activities, some were arguments (e.g., Langer & Applebee, 1987, chaps. 6 and 8). Argumentation has also been compared to writing in other genres (e.g., Langer & Applebee, 1987, Chapters 6 and 8; Newell & Winograd, 1995). In a meta-analysis of this research, Hebert et al. (2013) contrasted extended writing with question asking/answering, finding that the former produced significantly greater effects on posttest measures, if the posttests involved extended writing. However, the studies reviewed either did not report results on measures other than extended writing (e.g., free recall), or found that extended writing did not have significant effects on these other measures. It should be noted that for university students, there is some evidence that writing arguments contributes more to learning than writing in other genres (Wiley & Voss, 1999). Taken together with research showing that argumentation is more effective for secondary school writers if they receive instruction in this genre than if they do not (e.g., De La Paz, 2005), this suggests that learning through argumentation requires a moderately high level of writing performance.

Some researchers have investigated the variables that mediate the effects of persuasive writing on learning (Langer & Applebee, 1987, Chapters 6 and 8; Marshall, 1987). Recently, it has been found that variables such as the number of ideas that writers take up from sources, and the kind and number of rhetorical elements they include in their arguments, predict learning during writing (e.g., Klein & Samuels, 2010; Ruiz-Primo, Li, Tsai, & Schneider, 2010). Researchers have also noted that students show a "myside bias" in argumentation, such that they weigh reasons for their beliefs more heavily than reasons for alternative beliefs. Consequently, they have begun to investigate the effects of a deliberative approach to argumentation in which students weigh arguments for and against various alternatives, rather than simply trying to persuade the reader (Felton, Garcia-Mila, & Gilabert, 2009; Klein & Ehrhardt, 2013, April).

Summary Writing

Summarizing has sometimes been seen as a cognitively low-level activity (e.g., Krathwohl, 2002). However, it requires the learner to select important ideas from text, connect them to form a coherent macrostructure, and sometimes invent overarching propositions to integrate multiple basic propositions (see Gelati, Galvan, & Boscolo, 2014, for a review). In the meta-analysis mentioned earlier, Graham and Herbert (2011) found that writing a summary or synthesis produced effects on text comprehension. These effects were found for weak writers as well as for average writers. In a subsequent meta-analysis that compared different kinds of writing activities, summary writing had significantly greater effects than question answering on free recall measures (Hebert et al., 2013). However, the benefits of summary writing have been qualified by the findings of Leopold et al. (2013). Based on the principle of generativity, they hypothesized that tenth-grade students who wrote a summary would have better comprehension of a science text than students who read a prepared summary. Instead, they found the opposite, apparently because of the modest quality of the summaries that the students constructed (cf. Leopold & Leutner, 2012).

Writing Metacognitive Texts

The Bangert-Drowns et al. (2004) meta-analysis showed that in writing-intensive units of study, metacognitive prompts were significantly more effective than other kinds of writing prompts. These prompts focused on "[the student's] current level of comprehension in a content area, comprehension failures and successes, or affective and motivational responses to content that might facilitate or debilitate learning" (p. 38). Writing-intensive units were more effective if writing sessions were brief (less than 10 minutes) and if they were continued for one semester or longer. They were marginally more effective if writing was frequent (three times or more per week), and if students received feedback rather than no feedback, but these trends were not statistically significant. Reflective writing can also be motivationally important. Schmidt, Maier, and Nückles (2012) conducted a field study with secondary students comparing the use of personal-utility prompts to a no-prompt condition in daily journal writing in biology. They found that students in the prompt condition were more likely to relate the subject area content to their personal experiences, resulting in an increase in motivation and comprehension.

Recently, researchers have further explored the role of prompts for reflective writing. Hübner et al. (2010) set out to investigate what instructional methods would best enhance journal writing with cognitive and metacognitive prompts in high school students. Cognitive prompts hint at organization and elaboration of content, while metacognitive prompts hint at monitoring main points and planning remedial strategies. In the first journal writing exercise, all students received cognitive and metacognitive prompts. They were assigned to one of four conditions: control (prompts only); informed prompting (10-minute presentations explaining the benefits of learning strategies corresponding to the cognitive and metacognitive prompts); learning-journal example (a worked-out example of a well-written learning journal); and informed prompting plus learning-journal. After the second journal writing exercise, in which students only received cognitive and metacognitive prompts, posttests revealed that the informed prompting condition and learning-journal example condition produced significant, positive effects on learning outcomes.

In another study, Glogger, Holzäpfel, Schwonke, Nückles, and Renkl (2009) compared specific and nonspecific versions of cognitive, metacognitive, and problem-solving writing prompts; for example: "Organize the learning contents in a clear way" (nonspecific) versus "For this purpose, compose a brief summary of the topics of the last week using your exercise-book and your math book. Extract three to five main ideas of the learning contents"

(specific). Only the specific prompts produced significant effects on learning. Correlational research has confirmed that the number of cognitive operations and metacognitive operations engaged in by individual students contributes to learning and that students who use both types of operations show significantly greater learning than those who use only one type (cf. Glogger et al., 2012).

Multimedia Writing Activities

Given that disciplines such as science require students to compose documents that integrate text with other kinds of representations, this is an important area for research. In the study by Leopold et al. (2013) discussed earlier, the researchers found that creating a visual summary (which includes brief text phrases) was more effective than creating a purely textual summary; meditational analysis indicated that this was due to the effects of visual processing of the textual material. Similarly, in a study on teaching quantum theory to secondary students, Gunel, Hand, and Gunduz (2006) found that students who produced PowerPoint slides with brief text captions and embedded graphics and formulas showed greater learning than students who wrote a text-only summary of the same content. Subsequent studies have supported and elaborated the effects of multimedia composition (cf. Hand et al., 2009; McDermott & Hand, 2013).

Summary: Effects of Writing Task Characteristics on Learning

Writing contributes significantly to learning, at the level of both the individual activity and the unit of study. There is strong evidence that several kinds of writing contribute to learning: argumentation, summary writing, note taking, metacognitive journal writing (learning protocols), and multimedia composition. However, there is limited evidence that these genres differ significantly from one another in their effects. The effect of writing on learning is mediated by cognitive and metacognitive operations, and prompting these operations significantly increases the effect of writing on learning.

Research on the Effects of Instruction on Writing to Learn

During the past decade, research has shifted to a new question: Can instruction increase students' ability to use writing as a tool for learning? Graham and Hebert's (2011) meta-analysis of the effects of writing on reading comprehension showed that training students in writing had a small but significant main effect on learning. This was modified by a significant interaction effect, such that training high school students produced larger effects than training middle school students. Research methods on teaching students to use writing to learn may employ the following sequence: Initially, the experimental group and control group complete a pretest of topic knowledge. Next, the experimental group is taught a strategy for writing, while the control group participates in some comparable activity, such as reading and writing about the same topics. Finally, in the posttest phase, the experimental and control groups both participate in a WTL activity concerning a novel topic, sometimes followed by a topic posttest. The dependent variables comprise measures of content knowledge and reasoning derived from the final written text and/or the posttest. Additionally, researchers may use a method such as path analysis to investigate the cognitive or writing operations that are hypothesized to mediate the effects of instruction on the dependent variables (e.g., De La Paz & Felton, 2010; Klein & Kirkpatrick, 2010).

Teaching Argument Writing in Science

To date, much research on argumentation in science has been based on oral dialogue (see Cavagnetto, 2010, for a review). WTL projects in science education have usually taken a highly contextual approach, embedding argumentation activities in inquiry, sometimes with explicit scaffolding or instruction in elements of argumentation. These studies have produced gains in both content knowledge and argument writing skills (Chen & She, 2012; Sampson, Enderle, Grooms, & Witte, 2013; Zohar & Nemet, 2002). Whether teaching argumentation strategies per se contributes to students' subsequent ability to use writing to learn in science is less clear (Klein & Rose, 2010; but cf. Klein & Kirkpatrick, 2010).

Teaching Strategies for Historical Inquiry and Argument Writing

De La Paz (2005) created an approach to teaching writing from historical sources. The reading aspect comprises a strategy for critically examining primary sources; this includes considering who wrote each document, comparing details within and across sources, and making notes on what seems believable from each source. This source analysis feeds into two writing strategies, which were originally developed by De La Paz and Graham (1997), and taught through the self-regulated strategy development method (e.g., Graham & Harris, 2005). The first strategy, "STOP," is used to generate ideas for an essay based on considering both sides of a controversial issue; the second strategy, "DARE," is used to organize these ideas into an essay structure. On a posttest WTL task, students in the instructional group composed texts that were more persuasive, more accurate, and contained more arguments than students in the control group (cf. De La Paz & Felton, 2010). An important part of this line of research has been the inclusion of students with exceptionalities. In the De La Paz (2005) study, average students, students with disabilities (mainly learning disabilities), and talented students comprised the participants. There was a main effect of exceptionality on the dependent variables; however, exceptionality did not interact with the treatment, so its effectiveness did not differ significantly among groups of students (cf. Ferretti, MacArthur, & Okolo, 2001).

Teaching Strategies for WTL about Literature

A series of studies has suggested the value of teaching students to use writing to think analytically about literature. In an initial study, Boscolo and Carotti (2003) engaged ninth-grade students in a variety of creative and analytical writing activities, which significantly improved their ability to write thoughtfully about literature (cf. Correnti, Matsumura, Hamilton, & Wang, 2012). Subsequently, in two studies, Kieft et al. (2006) and Kieft, Rijalaarsdam, and van den Bergh (2008) instructed secondary students in a domain-general approach to argumentation (i.e., a form of argumentation that was not specific to literature). Based on Galbraith's (1992) knowledge-constituting model, they contrasted a revision condition in which students initially drafted text through freewriting and then revised the text, with a planning condition in which students made outlines before writing. They obtained complex results: The first study (2006) showed that the planning condition was more effective, regardless of students' orientation to planning or revision. The second study (2008) showed an interaction in which students high in revision orientation learned more from revision-oriented instruction than from planning-oriented instruction, but degree of planning orientation did not interact with the writing instruction condition. A more domain-specific approach was taken by Lewis and Ferretti (2009, 2011), who taught secondary students to use the rhetorical *topoi* of ubiquity and paradox to interpret texts. Additionally, they used self-regulated strategy development (e.g., Graham & Harris, 2005) to teach students how to write arguments based on this analysis. This resulted in gains for both average and below-average

writers, which transferred to novel writing tasks.

Teaching Summary and Discourse Synthesis

In the Graham and Hebert (2011) meta-analysis on the effects of writing on reading comprehension, training did not significantly affect learning from summarizing, although writing summaries, in comparison to nonwriting activities, contributed significantly to learning. The activity of discourse synthesis extends summarizing by requiring students to write using multiple sources. Good discourse synthesis requires a strategy of recursively reading sources, selecting content from across sources, connecting elements of this content, and integrating it to form a novel text. However, many students use simpler strategies such as paraphrasing one source after another (Mateos et al., 2008). A study by Reynolds and Perin (2009) compared the effects of three conditions on discourse synthesis. Instruction in a strategy that included teaching elements of text structure was more effective in improving content knowledge than a discourse synthesis strategy that did not include text structure; both were more effective than a control condition (cf. Martínez, Martín, & Mateos, 2011, cited in Mateos et al., 2014).

Teaching Journal Writing Strategies

In the previous section, we saw that during learning protocol writing, prompting the use of cognitive and metacognitive strategies increased students' learning. Recently, researchers have extended this line of research to support greater internalization of these strategies (Roelle et al., 2012). They taught fifth-grade students about the use of cognitive and metacognitive strategy prompts. They found that adding worked examples to an initial presentation to students and to writing materials during the first practice phase, and then fading these in a second practice phase, was more effective than providing prompts without worked examples in the first phase and then adding worked examples in the second phase. Analysis of the students' texts indicated that those who received worked examples in the first phase adopted effective strategies. When the introduction of worked examples was delayed, students initially adopted weak strategies, and when worked examples were subsequently introduced, then most students did not switch to more sophisticated strategies.

Summary: Teaching Strategies for WTL

In the past decade, the most important development in WTL has been the introduction of strategy instruction. Several studies have produced large effect sizes on specific dependent variables (e.g., De La Paz, 2005; De La Paz & Felton, 2010; Kieft et al., 2008; Reynolds & Perin, 2009). Importantly, these studies have also produced significant results with weak writers, for whom WTL might not otherwise be effective (Rivard, 2004). In addition to meeting an educational need, strategy instruction research has provided evidence for information-processing models of WTL by showing that goal-directed, metacognitive (strategic) problem solving, consisting of cognitive operations that operate on source propositions, contributes to learning. For a more detailed discussion of research on WTL in history, literature, and science, see MacArthur (2014).

Research on Writing in Collaborative Learning

A third approach to WTL involves collaboration, including CSCL. This literature is challenging to interpret. First, many kinds of CSCL software support writing, but they do so to differing degrees, so there is no clear boundary

around the CSCL literature that is relevant to WTL. Second, collaborative and CSCL writing activities are typically multifaceted interventions, and these facets are only sometimes decomposed into separate independent variables through controlled experimentation. Third, research on collaborative writing and CSCL often presents the discourse that students create, but no posttest of individual learning (Stahl, Koschmann, & Suthers, 2006). Consequently, we limit ourselves here to some illustrative projects that have foregrounded writing and included measures of individual learning.

The Science Writing Heuristic

The largest research program on WTL concerns the Science Writing Heuristic (SWH), a writing-based approach to laboratory inquiry (Keys, Hand, Prain, & Collins, 1999; Hand, Wallace, & Yang, 2004). In this approach, the teacher guides the class through a process in which individual writing alternates with other activities such as group concept mapping, laboratory activities, and interpretation of research results through negotiation with peers and results in negotiation with text sources. A template guides students to formulate questions, record observations, shape them into an argument, compare them to the ideas of others, and reflect on their changing conceptions (e.g., Hand, Wallace, & Yang, 2004). The SWH has shown positive effects on conceptual understanding; more recently, it has also shown positive effects on the basic literacy skills of students who have Individualized Education Programs (e.g., Akkus, Gunel, & Hand, 2007; Hand, Hohenshell, & Prain, 2004; Taylor, Therrien, Kaldenberg, et al., 2012). Additionally, several variations on the basic SWH framework have been found to increase student learning further: multiple writing activities (Hand, Prain, & Yore, 2001); multimedia writing (Hand et al., 2009); writing for younger audiences (Gunel, Hand, & McDermott, 2009); and receiving feedback from readers (Chen, Hand, & McDowell, 2013). Other research that has focused on embedding argumentation in science inquiry has similarly produced gains in content learning and argument writing (Chen & She, 2012; Sampson et al., 2013).

Computer-Supported Collaborative Learning

One of the first CSCL systems was a direct outgrowth of writing research. The Knowledge Forum (KF; formerly Computer Support Intentional Learning Environment) was developed by Bereiter and Scardamalia based on their knowledge-transforming model of writing (Chuy et al., 2012). The Knowledge Forum allows students to write and post notes; it includes multimedia tools and support for collaborative writing. KF cultivates students' *epistemic agency* by supporting activities such as goal setting, global planning, and evaluation. For example, to support goal setting, KF provides scaffolds for notes, such as "I need to understand." KF also supports the knowledge-transforming dialectic between rhetorical and content spaces using scaffolds such as "this theory does not explain. . . ." Several studies have investigated students' learning in the KF. For example, one recent study showed that during a unit of study in science, there was an increase in students' expression of valid scientific conceptions and a reduction in the expression of misconceptions (Zhang, Scardamalia, Lamon, Messina, & Reeve, 2007; cf. So, Seah, & Toh-Heng, 2010; Sun, Zhang, & Scardamalia, 2010). Other research has supported the effect of computer support for collaborative writing and reasoning, such as the Recurrent Online-Synchronous Scientific Argumentation platform (e.g., Chen & She, 2012; Yeh & She, 2010).

Summary: Research on Writing in Collaborative Learning

In this section, a few projects that illustrate collaborative forms of WTL have been selected for discussion. We

notice some characteristics that connect them: First, they include elements that have also been found to be effective in individual studies of WTL, such as prompting to students to reason about evidence for theories (e.g., De La Paz & Felton, 2010). Additionally, these projects include elements that have proven critical for the effectiveness of collaborative learning: group goals and individual accountability (Johnson & Johnson, 2002).

WHAT FURTHER RESEARCH IS NEEDED?

The area of WTL has recently expanded in several fruitful directions. Here, we will review some recent and emerging questions.

Measurement

An issue in many studies has been the use of "treatment-inherent measures," that is, posttests comprised of writing activities similar to those used in the treatment group (Hebert et al., 2013). In the humanities, this problem cannot be completely eliminated because authentic posttesting requires extended writing activities. However, it would be desirable to supplement these with nonwriting measures similar to those used in WTL research in science, such as concept maps and two-tiered multiple choice tests.

Cognitive Models

Concerning the information-processing models of writing to learn, empirical research to date on mediating processes has focused largely on specific operations (e.g., Glogger et al., 2012; Klein, 2000). Further evidence is needed concerning the global writing strategies that guide the process of WTL and the knowledge about writing that underpins these strategies. With respect to the knowledge-constituting model, we reviewed evidence showing that spontaneous drafting contributes to discovery for students who are low self-monitors. However empirical research is needed concerning the complex subsymbolic processes posited by this model. With respect to distributed cognition and related theories, some initial evidence shows that collaborators and external writing prompts contribute to learning. However, it would be desirable to see additional studies in which researchers vary specific features of complex learning environments, particularly CSCL environments, and collect data on the cognitive processes that mediate the effects of these elements on learning.

Instruction to Support Writing to Learn

Early research on WTL produced small-to-medium effects (e.g., Bangert-Drowns et al., 2004). However, as we noted earlier, several recent instructional studies have included large effects on learning. Can these effect sizes be consistently replicated? Additionally, instructional studies have focused on several different elements of the learning situation: text structure (Reynolds & Perin, 2009); inquiry methods specific to disciplines (e.g., De La Paz & Felton, 2010); and specific teaching techniques (Lewis & Ferretti, 2011; Roelle et al., 2012). Do all of these elements contribute to the effects of writing on learning? Do they combine additively?

Conceptions of Writing, Motivation to Write

Some studies have found that if students participate in WTL, it changes their conceptions of writing (Levin & Wagner, 2006), whereas other studies have not (Klein & Rose, 2010; Prain & Hand, 1999). This raises the question of what conceptions, if any, are critical to WTL. In a related issue, WTL activities have affected students' beliefs about the usefulness of writing, as well as their interest in specific topics (Boscolo, Ariasi, Del Favero, & Ballarin, 2011; Boscolo & Carotti, 2003). The area of motivation requires further investigation, both as a cause of WTL and as an effect.

IMPLICATIONS FOR TEACHING

In using WTL, educators could consider at least three kinds of issues. First, in a particular situation, what purposes will writing serve, in addition to supporting conceptual learning? Teaching students to write in a new text genre? Teaching discipline-specific modes of reasoning? Or providing a focus for collaborative inquiry? Second, what resources are available, including instructional time, pedagogical expertise, and computer hardware and software? Third, given these resources and goals, how can WTL be made most effective?

To make individual WTL activities most effective, educators could include the following elements:

- For a writing-intensive unit of study, consider frequent, brief, writing activities, sustained for at least one academic term (Bangert-Drowns et al., 2004).
- Provide students with cognitive, metacognitive, and problem-solving writing prompts; explain how these prompts contribute to learning; make prompts specific rather than general (e.g., Glogger et al., 2009; Hübner et al., 2010).
- To facilitate learning from reading, assign summary writing, note taking, or extended writing (e.g., Cantrell et al., 2000).
- If appropriate to the discipline, have students integrate writing with other relevant types of representations (e.g., diagrams, equations, graphs; see Gunel et al., 2006).

For teaching students to use WTL, consider the following practices:

- For journal writing, teach cognitive and metacognitive strategies; explain how the strategies contribute to learning; provide students with strategy prompts accompanied by worked examples of journal entries with annotations (e.g., Roelle et al., 2012).
- In literature, combine the teaching of argument writing strategies, with the teaching of discipline-specific analytic concepts, e.g., *topoi* (Lewis & Ferretti, 2009).
- In history, combine strategies for critically analyzing sources with strategies for writing arguments based on these sources (e.g., De La Paz & Felton, 2010).
- Include students with learning disabilities and talented students in writing strategy instruction for WTL (e.g., De La Paz, 2005).

Collaborative writing comprises a heterogeneous and quickly evolving set of practices, but educators could consider the following:

- For science inquiry, use the Science Writing Heuristic (e.g., Hand et al., 2004).
- Structure collaborative writing tasks to include individual accountability and group goals (Johnson & Johnson, 1985).

- Consider using computer supported collaborative learning software, such as Knowledge Forum (e.g., Chuy et al., 2012).

REFERENCES

Ackerman, J. (1993). The promise of writing to learn. *Written Communication, 10*, 334–370.

Akkus, R., Gunel, M., & Hand, B. (2007). Comparing an inquiry-based approach known as the Science Writing Heuristic to traditional science teaching practices: Are there differences? *International Journal of Science Education, 29*, 1745–1765.

Applebee, A. (1984). Writing and reasoning. *Review of Educational Research, 54*, 577–596.

Bangert-Drowns, R. L., Hurley, M. M., & Wilkinson, B. (2004). The effects of school-based writing-to-learn interventions on academic achievement: A meta-analysis. *Review of Educational Research, 74*, 29–58.

Beaufort, A. (2008). Writing in the professions. In C. Bazerman (Ed.), *Handbook of research on writing* (pp. 221–235). New York: Erlbaum.

Bereiter, C., & Scardamalia, M. (1987). *The psychology of written composition.* Hillsdale, NJ: Erlbaum.

Boscolo, P., Ariasi, N., Del Favero, L., & Ballarin, C. (2011). Interest in an expository text: How does it flow from reading to writing? *Learning and Instruction, 21*, 467–480.

Boscolo, P., & Carotti, L. (2003). Does writing contribute to improving high school students' approach to literature? *L1—Educational Studies in Language and Literature, 3*, 197–224.

Britton, J. (1982). Shaping at the point of utterance. In G. M. Pradl (Ed.), *Prospect and retrospect: Selected essays of James Britton* (pp. 139–145). Montclair, NJ: Boynton/Cook.

Cantrell, R. J., Fusaro, J. A., & Dougherty, E. A. (2000): Exploring the effectiveness of journal writing on learning social studies: A comparative study, *Reading Psychology, 21*, 1–11.

Cavagnetto, A. R. (2010). Argument to foster scientific literacy: A review of argument interventions in K–12 science contexts. *Review of Educational Research, 80*, 336–371.

Chen, C. H., & She, H. C. (2012). The impact of recurrent on-line synchronous scientific argumentation on students' argumentation and conceptual change. *Educational Technology and Society, 15*, 197–210.

Chen, Y. C., Hand, B., & McDowell, L. (2013). The effects of writing-to-learn activities on elementary students' conceptual understanding: Learning about force and motion through writing to older peers. *Science Education, 97*, 745–771.

Chuy, M., Scardamalia, M., & Bereiter, C. (2012). Development of ideational writing through knowledge building. In E. L. L. Grigorenko, E. Mambrino, & D. D. D. Preiss (Eds.), *Writing: A mosaic of new perspectives* (pp. 175–190). New York: Psychology Press.

Correnti, R., Matsumura, L. C., Hamilton, L. S., & Wang, E. (2012). Combining multiple measures of students' opportunities to develop analytic, text-based writing skills. *Educational Assessment, 17*, 132–161.

Cronin, B. (2004). Bowling alone together: Academic writing as distributed cognition. *Journal of the American Society for Information Science and Technology, 55*, 557–560.

De La Paz, S. (2005). Effects of historical reasoning instruction and writing strategy mastery in culturally and academically diverse middle school classrooms. *Journal of Educational Psychology, 97*, 139–156.

De La Paz, S., & Felton, M. K. (2010). Reading and writing from multiple source documents in history: Effects of strategy instruction with low to average high school writers. *Contemporary Educational Psychology, 35*, 174–192.

De La Paz, S., & Graham, S. (1997). Effects of dictation and advanced planning instruction on the composing of

students with writing and learning problems. *Journal of Educational Psychology, 89*, 203–222.

Felton, M., Garcia-Mila, M., & Gilabert, S. (2009). Deliberation versus dispute: The impact of argumentative discourse goals on learning and reasoning in the science classroom. *Informal Logic, 29*, 417–446.

Ferretti, R. P., MacArthur, C. A., & Okolo, C. M. (2001). Teaching for historical understanding in inclusive classrooms. *Learning Disability Quarterly, 24*, 59–71.

Flower, L., & Hayes, J. R. (1981). A cognitive process theory of writing. *College Composition and Communication, 32*, 365–387.

Galbraith, D. (1992). Conditions for discovery through writing. *Instructional Science, 21*, 45–71.

Galbraith, D. (2009). Writing about what we know: Generating ideas in writing. In R. Beard, D. Myhill, J. Riley, & M. Nystrand (Eds.), *Sage handbook of writing development* (pp. 48–64). Los Angeles: SAGE.

Gelati, C., Galvan, N., & Boscolo, P. (2014). Summary writing as a tool for improving the comprehension of expository texts: An intervention study in primary school. In P. D. Klein, P. Boscolo, L. C. Kirkpatrick, & C. Gelati (Eds.), *Studies in writing, Vol. 28: Writing as a Learning Activity*. Leiden, The Netherlands: Brill.

Glogger, I., Holzäpfel, L., Schwonke, R., Nückles, M., & Renkl, A. (2009). Activation of learning strategies in writing learning journals. *Zeitschrift für pädagogische Psychologie, 23*, 95–104.

Glogger, I., Schwonke, R., Holzäpfel, L., Nückles, M., & Renkl, A. (2012). Learning strategies assessed by journal writing: Prediction of learning outcomes by quantity, quality, and combinations of learning strategies. *Journal of Educational Psychology, 104*, 452–468.

Graham, S., & Harris, K. R. (2005). *Writing better: Effective strategies for teaching students with learning difficulties.* Baltimore, MD: Paul H. Brookes.

Graham, S., & Hebert, M. (2011). Writing to read: A meta-analysis of the impact of writing and writing instruction on reading. *Harvard Educational Review, 81*, 710–744.

Graham, S., & Perin, D. (2007). *Writing next: Effective strategies to improve writing of adolescents in middle and high schools. A report to Carnegie corporation of New York*. New York: Alliance for Excellent Education.

Gunel, M., Hand, B., & Gunduz, S. (2006). Comparing student understanding of quantum physics when embedding multimodal representations into two different writing formats: Presentation format versus summary report format. *Science Education, 90*, 1092–1112.

Gunel, M., Hand, B., & McDermott, M. A. (2009). Writing for different audiences: Effects on high-school students' conceptual understanding of biology. *Learning and Instruction, 19*, 354–367.

Haas, C., & Witte, S. P. (2001). Writing as an embodied practice: The case of engineering standards. *Journal of Business and Technical Communication, 15*, 413–457.

Hand, B., Gunel, M., & Ulu, C. (2009). Sequencing embedded multimodal representations in a writing to learn approach to the teaching of electricity. *Journal of Research in Science Teaching, 46*, 225–247.

Hand, B., Hohenshell, L., & Prain, V. (2004). Exploring students' responses to conceptual questions when engaged with planned writing experiences: A study with year 10 science students. *Journal of Research in Science Teaching, 41*, 186–210.

Hand, B. M., Prain, V., & Yore, L. (2001). Sequential writing tasks' influence on science writing. In P. Tynjälä, L. Mason, & K. Lonka (Eds.), *Studies in Writing: Vol. 7. Writing as a learning tool: Integrating theory and practice* (pp. 105–129). Dordrecht, The Netherlands: Kluwer.

Hand, B., Wallace, C. W., & Yang, E. M. (2004). Using a Science Writing Heuristic to enhance learning outcomes from laboratory activities in seventh-grade science: Quantitative and qualitative aspects. *International Journal of Science Education, 26*, 131–149.

Hebert, M., Gillespie, A., & Graham, S. (2013). Comparing effects of different writing activities on reading

comprehension: A meta-analysis. *Reading and Writing, 26*, 111–138.

Hübner, S., Nückles, M., & Renkl, A. (2010). Writing learning journals: Instructional support to overcome learning-strategy deficits. *Learning and Instruction, 20*, 18–29.

Hutchins, E. (1995). *Cognition in the wild*. Cambridge, MA: MIT Press.

Johnson, D. W., & Johnson, R. (1985). Classroom conflict: Controversy versus debate in learning groups. *American Educational Research Journal, 22*, 237–256.

Johnson, D. W., & Johnson, R. T. (2002). Learning together and alone: Overview and meta-analysis. *Asia Pacific Journal of Education, 22*, 95–105.

Keys, C. W., Hand, B., Prain, V., & Collins, S. (1999). Using the Science Writing Heuristic as a tool for learning from laboratory investigations in secondary science. *Journal of Research in Science Teaching, 36*, 1065–1084.

Kieft, M., Rijlaarsdam, G., & van den Bergh, H. (2006). Writing as a learning tool: Testing the role of students' writing strategies. *European Journal of Psychology of Education, 21*, 17–34.

Kieft, M., Riujlaarsdam, G., & van den Bergh, H. (2008). An aptitude-treatment interaction approach to writing-to-learn. *Learning and Instruction, 18*, 379–390.

Klein, P. D. (1999). Reopening inquiry into cognitive processes in writing-to-learn. *Educational Psychology Review, 11*, 203–270.

Klein, P. D. (2000). Elementary students' strategies for writing-to-learn in science. *Cognition and Instruction, 18*, 317–348.

Klein, P. D., Boman, J. S., & Prince, M. P. (2007). Developmental trends in a writing to learn task. In M. Torrance, D. Galbraith, & L. Van Waes (Eds.), W*riting and cognition: Research and application* (pp. 201–217). Amsterdam: Elsevier.

Klein, P. D., Ehrhardt, J. S. (2013, April). *Effects of writing goals and distribution of subgoals on cognitive load and science learning*. Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA.

Klein, P. D., & Kirkpatrick, L. C. (2010). A framework for content area writing: Mediators and moderators. *Journal of Writing Research, 2*, 1–46.

Klein, P. D., & Leacock, T. L. (2012). Distributed cognition as a framework for understanding writing. In V. W. Berninger (Ed.), *Past, present, and future contributions of cognitive writing research to cognitive psychology* (pp. 133–152). New York: Psychology Press/Taylor & Francis Group.

Klein, P. D., & Rose, M. A. (2010). Teaching argument and explanation to prepare junior students for writing to learn. *Reading Research Quarterly, 45*, 433–461.

Klein, P. D., & Samuels, B. (2010). Learning about plate tectonics through argument writing. *The Alberta Journal of Educational Research, 56*, 196–217.

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into practice, 41*, 212–218.

Langer, J. A., & Applebee, A. N. (1987). *How writing shapes thinking: A study of teaching and learning.* Urbana, IL: National Council of Teachers of English.

Leopold, C., & Leutner, D. (2012). Science text comprehension: Drawing, main idea selection, and summarizing as learning strategies. *Learning and Instruction, 22*, 16–26.

Leopold, C., Sumfleth, E., & Leutner, D. (2013). Learning with summaries: Effects of representation mode and type of learning activity on comprehension and transfer. *Learning and Instruction, 27*, 40–49.

Levin, T., & Wagner, T. (2006). In their own words: Understanding student conceptions of writing through their spontaneous metaphors in the science classroom. *Instructional Science, 34*, 227–278.

Lewis, W. E., & Ferretti, R. P. (2009). Defending interpretations of literary texts: The effects of topoi instruction on

the literary arguments of high school students. *Reading and Writing Quarterly, 25*, 250–270.

Lewis, W. E., & Ferretti, R. P. (2011). Topoi and literary interpretation: The effects of a critical reading and writing intervention on high school students' analytic literary essays. *Contemporary Educational Psychology, 36*, 334–354.

MacArthur, C. A. (2014). Strategy instruction in writing in academic disciplines. In P. D. Klein, P. Boscolo, L. C. Kirkpatrick, & C. Gelati (Eds.), *Studies in Writing, Vol. 28: Writing as a learning activity*. Leiden, The Netherlands: Brill.

Marshall, J. D. (1987). The effects of writing on students' understanding of literary texts. *Research in the Teaching of English, 21*, 30–63.

Mateos, M., Martín, E., Villalón, R., & Luna, M. (2008). Reading and writing to learn in secondary education: Online processing activity and written products in summarizing and synthesizing tasks. *Reading and Writing, 21*, 675–697.

Mateos, M., Solé, I., Martín, E., Cuevas, I., Miras, M. & Castells, N. (2014). Writing a synthesis from multiple sources as a learning activity. In P. D. Klein, P. Boscolo, L. C. Kirkpatrick, & C. Gelati (Eds.), *Studies in Writing, Vol. 28: Writing as a learning activity*. Leiden, The Netherlands: Brill.

McDermott, M. A., & Hand, B. (2013). The impact of embedding multiple modes of representation within writing tasks on high school students' chemistry understanding. *Instructional Science, 41*, 217–246.

Nardi, B. A. (1996). Studying context: A comparison of activity theory, situated action models, and distributed cognition. *Context and consciousness: Activity theory and human-computer interaction* (pp. 69–102). Cambridge, MA: MIT Press.

Newell, G. E. (2006). Writing to learn. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 235–247). New York: Guilford Press.

Newell, G. E., & Winograd, P. (1995). Writing about and learning from history texts: The effects of task and academic ability. *Research in the Teaching of English, 29*, 133–163.

Ong, J. (2013). Discovery of ideas in second language writing task environment. *System, 41*, 529–542.

Prain, V., & Hand, B. (1999). Students perceptions of writing for learning in secondary school science. *Science Education, 83*, 151–162.

Reynolds, G. A., & Perin, D. (2009). A comparison of text structure and self-regulated writing strategies for composing from sources by middle school students. *Reading Psychology, 30*, 265–300.

Rivard, L. P. (2004). Are language-based activities in science effective for all students, including low achievers? *Science Education, 88*, 420–442.

Roelle, J., Krüger, S., Jansen, C., & Berthold, K. (2012). The use of solved example problems for fostering strategies of self-regulated learning in journal writing. *Education Research International, 12*, 14.

Ruiz-Primo, M. A., Li, M., Tsai, S. P., & Schneider, J. (2010). Testing one premise of scientific inquiry in science classrooms: Examining students' scientific explanations and student learning. *Journal of Research in Science Teaching, 47*, 583–608.

Sampson, V., Enderle, P., Grooms, J., & Witte, S. (2013). Writing to learn by learning to write during the school science laboratory: Helping middle and high school students develop argumentative writing skills as they learn core ideas. *Science Education, 97*, 643–670.

Schmidt, K., Maier, J., & Nückles, M. (2012). Writing about the personal utility of learning contents in a learning journal improves learning motivation and comprehension. *Education Research International, 2012*, 10 pages.

So, H. J., Seah, L. H., & Toh-Heng, H. L. (2010). Designing collaborative knowledge building environments accessible to all learners: Impacts and design challenges. *Computers and Education, 54*, 479–490.

Stahl, G., Koschmann, T., & Suthers, D. (2006). Computer-supported collaborative learning: An historical perspective. In K. Sawyer (Ed.), *Cambridge handbook of the learning sciences* (pp. 409–425). New York: Cambridge University Press.

Sun, Y., Zhang, J., & Scardamalia, M. (2010). Knowledge building and vocabulary growth over two years, Grades 3 and 4. *Instructional Science, 38*, 147–171.

Taylor, J. C., Therrien, W. J., Kaldenberg, E., Watt, S., Chanlen, N., & Hand, B. (2012). Using an inquiry-based teaching approach to improve science outcomes for students with disabilities: Snapshot and longitudinal data. *Journal of Science Education for Students with Disabilities, 15*, 27–39.

Taylor, J., Therrien, W. J., Kaldenberg, E. R., Watt, S. J., Chanlen, N., & Hand, B. (2013). Using an inquiry-based teaching approach to improve science outcomes for students with disabilities: Snapshot and longitudinal data. *Journal of Science Education for Students with Disabilities, 15*, 27–39.

Wiley, J., & Voss, J. F. (1999). Constructing arguments from multiple sources: Tasks that promote understanding and not just memory for text. *Journal of Educational Psychology, 91*, 301–311.

Wong, B. Y., Kuperis, S., Jamieson, D., Keller, L., & Cull-Hewitt, R. (2002). Effects of guided journal writing on students' story understanding. *Journal of Educational Research, 95*, 179–191.

Yeh, K. H., & She, H. C. (2010). On-line synchronous scientific argumentation learning: Nurturing students' argumentation ability and conceptual change in science context. *Computers and Education, 55*, 586–602.

Zhang, J., & Patel, V. L. (2006). Distributed cognition, representation, and affordance. *Pragmatics and Cognition, 14*, 333–341.

Zhang, J., Scardamalia, M., Lamon, M., Messina, R., & Reeve, R. (2007). Socio-cognitive dynamics of knowledge building in the work of 9- and 10-year-olds. *Educational Technology Research and Development, 55*, 117–145.

Zohar, A., & Nemet, F. (2002). Fostering students' knowledge and argumentation skills through dilemmas in human genetics. *Journal of Research in Science Teaching, 39*, 35–62.

CHAPTER 17

Sociocultural Approaches to High School Writing Instruction

Examining the Roles of Context, Positionality, and Power

Michelle Nguyen Kwok, Exequiel Ganding III, Glynda A. Hull, and Elizabeth Birr Moje

In our increasingly globalized world, adolescents have many opportunities to write for different audiences, in different genres, and with different tools (Hull & Katz, 2006; Itō et al., 2009; Yi, 2010). Writing has long been recognized as a powerful aspect of literacy, contributing to learning, representation, knowledge construction, and sharing. Its importance is likely to increase, as composing takes center stage as the dominant literacy practice in our digital age (Brandt, 2009). The current era demands that workers communicate in multiple ways and across languages and knowledge domains. Beyond school, certain kinds of writing are claimed to facilitate upward mobility professionally as workers are expected to perform writing tasks in the form of reports, memos, and electronic correspondence. Writing continues to be central to an individual's ability to navigate the conditions of this

era.

And yet, policy briefs and national reports claim a crisis of writing achievement among U.S. youth (Graham & Perin, 2007; National Commission on Writing, 2003). Driven by calls for improved writing achievement, high school students are faced with pressure to write in particular ways to meet state and national accountability exams (Amrein & Berliner, 2002). The distressing truth is that meaningful writing opportunities matter a great deal in every arena *but* school. Writing is assigned and tested, but rarely explicitly taught in high schools (Read & Landon-Hays, 2013). Despite the demand by the Common Core State Standards (NGACBP & CCSSO, 2010) for increased opportunities to write increasingly complex texts, high school is a great writing abyss, wherein writing is practiced and experienced today much as it was over 30 years ago (Applebee & Langer, 2011). The high school writing abyss is reflected in the limited amount of research available on writing in high school classrooms (National Commission on Writing, 2003).

As the authors of *Writing Next* argue, "New researchers must take on the challenge of studying writing instruction in all its complexity" (Graham & Perin, 2007, p. 27). The meta-analysis offered in *Writing Next* laid out 11 research-based strategies for writing instruction, many of which are relevant to a sociocultural approach. Yet, these teaching practices and strategies were presented in isolation from the larger social and cultural contexts in which the use of these practices and strategies occur. Although we appreciate the attention to the importance of learning skills, we also draw on the work of Scribner and Cole (1981) who argue that "literacy is not simply knowing how to read and write a particular script but applying this knowledge for specific purposes in specific contexts of use" (p. 236). Through this view of literacy, we examine the way the teaching and learning of skills are always situated in and mediated by social and cultural contexts. In high schools, those contexts can include the particular communities in which a school is situated, the culture of the school itself, and the multiple disciplines, or subcultures, (O'Brien, Stewart, & Moje, 1995) among which youth navigate on a daily basis.

In this chapter, we tease out the implications of sociocultural theory for writing instruction in high school classrooms and wrap these implications around instructional strategies offered in other studies. Building on the chapter on sociocultural tenets of writing instruction in the 2006 *Handbook of Writing Research* (Englert, Mariage, & Dunsmore), which included attention to communities of practices, procedural facilitators and tools, and sociocognitive apprenticeships, we draw attention to other strands of sociocultural theory that may address the disjuncture between writing in the world and writing in high school classrooms. Specifically, we examine research on high school writing instruction that draws attention to the social and cultural contexts and discourses in which teaching and learning to write occur, a context where students move from one disciplinary domain to another and experience different writing tasks and demands, even as they move from one learning context, populated by a teacher and group of fellow learners, to another learning context multiple times throughout the day. We also attend to the positions taken up and assigned in writing instruction in these varied and sometimes alienating learning contexts, together with the power relations that flow in and through the practices of teaching and learning to write. We hope that this work will help to draw attention to the role of contexts, positionalities, and power in teaching and learning writing because these constructs are at work in discourse and practices even when people are not aware of their influence.

We include attention to these three constructs because our theory and research suggest that if educators are serious about providing opportunities for people to develop literate identities that allow them to engage fully with the cultural tools and symbols valued in society, then educators need to attend to the ways that instruction makes spaces for people to see themselves as writers. Teachers need to help students claim power and agency as writers by being able to stand outside the discursive practices of their daily lives. In addition, teachers can apprentice learners to the practices of discourse communities even as they help them learn that the communities' ways with words are human

constructions that can be changed. In the process of learning that disciplinary discourse communities can change, students can learn that writers are most effective when they not only possess facility with cultural tools, but also have power over the cultural tools that dominate their worlds. We are particularly interested in the power that people have within and across contexts and discourses and the ways that power works in both micro-interactions and in larger structural forms. If writing works well, it allows people to navigate both everyday micro-interactions and larger forces of power.

In the remainder of the chapter, we discuss the tenets of a sociocultural approach to writing instruction; review related research, including three exemplar studies; and draw implications for future high school writing research, theory, and instruction.

WHAT DOES IT MEAN TO REFER TO A SOCIOCULTURAL APPROACH TO WRITING INSTRUCTION?

Sociocultural studies often refer to *practices*, rather than to processes. According to Scribner and Cole (1981) "A practice . . . consists of three components: technology, knowledge, and skills. . . . Whether defined in broad or narrow terms, practice always refers to socially developed and patterned ways of using technology and knowledge to accomplish tasks" (p. 236). The value of the process/practice distinction is the emphasis on the idea that all processes—cognitive or otherwise—are embedded in social and cultural practices that are engaged for particular purposes. Practices are, however, often taken for granted to the extent that they are almost invisible. When people's practices do not fit the "norm," as is often the case for youth whose social, cultural, and economic circumstances diverge from the mainstream, then those practices may be deemed inappropriate or problematic, or may be ignored.

Scholars working from social, cultural, and sociocultural perspectives have clearly established—through both theory generating and theory testing—a number of basic learning principles, briefly represented here (cf. Bazerman, Chapter 1; and Beach, Newell, & VanDerHeide, Chapter 6, this volume). First, learning is *embedded in practice*. That is, learning occurs as a function of participation in activities and practices (Lave & Wenger, 1991; Rogoff, 1990). As such, learning is domain-specific. Because learning is embedded in practice, much of what happens when people learn stems from *implicit teaching* behaviors. In practice, however, learning also depends on a *range of explicit teaching practices*, particularly when what people learn is abstract or not observable in everyday practice. Written language learning, in particular, is facilitated by having those who are more proficient explain their decisions about language use or form to those who are new to the community. Thus, although peer-learning settings are powerful, learning typically depends on interaction with a more knowledgeable other. Support may take the form of explicit apprenticeships, or knowledge may be acquired as "newcomers" (or novices) interact with "old timers" (or experts) and engage in "legitimate peripheral participation" (Lave & Wenger, 1991) wherein novices observe the practice of experts and slowly take on tasks over time. Learning in these contexts is scaffolded to provide supports as needed until newcomers/novices move from peripheral to full participation. The apprenticeship model of learning suggests that learning, especially of complex or abstract tasks/knowledge, is time dependent. Learning is situated in and mediated by (1) the cultural practices of the group (often taken for granted), (2) the social interactions of the group, (3) the available tools for sense-making (whether physical/material, linguistic, discursive, or conceptual tools), including a host of technologies, (4) the particular activities and activity systems in which literate activity occurs, and (5) the institutions in which these activities and systems are embedded.

Contexts, Positions, and Power: A Critical Sociocultural Perspective on Writing

Perhaps the most central and stable finding of sociocultural studies of literacy is that people learn and practice literacy outside of school, often with high degrees of proficiency, across multiple domains, with a range of systems, and for multiple purposes (e.g., Jocson, 2010; MacGillivray & Curwen, 2007; Moje, 2008; Scribner & Cole, 1981). This finding might be dismissed as irrelevant because academic/conventional literacy skills and practices are the ones that are assumed to matter for social and economic success. However, we emphasize this finding because it reminds us that the challenge some people experience in learning conventional academic literacies may not necessarily be one of neurological, cognitive, or motivational deficit, but may be a matter of inappropriate teaching practices, less than meaningful texts, or demotivating learning environments. This finding also underscores that what counts as "success" in literacy learning need always be qualified because writing contexts and opportunities are always influenced by structures of power that deem what literacy practices are appropriate or accepted; successful writing practice in a school context may be considered inappropriate, or even odd, in another (see Heath, 1983). As a result, it is not always clear what kinds of literacy practice and skill lead to social and economic success. People whose cultural practices and ways of engaging in literacy are not centrally situated within dominant literacy practices are often marginally positioned and considered to be "failing" at literacy because their literate practices fall outside what is considered normative or valuable (Street, 2009).

What's more, the nature of writing is changing in our digital and interconnected world, with the rapid creation of new genres, combinations of modes, varied purposes, and vast and distant audiences. Although these changes may not as yet be part of most school-based curricula, they are important in the world at large, and they represent the changing mediational means, or the powerful new symbol systems, of our historical moment. Ultimately, literacy can more accurately be conceptualized as literacies. That is, within different contexts, reading and writing practices vary considerably and reflect, as Scribner and Cole (1981) have noted, particular configurations of knowledge, skills, and technologies. Sociocultural research has documented a range of literacies across communities, societies, and institutions, including schooling, where academic language represents a specialized form of literacy and where reading and writing requirements vary according to knowledge domains and disciplines (Blommaert, Street, & Turner, 2007; Lee & Spratley, 2006). Students need to be apprenticed into the literacy practices of these different domains and contexts. Such apprenticeships are especially important in highly specialized domains that demand highly specialized literacy practices such as particular ways of using evidence, particular lexicons and discourses for signaling stance, or voice, and particular ways of organizing an idea, exposition, or argument (Chin & Osborne, 2010; Greenleaf, Schoenbach, Cziko, & Mueller, 2001). The academic disciplines are one form of highly specialized domains into which some learners are apprenticed through life experiences—particularly if family members or friends are immersed in those domains—and other students are left at the edges or even excluded (Moje, 2007).

A second finding of sociocultural research on literacy is the critical relationship between literacy and identity development/construction/enactment. Issues of identity are especially important when considering the impact of being labeled "illiterate" or "struggling." The impact of these identity labels is both a matter of the adolescent's self-esteem and the teachers' or school's perspectives and assumptions about the learner's capacities (Hull, 1999; Harklau, 2000). Identity issues are especially important when considering questions of motivating adolescents who have not been successful in mainstream education (Hicks, 2004; Holland & Leander, 2004; Mishler, 2004). But identities are about more than motivation. Lave and Wenger (1991), for example, argue that real learning both requires and produces shifts in identity. That is, as people enter new domains and take up new literacies, they begin to identify themselves, others, and their relationships with others in new ways that are realized in their writing (Carbone & Orellana, 2010). These shifts in identity not only represent learning but make a space—or a motivation—for new learning, and this is certainly true when one learns to write as a member of a particular community. The writer/learner begins to see herself as a member who has the right to speak—in the written word—and shifts from a

recipient to an agent of the written word. Thus, shifts in identity produce shifts in agency and power (Moje & Luke, 2009).

To experience shifts in identity, adolescents need opportunities to engage in literate practice and opportunities to use literacy for a broad range of life activities that index goals and desires beyond the moment of instruction. The need for meaningful, conceptual learning experiences is well warranted by cognitive research (Bransford, 2000) as well as by sociocultural studies. Sociocultural theories, however, remind teachers that what counts as meaningful is likely to vary by student and context and may be intimately tied to students' cultural experiences, norms, and conventions (e.g., Heath, 1983; Lofty, 1990). Thus, the critical point of sociocultural theories for writing instruction is that teachers need to attend to the many different perspectives and values their students bring to learning how to write, including perspectives on and values for and about writing itself, to position them as writers and learners in the classroom and beyond. Furthermore, although the need for opportunities to learn meaningful concepts and practices is critical for all students, it may be especially important for adolescents who feel disenfranchised from formal schooling precisely because they fail to see a meaningful purpose for the writing they are asked to do and have many demands on their time that shape their views of the nature, purpose, and value of written work. When meaningless writing activities are demanded of youth who lack socioeconomic privilege and have limited access to postsecondary learning opportunities, the young people are likely to see little value for the written work of schooling.

In addition, adolescents are likely to take advantage of and persist with opportunities for learning to write when connections are made to the knowledge they already possess and when that knowledge is valued. Again, although critical for all students, it may be even more critical for the adolescent who has successfully navigated other life arenas without having developed powerful academic writing practices. Adolescents are likely to have extensive and rich funds of knowledge that could contribute to their new learning about writing (Moll, 1994). Moreover, if such resources are ignored and youth are continuously positioned as marginalized or excluded from certain academic communities, they could assume a devalued learning identity.

Last, students need *appropriate tools* for sense-making and representation of understanding, including multimodal tools. These tools are necessary to position adolescents to take part successfully in an information-rich, indeed dependent, global society and in work environments where knowledge production and communication increasingly rely on a variety of semiotic systems that extend beyond print (Haas & Witte, 2001). Such tools allow for the development of deeper understandings of a concept or idea as learners encounter multiple ways of representing that idea (Siegel, 1995). For example, high school students can benefit from developing facility with transforming information and knowledge from one mode of representation to another in the process of "transduction" (Kress, 2003). Although young people engage in an array of multimodal literacy practices in informal settings, there is a need for explicit instructional attention to the different language and literacy practices demanded by disciplinary domains that differ not only in substance but also in form, with a focus on helping students learn to navigate across domains.

Conducting Sociocultural Research

Research conducted from a sociocultural perspective—whether on basic processes/practices or on instruction—often demands qualitative or ethnographic data because the study of practices generally requires close examinations of invisible, taken-for-granted norms at work in people's interactions. What is more, carefully conducted qualitative analysis can be used to draw relational, if not directly causal inferences, between patterns of practice and outcomes (Erickson, 2004). Some sociocultural literacy scholars have conducted mixed methods research (see Scribner &

Cole, 1981) to allow for the testing as well as generation of theory about instructional approaches to literacy learning. Within the particular realm of writing research, however, we were able to unearth few research studies that are both sociocultural and mixed in design. A number of mixed methods studies on writing instruction have examined teachers' and students' cognitive processes, taking into account social interactions within disciplinary domains (Greenleaf et al., 2001; Hohenshell & Hand, 2006). However, those mixed methods studies, which we would describe as sociocognitive in orientation, do not explicitly address issues of power, position, or culture.

Specific instructional practices associated with the tenets of context, positionality, and power have not been tightly specified in large part because of the theories themselves, which highlight the contextually and relationally dependent nature of such work. In addition, the lack of methods for ascertaining the kinds of writing instruction that make a difference in people's learning with attention to the role of contexts, position, and power has hampered efforts to define specific instructional interventions that meet the needs of a range of learners in a range of learning environments. Finally, the demand for curriculum standards and for higher student achievement as assessed in terms of particular literacy learning outcomes has privileged experimental testing of writing interventions, rather than qualitative or design research methods. Qualitative and design methods, unlike experimental studies, seek to understand how, when, and why a particular method works, as well as how, when, and why a method does not work, for a given set of students (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003; Collins, Joseph, & Bielaczyc, 2004; Gutierrez & Penuel, 2014). Examples of design research endeavors are well represented across the fields of literacy, mathematics, science, and technology (Hoadley, 2005; Steffe & Thompson, 2000) but are less widely used in the study of secondary writing instruction.

FINDINGS FROM CURRENT SOCIOCULTURAL RESEARCH ON WRITING INSTRUCTION

In this section, we focus squarely on high school instruction research within the last decade to continue the work that Englert et al. (2006) began in the previous volume of the *Handbook of Writing Research*. We reviewed studies on high school writing instruction from 2004 to the present in major literacy, composition, and educational research journals, including but not limited to, the *Journal of Literacy Research*, *Journal of Writing Research, Journal of Adolescent and Adult Literacy*, *American Educational Research Journal Research in the Teaching of English*, *Journal of Second Language Writing*, and *Written Communication*.

By and large, the current research on high school writing instruction attends to the sociocultural tenets of writing instruction outlined in the previous volume, which included attention to communities of practices, procedural facilitators and tools, and sociocognitive apprenticeships. Little research explicitly addresses the three tenets we have argued are important for writing instruction in the 21st century: contexts, positionality, and power. Yet, in this current era of education, there is evidence that researchers are beginning to think about how context, positionality, and power play a role in writing instruction and students' opportunities to write. In the following section, we point to areas in the current research that address communities of practice, tools, and apprenticeships, and where discussion of the sociocultural tenets of context, positionality, and power is emerging.

Relationships of Power and Positionality within Apprenticeships

It is generally understood that as students are apprenticed into particular discourse communities, they depend heavily on the mentorship of their teacher or more knowledgeable other (Vygotsky, Cole, John-Steiner, Scribner, & Souberman, 1978). Yet, recent studies on high school writing instruction have begun to complicate the

mentor/mentee relationship, for example, by showing how students and teachers might have different understandings about expectations embedded within writing assignments (Helstad & Lund, 2012). These differing expectations can be shaped by students' and teachers' respective understandings of the content areas (Kibler, 2011), or students might have different long-term goals or envision themselves differently from the goals that their teachers set for them (Wolsey, Lapp, & Fisher, 2012). Findings from these studies complicate the mentor/mentee apprenticeship and show how students take up skill and knowledge through careful scaffolding of writing practices; they also reveal how students are learning to negotiate their roles and identities in relation to their peers and mentors. Researchers who study apprenticeships of writing are beginning to show how positions matter in students' opportunities to write, yet the sociocultural tenets of positionality and power are often implied, not foregrounded in these studies as they are in studies of out-of-school or extracurricular contexts.

There is continued research on how students can be positively positioned, especially within out-of-school, extracurricular, or online communities as creative and empowering contexts for developing identities, a sense of ownership of writing practice, and a sense of belonging (Tatum & Gue, 2012; Yi, 2010). Researchers have focused on bridging students' in-school lives to the writing practices, cultures, and identities they enact out of school, with hopes of providing positive implications for academic writing instruction (Fisher, 2005; Garcia & Gaddes, 2012; Hall, 2012; Jocson, 2010; Mahiri, 2004).

Making Tacit Ways of Thinking and Practices Explicit within Disciplinary Communities

Other attempts to improve high school writing instruction have involved evaluating the effectiveness of professional development on writing instruction, which has shown positive results on teachers' knowledge and perspectives of their own instruction (Grisham & Wolsey, 2011). However, for teachers to apprentice students into disciplinary ways of writing, teachers themselves must also be able to know how to write in the disciplines (Pytash, 2012). To this end, some researchers, such as Monte-Sano (2008, 2010) have examined students' and teachers' understandings of what it means to write and to teach writing as they develop disciplinary understanding. Others have studied writing instruction that emphasizes metacognitive strategy and communication to make explicit often taken-for-granted disciplinary ways of thinking, reasoning, and representing thoughts in writing (Chin & Osborne, 2010; Greenleaf et al., 2001). Overall, these studies have provided valuable findings on the cognitive processes of teachers and students within the disciplines as social contexts; however, they do not take into account how students' and teachers' cultural backgrounds matter in taking up writing as a social practice or in positioning students as writers and learners. Nor do they examine how learning to write in a disciplinary area is, in itself, a matter of being enculturated to a set of norms and practices.

Research on writing instruction from social semiotic or linguistic views has brought attention to the characteristics of academic writing, particularly the argumentative genre, which some consider to be one of the most challenging genres to teach and learn in high school (Beck & Jeffery, 2009). This notion, however, is complicated by research on the nature of opportunities to write in high school settings cited previously (Applebee & Langer, 2011). It is, in fact, unclear to what extent the people who inhabit the subject areas of secondary schools actually value the writing of argument as a core practice in subject areas, as evidenced by the lack of opportunity to practice the writing of argument. Notwithstanding the lack of attention to instruction in, or even opportunity to engage in, argument writing, literacy researchers have investigated the nature of argument in different disciplinary domains. Linguists, for example, have explored the characteristics of linguistic resources needed to take an argumentative stance for writing in history (Chang & Schleppegrell, 2011; Coffin, 2004; de Oliveira, 2010).

Changes in Tools, Tool Use, and Enactment/Construction/Representation of Identity

Attention to multimodal forms of representation has increased as the tools for writing and representation have changed (Hull & Nelson, 2005; Vasudevan, 2010) along with the relationship of writers to their perceived audiences (Hull & Stornaiuolo, 2014; Lankshear & Knobel, 2006). Researchers have recognized other ways of enacting identities through means such as multimedia presentations and texting (Hull & Katz, 2006; Lewis & Fabos, 2005). These findings include ways of exploring enactments of cultural and academic identity that do not rely on digital modes of expression (Smagorinsky, Cook, & Reed, 2005; Wilson & Boatright, 2011).

As tools for writing are constantly changing, research has also paid attention to the changing adolescent populations who write in and out of school. An emerging area of research examines the complexities of adolescent English language learners as youth who must navigate social, cultural, and language boundaries (e.g., Cox, Jordan, Ortmeier-Hooper, & Schwartz, 2010; Harklau, 2011). Based on their writing abilities, adolescent English language learners are identified through systems of assessment and practice that place them in learning environments that often do not meet their needs and where students are socialized toward a narrow view of what counts as academic writing (Enright & Gilliland, 2011). Researchers have also examined adolescent second-language learners' understandings of their identity: in resistance to their identification as English language learners (Ortmeier-Hooper, 2010), as influenced by their teachers (Harklau, 2000), and as influenced by their understanding of the academic disciplines (Hyland, 2012). This body of research not only speaks to the need for changing the way students are positioned in school, but the ways that tool use, including language use, can be taught to support all students to take on academic and writerly identities.

In sum, a review of the most current research findings suggests that apprenticeships, tools, and communities of practice remain powerful tenets of writing instruction research. Yet, this body of writing research also suggests necessary shifts within each tenet to examine how power works within apprenticeships, how dramatic changes in the tools used to write and compose may influence students' writing practices, identities, and skill learning, and the ways that students position themselves and are positioned within discourse communities.

THREE EXEMPLARS OF CONTEXTS, POSITIONALITIES, AND POWER

Based on the review of current research findings on high school writing instruction, we note moves to acknowledge the role that contexts, positions, and power play in teaching and learning to write. However, few researchers have foregrounded these tenets in their studies of high school writing instruction. In this section, we highlight three studies that focus on the important roles that particular contexts, positionalities, and power play in shaping adolescents' writing experiences and identities, which in turn, allows us to theorize about their importance to future research and theory around high school writing instruction.

Contextualizing Meaning Making in Composing Architectural Text: Study Exemplar 1

To illustrate the importance of context in writing instruction, we examine Smagorinsky et al.'s (2005) study of composing a text in an architectural design course. The authors explored the settings, goals, and tools through which a student, Rick, composed the plans of a house in which he imagined himself living. Through analyzing the processes and social relationships involved in the composition and reading of the house blueprint, including the role of cultural knowledge and practice in Rick's apprenticeship into architectural design, the authors examined how Rick's text was understood by his most immediate reader, his teacher Bill. The authors also explored the tensions

and differing goals that existed as Bill apprenticed Rick into particular disciplinary conventions.

Readers and texts are parts of larger communities of discourse and practice that suggest the need for appropriate ways to encode texts with meaning. These communities provide the larger harmonic structure and performative genres that enable different players to communicate with one another effectively. Both Rick and Bill invoked these conventions in the production and interpretation of the house design. To provide for a broader view, we have examined this collaborative social act as not just a tug-of-war between Rick and Bill over what constituted a suitable house design, but as an illustration of the ways in which composition and reading include a host of complex, socially created, power-imbued acts. The researchers demonstrated the role that context plays in shaping writing, illuminating the ways that processes of meaning making are shaped by the discipline. Writing, as popularly perceived, often is relegated to be taught and learned in the English classroom, the sole responsibility of English teachers. However, the authors illustrated that the discipline of architectural design is characterized with its own unique schematic and symbolic tools, textual conventions, and forms of discourse. In other words, all strategies of writing as taught in the English classroom do not easily transfer into or are not applicable to the domain of architectural design.

The argument about differences in discourses is more obvious in this exemplar than in word-based disciplines such as the social or natural sciences due to the unique symbolic system used in architectural design (although some readers might not consider architectural symbols to be part of literate practice). However, disciplinary domains or contexts also influence the practice of writing in subjects such as history and science because the goals and tools of writing change in subtle but powerful ways (Moje, 2007). The subtle nature of these differences demands explicit attention on the part of teachers, especially for students whose lives do not necessarily open opportunities for lifetime apprenticeships to disciplinary work.

Similar to our other two exemplar studies, Rick engaged in questions of identity as part of the process of composing and having his text read by others. While attempting to compose a text as an act of self-expression, Rick also had to comply with the textual conventions of architectural design through consultation with a more knowledgeable other, his teacher. Through his iterations, Rick found himself positioning his work relative to a community of architectural design practitioners, determining where he would conform to the power of this community, where he would challenge it, and where he could compromise. To this end, the authors argued that Rick negotiated these processes and tensions as part of a larger project of his ongoing identity development and life trajectory.

Positioning Students to Enact Literate Identities: Study Exemplar 2

We use Vetter's (2010) microethnography of an 11th-grade classroom to illustrate the sociocultural tenet of positionality. In this interactional analysis of discourse, Vetter explored how an English teacher situated her students as writers and readers. As part and parcel of helping students master canonical forms such as essays and perform well on high-stakes writing assessments, the teacher in this study enabled her students to enact and adopt powerful literate identities; that is, senses of themselves as writers authorized and able to compose. Indeed, Vetter would argue that fostering such identities is not an ancillary but a central part of teaching writing. In her words, "learning literacy is not just about learning a set of skills and strategies but is also about acquiring behaviors and discourses associated with reading and writing identities" (p. 36). She was especially interested in "resistant" readers and writers and how such students were coached and coaxed, through classroom interactions with their teacher and each other, to construct writerly identities. Vetter conceptualized the process of constructing an identity as writer and learner as necessarily influenced by other conceptions of self, including those related to gender, sexuality, class, or

race. The teacher's challenge, then, was to acknowledge the identities that the students brought to her classroom in such a way as to facilitate rather than hinder the construction of literate senses of self. Vetter saw this process as interactional, constructed through classroom talk, and also as improvisational, with the teacher drawing on knowledge of students, teaching, and subject matter in the moment of interaction.

Vetter carried out her study in a classroom that was diverse in terms of ethnicity, socioeconomic status, language background, and writing performance. Such a range of difference is often viewed as a challenge, the impetus for classrooms to become contact zones where power and privilege are distributed unequally and where misunderstandings between and among students and teacher abound. A great part of the interactional prowess of the teacher Vetter studied was to orchestrate the different voices in this classroom, not simply allowing all to be heard, but responding to students' commentary and interactions so as to position them as readers and writers within their classroom community. The teacher employed a "writer's workshop" approach, whereby students worked in small groups to conceptualize, revise, and edit their papers, interacting frequently with their teacher and each other, a kind of process instruction whose effectiveness researchers have unpacked (Graham & Perin, 2007; cf. Hillocks, 1984). However, the focus of Vetter's research was not the writer's workshop approach per se, but the talk, negotiations, and positionings that contextualized the approach (see also Chisholm & Godley, 2011), all of which made it possible for students to buy into literate identities. An important aspect of these literate identities for students was for them to believe themselves capable of writing by building an "agentive narrative" (p. 51), or the sense of having the know-how and ability to carry out the writing assignment. It is precisely such negotiations and positionings to which we wish to call attention.

Designing Identities and Worlds through New Ways of Writing: Study Exemplar 3

The study by Glynda Hull and Amy Stornaiuolo (2014) exemplifies how the skills of writing are embedded in social contexts replete with relations of power and imbricated racial, ethnic, gendered, linguistic, and national identities. This piece also highlights new ways of thinking about writing as designing, prompted in large part by the speed of access to multiple forms of representation.

Hull and Stornaiuolo report on 3 years of design research with high school-aged youth from the United States, India, South Africa, and Norway in school-based and after school learning contexts. The project engaged youth who did not routinely have access to media and social networking tools in cross-cultural interaction using multimodal tools embedded in social networks (see also Lam & Rosario-Ramos, 2009). Hull and Stornaiuolo use tools of discourse, textual, and constant comparative analyses to offer a case of one Norwegian youth participant's efforts to understand his Indian audience. The authors documented the young man's initial misunderstandings, his failed initial attempts to communicate without understanding, and the work he had to do once he understood how to help the audience understand. His end product included explicit demonstrations and explanations of everything from images and linguistic devices meaningful in his world to norms, practices, and values that contextualized, mediated, and animated the images and linguistic devices he used.

Hull and Stornaiuolo attended to the ways that out of school (or after school) contexts shaped instructional moves and the students' take-up of those moves as they composed, stitched, mashed, designed, and navigated multiple media, power relations, and identities. Specifically, the analysis showed that the young people in the study stitched together multiple modes to engage and collaborate with each other, rather than to persuade and dominate. As "cosmopolitanism" actors, they reframed writing from an act of persuasion to an act of understanding. Such moves change the typical workings of power in traditional views of writing and rhetoric, in which the goal is to persuade a reader to one's perspective.

Finally, the study makes a strong exemplar of the role of power and its intersection with the other tenets of a sociocultural theory because it reveals the ways that tools (including language) can be used to empower and disempower, to position others and take positions or identities, or to express oneself and engage a community. In short, the piece illustrates how writing—or designing—is about identity construction and development and is always also about navigating relations of power (see also Wilson & Boatright, 2011).

NEW QUESTIONS AND IMPLICATIONS FOR SOCIOCULTURAL RESEARCH IN WRITING INSTRUCTION

The studies reviewed suggest that a great deal remains to be studied in regard to teaching writing in high school classrooms, particularly because so little research is currently being done within the myriad, complex contexts of high schools. In what follows, we briefly discuss theoretical, empirical, and practical directions for future writing research.

Theoretical Implications

As our literature review illustrates, a sociocultural theory of writing instruction includes attention to contexts, positions, and power relations people navigate as they write, learn to write, and teach writing. Context both surrounds and is weaved into every act of writing, which is regulated by structures and dynamics of power (Holland & Leander, 2004; Street, 2009). While students engage in a process of designing texts, they simultaneously locate, or position, themselves within a given context relative to the structures of power in place. They are also positioned by others through their written work. Power relations position adolescents in (and out of) high school classrooms, shaping how they enact identities and, ultimately, how they write.

To understand how youth learn to participate through written communication in the varied societies of the 21st century, theories of writing instruction need to expand in multiple ways. First, the concept of writing needs to include the production and design of texts that use symbolic systems and modalities beyond alphabetic print (e.g. Smagorinsky et al., 2005; Hull & Stornaiuolo, 2014) to reflect the multiple and ever-changing tools that youth can use to navigate understandings, contexts, positions, and power relations in and through their compositions. Texts have long been multimodal, of course, but the ease and speed of access has changed the nature of youths' writing. Writing theories need to account for the ways that the use of words rendered in print may give way to using other more powerful forms of representation to convey ideas and arguments.

Second, in relation to the notion of tool use, the concept of writing needs to be reconceived as designing. Reconceptualizing writing as designing is necessary, in part, to attend to the many different modes of communicating an idea, argument, or theory in a 21st-century world. This move to think of writing as designing is not, however, limited to media use. The concept of writing-as-designing recognizes the ways that designed texts are avenues for identity construction and representation. People have always used writing to position and identify themselves, but new multimodal designs offer even more potential for designing and positioning the self. These designs may also have negative consequences for youth identity representation, and theories need to examine both the power and potential in writing as designing.

Finally, as all three exemplar studies illustrate, theories that focus primarily on argument writing for secondary school instruction are limited for the work of designing texts in the 21st century. As the world becomes more global and its actors more cosmopolitan, argument writing will continue to be valuable and important, but theories of

designing to understand, to connect, and to cross boundaries will be powerful for a 21st-century world. Indeed, writing that seeks only to persuade may fail to communicate because 21st-century writers live, work, and play across cultures and must learn to navigate difference, and power, in ways not required in the past. This last point leads to questions of how to conduct research on writing as designing to understand, which we take up in the next section.

Research Implications

Given the reminder that sociocultural theories demand attention to contexts, positions, and power, together with advances in theory articulated previously, we call for research that attends to writing instruction as more than an act of teaching youth to apply skills. Instead, the field needs research that examines the roles that contexts, positions, and power play in how teachers can teach writing to empower students beyond school classroom performance. Such research should examine classrooms wherein teachers and/or curricula interrupt unequal power relations by using tools and texts in powerful ways (e.g., Hull & Nelson, 2005; Vasudevan, 2010), attend to how students' and teachers' moves position others (e.g., Chisholm & Godley, 2011; Vetter, 2010), and acknowledge and plan for the role of contexts and discourses at work in writing and learning to write (e.g., Smagorinsky et al., 2005; Wilson & Boatright, 2011). To those ends, we see the need for at least three types of writing instruction research.

First, we encourage researchers to renew attention to classroom ethnographies—that is, the study of classroom cultures—particularly in settings where teachers are taking up new modes of writing as design and where they are able to provide access to complex, digital tools. Such studies would focus on how the teacher and students together build and maintain a culture of writing-as-design, rather than on writing as a series of steps or procedures. In this case, the goal would be to focus on processes and practices rather than on products, although it remains incumbent on ethnographers to clarify for readers the nature and quality of students' writing.

A second type of research that would move this work forward is design-based research that examines teachers' and students' enactments of new writing curricula. A sociocultural approach to design-based research on writing instruction requires that researchers attend to the particular ways high schools and high school classrooms shape the work of teaching and learning writing. Design-based studies could examine important sociocultural dimensions of writing instruction, such as access to tools, the cultural experiences students bring to their writing, how writing tasks make space for a range of social identities, and how teachers apprentice students to the norms and practices of disciplinary communities. Especially innovative design-based studies would examine curricula that promote concepts of writing as design or an orientation of writing to understand rather than to persuade. The latter would be particularly useful if embedded in disciplinary literacy curricula, which tend to assume persuasion (or argument writing) to be the primary mode of knowledge production in the disciplines. Studies could ask questions such as what would it mean to shift disciplinary work from the goal of persuasion to that of understanding. Equally valuable could be design studies of curricula that engage students both in writing to persuade and writing to understand and then work with students to explore, at a metadiscursive level, what it takes to understand rather than persuade, and to examine when a persuasion and understanding are more or less appropriate. Regardless of focus, the goal of design-based research is to examine the feasibility and usability of the enacted curriculum, although the question of what students appear to learn from the curricula is equally important.

Finally, given the paucity of mixed, or integrated, methods research on writing that we located, we recommend more attention to integrating multiple methods for the purpose of examining the effects of different curricular approaches in relation to the contexts in which the curricula are situated. Mixed methods sociocultural research would focus on how teachers make sense of and students experience the writing instruction and on the results of the approaches in traditional measures (i.e., student achievement) and in terms of how student identities are constructed

in and represented through the writing/designing they do. A central goal of such work should be to understand not only what works, but also how a particular writing/designing curriculum intervention works, for whom, why, and under what conditions.

Instructional Implications

As literacy educators move forward in supporting students to write in the 21st century, it will be important to remember that situated, sociocultural approaches to writing instruction make room for skills and strategies that are often embedded in academic, disciplinary practice. Because academic writing skills are situated within the disciplines, writing instruction should also be understood as the work of all teachers, not only English teachers. In addition, our review suggests that 21st-century composing or designing skills demand the teaching of a range of digital tools, artistic and speaking skills, skills in mashing and stitching concepts into new products, and strategies and practices for navigating difference and power relations.

More specifically, teachers can carefully create opportunities for students to write in ways through which they can carry forward their everyday lives into disciplinary, academic discourse communities and back again. Such writing/designing experiences can serve as opportunities for students to enact their identities and take ownership of writing/designing to serve communal and individual goals.

Finally, literacy educators must recognize and acknowledge the power relations that are at play at school and in the classroom. To examine writing instruction within relationships of power is a vast, yet necessary, undertaking for fully supporting high school students as they write and participate in the 21st century.

REFERENCES

Amrein, A. L., & Berliner, D. C. (2002). High-stakes testing, uncertainty, and student learning. *Education Policy Analysis Archives, 10*(18), 1–74.

Applebee, A. N., & Langer, J. A. (2011). A snapshot of writing instruction in middle schools and high schools. *English Journal, 6*, 14–27.

Beck, S. W., & Jeffery, J. V. (2009). Genre and thinking in academic writing tasks. *Journal of Literacy Research, 41*, 228–272.

Blommaert, J., Street, B. V., & Turner, J. (2007). Academic literacies—What have we achieved and where to from here? *Journal of Applied Linguistics, 4*, 137–148.

Brandt, D. (2009). *Literacy and learning: Reflections on writing, reading, and society*. Hoboken, NJ: Wiley.

Bransford, J. (Ed.). (2000). *How people learn*. Washington DC: National Academy Press.

Carbone, P. M., & Orellana, M. F. (2010). Developing academic identities: Persuasive writing as a tool to strengthen emergent academic identities. *Research in the Teaching of English, 44*, 292–316.

Chang, P., & Schleppegrell, M. (2011). Taking an effective authorial stance in academic writing: Making the linguistic resources explicit for L2 writers in the social sciences. *Journal of English for Academic Purposes, 10*, 140–151.

Chin, C., & Osborne, J. (2010). Students' questions and discursive interaction: Their impact on argumentation during collaborative group discussions in science. *Journal of Research in Science Teaching, 47*, 883–908.

Chisholm, J. S., & Godley, A. J. (2011). Learning about language through inquiry-based discussion: Three bidialectal high school students' talk about dialect variation, identity, and power. *Journal of Literacy Research, 43*, 430–468.

Cobb, P., Confrey, J., diSessa, A., Lehrer, R., & Schauble, L. (2003). Design experiments in educational research. *Educational Researcher, 32*(1), 9–13.

Coffin, C. (2004). Learning to write history: The role of causality. *Written Communication, 21*, 261–289.

Collins, A., Joseph, D., & Bielaczyc, K. (2004). Design research: Theoretical and methodological issues. *The Journal of the Learning Sciences, 13*, 15–42.

Cox, M., Jordan, C., Ortmeier-Hooper, C., & Schwartz, G. G. (2010), *Reinventing identities in second language writing*. Urbana, IL: NCTE.

de Oliveira, L. C. (2010). *Knowing and writing school history: The language of students' expository writing and teachers' expectations*. Charlotte, NC: Information Age Publishing.

Englert, C. S., Mariage, T. V., & Dunsmore, K. (2006). Tenets of sociocultural theory in writing instruction research. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 208–221). New York: Guilford Press.

Enright, K. A., & Gilliland, B. (2011). Multilingual writing in an age of accountability: From policy to practice in U.S. high school classrooms. *Journal of Second Language Writing, 20*, 182–195.

Erickson, F. (2004). Demystifying data construction and analysis. *Anthropology and Education Quarterly, 35*, 486–493.

Fisher, M. T. (2005). From the coffee house to the school house: The promise and potential of spoken word poetry in school contexts. *English Education, 37*, 115–131.

Garcia, A., & Gaddes, A. (2012). Weaving language and culture: Latina adolescent writers in an after-school writing project. *Reading and Writing Quarterly, 28*, 143–163.

Graham, S., & Perin, D. (2007). *Writing next: Effective strategies to improve writing of adolescents in middle and high school—A report to Carnegie Corporation of New York.* Washington, DC: Alliance for Excellent Education.

Greenleaf, C., Schoenbach, R., Cziko, C., & Mueller, F. L. (2001). Apprenticing adolescent readers to academic literacy. *Harvard Educational Review, 71*, 79–129.

Grisham, D. L., & Wolsey, T. D. (2011). Writing instruction for teacher candidates: Strengthening a weak curricular area. *Literacy Research and Instruction, 50*, 348–364.

Gutierrez, K. D., & Penuel, W. R. (2014). Relevance to practice as a criterion for rigor. *Educational Researcher, 43*(19), 19–23.

Haas, C., & Witte, S. (2001). Writing as embodied practice: The case of engineering standards. *Journal of Business and Technical Communication, 15*, 413–457.

Hall, L. A. (2012). How popular culture texts inform and shape students' discussions of social studies texts. *Journal of Adolescent & Adult Literacy, 55*, 296–305.

Harklau, L. (2000). From the "good kids" to the "worst": Representations of English language learners across educational settings. *TESOL Quarterly, 34*, 35–67.

Harklau, L. (2011). Commentary: Adolescent L2 writing research as an emerging field. *Journal of Second Language Writing, 20*, 227–230.

Heath, S. B. (1983). *Ways with words: Language, life, and work in communities and classrooms*. Cambridge, UK: Cambridge University Press.

Helstad, K., & Lund, A. (2012). Teachers' talk on students' writing: Negotiating students' texts in interdisciplinary teacher teams. *Teaching and Teacher Education, 28*, 599–608.

Hicks, D. (2004). Growing up girl in working-poor America: Textures of language, poverty, and place. *ETHOS, 32*, 214–232.

Hillocks, G. (1984). What works in teaching composition: A meta-analysis of experimental treatment studies.

American Journal of Education, 133–170.

Hoadley, C. M. (2005). Design-based research methods and theory building: A case study of research with *SpeakEasy*. *Educational Technology, 45*(10), 42–47.

Hohenshell, L. M., & Hand, B. (2006). Writing-to-learn strategies in secondary school cell biology: A mixed method study. *International Journal of Science Education, 28*, 261–289.

Holland, D., & Leander, K. (2004). Ethnographic studies of positioning and subjectivity: An introduction. *Ethos, 32*, 127–139.

Hull, G. A. (1999). Literacy and labeling. *Journal of Adolescent and Adult Literacy, 42*, 540–544.

Hull, G. A., & Katz, M. L. (2006). Crafting an agentive self: Case studies of digital storytelling. *Research in the Teaching of English*, 43–81.

Hull, G. A., & Nelson, M. E. (2005). Locating the semiotic power of multimodality. *Written Communication, 22*, 224–261.

Hull, G. A., & Stornaiuolo, A. (2014). Cosmopolitan literacies, social networks, and "proper distance": Striving to understand in a global world. *Curriculum Inquiry, 44*, 15–44.

Hyland, K. (2012). *Disciplinary identities: Individuality and community in academic discourse*. New York: Oxford University Press.

Itō, M., Horst, H. A., Bittani, M., Boyd, D., Herr-Stephenson, B., Lange, P. G., Pascoe, C. G., Robinson, L. (2009). *Living and learning with new media: Summary of findings from the Digital Youth Project*. Cambridge, MA: MIT Press.

Jocson, K. M. (2010). Unpacking symbolic creativities: Writing in school and across contexts. *Review of Education, Pedagogy and Cultural Studies, 32*, 206–236.

Kibler, A. (2011). "I write it in a way that people can read it": How teachers and adolescent L2 writers describe content area writing. *Journal of Second Language Writing, 20*, 211–226.

Kress, G. (2003). *Literacy in the new media age*. London: Routledge Press.

Lam, W. S. E., & Rosario-Ramos, E. (2009). Multilingual literacies in transnational digitally mediated contexts: An exploratory study of immigrant teens in the United States. *Language and Education, 23*, 171–190.

Lankshear, C., & Knobel, M. (2006). *New literacies: Everyday practices and classroom learning.* New York: Open University.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* New York: Cambridge University Press.

Lee, C. D., & Spratley, A. (2006). *Reading in the disciplines and the challenges of adolescent literacy*. New York City: Carnegie Corporation of New York.

Lewis, C., & Fabos, B. (2005). Instant messaging, literacies, and social identities. *Reading Research Quarterly, 40*, 470–501.

Lofty, J. S. (1990). Time to write: Resistance to literacy in a Maine fishing community. In A. A. Lunsford, H. Moglen, & J. Slevin (Eds.), *The right to literacy* (pp. 39–49). New York: Modern Language Association.

MacGillivray, L., & Curwen, M. S. (2007). Tagging as a social literacy practice. *Journal of Adolescent & Adult Literacy, 50*, 354–369.

Mahiri, J. (Ed.). (2004). *What they don't learn in school: Literacy in the lives of urban youth*. New York: Peter Lang.

Mishler, E. G. (2004). Historians of the self: Restorying lives, revising identities. *Research in Human Development, 1*, 101–121.

Moje, E. B. (2007). Developing socially just subject-matter instruction: A review of the literature on disciplinary

literacy. In L. Parker (Ed.), *Review of research in education* (pp. 1–44). Washington, DC: American Educational Research Association.

Moje, E. B. (2008). Youth cultures, literacies, and identities in and out of school. In J. Flood, S. B. Heath, & D. Lapp (Eds.), *Handbook of research in teaching the communicative and visual arts* (pp. 207–219). Mahwah, NJ: Erlbaum.

Moje, E. B., & Luke, A. (2009). Literacy and identity: A review of perspectives on identity and their impact on literacy studies. *Reading Research Quarterly, 44*, 415–437.

Moll, L. C. (1994). Literacy research in community and classrooms: A sociocultural approach. In R. B. Ruddell, M. R. Ruddell, & H. Singer (Eds.), *Theoretical models and processes of reading* (4th ed., pp. 179–207). Newark, DE: International Reading Association.

Monte-Sano, C. (2008). Qualities of historical writing instruction: A comparative case study of two teachers' practices. *American Educational Research Journal, 45*, 1045–1079.

Monte-Sano, C. (2010). Disciplinary literacy in history: An exploration of the historical nature of adolescents' writing. *Journal of the Learning Sciences, 19*, 539–568.

National Commission on Writing. (2003). *The neglected "R": The need for a writing revolution*. New York: College Board.

National Governors Association Center for Best Practices and Council of Chief State School Officers (NGACBP & CCSSO). (2010). *Common Core State Standards.* Washington, DC: Authors.

O'Brien, D. G., Stewart, R. A., & Moje, E. B. (1995). Why content literacy is difficult to infuse into the secondary school: Complexities of curriculum, pedagogy, and school culture. *Reading Research Quarterly, 30*, 442–463.

Ortmeier-Hooper, C. (2010). The shifting nature of identity: Social identity, L2 writers, and high school. In M. Cox, C. Jordan, C. Ortmeier-Hooper, & G. G. Schwartz (Eds.), *Reinventing identities in second language writing*. Urbana, IL: NCTE.

Pytash, K. E. (2012). Engaging preservice teachers in disciplinary literacy learning through writing. *Journal of Adolescent & Adult Literacy, 55*, 527–538.

Read, S., & Landon-Hays, M. (2013). The knowing/doing gap: Challenges of effective writing instruction in high school. *Teaching/Writing: The Journal of Writing Teacher Education, 2*(3), 6–15.

Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context.* New York: Oxford University Press.

Scribner, S., & Cole, M. (1981). *The psychology of literacy*. Cambridge, MA: Harvard University Press.

Siegel, M. (1995). More than words: The generative power of transmediation for learning. *Canadian Journal of Education/Revue Canadienne de l'education*, 455–475.

Smagorinsky, P., Cook, L. S., & Reed, P. M. (2005). The construction of meaning and identity in the composition and reading of an architectural text. *Reading Research Quarterly, 40*, 70–88.

Steffe, L. P., & Thompson, P. W. (2000). Teaching experiment methodology: Underlying principles and essential elements. In R. Lesh & A. E. Kelly (Eds.), *Research design in mathematics and science education* (pp. 267–307). Hillsdale, NJ: Erlbaum.

Street, B. V. (2009). 'Hidden' features of academic paper writing. *Working Papers in Educational Linguistics, 24*(1), 1–17.

Tatum, A., & Gue, V. (2012). The sociocultural benefits of writing for African American adolescent males. *Reading and Writing Quarterly, 28*(2), 123–142.

Vasudevan, L. (2010). Education remix: New media, literacies, and the emerging digital geographies. *Digital Culture and Education, 2*, 62–82.

Vetter, A. (2010). Positioning students as readers and writers through talk in a high school English classroom. *English Education, 43, 33*(1), 33–64.

Vygotsky, L. S., Cole, M., John-Steiner, V., Scribner, S., & Souberman, E. (Eds.). (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Wilson, A. A., & Boatright, M. D. (2011). One adolescent's construction of native identity in school: Speaking with dance and not in words and writing. *Research in the Teaching of English, 45*, 252–278.

Wolsey, T. D., Lapp, D., & Fisher, D. (2012). Students' and teachers' perceptions: An inquiry into academic writing. *Journal of Adolescent and Adult Literacy, 55*, 714–724.

Yi, Y. (2010). Adolescent multilingual writers' transitions across in- and out-of-school writing contexts. *Journal of Second Language Writing, 19*, 17–32.

CHAPTER 18

Instruction in Evaluation and Revision

Charles A. MacArthur

Revision is widely accepted as a critical part of writing and writing instruction. Writing instructors commonly seek to improve students' writing by providing feedback and encouraging multiple cycles of revision. From an instructional perspective, revision is important for two reasons. First, revision is a critical aspect of writing that differentiates expert and novice writers. Proficient writers devote substantial time and effort to revision to meet their rhetorical goals. As they revise, they keep their audience and purposes in mind as they evaluate their writing for content, organization, and style (Hayes, 2004; MacArthur, 2012). In the process, they may develop new understandings about the content or the rhetorical situation. In contrast, students at the elementary and secondary school levels, and struggling writers at all ages, engage in relatively little substantive revision, making primarily surface changes or local revisions to content and wording (Fitzgerald, 1987). To become proficient writers, students need to learn to evaluate their writing and revise effectively.

Second, revising provides an opportunity for teachers to guide students in learning about the characteristics of effective writing in ways that will not only improve the current piece, but that will also carry over to future writing (MacArthur, 2012). Instruction in revision can help students learn to evaluate their writing, consider audience and purpose, solve common writing problems, and develop knowledge about writing forms.

The purpose of this chapter is to review research on instruction in evaluation and revision. Revision has been taught or supported using a variety of methods, including teacher feedback, peer review, automated evaluation, instruction in evaluation criteria, goal setting, experiences as readers or observers, and strategy instruction. The chapter begins with a brief review of research on models of revision as background.

THEORETICAL MODELS OF REVISION

Revision processes were included in the earliest cognitive models of writing by Hayes and Flower (1980) and expanded with colleagues in a later model (Hayes, Flower, Schriver, Stratman, & Carey, 1987). Early theoretical

conceptions focused on evaluation of problems in texts, but more recent models have included discovery of new opportunities and ideas as well as identification and resolution of problems (Hayes, 1996). In his reorganized model of writing processes, Hayes (1996) defined revision as a composite of critical reading, reflection, and text production, all guided by a task schema. The task schema included overall goals for revising, expected activities, subgoals for what aspects of the text to consider, evaluation criteria, and typical strategies for resolving problems. Critical reading was conceptualized as parallel to reading comprehension but with the specific purpose of evaluating text for problems and opportunities. Reflection included problem solving and decision making. Text production involved generation of alternatives that would then be evaluated.

Bereiter and Scardamalia (1987) developed a cognitive model of revising focused on problem detection. According to the model, writers first compare (C) the text to their intended meanings to identify problems, then diagnose (D) the problems, and finally operate (O) to improve the text. This CDO model was tested using procedural facilitation to support students' regulation of the three processes; students were guided to apply each process sentence by sentence to revise their text. Students made more revisions with this support than without, though they did not improve the overall quality of their writing. Bereiter and Scardamalia's (1987) dual models of the overall writing process—knowledge telling versus knowledge transforming—are also relevant for understanding evaluation and revision. Knowledge telling involves minimal evaluation, but knowledge transforming is a goal-directed, problem-solving process in which interaction between content problems and rhetorical problems leads writers to evaluate and revise their own understanding as well as their communication with others.

Galbraith and Torrance (2004) posited that revision processes would differ dramatically depending on the overall writing process adopted by writers. Some writers engage in relatively little advance planning, instead working out what they have to say in the course of multiple drafts. In this more interactive, free-writing approach, revision is a process of evaluation to identify valued ideas in the initial draft for exploration in further drafts. Galbraith (1996) has identified individual differences between writers who use a rhetorical planning approach and those who use a free-writing, interactive approach, but revision processes within the more interactive approach have not been well described yet.

The social context for writing and the nature of writing tasks are important factors in determining the amount and type of revision (Freedman, 1985; Nystrand, 1996). Because writing is a reciprocal process between writers and readers (Nystrand, 1986), revision is affected by anticipation of audience and actual responses from readers. Also, in nonschool contexts, much writing is done collaboratively with revision supported or required by others. In school contexts, most writing tasks lack an authentic audience and purpose; without a rhetorical or communicative purpose, students may have little motivation to revise their writing and little experience in adjusting their writing for varied audiences.

DEVELOPMENTAL AND INDIVIDUAL DIFFERENCES

Theoretical research on the cognitive and social processes involved in evaluation and revision are relevant to instructional design. In particular, explanations of developmental and individual differences may help teachers and researchers understand what students need to learn and how to teach it. This section outlines some key points that may be instructionally relevant.

First, writers differ in their goals for revising and their conceptions of what revising entails. Inexperienced writers may have a limited task schema (Hayes, 1996) for revision that focuses on correcting errors and surface features. Wallace and Hayes (1991) induced college freshmen to engage in more global revision simply by providing them

with an 8-minute demonstration of revision. More evidence for the importance of a global revision schema comes from a pair of further studies of the CDO procedure of Bereiter and Scardamalia (1987). Graham (1997) replicated the study with students with learning disabilities (LD) using similar sentence-level prompts to evaluate and revise; modest changes in numbers of revisions were found, but there was no effect on writing quality. De La Paz, Swanson, and Graham (1998) modified the CDO procedure to add procedural facilitation for global revision prior to sentence revision. When guided to consider global goals, middle school students with writing difficulties made more global revisions and improved the quality of their writing. Helping students to set appropriate goals for revising may affect their task schema and change their approach to revision.

Second, revision requires all the skills involved in critical reading. Revision processes parallel reading comprehension at all levels, including sentence comprehension, sensitivity to organization, content comprehension, connections to prior knowledge, and critical evaluation. Thus, to make global changes, writers must construct the gist of the text by attending to the main ideas and organization, which can be challenging for many students.

Third, effective evaluation and revision require audience awareness and the ability to take the perspective of the reader (Nystrand, 1986). Learning to take the perspective of others is a challenging task for children and adolescents that can affect writing (Clark & Delia, 1977). Thus, experiences as readers, either in peer review or special activities, may have an impact on ability to revise one's own writing.

Fourth, central to revision is the process of evaluation. Proficient writers have extensive knowledge about evaluation criteria for writing and about typical problems (Fitzgerald, 1987). Like newspaper editors, they know to look for an interesting lead, good paragraph structure, and vivid details. They may automatically detect some problems of grammar and clarity. They have knowledge about particular genres. In contrast, typical elementary school students, when asked why they like one paper more than another, cite length, spelling, topic, and general characteristics, such as "It's funny" (MacArthur, Graham, & Schwartz, 1991).

Finally, writing and revising are complex processes that require substantial metacognition and self-regulation (Bereiter & Scardamalia, 1987; Hayes & Flower, 1980; Zimmerman & Risemberg, 1997). Proficient writers need to switch flexibly from drafting to revising as they encounter problems or opportunities. When revising a draft, they need to keep goals and audience in mind while critically reading the text and considering alternatives. Less proficient writers may have considerable difficulty managing the complexity of writing processes.

In summary, research has supported a number of explanations for individual and developmental differences in revision. The task schema and goals for revision of novice writers may focus on minor issues. Critical reading skills may be limited. Younger writers may have difficulty taking on the perspective of a reader to see problems in their own text. Inexperienced writers may have limited knowledge of evaluation criteria for good writing. Evaluation and revision may overtax limited working memory and self-regulation. In addition, without an authentic context for writing, they may not be motivated to engage in the extra effort needed to revise an already completed paper. Research on instruction in revising has taken all of these factors into account.

METHOD

A systematic search of the literature was conducted to find studies that met the following criteria: (1) studied instruction in evaluation or revision of writing, including brief interventions as well as longer studies, (2) included a measure of a writing outcome, including revisions or quality, (3) published in a peer-reviewed journal or book in English, (4) included participants at elementary, secondary, or college levels, and (5) included first-language writing. Thus, studies were excluded that described revision processes separate from instruction or that described

instructional methods or types of feedback without measuring writing outcomes.

Several methods were used to search the literature. First, electronic searches were conducted using ERIC and PsycINFO with search terms that combined writing instruction (e.g., writing instruction, written composition) with revision (e.g., evaluation, feedback, revision, peer review) from 1980 to the present. Second, hand searches were conducted for the past 15 years in the following journals: *Written Communication*, *Research in the Teaching of English*, *Reading and Writing*, *Writing Assessment*, and *Journal of Writing Research*. Titles and abstracts were read to identify relevant articles. Third, references in selected articles were pursued. Finally, electronic searches for work by authors of selected articles were conducted.

Studies were categorized by instructional method: teacher feedback, peer review or feedback, computer feedback, instruction in evaluation criteria and goals, experience as readers or observing readers, and strategy instruction.

FINDINGS

Teacher Feedback

A common approach to teaching writing in elementary school, high school English classes, and college composition courses is to provide feedback to students and ask them to revise. A meta-analysis of research on writing instruction (Hillocks, 1986) concluded that teacher-written feedback was generally ineffective. Descriptive research indicates that much teacher feedback is too general and focused on surface features to help students revise effectively (Beach & Friedrich, 2006; Smith, 1997). Some research, most of it qualitative, has analyzed how the type and quality of teacher written and oral feedback affect students' writing. In a review, Beach and Friedrich (2006) drew a number of general conclusions: Effective feedback helps students to understand the rhetorical demands of writing tasks and helps them develop skill in self-evaluation. Students prefer feedback that explains problems and suggests specific improvements, and they are more successful in using such feedback in revising. However, it is also important that feedback be supportive and encouraging. Written feedback may not be as effective as conferences where ideas and language can be discussed.

Limited research has directly examined the effects of teacher feedback on student writing. Newell (1994) compared two types of written teacher feedback on high school students' understanding of literary stories. Teachers wrote either directive comments or dialogic questions and comments on students' interpretive essays, and students revised their papers. On a subsequent written assessment of story understanding, students in the dialogic condition scored higher. Analysis of composing-aloud protocols showed that the dialogic feedback enhanced students' own interpretations while the directive comments changed their initial interpretations.

Schunk and Swartz (1993) investigated teacher feedback in the context of strategy instruction. All students received instruction in a planning strategy, but were given different goals and teacher feedback as they wrote. One group received a goal to use the strategy and feedback on their strategy use as well as their written product, while another group received a goal to write a good product and feedback on the product, and a control group received general feedback. Students who received strategy goals and feedback wrote better papers and evidenced higher writing self-efficacy than students receiving the product goal and feedback, who in turn wrote better than students in the general feedback condition.

Several studies have compared feedback from teachers and peers. A broad review of peer assessment at the college level by Topping (1998) included four studies (all dissertations) that compared teacher evaluation and peer evaluation in college writing classes; two of the four found better writing outcomes with peer feedback, and the other two found no difference. Cho and MacArthur (2010) compared college students in psychology classes who

received feedback from a single expert, single peer, or multiple peers; feedback was provided anonymously through a computer-mediated peer review system. Students in the multiple-peer condition received more feedback and wrote higher-quality final drafts than students in the expert condition. The effects of peer review are addressed in the next section.

Peer Review and Feedback

One reason that typical teacher-written feedback is not effective may be that providing elaborated, individual feedback is a time-consuming task. Peers can provide feedback that is more frequent, extensive, and immediate than teachers. In addition, peer review is generally reciprocal, and students may benefit both from giving and receiving feedback. On the other hand, peer review presents potential difficulties as well. Students may not know how to help each other. They may also be reluctant to criticize each other or reluctant to accept feedback from their peers.

Effects of Peer Review

Research has generally reported positive effects of peer review on students' writing. Topping (1998), as noted earlier, concluded that peer evaluation was at least as effective as teacher feedback. A meta-analysis of writing instruction in grades 4 to 12 (Graham & Perin, 2007) found a large effect size (0.75) for seven studies of peer collaboration. However, although all seven studies included peer review for revision, several also included peer collaboration during planning and drafting.

Boscolo and Ascorti (2004) taught students in grades 4, 6, and 8 to work in pairs to evaluate each other's personal narratives, looking particularly for problems of clarity. Students who practiced peer review, compared to those who only received teacher feedback, wrote personal narratives with fewer information gaps and identified more problems of clarity in standard papers. Olson (1990) assigned sixth-grade students to receive brief direct instruction in revision, reciprocal peer review, both, or neither; students wrote and revised six papers. The classes that received instruction in revision made more revisions on a posttest paper, but only the class that received both instruction and peer review wrote papers with higher quality. The results should be taken cautiously since only a single class was assigned to each condition.

MacArthur and his colleagues (MacArthur, Schwartz, & Graham, 1991; Stoddard & MacArthur, 1993) investigated a reciprocal peer revision strategy that combined strategy instruction, peer interaction, instruction in specific evaluation criteria, and word processing. Students with learning disabilities (LD) in upper elementary grades worked in pairs with the strategy guiding their interaction. In preparation for the peer review, students received instruction in evaluation criteria, teacher think-aloud modeling of the process of evaluation and revision, and extensive guided practice. In both studies, students made more substantive revisions and improved the quality of their papers.

In two other studies, students worked collaboratively with peers throughout the writing process. Yarrow and Topping (2001) developed sets of prompts for planning, drafting, revising, and editing processes. Students ages 10–11 were randomly assigned to work collaboratively in pairs or alone on a set of five essay tasks; all students used the process prompts. In the collaborative condition, one student consistently served as Helper and the other as Writer; it was not reciprocal. Both helpers and writers in the collaborative condition wrote independent posttest essays of higher quality than controls. Rouiller (2004) assigned sixth-grade students to work in pairs or individually to plan and write a narrative based on a sequence of pictures. Students in pairs made more revisions when working together, but there were no effects on transfer to individual writing. Writing quality was not measured.

With the exception of the study by Rouiller (2004), all of these studies involved instruction in evaluation and revision. Instruction ranged from direct instruction in evaluation (Boscolo & Ascorti, 2004) or in revision processes (Olson, 1990), to procedural prompts (Yarrow & Topping, 2001), to strategy instruction with evaluation criteria and revising processes (MacArthur, Schwartz, & Graham, 1991). All of the studies with such instruction plus peer review resulted in improved writing quality. The Olson study (1990) suggested that peer review without instruction was less effective, but the study had a weak design. A study by McGroarty and Zhu (1997) investigated the effects of additional training in peer review in college composition classes. All students watched an instructional video on peer review and engaged in peer review groups during class. In addition, experimental students participated in small teacher-led conferences to learn strategies for peer response. Students who received training provided more total feedback as well as more suggestions that addressed global issues. However, no differences were found in writing quality. Overall, some instruction in revision seems to be critical to effective peer review.

Types of Feedback Comments

Several studies have investigated the types of peer feedback most likely to have an impact on actual revisions. Gielen and colleagues (Gielen, Peeters, Dochy, Onghena, & Struyven, 2010) analyzed the feedback comments of seventh-grade students. The only category of comment that predicted quality change was "justification," or explanation of the reasons for a suggestion; however, justification was rarely used, and the impact was limited to lower-achieving writers. Cho and MacArthur (2010), in a study of anonymous computer-supported peer review in college, categorized the feedback comments of reviewers and the revisions made by recipients. Nondirective comments (i.e., not specific to a particular action or location in the paper) positively predicted revision focused on content clarification and elaboration at the local and global levels. Contrasting results were found in a similar study (Nelson & Schunn, 2009) using the same computer-supported peer review system in a college history class. They found that comments that identified the location of the problem and suggested solutions were more likely to be implemented. This research group has conducted other analyses connecting reviewer comments to helpfulness ratings by recipients (e.g., Cho, Schunn, & Charney, 2006) but not directly analyzing the impact on revisions or writing quality.

Studies using computer-based peer review systems generally provide anonymous peer reviews. Lu and Bol (2007) used a computer review system and investigated both the types of comments and the anonymity of reviewers. College composition classes were assigned to face-to-face peer review for the semester or to anonymous online review. Students in the anonymous online condition provided more negative, critical comments; they also wrote higher quality essays on a posttest at the end of the semester.

Overall, no clear conclusions can be made about the types of feedback that are most helpful to authors in improving their writing. Studies used different categories to analyze reviewer comments, and few studies included writing outcome measures.

Effects of Giving Feedback

Research on the types of feedback that are most helpful presumes that peer review works because authors receive feedback. However, peer review is a reciprocal process in which students both give and receive feedback. The effects of giving feedback may be as powerful as the effects of receiving it. First, giving feedback requires students to take the perspective of readers, which may increase awareness of audience (Nystrand, 1986). Second, peer review engages students in reading critically, applying evaluation criteria, and recommending solutions (Bereiter &

Scardamalia, 1987; Hayes et al., 1987). Students can apply the same evaluation processes later to self-evaluation.

Crinon and his colleagues (Crinon, 2012; Crinon & Marin, 2010) conducted two studies that separated giving feedback from receiving feedback. Crinon and Marin (2010) studied French elementary students (grades 4–5) who wrote explanatory texts following science lessons four times during the school year. Two classes were assigned to give written feedback to three peers, and two classes were assigned to receive feedback from three peers, after which they all revised their papers. The teacher provided instruction and feedback only on the first paper. Over the year, the feedback givers made greater progress than feedback recipients in writing quality on both first and revised drafts. Crinon (2012) conducted a similar study but used narrative writing. Givers added more information and more relevant information during revision; they also wrote better quality first drafts on the final paper of the year. The authors interpret the findings to mean that givers learned evaluation criteria and the characteristics of the genre.

Lundstrom and Baker (2009) assigned college second-language writing classes to giving-feedback and receiving-feedback conditions. Both groups received the same instruction in features of good writing four times during the semester. Students in the giving-feedback condition wrote suggestions for revision on sample papers. Students in the receiving-feedback condition read the same papers with suggestions already in the margins and actually made revisions. At the high beginning level, students who gave feedback made greater gains in writing over the semester; no effect was found in intermediate classes. This study and those by Crinon (Crinon, 2012; Crinon & Marin, 2010) should be interpreted with caution as small quasi-experiments.

Cho and MacArthur (2011) randomly assigned undergraduate students in a physics class to reviewing, reading, or control conditions. All students received training in a rubric for evaluating writing and practice scoring two papers. Reviewers rated and commented on three papers of varying quality written by peers. Readers read the same papers without rating or commenting, and controls read unrelated material. All students then wrote a paper in the same genre (introduction to a physics lab) but on a different topic. Students in the reviewing condition significantly outperformed those in both other conditions on the quality of the report.

Philippakos and MacArthur (2014) conducted a study with a similar design with elementary school students (ages 10–11). Students wrote two persuasive essays and then received instruction on a genre-specific evaluation rubric. Subsequently, students were randomly assigned to three conditions: reviewers, readers, and control. The reviewers read two persuasive papers each day for 3 days, rated them using the rubric, and gave written suggestions. The readers read the same papers without evaluating them, and the control group read narrative texts. Students revised their pretest essays and wrote and revised an immediate transfer essay and a maintenance essay 2 weeks later. Compared to the other groups, reviewers wrote higher-quality essays on one posttest and on transfer and maintenance essays. Reviewers also produced better quality first drafts at transfer and included more elements of persuasion on the posttest.

Several studies have reported positive effects of giving feedback to peers, including two brief controlled experiments and three studies of classroom writing. All studies included some instruction in evaluation criteria and offered repeated practice in evaluating papers in a constant genre. Presumably, the instruction and practice worked to develop students' understanding of criteria and ability to self-evaluate. The research has clear instructional implications. Practice reviewing papers by unknown peers offers a possible way to train students for peer review.

Computer Feedback

Automated essay scoring (AES) systems are used to rate quality in some large-scale writing assessments, and a growing body of research supports their reliability and validity for this purpose (Shermis & Burstein, 2013). In addition to summative assessment, AES may be able to provide instructional feedback, or formative assessment, to

students as part of classroom instruction. Several systems have been developed and commercially marketed for classroom instruction. However, only a few studies have investigated the effects on student writing.

Two studies examined the effects of Summary Street, a program designed to help students write summaries by giving them feedback on content coverage and length (Franzke, Kintsch, Caccamise, Johnson, & Dooley, 2005; Wade-Stein & Kintsch, 2004). Students (grade 8) who received the feedback spent longer revising their work and received higher content and quality scores than students who worked without feedback. Kellogg, Whiteford, and Quinlan (2010) investigated the use in college composition classes of an AES system that provided feedback on development, organization, style, grammar, usage, and mechanics as well as an overall quality score. Students wrote and revised three papers with AES feedback on none, one, or all three. No group differences in length or quality were found on these three papers or on a transfer paper written without support; however, students using AES the most made fewer errors in mechanics, usage, and grammar. Another study (Wilson, Olinghouse, & Andrada, 2014) examined the revisions made by a large sample of students (grades 4–8) who made repeated revisions of papers with AES feedback. Writing quality did improve across multiple revisions of the same paper, but no transfer effects to the first draft of a new essay topic were found.

AES has promise as a way to provide formative feedback to students; such systems can provide immediate feedback with far greater frequency than teachers. However, much work remains to be done to design effective instruction and demonstrate its effects on writing.

Teaching Goals and Evaluation Criteria

One direct approach to improving revision skills is to teach students to evaluate their writing using specific goals and evaluation criteria and then to revise their papers. This approach draws directly on cognitive models that explain revision as a goal-directed process of evaluation and generation of alternatives (Bereiter & Scardamalia, 1987; Hayes, 1996).

Four theoretically motivated studies involving goals and evaluation criteria have been mentioned above. The CDO procedure (Bereiter & Scardamalia, 1987; Graham, 1997) included sentence-level evaluation criteria in the Diagnose step, and students made more local revisions but quality was not affected. In an extension of this study (De La Paz et al., 1998), students were given additional goals and criteria focused on global changes, which enabled them to make global revisions and improve the quality of their writing. Wallace and Hayes (1991) found that brief instruction in a revision task schema with global goals and criteria led to global revision and quality improvement.

Two other studies have provided goals and evaluation criteria in brief studies. Graham, MacArthur, and Schwartz (1995) gave students with LD (grades 5–6) enhanced goals for revision that asked them to add details to make their personal narratives more interesting and to fix anything that might not be clear. Compared to a group that received a general goal to improve their paper, these students made more substantive revisions and produced better final drafts. Midgette, Haria, and MacArthur (2008) gave middle school students either content goals or audience-awareness goals for revising persuasive essays. Students given the content or audience goals, in contrast to students given a general goal, made more substantive revisions and improved the quality of their papers. Further, those in the audience goal condition revised their papers to address potential opposing arguments.

A common feature across the goal-setting, task schema, and CDO studies is the provision of evaluation criteria. The prompting cards in the CDO studies were primarily evaluation criteria (e.g., from De La Paz et al., 1998: “Ignores obvious point against my idea.” “Part of the essay doesn’t belong with the rest.”). The goals in the goal-setting studies can be interpreted as evaluation criteria (e.g., from Midgette et al., 2008: “Use evidence and examples to support your reasons.” “Think about opposing reasons and show why they are wrong.”). These studies all

involved very brief experimental interventions, but they have implications about the importance of instruction in evaluation criteria.

The meta-analysis of writing instruction by Hillocks (1986) found moderate effects on revision and writing quality in six studies in which students learned evaluation criteria and practiced applying the criteria to make revisions. A more recent meta-analysis of formative assessment for writing (Graham, Harris, & Hebert, 2011) found moderate effects in seven studies that involved teaching evaluation criteria. Five of the studies discussed above under peer review included instruction in evaluation criteria. In one peer review study (Boscolo & Ascorti, 2004), students were taught to look for problems of clarity in peers' personal narratives. Two studies of peer revision strategies (MacArthur, Schwartz, & Graham, 1991; Stoddard & MacArthur, 1993) included instruction and practice in applying evaluation criteria. A study of giving peer feedback with college students (Cho & MacArthur, 2011) included brief instruction in applying a holistic rubric. A study of giving peer feedback with elementary students (Philippakos & MacArthur, 2014) included instruction in applying a rubric with genre-specific criteria.

A few studies have investigated the effects of instruction using general analytic rubrics for writing. Andrade and Boulay (2003) provided two sessions of instruction in an analytic rubric to middle school students but found no effects on writing quality. Andrade, Du, and Wang (2008) provided similar instruction to younger students (grades 3–4) and found variable effects on writing quality. Unfortunately, the study design confounded genre with condition; for the classes that wrote the same genre, no treatment effects were found. These two studies did not include actual practice in applying the criteria in revising papers. Fourth-grade students in a study by Guastello (2001) did receive practice in applying an analytic scale to revise narratives, and improvements in quality were found. In another study (Ross, Rolheiser, & Hogaboam-Gray, 1999), students (grades 4–6) developed evaluation criteria with their teachers and applied them to revise their writing over 8 weeks; a small positive effect on writing quality was found.

Other studies have focused on teaching more specific evaluation criteria. Beal, Garrod, and Bonitatibus (1990) taught a process of reading comprehension focused specifically on looking for problems caused by missing information in manipulated texts and then found transfer to improved revision of texts with similar information problems. Butler and Britt (2011), noting the difficulty that college students have writing arguments, developed two brief written tutorials: one on a global revision schema and one on an argument schema. Students wrote argumentative essays and then read neither, one, or both of the tutorials before revising their essays. Compared to the control group, both tutorials led to more global changes and more changes rated high quality. However, only the argument tutorial led to changes in argument content.

Song and Ferretti (2013) took a further step in teaching evaluation criteria for argumentative writing. They taught college students a revision strategy based on "critical questions" about particular argumentation schemes, namely, arguments from consequence and arguments from example. They compared strategy instruction in critical questions with strategy instruction in general argument structure and a control group. Compared to the other conditions, students who were taught the critical questions wrote essays that were of higher quality and included more counterarguments, alternative standpoints, and rebuttals.

Substantial research supports the value of teaching evaluation criteria and providing opportunities for students to practice applying them to revising papers. One question for future research is whether genre-specific criteria are more effective than more general writing criteria. Philippakos and MacArthur (2014) used genre-specific criteria for arguments with elementary students, and Song and Ferretti (2013) found that highly specific criteria were more effective than general argumentative criteria with college students. Yet other studies have found positive effects on quality with general criteria (e.g., Boscolo & Ascorti, 2004; Cho & MacArthur, 2011).

Experience as Readers and Observation of Readers

Cognitive and social research on writing both suggest that audience awareness is critical to effective revision (Hayes et al., 1987; Nystrand, 1986). Inexperienced writers often proceed with minimal attention to the needs of their readers, and they may not see problems with their text because they have difficulty taking the perspective of their readers. As noted earlier, giving students audience-awareness goals or questions for revising (Midgette et al., 2008; Roen & Willey, 1988) had positive effects on writing quality. A number of studies have gone beyond simply prompting audience awareness to study instructional activities that provide writers with experience as readers themselves, with feedback from readers, or with the opportunity to observe readers trying to understand their writing.

Traxler and Gernsbacher (1993) examined the effects of experience as a reader using a highly concrete writing task—descriptions of tangrams (abstract geometric figures). College students assigned to a reader group read others' descriptions and matched them to tangrams, whereas students in a control group read and evaluated descriptions but without attempting to match them to tangrams. The readers received higher-quality ratings on their revised descriptions. Holliway and McCutchen (2004) used the same tangram task and a similar design with fifth-grade students. Readers scored higher than controls on their revised descriptions and on transfer to a new set of tangram descriptions. Sato and Matsushima (2006) used a similar writing task to study the effects of receiving detailed feedback from readers. Students wrote descriptions of geometric figures, and other students read them and tried to draw the figures and wrote feedback. Writers who received this feedback that graphically showed comprehension failures did better revising their descriptions and writing new descriptions than controls.

Several studies have investigated the effects of observing readers as they tried to comprehend a text. Lumbelli, Paoletti, and Frausin (1999) provided students (grade 6) with instruction that involved reading directions to play a game written by other students, listening to a carefully planned think aloud of a reader analyzing problems in comprehension of the directions, and then generating a list of ways to fix it. Note that the sample texts were not written by the participants in the study. After three such sessions, students in the treatment group did better at identifying problems in a new text and writing directions for another game.

Rijlaarsdam and his colleagues (for a review see Rijlaarsdam et al., 2008) have conducted a number of studies focused on the effects of learning from observation of writers and readers, including several studies on revision. One study investigated both the effects of experience as a reader and observation of readers (Rijlaarsdam, Couzijn, Janssen, Braaksma, & Kieft, 2006); high school students were asked to write directions for a simple science experiment under several conditions. In the control condition, a research assistant explained the experiment, and students performed it and then wrote directions for another student. In three observing readers conditions, students wrote directions in this way and later observed video of other students reading and thinking aloud as they attempted to follow their directions and do the experiment; they then revised their directions. In two reader conditions, students read descriptions written by the other students and thought aloud as they attempted to follow the directions precisely; they then wrote their own directions. With quality of the revised directions as the outcome, students in the observation groups performed better than those in the reader groups who did better than controls.

The studies reviewed so far in this section involved writing tasks with concrete and observable comprehension goals. Couzijn (1999) investigated the effects of observation on the more common task of argumentative writing. His experiment contrasted practice writing with various modes of learning by observation, including observing a writer plan, observing a writer plan and get feedback from a reader, and writing a paper and observing a reader read it and give feedback. All three observation conditions resulted in higher-quality writing than writing practice.

Two other studies compared experience being readers with experience observing readers using argumentative

writing. Rijlaarsdam and colleagues (2008) asked students (grades 7–8) to write persuasive letters to a business. A group of students simulating a review board (readers) at the business read several letters and discussed which one was the most persuasive. Another group simulating researchers (observers) watched the readers, analyzed the evaluation criteria they used, and presented their findings to the class. Then all students revised their own letters. Both groups improved the quality of their letters, but the observers improved more. In a related study (Moore & MacArthur, 2012), students (grade 5) wrote persuasive letters to their principals. Small groups of readers discussed three letters of varying quality and evaluated their persuasiveness. Small groups of observers took notes and had a discussion to generate a list of the criteria used by the readers. The readers produced revised drafts that were of better quality and contained more evidence of audience awareness than a control group that practiced writing. The observer group did not differ from either group. The readers also made significantly more revisions that addressed opposing positions than control students. Analysis of think-aloud protocols showed greater audience awareness by the readers. The difference in effects on observers in the two studies may be due to the fact that observers in the Rijlaarsdam et al. (2008) study were asked to organize and present their findings to the class. The results for both readers and observers seem to depend on the quality of the group discussion of evaluation criteria.

Experiences reading texts or observing readers presumably give writers a deeper understanding of what makes a particular type of text effective. On concrete tasks, like identifying a tangram or conducting an experiment, the effects of clear writing are observable. For less concrete tasks, like persuasive writing, observing readers discuss whether texts are effective can provide similar information about effective writing.

Strategy Instruction

Recent meta-analytic reviews have found large effect sizes for strategy instruction in writing in general (Graham, 2006; Graham, Harris, & McKeown, 2013). Both reviews included both group and single-subject design studies; together the two reviews included four studies that taught revision strategies and another ten that taught revision together with planning. The reviews found large effects of strategy instruction on the amount of revision and writing quality.

Strategy instruction in revision includes many of the instructional components already discussed. Most studies include instruction in evaluation criteria together with processes for applying those criteria in making revisions. A key component of strategy instruction is observation of teachers as they think aloud while using the strategy. Teacher feedback on strategy use and performance is provided, and sometimes peer feedback is included.

In a single-subject design study (Graham & MacArthur, 1988), upper elementary students with LD learned criteria specific to evaluating persuasive essays and strategies for applying those criteria; all students made more substantive revisions and improved their essay quality. Fitzgerald and Markham (1987) taught general revision strategies without specific evaluation criteria over 12 sessions of teacher modeling; students (grade 6) in the treatment group made more substantive revisions, but differences in quality were not significant. Two studies of a reciprocal peer revision strategy (MacArthur, Schwartz, & Graham, 1991; Stoddard & MacArthur, 1993), reviewed in the peer review section, found significant effects on revision and writing quality.

One more recent study (De La Paz & Sherman, 2013) used a multiple-baseline across classrooms design focused on revising argumentative essays in inclusive classrooms with typical students, English learners, and students with LD. Evaluation criteria were based on the genre elements of an argumentative essay; processes for applying the criteria and making revisions were modeled and practiced. All types of students made gains in substantive revisions and overall writing quality.

Several studies have taught combined strategies for planning and revising. One of the earliest studies of writing

strategy instruction (Englert, Raphael, Anderson, Anthony, & Stevens, 1991) included instruction in planning and revising strategies based on expository text structures (e.g., comparison, persuasion) in upper elementary grades. Graphic organizers based on text structure elements were used in planning, and evaluation questions specific to the type of writing were taught for revising. High- and low-achieving students and students with LD made gains over the course of a year in the quality of their writing in two genres: comparison and explanation. Saddler and Asaro (2007) taught strategies for planning and revising stories to second-grade students in a single-subject study; posttest stories had more story elements and were higher in quality. Neither of these studies reported separate results for revision.

Combined instruction in planning and revising strategies based on text structure has also been shown to be successful with adult struggling writers (MacArthur & Lembo, 2009; MacArthur, Philippakos, & Ianetta, 2014). In a single-subject design (MacArthur & Lembo, 2009), adult education learners working toward their GED (age 40+) learned a strategy for planning argumentative essays based on genre elements; revision criteria focused on the same elements. All students made gains in inclusion of elements and overall quality. MacArthur and colleagues (MacArthur et al., 2014) developed and evaluated a curriculum for college basic writing courses that included planning and revising strategies based on genre elements. Instruction on evaluation criteria began with analysis of model essays and continued through peer review. The quasi-experimental study found large positive effects on overall writing quality.

The studies of combined planning and revising strategies cannot isolate the effects of the revising strategies, much less the effects of specific evaluation criteria, observation, and peer review. However, these studies do bring together instructional components shown to be effective on their own and combine them into feasible and effective long-term instructional programs.

DISCUSSION

This chapter has reviewed research on instruction in evaluation and revision in several categories: teacher feedback, peer review, automated feedback, instruction in goals and evaluation criteria, experience as readers and observation of readers, and strategy instruction. With the possible exception of automated feedback where research is just beginning, all approaches have been found to have positive effects on revision and writing quality. Two important components cut across these categories: feedback and response from others and learning to apply evaluation criteria.

Feedback from others ranges on a continuum from authentic responses from readers to more conscious evaluative feedback. Response from readers without explicit evaluation is possible with writing tasks that have concrete goals, such as selecting the correct tangram (Holliway & McCutchen, 2004) or conducting a science experiment (Rijlaarsdam et al., 2006). In such cases, writers can learn from observing readers' attempts to carry out a task or from attempting to read and understand problematic texts.

On less concrete writing tasks, readers can respond authentically by asking questions about things that are confusing, expressing emotional reactions, or discussing the content. Process approaches to writing value such authentic responses (Freedman, 1985). However, typically when teachers and peers comment on writing, they evaluate that writing more or less explicitly, identifying problems and offering suggestions for improvement. When peers are asked to provide such evaluative feedback, training in evaluation is important. All the studies reviewed in the section on peer review included instruction and practice in applying evaluation criteria.

Instruction in evaluation criteria was common across all approaches to revision. Two meta-analyses 25 years apart (Graham et al., 2011; Hillocks, 1986) support a conclusion that instruction in evaluation criteria with practice

making revisions has a positive impact on writing quality. Brief experimental studies on goal setting (Graham et al., 1995; Midgette et al., 2008), revision task schema (Wallace & Hayes, 1991), and the CDO model of revision (Bereiter & Scardamalia, 1987; De La Paz et al., 1998; Graham, 1997) all prompted students to apply evaluation criteria to make revisions. Studies of peer review have also included instruction in evaluation criteria (Boscolo & Ascorti, 2004; Cho & MacArthur, 2011; Philippakos & MacArthur, 2014). Two studies found that peer review was more effective when combined with instruction in evaluation criteria (McGroarty & Zhu, 1997; Olson, 1990). Instruction in specific evaluation criteria is also a component of strategy instruction (Englert et al., 1991; Graham & MacArthur, 1988; MacArthur, Schwartz, & Graham, 1991; Stoddard & MacArthur, 1993). Two studies that compared experience as readers and observing readers (Rijlaarsdam et al., 2008; Moore & MacArthur, 2012) engaged readers and observers in generating evaluation criteria for persuasive letters. Given the prominence of evaluation in cognitive models of revision (Bereiter & Scardamalia, 1987; Hayes, 1996), it is not surprising that instruction in evaluation criteria is important to learning to revise effectively.

This review raises many questions for future research on instruction in revision. Although it seems fairly clear that instruction in evaluation criteria is an effective practice, many issues have not been investigated systematically. How specific should evaluation criteria be? That is, is it more effective to teach genre-specific criteria, as in current practice in strategy instruction, or to teach more general analytic evaluation criteria with wider application to multiple forms? For example, several studies used genre-specific criteria for arguments (Butler & Britt, 2011; Philippakos & MacArthur, 2014; Song & Ferretti, 2013). On the other hand, several studies (Boscolo & Ascorti, 2004; Cho & MacArthur, 2011) found positive effects with general analytic criteria. Perhaps the type of criteria should vary depending on the developmental level of the students?

The research on peer review and observation of readers also raises questions about instruction in evaluation and revision. It is often assumed that peer review works much like teacher feedback, with students benefiting from receiving feedback. However, the research on giving feedback (Cho & MacArthur, 2011; Crinon, 2012; Crinon & Marin, 2010; Lundstrom & Baker, 2010; Philippakos & MacArthur, 2014) indicates that students can learn by reviewing the work of others. Research on the effects of reading and observing readers (Rijlaarsdam et al., 2006; Moore & MacArthur, 2012; Rijlaarsdam et al., 2008) found that students can learn to improve their own writing by reading problematic texts or observing readers evaluating texts. In the peer revision strategy studies by MacArthur and colleagues (MacArthur, Schwartz, & Graham, 1991; Stoddard & MacArthur, 1993), students received extensive practice in applying evaluation criteria to improve papers written by unknown peers before engaging in peer review. As a practical matter, learning about evaluation and revision by practicing with papers written by unknown peers has several advantages over focusing on revising one's own papers or normal peer review. Students can quickly receive practice with multiple papers; the teacher can scaffold the evaluation and revision process with a group; and papers can be selected by the teacher to illustrate common problems and opportunities.

The theoretical literature on revision suggests a few other directions for instructional research. For example, Galbraith (1996) has argued that writing involves dual processes for content generation: a rhetorical planning process and an implicit text-production process. Individuals vary in their disposition to engage in advance planning versus discovery of ideas through drafting. Galbraith and Torrance (2004) have explored the implications for revision processes, but these ideas have not been pursued as instructional research. The cognitive models of Hayes (1996, 2004) describe two types of revision processes: more or less automatic detection of problems followed by revision and an intentional reflective activity involving systematic evaluation of the text. Instructional research has primarily targeted the intentional reflective process. However, many writers, especially struggling writers, need to learn how to detect and revise local problems of language and mechanics. Instructional research could investigate how to help students develop such editing skills.

Revision is commonly required in writing classrooms. However, too often that revision is supported only by peer review with minimal training and written teacher feedback. Research has identified practices for teaching evaluation and revision that have positive effects on the quality of students' writing, including transfer to new papers. Although further research is needed, many of these practices are ready for implementation and could improve student achievement.

REFERENCES

Andrade, H. G., & Boulay, B. A. (2003). Role of rubric-referenced self-assessment in learning to write. *Journal of Educational Research, 97*, 21–34.

Andrade, H. L., Du, Y., & Wang, X. (2008). Putting rubrics to the test: The effect of a model, criteria generation, and rubric-referenced self-assessment on elementary school students' writing. *Educational Measurement: Issues and Practice, 27*, 3–13.

Beach, R., & Friedrich, T. (2006). Response to writing. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 222–234). New York: Guilford Press.

Beal, C. R., Garrod, A. C., & Bonitatibus, G. J. (1990). Fostering children's revision skills through training in comprehension monitoring. *Journal of Educational Psychology, 82*, 275–280.

Bereiter, C., & Scardamalia, M. (1987). *The psychology of written composition*. Hillsdale, NJ: Erlbaum.

Boscolo, P., & Ascorti, K. (2004). Effects of collaborative revision on children's ability to write understandable narrative texts. In L. Allal, L. Chanquoy, & P. Largy (Eds.), *Revision: Cognitive and instructional processes* (Vol. 13, pp. 157–170). Boston: Kluwer.

Butler, J. A., & Britt, M. A. (2011). Investigating instruction for improving revision of argumentative essays. *Written Communication, 28*(1), 70–96.

Cho, K., & MacArthur, C. A. (2010). Student revision with peer and expert reviewing. *Learning and Instruction, 20*, 328–338.

Cho, K., & MacArthur, C. (2011). Learning by reviewing. *Journal of Educational Psychology, 103*, 73–84.

Cho, K., Schunn, C. D., & Charney, D. (2006). Commenting on writing: Typology and perceived helpfulness of comments from novice peer reviewers and subject matter experts. *Written Communication, 23*, 260–294.

Clark, R. A., & Delia, J. G. (1977). Cognitive complexity, social perspective-taking and functional persuasive skills in second- to ninth-grade children. *Human Communication Research, 3*, 128–134.

Couzijn, M. (1999). Learning to write by observation of writing and reading processes: Effects on learning and transfer. *Learning and Instruction, 9*, 109–142.

Crinon, J. (2012). The dynamics of writing and peer review at primary school. *Journal of Writing Research, 4*, 121–154.

Crinon, J., & Marin, B. (2010). The role of peer-feedback in learning to write explanatory texts: Why the tutors learn the most. *Language Awareness, 19*, 111–128.

De La Paz, S., & Sherman, C. K. (2013). Revising strategy instruction in inclusive settings: Effects for English learners and novice writers. *Learning Disabilities Research and Practice, 28*, 129–141.

De La Paz, S., Swanson, H. L., & Graham, S. (1998). The contribution of executive control to the revising by students with writing and learning difficulties. *Journal of Educational Psychology, 90*, 448–460.

Englert, C. S., Raphael, T. E., Anderson, L. M., Anthony, H. M., & Stevens, D. D. (1991). Making writing strategies and self-talk visible: Cognitive strategy instruction in writing in regular and special education classrooms. *American Educational Research Journal, 28*, 337–372.

Fitzgerald, J. (1987). Research on revision in writing. *Review of Educational Research, 57*, 481–506.

Fitzgerald, J., & Markham, L. R. (1987). Teaching children about revision in writing. *Cognition and Instruction, 4*, 3–24.

Franzke, M., Kintsch, E., Caccamise, D., Johnson, M., & Dooley, S. (2005). Summary Street: Computer support for comprehension and writing. *Journal of Educational Computing Research, 33*, 53–80.

Freedman, S. W. (Ed.). (1985). *The acquisition of written language: Response and revision*. Norwood, NJ: Ablex.

Galbraith, D. (1996). Self-monitoring, discovery through writing and individual differences in drafting strategy. In G. Rijlaarsdam, H. van den Bergh, & M. Couzijn (Eds.), *Studies in writing: Vol. 1, Theories, models and methodology in writing research* (pp. 121–144). Amsterdam: Amsterdam University Press.

Galbraith, D., & Torrance, M. (2004). Revision in the context of different drafting strategies. In L. Allal, L. Chanqouy, & P. Largy (Eds.), *Revision: Cognitive and instructional processes* (Vol. 13, pp. 63–85). Boston: Kluwer.

Gielen, S., Peeters, E., Dochy, F., Onghena, P., & Struyven, K. (2010). Improving the effectiveness of peer feedback for learning. *Learning and Instruction, 20*, 304–315.

Graham, S. (2006). Strategy instruction and the teaching of writing: A meta-analysis. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 187–207). New York: Guilford Press.

Graham, S. (1997). Executive control in the revising of students with learning and writing difficulties. *Journal of Educational Psychology, 89*, 223–234.

Graham, S., Harris, K. R., & Hebert, M. (2011). *Informing writing: The benefits of formative assessment.* Washington, DC: Alliance for Excellent Education.

Graham, S., Harris, K. R., & McKeown, D. (2013). The writing of students with learning disabilities: Meta-analysis of self-regulated strategy development writing intervention studies and future directions: Redux. In H. L. Swanson, K. Harris, & S. Graham (Eds.), *Handbook of learning disabilities* (2nd ed., pp. 565–590). New York: Guilford Press.

Graham, S., & MacArthur, C. (1988). Improving learning disabled students' skills at revising essays produced on a word processor: Self-instructional strategy training. *Journal of Special Education, 22*, 133–152.

Graham, S., MacArthur, C. A., & Schwartz, S. S. (1995). The effects of goal setting and procedural facilitation on the revising behavior and writing performance of students with writing and learning problems. *Journal of Educational Psychology, 87*, 230–240.

Graham, S., & Perin, D. (2007). A meta-analysis of writing instruction for adolescent students. *Journal of Educational Psychology, 99*, 445–476.

Guastello, E. F. (2001). Parents as partners: Improving children's writing. In W. M. Linek, E. G. Sturtevant, J. A. R. Dugan, & P. E. Linder (Eds.), *Celebrating the voices of literacy: Yearbook of the College Reading Association* (pp. 279–295). Readyville, TN: College Reading Association.

Hayes, J. R. (1996). A new framework for understanding cognition and affect in writing. In C. M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences, and applications* (pp. 1–27). Mahwah, NJ: Erlbaum.

Hayes, J. R. (2004). What triggers revision? In L. Allal, L. Chanqouy, & P. Largy (Eds.), *Revision: Cognitive and instructional processes* (pp. 9–20). Boston: Kluwer.

Hayes, J. R., & Flower, L. (1980). Identifying the organization of writing processes. In L. W. Gregg & E. R. Steinberg (Eds.), *Cognitive processes in writing: An interdisciplinary approach* (pp. 3–30). Hillsdale, NJ: Erlbaum.

Hayes, J. R., Flower, L., Schriver, K. A., Stratman, J. F., & Carey, L. (1987). Cognitive processes in revision. In S.

Rosenberg (Ed.), *Advances in applied psycholinguistics: Vol. II. Reading, writing, and language learning* (pp. 176–240). New York: Cambridge University Press.

Hillocks, G. (1986). *Research on written composition: New directions for teaching*. Urbana, IL: ERIC Clearinghouse on Reading and Communication Skills.

Holliway, D. R., & McCutchen, D. (2004). Audience perspective in young writers' composing and revising. In L. Allal, L. Chanqouy, & P. Largy (Eds.), *Revision: Cognitive and instructional processes* (Vol. 13, pp. 87–101). Boston: Kluwer.

Kellogg, R. T., Whiteford, A. P., & Quinlan, T. (2010). Does automated feedback help students learn to write? *Journal of Educational Computing Research, 42*(2), 173–196.

Lu, R., & Bol, L. (2007). A comparison of anonymous versus identifiable e-peer review on college student writing performance and the extent of critical feedback. *Journal of Interactive Online Learning, 8*, 100–115.

Lumbelli, L., Paoletti, G., & Frausin, T. (1999). Improving the ability to detect comprehension problems: from revising to writing. *Learning and Instruction, 9*, 143–166.

Lundstrom, K., & Baker, W. (2009). To give is better than to receive: The benefits of peer review to the reviewer's own writing. *Journal of Second Language Writing*, *18*, 30–43.

MacArthur, C. A. (2012). Evaluation and revision processes in writing. In V. W. Berninger (Ed.), *Past, present, and future contributions of cognitive writing research to cognitive psychology* (pp. 461–483). New York: Psychology Press.

MacArthur, C. A., Graham, S., & Schwartz, S. (1991). Knowledge of revision and revising behavior among learning disabled students. *Learning Disability Quarterly, 14*, 61–73.

MacArthur, C. A., & Lembo, L. (2009). Strategy instruction in writing for adult literacy learners. *Reading and Writing, 22*, 1021–1032.

MacArthur, C. A., Philippakos, Z. A., & Ianetta, M. (2014). Self-regulated strategy instruction in college developmental writing. *Journal of Educational Psychology*. Available at *http://dx.doi.org/10.1037/edu0000011*.

MacArthur, C. A., Schwartz, S. S., & Graham, S. (1991). Effects of a reciprocal peer revision strategy in special education classrooms. *Learning Disabilities Research and Practice, 6*, 201–210.

McGroarty, M. E., & Zhu, W. (1997). Triangulation in classroom research: A study of peer revision. *Language Learning, 47*, 1–43.

Midgette, E., Haria, P., & MacArthur, C. A. (2008). The effects of content and audience awareness goals for revision on the persuasive essays of fifth- and eighth-grade students. *Reading and Writing, 21*, 131–151.

Moore, N. S., & MacArthur, C. A. (2012). The effects of being a reader and of observing readers on fifth grade students' argumentative writing and revising. *Reading and Writing, 25*, 1449–1478.

Nelson, M. M., & Schunn, C. D. (2009). The nature of feedback: How different types of peer feedback affect writing performance. *Instructional Science, 37*(4), 375–401.

Newell, G. E. (1994). The effects of written between-draft responses on students' writing and reasoning about literature. *Written Communication, 11*, 311–347.

Nystrand, M. (1986). *The structure of written communication: Studies in reciprocity between writers and readers.* New York: Academic Press.

Olson, V. B. (1990). The revising processes of sixth-grade writers with and without peer feedback. *Journal of Educational Research, 84*, 22–29.

Philippakos, Z. A., & MacArthur, C. A. (2014, Feb.). *The effects of giving feedback using genre-specific evaluation criteria on the quality of persuasive essays written by fourth and fifth-grade students.* Paper presented at Writing Research Across Borders, Paris, France.

Rijlaarsdam, G., Braaksma, M., Couzijn, M., Janssen, T., Raedts, M., Van Steendam, E., et al. (2008). Observation of peers in learning to write: Practice and research. *Journal of Writing Research, 1*, 53–83.

Rijlaarsdam, G., Couzijn, M., Janssen, T., Braaksma, M., & Kieft, M. (2006). Writing experiment manuals in science education: The impact of writing, genre, and audience. *International Journal of Science Education, 28*, 203–233.

Roen, D. H., & Willey, R. J. (1988). The effects of audience awareness on drafting and revising. *Research in the Teaching of English, 22*, 75–88.

Ross, J. A., Rolheiser, C., & Hogaboam-Gray, A. (1999). Effects of self-evaluation training on narrative writing. *Assessing Writing, 6*, 107–132.

Rouiller, Y. (2004). Collaborative revision and metacognitive reflection in a situation of narrative text production. In L. Allal, L. Chanquoy, & P. Largy (Eds.), *Revision: Cognitive and instructional processes* (pp. 171–187). New York: Kluwer.

Saddler, B., & Asaro, K. (2007). Increasing story quality through planning and revising: Effects on young writers with learning disabilities. *Learning Disability Quarterly, 30*, 223–234.

Sato, K., & Matsushima, K. (2006). Effects of audience awareness on procedural text writing. *Psychological Reports, 99*, 51–73.

Schunk, D. H., & Swartz, C. W. (1993). Goals and progress feedback: Effects on self-efficacy and writing achievement. *Contemporary Educational Psychology, 18*, 337–354.

Shermis, M. D., & Burstein, J. (Eds.). (2013). *Handbook of automated essay evaluation: Current applications and new directions.* New York: Routledge.

Smith, S. (1997). The genre of the end comment: Conventions in teacher responses to student writing. *College Composition and Communication, 33*, 148–156.

Song, Y., & Ferretti, R. P. (2013). Teaching critical questions about argumentation through the revising process: Effects of strategy instruction on college students' argumentative essays. *Reading & Writing, 26*(1), 67–90.

Stoddard, B., & MacArthur, C. A. (1993). A peer editor strategy: Guiding learning disabled students in response and revision. *Research in the Teaching of English, 27*, 76–103.

Topping, K. J. (1998). Peer assessment between students in colleges and universities. *Review of Educational Research, 68*, 249–276.

Traxler, M., & Gernsbacher, M. (1993). Improving written communication through perspective taking. *Language and Cognitive Process, 8*, 311–334.

Wade-Stein, D., & Kintsch, E. (2004). Summary Street: Interactive computer support for writing. *Cognition and Instruction, 22*, 333–362.

Wallace, D. L., & Hayes, J. R. (1991). Redefining revision for freshmen. *Research in the Teaching of English, 25*, 54–66.

Wilson, J., Olinghouse, N. G., & Andrada, G. N. (2014). Does automated feedback improve writing quality? *Learning Disabilities: A Contemporary Journal, 12*, 93–118.

Yarrow, F., & Topping, K. J. (2001). Collaborative writing: The effects of metacognitive prompting and structured peer interaction. *British Journal of Educational Psychology, 71*, 261–282.

Zimmerman, B., & Risemberg, R. (1997). Becoming a self-regulated writer: A social cognitive perspective. *Contemporary Educational Psychology, 22*, 73–101.

Grammar Instruction

Richard Hudson

A BRIEF HISTORY (AND GEOGRAPHY) OF GRAMMAR TEACHING

Grammar instruction is an extremely ancient art, and almost certainly one of the oldest branches of formal education in literate societies. The reason for this is its close relationship to the art of writing, which defines the notion of "literate." As early as the start of the second millennium B.C.E., Babylonian scribes were studying clay tablets showing lists of verb forms in two languages: a dead language (in this case, Sumerian) and their own language, Akkadian (Gragg, 1994; Huber, 2007). Four thousand years later, grammar is still a central pillar of education in many countries, and this chapter is evidence that it is still under consideration even where it was abandoned in the 20th century.

During the intervening centuries, the study and teaching of grammar tracked the development of literacy, as witness the term *grammar* itself, derived from the Greek *grammatiké*, as in *techné grammatiké*, "the art of writing" (which itself was built out of *gramma*, "letter." derived from *gráphein*, "to draw or write"). The Babylonian grammarians may have influenced Panini, the founder of the Indian grammatical tradition used in the teaching of Sanskrit—another dead language (Black, 1991; Shukla, 2006). Meanwhile, Alexander's empire and the Roman Empire disseminated the cultural legacy of classical Greece across Europe and Asia, with the result that grammar dominated the education of medieval Europe. As in Babylon and India, grammar was a tool in the teaching of a dead language (Latin), but as the vernaculars rose in status, it was applied to them as well. Thus, young Shakespeare learned to write (and speak) Latin by first learning how English grammar worked (Gwosdek, 2013), and schools established in England at that time were called "grammar schools."

Since the medieval period, grammar teaching spread throughout Europe, and in many European countries and former colonies, grammar still flourishes in the classroom. To mention one example, the Czech Republic takes the teaching of grammar so seriously that school children's analyses of sentences might be sufficiently accurate to use in projects such as machine translation (Hana & Hladka, 2012). Another European country, France, has returned from a temporary grammar-free period during the 1960s and 1970s to its more "normal" state, though with some changes to the approach (Bentolila, 2006; Fougerouse, 2001). And Spain not only continues to teach grammar, but has a lively research group exploring promising new ways to teach it (Ribas, Fontich, & Guasch, 2014). In short, most countries in Europe do see grammar instruction as an important part of their school curriculum; and the same is true of previous European colonies such as Brazil.

The big exception consists of all the major English-speaking countries, and in particular Britain, the United States, Canada, New Zealand, and Australia. In all these countries, systematic instruction in grammar went out of fashion during the 1960s and 1970s (Rothery, 1996; Kolln & Hancock, 2005; Carter, 1996; Locke, 2009). At least in Britain, this change started in the teaching of first-language English and then about a decade later extended to foreign-language teaching. In Britain, the outcome was a school system in which virtually no grammar at all was taught in any state schools, though it persisted in some fee-paying schools (Hudson & Walmsley, 2005). The United States presents a more complex picture (Cutler & Graham, 2008; Kiuhara, Graham, & Hawken, 2009; Gilbert & Graham, 2010; Applebee & Langer, 2011). On the one hand, we note "the anti-grammar policy that has dominated the

American English curriculum for forty years" (Kolln & Hancock, 2005, p. 16), and the compromise of "grammar in context," which advocates a very small minimum of grammar to be taught only when relevant to the individual pupil (Weaver, 1996). On the other hand, many schools also continue a long American tradition of "sentence diagramming" (Brinton & Brinton, 2010; Florey, 2006; Hefty, Ortiz, & Nelson, 2008), which has never had much impact on British education.

This brief review of the history and geography of grammar instruction has raised a number of general issues, which are reviewed in the next section. The rest of this chapter continues to focus on the teaching of writing, but it will also emphasize that writing is only one possible application of grammar.

ISSUES IN THE TEACHING OF GRAMMAR

The main issues fall into these five categories:

1. Why should grammar be taught?
2. When should grammar be taught?
3. How should grammar be taught?
4. What grammar should be taught?
5. Who should teach grammar?

In each case, the term *grammar* means explicit teaching about grammar, including technical terminology.

Why Should Grammar Be Taught?

Grammar clearly has a cost—the time and effort expended by both the teacher and the students—so it is important to be sure that it produces benefits that outweigh the cost. At least in principle grammar teaching could be helpful in a number of different ways:

- In the teaching of writing (the main focus of this chapter).
- In the teaching of reading, where it can be shown that complex syntax and vocabulary are easier to read after some explicit instruction (Chipere, 2003).
- In the teaching of foreign languages, where it is widely accepted that "focus on forms" (i.e., direct teaching about grammatical patterns) is helpful (Norris & Ortega, 2000; Ellis, 2008a; Scheffler & Cinciala, 2011).
- In the development of general cognitive abilities—an aim that has vanished from recent discussions of grammar teaching, but that was explicit in 19th-century school books in passages such as the following:

> Grammar is eminently a means of mental training; and while it will train the student in subtle and acute reasoning, it will at the same time, if rightly presented, lay the foundation of a keen observation and a correct literary taste. The continued contact with the highest thoughts of the best minds will create a thirst for the "well of English undefiled." (Baskervill & Sewell, 1895/2005, n.p.)

In short, it is not only writing that may benefit from a knowledge of grammar—a point missed in most of the research; and the study of grammar, like the study of, say, mathematics or literature, may be good for the mind.

When Should Grammar Be Taught?

The question of timing has two parts, relating to age and to time-tabling.

1. How old should pupils be before they can benefit from teaching about grammar? One belief is that grammar is too difficult for children in primary school (i.e., up to the age of 11); the contrasting view is that even primary-age children can benefit.
2. As far as timing is concerned, the choice is between systematic teaching, with planned instruction in grammar following a syllabus based on the internal logic of grammar itself; and the approach mentioned earlier called "grammar in context." in which grammar is taught only as and when it becomes relevant in the teaching of writing.

How Should Grammar Be Taught?

The "How?" question divides into three parts.

1. What should be the role of technical grammatical metalanguage? Three answers have been defended:
    - None at all: Grammar should be taught through activities such as "sentence combining" (Hillocks & Mavrognes, 1986; Hillocks, 2003) without using technical terms.
    - As target: The main purpose of teaching grammar is to teach terminology, with rote memorization of definitions, continuing a very long tradition of grammar teaching based on the catechism (Gwosdek, 2013).
    - As instrument: The main aim of teaching grammar is an understanding of how language works, so teachers need terminology to communicate with pupils.
2. Is language itself the best medium for showing how a sentence is structured, or would it be better to use some kind of diagrammatic notation?
3. Should the examples used in the teaching be made up, or should they be taken from published texts or other sources of actual usage?

These questions distinguish two very different kinds of grammar instruction:

1. The extraordinarily long tradition sketched above in which children memorized definitions that led to verbal descriptions of words in specially selected sentences.
2. Teaching aimed at a deep understanding of grammar, which can be demonstrated by drawing structure diagrams for almost any sentences.

What Grammar Should Be Taught?

This question breaks down into four parts.

1. What approach: prescriptive, aimed at the avoidance of error, and typically consisting of a long list of "common errors," or descriptive, aimed at understanding the pupil's existing grammatical resources and also growth through learning new resources.
2. How much grammar: very little (just the main word classes) or the entire contents of one of the recently published "blockbuster" grammars of English (e.g., Huddleston & Pullum, 2002)—or something in between?

And more precisely, how much grammar is needed by teachers as opposed to pupils?

3. What areas: syntax, morphology, lexical relations, meaning, or pronunciation? Each of these areas is relevant to some aspect of writing: syntax to sentence-level structure, morphology to spelling, lexical relations to vocabulary choice, and pronunciation to both spelling and punctuation; and all these aspects of writing are important because they affect the way subject matter is evaluated (Graham, Harris, & Hebert, 2011).
4. Which "school" of grammatical theory, if any? This gives a three-way choice:
    - school grammar, often called "traditional grammar" because it transmitted the tradition of grammar taught in school without any research input; this tradition can be found in any school-grammar textbook of the early 20th century (e.g., those in the UK authored by Ronald Ridout);
    - the research-based but "theory-neutral" grammatical analysis of the blockbuster grammars;
    - Systemic Functional Linguistics, which has a large and active constituency among teachers and teacher-trainers (e.g., Williams, 2004, Derewianka & Jones, 2010).

Who Should Teach Grammar?

If grammar is only relevant to writing, then it should be taught by the teacher of writing, whether a primary generalist or a secondary specialist. But if it is also relevant to reading and to foreign languages, and foreign languages are taught by a different teacher from writing and reading, these teachers should collaborate in one of two ways.

1. One way is minimal collaboration, with neither paying much attention to what the other teaches. However ridiculous this policy is, it is widespread in the United Kingdom.
2. In contrast, maximum collaboration brings together the teachers of first-language writing and reading and of foreign languages in the sharing of terminology, activities, insights, and plans. The foreign language teacher reinforces and deepens the ideas and content introduced by the first-language teacher, and both teachers and pupils benefit.

Another fundamental issue for teachers is how they should develop their own knowledge of grammar to the point where they feel confident presenting it to a class of (possibly) thoughtful pupils. In an ideal world, a new teacher would have a solid foundation in elementary grammar derived from primary and secondary school and refined during undergraduate study, and many countries do indeed provide this ideal world. For example, in the Netherlands, teachers have a solid training in grammar and reportedly enjoy teaching it (Gert Rijlaarsdam at *http://teach-grammar.com/geography#nl*). Unfortunately, the grammar-free decades in the United Kingdom and other anglophone countries have produced a serious problem: a generation of established teachers who learned very little grammar in school.

THEORETICAL MODELS OF GRAMMAR TEACHING FOR WRITING

Discussions of grammar teaching and writing tend to polarize around one of two views:

1. Grammar teaching does not improve writing.
2. Grammar teaching does improve writing.

These views are generally supported as much by political and educational ideology as by careful argument, so it is

hard to find anything that could reasonably be called a "theoretical model" of how grammar teaching might affect writing. The rest of this section is an attempt to fill this gap.

We start with an important distinction between two kinds of teaching about grammar, which we can call teaching grammar and applying grammar:

Teaching grammar introduces the ideas and terminology of grammar, and teaches them as a system. It includes terms such as *noun* and *noun phrase*, *relative clause*, *subject* and *modifier*, as well as the understanding and knowledge needed to recognize examples and to discuss the pros and cons of competing analyses. This knowledge is a major part of what in the United Kindgom is called "knowledge about language" (Carter, 1990), so we can call it "knowledge about grammar," a conscious awareness of grammatical patterning, in contrast with the unconscious "knowledge of grammar" that every speaker has.

Applying grammar uses knowledge about grammar to help in teaching other subjects, such as writing. For instance, the teacher could use terms such as *relative clause* and *modify* in discussing alternative ways of expressing the same idea. This is still a kind of "grammar teaching," and good teaching of grammar may often lead directly to applications of grammar, but conceptually it is as different from teaching grammar as physics and geography are from mathematics. This distinction will play a fundamental part in the following discussion.

One rather obvious model links teaching grammar, via knowledge about grammar and applying grammar, to improved writing—a three-step model:

1. Teaching grammar (TG) produces Knowledge about grammar (KaG).
2. KaG enables Applying grammar (AG).
3. AG improves writing.

This model is implicit in traditional prescriptive grammar teaching; for instance, it makes no sense to teach pupils to improve their writing by not splitting infinitives until their knowledge about grammar includes the term *infinitive*. Figure 19.1 shows the elements of this model and how they interact.

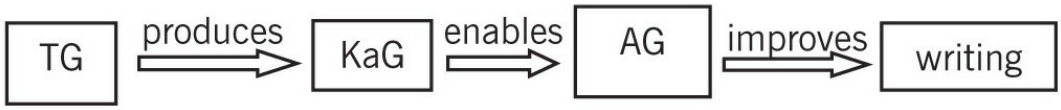


FIGURE 19.1. A three-step model of grammar for writing.

This model has two important characteristics that contrast with the assumptions implicit in almost all the research on the effectiveness of grammar teaching in the teaching of writing:

1. It does not assume a direct causal connection between teaching of grammar and writing skills. It predicts that it is only applying grammar that affects writing skills; teaching grammar on its own is not enough.
2. Nor does it assume that the teaching of writing is the only possible application of knowledge about grammar, so writing does not have to justify all the costs of TG.

In contrast, most of the research outlined above assumes that, if grammar teaching has any effect on writing, it must be a direct consequence of teaching grammar; and all the costs of this teaching must be justified by its positive effects on writing. These assumptions are incorporated in the one-step model of Figure 19.2. One of the curious characteristics of this model is that teaching grammar produces knowledge about grammar that has no direct connection to any improvements in writing.

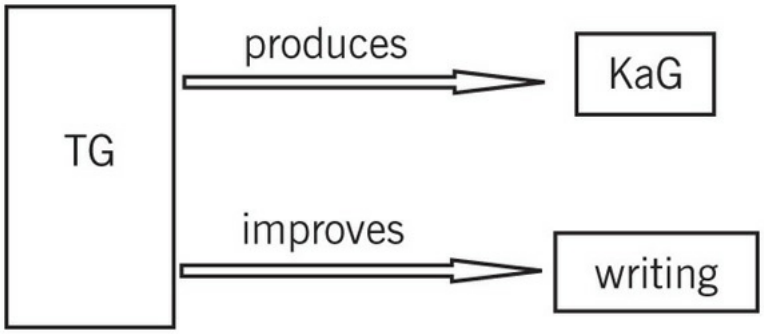


FIGURE 19.2. A one-step model of grammar for writing.

This model has been refuted by a mass of research since the mid-20th century, which has shown that teaching grammar, in itself, does not improve writing. However it does have the virtue of recognizing that teaching grammar does not just lead to knowledge about grammar. This idea can be developed in two directions.

First, teaching grammar can expand the student's knowledge **of** grammar (KoG); so they learn new patterns. It is commonly assumed, in government documents as well as in academic research, that children merely have to learn to use their existing KoG. For instance, the National Curriculum for England published in 2013 requires Year 2 pupils to "learn how to use . . . some features of written Standard English" (Anon, 2013), implying that the pupils must already know what these features are, so all they have to learn is how to use them. But maybe young children simply don't know all the elaborate grammar and vocabulary of academic English. Patterns such as *the book in which I saw it* are almost as foreign and unfamiliar to them as the French equivalent. Consequently, one reasonable goal for teaching grammar is to increase students' KoG.

Another goal is a more diffuse and general "awareness" of grammatical patterning, often described as language awareness (Carter, 1994; Denham & Lobeck, 2010; Hawkins, 1994). By studying grammatical structures, children learn to "notice" them in their reading, and therefore to learn from them in a way that they might not if their only concern was the meaning (Keith, 1999). A great deal of research in second-language acquisition has shown the benefit of this kind of noticing (Ellis, 2008a). Moreover, the same awareness of grammatical structure presumably also helps learners to write better by noticing patterns in their own writing and evaluating them against the alternatives—past or present tense, main or subordinate clause, clause or noun phrase, and so on.

Adding these two extra elements (increased KoG and awareness) to the earlier three-step model gives the model shown in Figure 19.3.

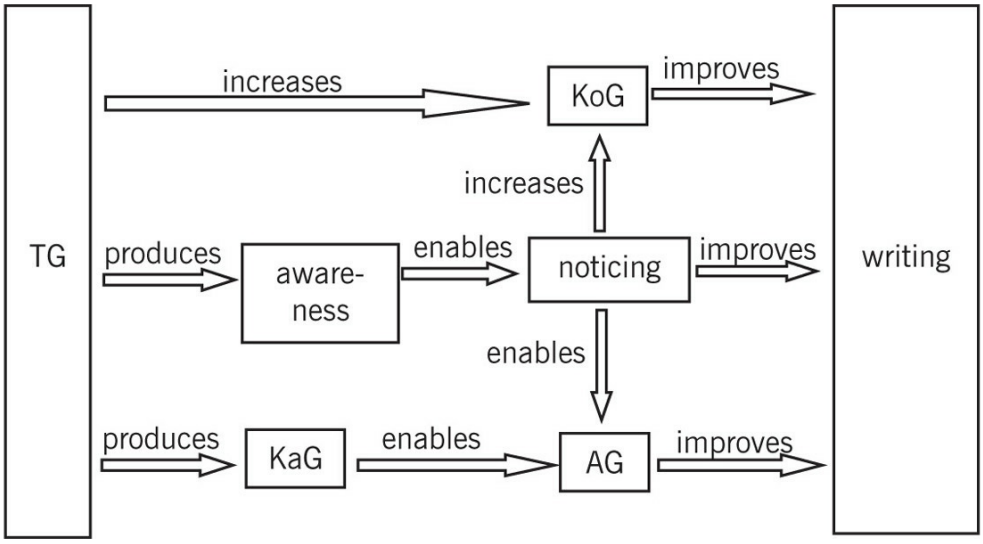


FIGURE 19.3. A complex three-step model of grammar for writing.

To make this model concrete, imagine a lesson about relative clauses. The lesson starts with examples from a passage of writing and explores the ways in which these examples work. Some are very elementary, such as (*the man*) *who came to the door*, but others are more challenging, such as (*his famous father*), *a picture of whom hung over the mantelpiece*. At first, this example is so unfamiliar that the students can only guess its meaning, but through a mixture of formal analysis and discussion, the teacher explains how the syntax works. During the discussion, the students learn a number of technical grammatical terms, including *relative clause* and *"pied-piped" relative clause* (a term used in modern grammatical discussions of this pattern and based on the mythological Pied Piper of Hamlyn who "pied-piped" rats and children into the river). The lesson ends with the class producing its own examples of pied-piped relative clauses in descriptions of objects in the classroom.

In terms of the model in Figure 19.3, teaching grammar is what the teacher says about relative clauses and their subtypes, such as pied-piped relative clauses. It introduces technical terminology, but more importantly it makes the students aware of a grammatical structure to which they had not previously paid attention. (Incidentally, the previous sentence contained an example of a pied-piped relative clause.)

The effect of this grammar teaching is, first, an expansion of the students' existing KoG (through the learning of the pied-piped pattern). Second, it increases their general awareness of grammatical structure through the experience of studying one particular pattern in detail, and this awareness enables noticing relative clauses. Every relative clause they notice in their own reading or listening increases their knowledge **of** grammar, and being able to notice relative clauses will help them in future lessons about writing. And third, it increases their knowledge **about** grammar in the area of relative clauses, which equips them with both the understanding and terminology they will need in these lessons. For example, it will allow the teacher to say things such as "How about using a pied-piped relative clause here?" or: "Remember—when you're using a relative clause one of the options to consider is pied-piping."

One further theoretical model remains to be discussed, namely, the one assumed by the "grammar in context" movement. If grammar is only taught when it is directly relevant to a writing task, then there is essentially no systematic teaching about grammar because the teacher has to provide whatever knowledge about grammar is needed at the time. Whether and how the new item of knowledge relates to the items that students know already is a

matter of chance, so the students' understanding of grammar is unlikely to be more than an unstructured list of unrelated items. The model (in Figure 19.4) looks very much like the one in Figure 19.2, but unlike the latter it does not invite an expansion of the aims of grammar teaching. Indeed, it assumes that grammar teaching and grammar application are the same thing, and only exist in the service of writing.

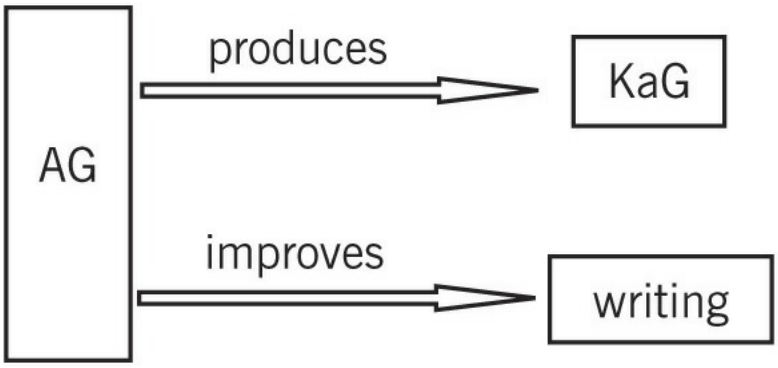


FIGURE 19.4. Another one-step model of grammar for writing.

RESEARCH QUESTIONS AND METHODS

Research in the area of grammar instruction has focused on two questions:

1. What is "mature" grammar? In other words, what is the target of teaching, the knowledge of grammar (KoG) of a suitably literate adult, and how is it different from the children's existing KoG?
2. How, if at all, can teaching about grammar (TaG) help to move children's KoG towards mature grammar?

These two questions are conceptually quite distinct, as is the research they have provoked. The following review focuses on writing research, ignoring the vast literature on children's speech.

Research on mature grammar uses the usual methods of textual linguistics: collecting and grammatically analyzing a corpus of relevant texts. In this case, the corpus consists of two subcorpora: a collection of selected mature writing representing the range of genres and styles that adults are expected to read and write, and a collection of children's writing representing the typical abilities of children at various selected ages. In principle, each collection would be exhaustively analyzed, with a complete syntactic and morphological analysis of every word in every sentence; and then the two analyses would be compared. However, we all know in advance that most of the grammar is the same, and since the ultimate aim is to find how mature writing is different from children's writing, it makes sense in this research to concentrate on patterns where the two collections are known, or at least believed, to differ. This selection is a methodological necessity, but also a point of weakness because the researcher's subjective choice may well miss points of difference that are less salient but still important.

This research has a relatively long history, dating back at least to 1924 (Stormzand & O'Shea, 1924) and culminating in the work of Perera (1984, 1986, 1990). We now have a solid basis of statistical information about broad changes on the route to maturity (Hudson, 2009), but we know far less about the particular words and structures that can (and should) be taught. Most research stopped in the 1970s, but the new climate makes it relevant again, so one hopes that new projects will push forward the earlier achievements.

The second research question is about whether and how teaching about grammar can help to improve children's

writing. The method in this case is classroom-based research in which the effects of TaG on writing are measured, and the effects can be isolated by comparing a "treatment" group (which receives this teaching) with an otherwise similar control group which does not. An alternative method is a simple before/after comparison with a single group.

The matched-groups paradigm is generally considered (e.g., Kolln et al., 2005) to have started with a research project in 1962 (Harris, 1962), in which five classes "with grammar" were contrasted with five without. The treatment received by the grammar class was one grammar lesson per week over a 2-year period. Otherwise the two groups received similar teaching, which meant that the grammar learned by the grammar group was never applied to the children's writing. This is a clear example of research based on the simple one-step model of Figure 19.2, in which teaching grammar is expected to impact directly on children's writing, without any intervening application. This project stimulated a spate of similar projects during the next two decades in the United Kingdom and the United States (reviewed in Andrews et al., 2004a; Andrews, 2005).

One of the key variables in this research is the content of the grammar taught to the with grammar group. To state the obvious, the effect of teaching grammar is likely to vary according to what the teaching consists of. This varies considerably in this research and includes at least four very different kinds of teaching, which produced predictably different results: (1) traditional grammar; (2) transformational grammar (Bateman & Zidonis, 1966; Elley, Barham, Lamb, & Wyllie, 1979); (3) morphology and spelling (Nunes & Bryant, 2006; Graham & Santangelo, 2014); and (4) sentence-combining, an activity in which the teacher presents a number of simple sentences for the class to combine into a single sentence (Hillocks & Mavrognes, 1986; Graham & Perin, 2007a). The research showed consistently that traditional grammar and transformational grammar had little or no effect on writing, whereas morphology and spelling produced a clear positive effect, as did sentence combining.

Another variable is the teachers' own competence. Given that teachers, at least those in the United Kingdom, were teaching grammar purely on the basis of what they themselves had learned at school, it would not be surprising if their grasp of grammar was uncertain. This suspicion is supported by a remark in Harris's thesis about a group of teachers:

> sixteen teachers of English, all of more than two years' experience . . . the sentence "Thinking it would be late, the man ran to the house" was analysed in a passing comment to the . . . teachers, and at the second meeting a week later they were asked to analyse into clauses the sentence, "Thinking it would be late, the man ran to the house where his friend lived" . . . only four of the sixteen teachers managed to provide a correct answer. (Harris 1962, p. 57, quoted in Walmsley, 1984)

Poorly prepared teachers are unlikely to produce good results in any subject, and it is hardly surprising to read in one report that hardly any pupils had learned even the most elementary grammatical concepts during three or more years of instruction (Macauley, 1947). This finding contrasts sharply with the enthusiasm for grammar found among Dutch teachers (Tordoir & Wesdorp, 1979), who believed strongly that it had a beneficial effect. As mentioned above, the Dutch enthusiasm for grammar persists in spite of the anglophone scepticism. One plausible explanation for the difference is that Dutch teachers have a more solid grasp of grammar.

Teachers' own knowledge about grammar is clearly a critical constraint on research on the effectiveness of grammar teaching, especially in countries such as the United Kingdom where most teachers learned very little grammar at school and none at university. Research has shown that both primary and secondary English teachers typically feel, and are, inadequately prepared to teach grammar (Cajkler & Hislam, 2002; Williamson & Hardman,

1995). The most recent research projects in the United Kingdom have recognized this problem, and found two solutions: either a researcher takes over the teaching (Nunes & Bryant, 2006), or the regular teacher is given extra training in grammar (Myhill, Lines, & Watson, 2011). Perhaps it is not surprising that the results of these projects are different from those produced in the 1960s and 1970s when it was assumed that teachers were grammar experts. Indeed, one explanation for the decline in grammar teaching during the early 20th century is that universities failed to provide the academic training that future teachers needed (Hudson & Walmsley, 2005).

FINDINGS

A recent research review "argues that there is no evidence for the assumption made by policy-makers and researchers in the United Kingdom that knowledge about grammar is a useful tool in helping school pupils to write more fluently and accurately" (Andrews, 2005, p. 69). In other words, the review supports what the author elsewhere calls "the prevailing belief that the teaching of the principles underlying and informing word order or 'syntax' [generalized in 2005 to 'grammar'] has virtually no influence on the writing quality or accuracy of 5 to 16 year-olds" (Andrews et al., 2004a, p. 1).

Although the conclusion is an accurate summary of the research reported, there are reasons for reconsidering it. First, the review overlooks a major research project on the effects of teaching morphology (which, as the study of word structure, is a major area of grammar). Bryant, Nunes, and Hurry showed that teaching about morphology affected children's writing by improving their spelling (Hurry et al., 2005; Nunes & Bryant, 2006; Nunes, Bryant, & Olsson, 2003; Nunes, Bryant, & Bindman, 1997; Nunes & Bryant, 2011). For example, compared with control groups, 9- to 11-year-old children improved their use of apostrophes (Bryant, Devine, Ledward, & Nunes, 2002), and 7- to 8-year-olds spelled better (Nunes et al., 2003). Their main point is the "important, though shockingly neglected, fact that one of the best ways to help children become experts in their reading and spelling is to make sure they are thoroughly familiar with the morphemic system in their own language" (Nunes & Bryant, 2006, p. 3).

A second weakness in the report's conclusions is that it explicitly excludes from grammar teaching the one method for teaching about syntax that is generally accepted as effective in improving writing: sentence combining. As explained earlier, sentence combining is an activity for pupils in which they combine a number of simple sentences into a single larger one. A separate review by the same team is devoted to sentence combining and concludes that (1) sentence combining is an effective means of improving the syntactic maturity of students in written English between the ages of 5 and 16, and (2) in the most reliable studies, immediate posttest effects were seen to be positive, with some tempering of the effect in delayed posttests (Andrews et al., 2004b). Other surveys have reached the same positive conclusion about sentence combining (Hillocks & Mavrognes, 1986; Hillocks, 2003; Graham & Perin, 2007b).

But why does this activity not count as grammar instruction? It is explicitly focused on formal patterning, and there is no reason to doubt that the options available could be articulated in technical terms, even if that is not an essential part of the activity. Indeed, it seems likely that the use of metalanguage would increase the benefits of the activity. Moreover, there is no suggestion that it is only done "in context." in reaction to particular issues in the students' own writing, so it is a clear example of teaching grammar rather than applying grammar. As a challenging activity likely to raise important grammatical issues, it is an excellent candidate for any collection of methods for teaching grammar; so teaching grammar it certainly is.

A third weakness in the report's negative conclusions about grammar teaching cannot be blamed on the report's authors, but it is probably the most telling: Since the report was written (in 2004), an important research project by

Myhill and her colleagues at Exeter has demonstrated that explicit instruction in grammar does, in fact, improve students' writing (Jones, Myhill, & Bailey, 2013; Myhill, Jones, & Watson, 2013; Myhill, Jones, Watson, & Lines, 2013; Myhill, Jones, Lines, & Watson, 2012). In contrast with all the earlier projects, Myhill's intervention was focused on specific grammatical patterns such as modal verbs, and (in terms of our third model above) it applied the taught grammar directly to writing tasks. In contrast with all previous experimental investigations, later tests showed a very strong positive effect on writing. The strong effect is all the more remarkable for the fact that neither the students nor the teachers knew much grammar before the intervention started, so teaching grammar had to start from scratch. In terms of our earlier theoretical models, Myhill has discovered that teaching grammar does indeed improve writing, provided that the grammar is also applied.

In conclusion, although the research since the 1960s has shown that it is possible to teach grammar in such a way that it has no effect on writing, we now know that, given the right focus and methods, grammar instruction can have clear benefits for writing.

FURTHER RESEARCH

For too long, research in the area of grammatical instruction for writing has been driven by the hope that it was not necessary. As explained earlier, the 20th century saw grammar downgraded not only in schools, but also in universities where the lack of research led to a lack of teaching and several generations of undertrained and undersupported grammar teachers. Since the 1960s, grammar has turned into a hot topic for academic research; but by the 1960s many school teachers were sick of teaching this apparently pointless and difficult subject, so they welcomed research evidence that seemed to solve the problem at a stroke. Now that the pendulum is swinging back toward more grammar teaching, it is easy to identify yawning gaps in the research that should underpin it.

The most general gap concerns research in countries other than the anglophone triangle of the United Kingdom, the United States, and Australia. As explained earlier, in many European countries (and their former colonial dependents) the teaching of grammar was never interrupted (as it was in the anglophone countries), and it is still an important part of the school curriculum. Some of these countries have very successful programs in the teaching of grammar, as exemplified earlier by the Czech Republic, but we simply do not know what research, if any, has been carried out on the effects of this teaching on writing (or on any other skills). Almost as important is our ignorance of research in related areas of education, and in particular research on foreign-language teaching (including English as a foreign language), where the consensus has also shifted in favor of explicit teaching through grammar (Ellis, 2008b). Rather obviously, if the teacher of first-language literacy and the foreign-language teacher both apply grammar, the case for systematic grammar teaching is overwhelming, and it is essential for the two to support each other.

More specific research gaps correspond to most of the issues listed in the first section:

- *Why should grammar be taught?* Although we now know that it can benefit writing, we still don't know its other benefits, such as its effect on reading (but see Chipere, 2003) or on general cognitive development.
- *When should grammar be taught?* The practice of other countries shows that some grammar can be taught to young primary children, but at what age should the various parts of grammar be introduced?
- *How should grammar be taught?* What are the most successful pedagogies for the teaching of grammar? For example, is there a role for diagramming systems and other kinds of special grammatical notation? And how can teachers expand and consolidate their own limited knowledge of grammar?
- *What grammar should be taught?* Which grammatical constructions should be explained, and at what age? Are

some kinds of grammatical analysis better than others for use in schools?

- *Who should teach grammar?* Even if grammar is initially taught by the teacher of writing, it will also be used (and reinforced) by foreign-language teachers. But, paradoxically, it is the foreign-language teachers who may well know more grammar, so collaboration may help both parties at a time when teachers are struggling to upgrade their own knowledge of grammar.

In the words of an earlier review of these issues, "the debate clearly needs to be recast, and the research agenda also" (Locke, 2009).

IMPLICATIONS FOR INSTRUCTION

The present state of research shows that applying grammar is not, after all, a waste of time in the teaching of writing. But this is only true if the teaching is clearly focused on growth-points in the children's grammar. These points may involve low-level transcription skills of writing such as spelling, or higher-level composition skills such as reviewing the ordering of elements or choosing how much detail to provide. In almost every case, writers have to make grammatical analyses and grammatical choices, and the more understanding they bring to bear on these analyses and choices, the better. But the research shows that it is not enough to teach the grammatical system; if this teaching is to affect writing, then it must be explicitly applied to writing.

A more theoretical conclusion for instruction is that the teaching of grammar can, and should, be separated from the application of grammar. For example, the teacher should be able to apply terms and concepts such as *relative clause* or *modal verb* for which pupils already have the deep understanding that can only come from systematic teaching; and the terms are just as relevant for reading and foreign-language teaching as they are for the teaching of writing.

REFERENCES

Andrews, R. (2005). Knowledge about the teaching of [sentence] grammar: The state of play. *English Teaching: Practice and Critique, 4*, 69–76.

Andrews, R., Beverton, S., Locke, T., Low, G., Robinson, A., Torgerson, C., et al. (2004a). *The effect of grammar teaching (syntax) in English on 5 to 16 year olds' accuracy and quality in written composition*. London: EPPI-Centre, Social Science Research Unit, Institute of Education.

Andrews, R., Torgerson, C., Beverton, S., Freeman, A., Locke, T., Low, G., et al. (2004b). *The effect of grammar teaching (sentence combining) in English on 5 to 16 year olds' accuracy and quality in written composition*. London: EPPI-Centre, Social Science Research Unit, Institute of Education—Research Evidence in Education Library.

Anonymous. (2013). *Statutory guidance. National curriculum in England: English programmes of study*. London: Department for Education.

Applebee, A., & Langer, J. (2011). A snapshot of writing instruction in middle schools and high schools. *English Journal, 100*, 14–27.

Baskervill, W., & Sewell, J. (1895). *An English grammar for the use of high school, academy and college classes.* The Echo Library. Originally published 2005.

Bateman, D. R., & Zidonis, F. J. (1966). *The effect of a study of transformational grammar on the writing of ninth and tenth graders* (NCTE Research Report no. 6.). Champaign, IL: National Council of Teachers of English.

Bentolila, A. (2006). *Rapport de mission sur l'enseignement de la grammaire*. Paris, France: Ministère de L'éducation Nationale, de L'Enseignement Supérieur et de la Recherche,

Black, J. (1991). *Sumerian grammar in Babylonian theory*. Gregorian Biblical BookShop.

Brinton, L., & Brinton, D. (2010). *The linguistic structure of modern English.* Amsterdam: John Benjamins.

Bryant, P., Devine, M., Ledward, A., & Nunes, T. (2002). Spelling with apostrophes and understanding possession. *British Journal of Educational Psychology, 67*, 91–110.

Cajkler, W., & Hislam, J. (2002). Trainee teachers' grammatical knowledge: The tension between public expectations and individual competence. *Language Awareness, 11*, 161–177.

Carter, R. (1990). *Knowledge about language and the curriculum: The LINC Reader.* London: Hodder and Stoughton.

Carter, R. (1994). Language awareness for language teachers. In M. Hoey (Ed.), *Data, discourse and description: Essays in honour of Professor John Sinclair* (pp. 137–150). London: Collins.

Carter, R. (1996). Politics and knowledge about language: The LINC project. In R. Hasan & G. Williams (Eds.), *Literacy in society* (pp. 1–28). London: Longman.

Chipere, N. (2003). *Understanding complex sentences: Native speaker variation in syntactic competence*. London: Palgrave Macmillan.

Cutler, L., & Graham, S. (2008). Primary grade writing instruction: A national survey. *Journal of Educational Psychology, 100*, 907–919.

Denham, K., & Lobeck, A. (2010). *Linguistics at school. Language awareness in primary and secondary education*. Cambridge, UK: Cambridge University Press.

Derewianka, B., & Jones, P. (2010). From traditional grammar to functional grammar: bridging the divide. In C. Coffin (Ed.), *Language support in EAL contexts. Why systemic functional linguistics? (Special Issue of NALDIC Quarterly)*. Reading, UK: National Association for Language Development in the Curriculum.

Elley, W., Barham, I., Lamb, H., & Wyllie, M. (1979). *The role of grammar in a secondary school curriculum.* Wellington: New Zealand Council for Educational Research.

Ellis, N. (2008a). Implicit and explicit knowledge about language. In J. Cenoz & N. Hornberger (Eds.), *Encyclopedia of language and education, 2nd ed., Vol. 6: Knowledge about language* (pp. 1–13). New York: Springer.

Ellis, R. (2008b). Explicit form-focused instruction and second language acquisition. In B. Spolsky & F. Hult (Eds.), *The handbook of educational linguistics* (pp. 437–455). Oxford, UK: Blackwell.

Florey, K. B. (2006). *Sister Bernadette's barking dog: The quirky history and lost art of diagramming sentences*. New York: Melville House.

Fougerouse, M.-C. (2001). L'enseignement de la grammaire en classe de français langue étrangère. *Études de linguistique appliquée*, 165–178.

Gilbert, J., & Graham, S. (2010). Teaching writing to elementary students in grades 4–6: A national survey. *The Elementary School Journal, 110*, 494–518.

Gragg, G. (1994). Babylonian grammatical texts. In R. Asher (Ed.), *Encyclopedia of language and linguistics* (pp. 296–298). Oxford, UK: Pergamon.

Graham, S., Harris, K., & Hebert, M. (2011). It is more than just the message: Presentation effects in scoring writing. *Focus on Exceptional Children, 44*, 1–12.

Graham, S., & Perin, D. (2007a). A meta-analysis of writing instruction for adolescent students. *Journal of Educational Psychology, 99*, 445–476.

Graham, S., & Perin, D. (2007b). *Writing next: Effective strategies to improve writing of adolescents in middle and*

high schools. A report to Carnegie Corporation of New York. Washington, DC: Alliance for Excellent Education.

Graham, S., & Santangelo, T. (2014). Does spelling instruction make students better spellers, readers, and writers?: A meta-analytic review. *not known*. *Reading and Writing, 27*, 1703–1743.

Gwosdek, H. (2013). *William Lily's grammar of Latin in English: An introduction of the Eyght Partes of Speche, and the construction of the same*. Oxford, UK: Oxford University Press.

Hana, J., & Hladka, B. (2012). Getting more data—Schoolkids as annotators. In. R. Harris, (1962), *An experimental inquiry into the functions and value of formal grammar in the teaching of English, with special reference to the teaching of correct written English to children aged twelve to fourteen.* Unpublished doctoral thesis, University of London.

Harris, R. J. (1962). *An experimental inquiry into the functions and value of formal grammar in the teaching of written English to children aged twelve to fourteen*. Unpublished doctoral dissertation, University of London.

Hawkins, E. (1994). Language awareness. In R. Asher (Ed.), *Encyclopedia of language and linguistics* (pp. 1933–1938). Oxford, UK: Pergamon.

Hefty, M., Ortiz, S., & Nelson, S. (2008). *Sentence diagramming: A step-by-step approach to learning grammar through diagramming*. New York: Longman.

Hillocks, G. (2003). *Reconceptualizing writing curricula: What we know and can use*. Unpublished manuscript.

Hillocks, G., & Mavrognes, N. (1986). Sentence combining. In G. Hillocks (Ed.), *Research on written composition: New directions for teaching* (pp. 142–146). Urbana, IL: National Council for the Teaching of English.

Huber, P. (2007). On the Old Babylonian understanding of grammar. A reexamination of OBGT VI-X. *Journal of Cuneiform Studies, 5*, 1–17.

Huddleston, R., & Pullum, G. (2002). *The Cambridge grammar of the English Language*. Cambridge, UK: Cambridge University Press.

Hudson, R. (2009). Measuring maturity. In R. Beard, D. Myhill, M. Nystrand, & J. Riley (Eds.), *SAGE handbook of writing development* (pp. 349–362). London: Sage.

Hudson, R., & Walmsley, J. (2005). The English patient: English grammar and teaching in the twentieth century. *Journal of Linguistics, 41*, 593–622.

Hurry, J., Nunes, T., Bryant, P., Pretzlik, U., Parker, M., Curno, T., et al. (2005). Transforming research on morphology into teacher practice. *Research Papers in Education, 20*, 187–206.

Jones, S., Myhill, D., & Bailey, T. (2013). Grammar for writing? An investigation into the effect of contextualised grammar teaching on student writing. *Reading and Writing, 26*, 1241–1263.

Keith, G. (1999). Noticing grammar. In Anonynous (Ed.), *Not whether but how: Teaching grammar in English at Key Stage 3 and 4* (pp. 22–32). London: Qualifications and Curriculum Authority.

Kiuhara, S., Graham, S., & Hawken, L. (2009). Teaching writing to high school students: A national survey. *Journal of Educational Psychology, 101*, 136–160.

Kolln, M., & Hancock, C. (2005). The story of English grammar in United States schools. *English Teaching: Practice and Critique, 4*, 11–31.

Locke, T. (2009). Grammar and writing—The international debate. In R. Beard, D. Myhill, J. Riley, & M. Nystrand (Eds.), *The Sage handbook of writing development* (pp. 182–193). London: Sage.

Macauley, W. J. (1947). The difficulty of grammar. *British Journal of Educational Psychology, 18*, 153–162.

Myhill, D., Jones, S., Lines, H., & Watson, A. (2012). Re-thinking grammar: The impact of embedded grammar teaching on students' writing and students' metalinguistic understanding. *Research Papers in Education, 27*, 139–166.

Myhill, D., Jones, S., & Watson, A. (2013). Grammar natters: How teachers' grammatical subject knowledge

impacts on the teaching of writing. *Teaching and Teacher Education*, *36*, 77–91.

Myhill, D., Jones, S., Watson, A., & Lines, H. (2013). Playful explicitness with grammar: A pedagogy for writing. *Literacy*, *47*, 103–111.

Myhill, D., Lines, H., & Watson, A. (2011). Making meaning with grammar: A repertoire of possibilities. *mETAphor*, *2*, 1–10.

Norris, J., & Ortega, L. (2000). Effectiveness of L2 instruction: A research synthesis and quantitative meta-analysis. *Language Learning*, *50*, 417–528.

Nunes, T., & Bryant, P. (2006). *Improving literacy by teaching morphemes*. London: Routledge.

Nunes, T., & Bryant, P. (2011). Why we need to know about more than phonics to teach English literacy. In S. Ellis & E. McCartney (Eds.), *Applied linguistics and primary school teaching* (pp. 140–153). Cambridge, UK: Cambridge University Press.

Nunes, T., Bryant, P., & Bindman, M. (1997). Learning to spell regular and irregular verbs. *Reading and Writing*, *9*, 427–449.

Nunes, T., Bryant, P., & Olsson, J. (2003). Learning morphological and phonological spelling rules: An intervention study. *Scientific Studies of Reading*, *7*, 289–307.

Perera, K. (1984). *Children's writing and reading. Analysing classroom language*. Oxford, UK: B. Blackwell in association with A. Deutsch.

Perera, K. (1986). Language acquisition and writing. In P. Fletcher & M. Garman (Eds.), *Language acquisition. Studies in first language development* (2nd ed., pp. 494–518). Cambridge, UK: Cambridge University Press.

Perera, K. (1990). Grammatical differentiation between speech and writing in children aged 8 to 12. In R. Carter (Ed.), *Knowledge about language and the curriculum* (pp. 216–233). London: Hodder and Stoughton.

Ribas, T., Fontich, X., & Guasch, O. (2014). *Grammar at school: Research on metalinguistic activity in language education*. Brussels: Peter Lang.

Rothery, J. (1996). Making changes: Developing an educational linguistics. In R. Hasan & G. Williams (Eds.), *Literacy in society* (pp. 86–123). London: Longman.

Scheffler, P., & Cinciala, M. (2011). Explicit grammar rules and L2 acquisition. *ELT Journal*, *65*, 13–23.

Shukla, S. (2006). Panini. In K. Brown (Ed.), *Encyclopedia of language and linguistics* (2nd ed., pp. 153–155). Oxford, UK: Elsevier.

Stormzand, M., & O'Shea, M. (1924). *How much English grammar? An investigation of the frequency of usage of grammatical constructions in various types of writing together with a discussion of the teaching of grammar in the elementary and the high school.* Baltimore: Warwick and York.

Tordoir, A., & Wesdorp, H. (1979). *Het Grammatica-Onderwijs in Nederland: Een Researchoversicht Betreffende de Effecten Van Grammatica-Onderwijs en Een Verslag Van Een Onderzoek Naar de Praktijk Van Dit Onderwijs in Nederland's*-Gravenhage: Staatsuitgeverij.

Walmsley, J. (1984). *The uselessness of formal grammar?* (Working Papers Volume 2). London: Committee for Linguistics in Education.

Weaver, C. (1996). *Teaching grammar in context.* Portsmouth, NH: Heinemann.

Williams, G. (2004). Ontogenesis and grammatics: Functions of metalanguage in pedagogical discourse. In G. Williams & A. Lukin (Eds.), *The development of language: functional perspectives on species and individuals* (pp. 241–267). London: Continuum.

Williamson, J., & Hardman, F. (1995). Time for refilling the bath? A study of primary student-teachers' grammatical knowledge. *Language and Education*, *9*, 117–134.

CHAPTER 20

Argumentative Writing

Ralph P. Ferretti and Yueyue Fan

Argumentation is a form of communication about a real or imagined difference of opinion about a controversial issue (van Eemeren & Grootendorst, 2004; van Eemeren, Grootendorst, & Henkemans, 1996). Arguments can accomplish different rhetorical purposes, including persuading, cajoling, negotiating, consulting, debating, and resolving conflict (Walton, 1992). The discourse that expresses these purposes must be distinguished by the speech act obligations they entail because the failure to do so may undermine communication (van Eemeren & Grootendorst, 2004). Nevertheless, the core function of argumentation is to resolve differences of opinion by appealing to the interlocutor's reasonableness (van Eemeren, 2010; van Eemeren & Grootendorst, 2004). For more than two millennia, scholars have debated the evaluative standards that should be used to judge an argument's reasonableness (cf., Ferretti, Andrews-Weckerly, & Lewis, 2007). These debates have currency because they inform efforts to improve people's argumentative competence.

Oral argumentation emerges early in development (Dunn, 1988), but despite its precocity, it is subject to biases that are resistant to change. If the resolution of differences is a core function of arguments, then the privileging of one's perspective and the inability to consider counterevidence (my-side bias; Perkins, Farady, & Bushey, 1991) is a sin against reasonableness. Unfortunately, this failure of perspective taking appears in all forms of argumentative discourse, including written arguments. For example, the 2012 NAEP Writing Report Card (National Center for Education Statistics, 2012) showed that only about 25% of students' argumentative essays were competent. Competent essays usually develop strong reasons and provide supporting examples, but the support in these essays is not always effective, and they often fail to consider alternative perspectives. Evidence for my-side bias is widely found in the empirical literature (e.g., Ferretti, MacArthur, & Dowdy, 2000; Ferretti, Lewis, & Andrews-Weckerly, 2009; Klein, Arcon, & Baker, Chapter 16, this volume; Song & Ferretti, 2013).

There has been a dramatic expansion in research about argumentative writing. The aforementioned data from national assessments has given impetus to interventions intended to improve the quality of students' argumentative writing (Ferretti & Lewis, 2013). However, these data have gained further significance in the context of discussions about whether students are prepared for a competitive workplace (Biancarosa & Snow, 2006; Graham & Perin, 2007). The increasing importance of workplace expertise makes clear the value of sophisticated literacy skills as children progress through the curriculum (Ferretti & De La Paz, 2011). Literacy and content-area learning become inextricably interconnected, so academic progress increasingly depends on the acquisition of highly specialized knowledge and skills that are often discipline dependent. In short, students are expected to read and write like disciplinary experts (Shanahan & Shanahan, 2008) who are able to evaluate interpretative claims by applying analytic strategies and evaluative standards that are shared by members of their discourse community (Ferretti & De La Paz, 2011). It is unsurprising in this context that the Common Core Standards (Common Core State Standards Initiative, 2010) emphasize argumentative writing across the curriculum.

We begin by discussing some definitional issues that have historical importance and currency in the study of argumentation. We will then consider argumentation as a form of problem solving, highlighting the benefits of self-

regulatory interventions that are designed to mitigate people's capacity limitations. Argumentative writing is always dialogic because it involves communication between real or imagined interlocutors. For this reason, there is considerable interest in the effects of dialogic support on the development of argumentative writing. As the reader will see, our review gives particular attention to interventions intended to improve the quality of people's argumentative writing.

DEFINITIONAL ISSUES

Our perspective about argumentation is informed by pragma-dialectical theory (cf. van Eemeren & Grootendorst, 2004; van Eemeren, 2010), which attempts to account for both the rhetorical and dialectical aspects of argumentation. The rhetorical aspect focuses on the pragmatics of argumentation, including the argumentative situation, and task features, including the setting conditions, the interaction among interlocutors, and the instruction provided (Ferretti et al., 2007). The dialectical aspect focuses on the normative standards that should guide the evaluation of argumentative practices (van Eemeren, Grootendorst, Jackson, & Jacobs, 1993). Until recently, these two aspects were viewed as separate paradigms in the study of argumentation (van Eemeren & Houtlosser, 2009). This artificial division impeded efforts to improve people's argumentative capacities. It is now generally accepted that argumentation is a pragmatic activity that is influenced by situational factors and guided by normative standards for reasonable argumentation (van Eemeren & Grootendorst, 1992). According to van Eemeren et al. (1996): "Argumentation is a verbal and social activity of reason aimed at increasing (or decreasing) the acceptability of a controversial standpoint for the listener or reader, by putting forward a constellation of propositions intended to justify (or refute) the standpoint before a rational judge" (van Eemeren et al., 1996, p. 5).

Three aspects of this definition deserve attention. First, argumentation is *socially situated discourse* among interlocutors who disagree about some issue. Second, the interlocutors present a structured *set of propositions* that in their totality affect the acceptability of a standpoint. Third, reasonable people use *critical standards* to judge the acceptability of a standpoint. These standards may include varied criteria, and their relative importance may depend on the perspective of the discourse community within which the disagreement occurs. Nevertheless, the critical standards should include the relevance of interlocutors' argumentative strategies for accomplishing their discursive purposes (Walton, Reed, & Macagno, 2008). With respect to the latter criterion, there is agreement that interlocutors should *answer critical questions* about their argumentative strategies to establish the reasonableness of their arguments (Walton et al., 2008).

We briefly mentioned that arguments have different purposes and that these purposes carry different communicative obligations (Walton, 1992). As we will see, most studies of written argumentation focus on persuasion, which is a dialogue between people who try to convince each other by establishing the merits of their own position and the limitations of the other's. In a few cases, students were asked to write their opinion about an issue. An opinion essay simply expresses the writer's perspective about a potential controversy. In this case, the writer does not have an adversary and therefore is not obliged to point out the limitations of the adversary's perspective, or for that matter, anticipate the adversary's criticisms. As we mentioned, there are many other subspecies of argumentation (Walton, 1992), most of which have not been studied in the argumentative writing literature.

ARGUMENT AS PROBLEM SOLVING

Argumentative writing is a problem-solving process (Bereiter & Scardamalia, 1987) that requires the use of self-regulatory processes (Graham & Harris, 1997) to achieve the author's rhetorical goals. Certainly, there are nonstrategic and less explicit cognitive processes that impact text production (Torrance & Galbraith, 2009), but all major cognitive accounts of writing recognize the influence of constraints imposed by the writer's available capacities and processing resources (Flower & Hayes, 1980). These constraints compel the strategic writer to manage the writing process, which includes goal setting, planning, composing, and revising their essays. The failure to manage the task requirements and strategically allocate information-processing resources adversely affects writing performance.

Writers draw on their knowledge of argumentative discourse, the topic, their interlocutor, and critical standards of evaluation to resolve differences of opinion (Ferretti & De La Paz, 2011; Ferretti & Lewis, 2013). Expert writers possess fluent linguistic skills, as well as genre and topic knowledge (McCutchen, 2011), but are also skilled at setting specific goals that can be used to guide the writing process. In contrast, novices are less fluent, possess less genre and topic knowledge, and are also less able to strategically regulate the writing process (Harris, Graham, MacArthur, Reid, & Mason, 2011; McCutchen, 2011). As a result, novices often write down topically relevant information and then use it to generate related information (Bereiter & Scardamalia, 1987). Furthermore, less able writers are often unable to devise strategies for managing the demands associated with planning and revising their essays (Graham, Harris, & McKeown, 2013). Consequently, difficulties with self-regulation are seen in all aspects of their problem solving (Graham et al., 2013).

Goal Setting

One approach to improving argumentative writing is to provide specific subgoals that focus on genre-relevant information (Flower & Hayes, 1980). Goals positively impact writing performance when they provide clear direction about what needs to be included (Page-Voth & Graham, 1999), and enable the writer to monitor writing performance. Goal-directed progress enhances self-efficacy and motivates continued effort (Zimmerman & Risemberg, 1997). However, limitations of self-regulation (Graham, 1997; Page-Voth & Graham, 1999) may prevent learners from generating genre-specific subgoals. Therefore, providing explicit subgoals may promote self-regulation and positively impact argumentative writing.

Five studies provide evidence about the effects of subgoals on students' argumentative essays (Ferretti et al., 2000; Ferretti et al., 2009; Midgette, Haria, & MacArthur, 2008; Nussbaum & Kardash, 2005; Page-Voth & Graham, 1999). Page-Voth and Graham (1999) studied the effects of argumentative goals and strategy instruction on the argumentative writing of seventh- and eighth-grade students with learning disabilities (LD). Half of the students received goals to produce reasons and refutations, and the remaining students received no specific goal. The students in both groups were then further divided into two subgroups. Half were taught a strategy to generate and evaluate genre-specific discourse elements in their essays, and the other half did not receive strategy instruction. The authors found that students in the goal-setting and goal-setting/strategy instruction conditions produced more reasons and refutations than students in the control condition. In addition, students in the goal-setting/strategy instruction condition produced more refutations than those in the goal-setting/no strategy instruction condition. Finally, students in the two goal-setting groups wrote better quality essays than students in the control condition. Although strategy instruction contributed little to the overall differences in writing performance, it resulted in more refutations when coupled with a relevant goal.

Ferretti et al. (2000) compared the effects of a general goal to persuade and an elaborated goal that included genre-specific subgoals on the argumentative writing of fourth and sixth graders. Students in the elaborated goal

condition were told to justify their standpoint with reasons, and to critique and rebut the reasons for an alternative standpoint. Students in the fourth grade were generally unaffected by the elaborated goal. However, sixth graders in the elaborated goal condition produced more persuasive essays and included a greater number of more alternative propositions, alternative reasons, and rebuttals than those in the general goal condition. Furthermore, about 45% of the variance in the quality of students' essays was accounted for by the inclusion of argumentative elements. Sixth-grade students were more likely to address the alternative perspective when they wrote with the elaborated goal.

Nussbaum and Kardash (2005) conducted two experiments that extended the Ferretti et al. (2000) findings. In the first study, they compared the effects of three different conditions on college students' argumentative writing. In the counterargument/rebuttal condition, students were told to provide reasons and evidence for their standpoint, and then generate counterarguments and rebut them. In the reason condition, students were told to provide reasons and evidence for their standpoint. In the control condition, students were told to write an essay that expressed their opinion about the controversial issue. The authors found that college students produced more counterarguments, rebuttals, and reasons for rebuttals in the counterargument/rebuttal condition than in the reason condition, and that students in the reason condition produced more reasons and evidence to support their standpoint than students in the control condition. Furthermore, they found that students with extreme attitudes about the controversial issue generated fewer alternative standpoints about the issue than those with less extreme attitudes.

The authors speculated that writing to persuade, in contrast to simply expressing an opinion, might inhibit the production of alternative standpoints and counterarguments because the failure to rebut them undermines the essay's persuasiveness. In the second experiment, college students were told to persuade an audience or simply to express their opinion (no persuasion) about an issue. They also studied whether a short text that provided information about both sides of the issue improved essay quality. Compared to the no persuasion goal, the persuasion goal reduced essay quality when students wrote without the support of a text. In addition, students included less support for counterarguments when writing to persuade whether or not a text was provided. However, the provision of a text in the no persuasion condition resulted in greater consideration of alternative standpoints, and texts were generally more effective for students with less extreme prior attitudes about the issue. The authors concluded that persuasion goals might encourage my-side bias.

Midgette et al. (2008) studied the effects of an elaborated goal on the revised essays of fifth- and eighth-grade students. Students were randomly assigned to one of three conditions: a general goal to revise, a goal to increase the justificatory support for the writer's standpoint (my-side), and a goal to increase the my-side justificatory support, and also critique and rebut the reasons for an alternative standpoint (my-side/your-side). The authors found that the final drafts of students in the my-side and my-side/your-side conditions wrote more persuasive essays than those in the general goal condition. Most interestingly, the final drafts of students in my-side/your-side condition showed greater consideration of the alternative perspective and more rebuttals than students in the other conditions. As was found in Ferretti et al. (2000), the effects of the elaborated goal were restricted to older students.

These findings show that genre-specific subgoals and the writing goal itself (to persuade or simply express one's opinion) affect the quality of students' argumentative essays and have rhetorical consequences that impact consideration of alternative standpoints (Ferretti et al., 2000; Midgette et al., 2008; Nussbaum & Kardash, 2005; Page-Voth & Graham, 1999). However, these conclusions rest on simple counts of argumentative elements. As we said earlier, arguments are not reducible to elements because they comprise a constellation of propositions that is intended to justify or refute a standpoint (van Eemeren et al., 1996). Furthermore, the aforementioned studies failed to analyze the kinds of argumentative strategies used by students, nor did they show how normative standards of evaluation impact their written arguments (Walton et al., 2008). Arguments have different aims, and interlocutors should use strategies that are best suited for their specific discursive purposes. These strategies, which have been

called *argumentation schemes* (van Eemeren, Grootendorst, & Henkemans, 2002; Walton et al., 2008), are conventionalized ways of representing the relationship between what is stated in the standpoint and its supporting justificatory structure. With one exception, the extant goal-setting literature is mute about the possible effects of writing goals on the structure of students' argumentative essays and the kinds of argumentation strategies they use.

Ferretti et al. (2009) studied the effects of an elaborated and general goal on the structure of written arguments and types of students' argumentative strategies. Students in the fourth and sixth grade wrote an argumentative essay about the advisability of a school policy with either genre-specific subgoals or a general goal to persuade. The structure of their written arguments and the types of argumentative strategies they used were analyzed using procedures derived from the pragma-dialectical theory (van Eemeren & Grootendorst, 2004; van Eemeren et al., 2002). In brief, the authors developed a coding system that graphically depicted the elements of an argumentative essay and the structural relationships among the elements (see Ferretti et al., 2009 for details about the coding). Specific measures that reflected the breadth and depth of the written arguments were derived from these structures. The essays' graphical representations were then used to analyze the students' argumentative strategies (van Eemeren et al., 2002).

Ferretti et al. (2009) found that the elaborated goal increased students' recognition of the alternative standpoint, as well as reasons for that standpoint and rebuttals of those reasons. Furthermore, as compared to the general goal, students in the elaborated goal condition wrote more persuasive essays. Most interestingly, measures derived from the graphical representations of the argumentative structures accounted for 70% of the variance in essay quality. After accounting for the structural properties associated with the writer's standpoint and the alternative standpoint, demographic and other nonstructural variables failed to contribute to the prediction of essay quality. Finally, students in the elaborated goal condition produced more argumentative strategies than those in the general goal condition, but did not differ with respect to the types of strategies or their relative distribution across strategy types.

Participants were asked to write about the advisability of a school policy, so the authors expected students to use the argument from consequences strategy (see Walton et al., 2008), which involves consideration of the costs and benefits of enacting the proposed policy. In fact, students overwhelming used this strategy, and although other argumentative strategies were observed, they were used most often in support of the argument from consequences strategy. In sum, the authors found that genre-specific goals increased the number but not the types of argumentative strategies used by students, and confirmed what Aristotle (trans, 1991) understood over two millennia ago: In disagreements about policy, arguments from consequences are commonly used.

Strategy Instruction

There is compelling evidence for the efficacy of writing interventions that teach students to regulate their problem solving (Graham & Perin, 2007; Graham et al., 2013). The self-regulated strategy development (SRSD) model is a demonstrably effective approach to explicitly scaffolding the acquisition and independent application of writing strategies (Harris & Graham, 1985, 1992). In this model, the teacher first provides explicit support for learning the strategy. Over time, the teacher cedes control to the student, who assumes greater responsibility for monitoring the strategy's application. In addition, students receive explicit instruction about the strategy's purposes and potential benefits, as well as experiences designed to ensure the strategy's internalization, maintenance, and generalization (Graham & Harris, 2005; Graham et al., 2013).

Graham and Harris (1989) conducted the first study of the effects of SRSD instruction on argumentative writing. Sixth graders were taught the *TREE* strategy, which prompted them to provide a *T*opic sentence, provide *R*easons for their opinion, *E*xamine the reason from the audience's perspective, and provide an *E*nding. Before instruction, few

of the students' essays contained elements of argumentative discourse and most of it served no rhetorical purpose. After instruction, most essays were of higher quality and included basic genre-relevant elements. Furthermore, the instruction positively impacted the students' self-efficacy as writers.

Sexton, Harris, and Graham (1998) taught fifth and sixth graders to write arguments using the TREE strategy and encouraged these students, who lacked academic motivation, to attribute their success to effort and the use of the strategy. Prior to instruction, the students spent little time planning and included few discourse elements in their essays, which were of poor quality. Furthermore, the students believed that effort and strategy use were not important to writing success. After instruction, students used the strategy to plan their essays, which dramatically increased the number of discourse elements and essay quality. Students also made stronger attributions about the importance of effort and strategy use for writing performance.

Graham, MacArthur, Schwartz, and Page-Voth (1992) taught fifth graders with LD the *PLANS* strategy (*P*ick goals, *L*ist ways to meet goals, *A*nd make *N*otes, *S*equence notes) to set process and product goals for argumentative writing. The product goals defined the purpose of writing, the structure of the essay, and the essay's length; the process goals established manageable subproblems for the writing process. Before instruction, the students averaged very few argumentative elements per essay, which were of poor quality, and few students included all genre-specific elements in their essays. After instruction, they wrote essays of higher quality, averaged more elements, and included nearly all elements in their essays. Finally, students planned little before instruction, but after instruction they used the PLANS strategy before writing.

De La Paz and Graham (1997) taught fifth graders with LD to use the *STOP and DARE* strategy to plan and write their argumentative essays. This strategy was designed to ensure that students stopped, reflected, and planned before writing (*S*uspend judgment, *T*ake a side, *O*rganize their ideas, and *P*lan as they wrote more), and then included the essential discourse elements in their essays (*D*evelop a topic sentence, *A*dd supporting ideas, *R*eject possible arguments for the other side, and *E*nd with a conclusion). Students spent little time planning or writing their essays before instruction, and their essays included little justificatory support. After instruction, students wrote longer essays that included many more argumentative elements, including refutations.

De La Paz and Graham (2005) taught students of varying abilities a three-step historical reasoning strategy for interpreting historical sources, and also taught the STOP and DARE strategy (De La Paz & Graham, 1997) for writing argumentative essays. These sources included documents that represented different perspectives about controversies that arose during the period of Westward Expansion. Students read and took notes about primary sources, and were taught to use their notes to prepare for writing argumentative essays. The STOP and DARE strategy was modified to address historical elements of the writing task, including the use of source material as evidence to support an historical argument. In a comparison condition, students read these sources but were taught neither the historical reasoning nor argumentative writing strategies.

The historical reasoning strategy included two self-questioning routines. The first routine prompted students to consider the text's source and then analyze it for potential inaccuracies. Students answered three questions: (1) What was the author's purpose? (2) Do the reasons make sense? And (3) Do you find evidence of bias? To detect bias, students were guided to examine the author's *word choice* and whether there was *only one point of view* in the document. The second routine prompted students to ask questions about conflicting perspectives or information. Students asked: (1) Is an author inconsistent? (2) Is a person described differently? (3) Is an event described differently? (4) What is missing from the author's argument? (5) What can you infer from reading *across* sources? These questions enabled students to discount untrustworthy information, and attend to information that could be corroborated. De La Paz and Graham (2005) found that students who learned these strategies wrote higher-quality essays that contained more discourse elements and more accurate historical content than students in the comparison

condition. Importantly, the findings suggest that strategy instruction that includes relevant disciplinary knowledge and skills improves students' written arguments about historical controversies.

Kiuhara, O'Neill, Hawken, and Graham (2012) taught tenth graders with disabilities to use the STOP, AIMS, and DARE strategy to plan and write their arguments. In addition to the aforementioned STOP and DARE strategy, the *AIMS* component enabled the students to write an introduction that would help the reader understand contextual information about the topic (*A*ttract the reader's attention, *I*dentify the problem of the topic so the reader understands the issues, *M*ap the context of the problem or provide background needed to understand the problem, and *S*tate the thesis so the premise is clear). Before instruction, students spent little time planning and writing their essays, which were of poor quality and unelaborated. After instruction, students spent more time planning and writing their essays, which were of higher quality, more elaborate, and attempted to refute the alternative perspective. In addition, the postinstruction essays usually contextualized the topic and provided relevant background information about it.

Strategy instruction has also been designed to support the revision process (Graham & MacArthur, 1988; Song & Ferretti, 2013). Thoughtful revision enables writers to reflect on their ideas, develop and apply critical standards of evaluation, and improve their essays (Scardamalia & Bereiter, 1986). Although expert writers revise their work to clarify important ideas, novices focus on surface issues (MacArthur, Schwartz, & Graham, 1991). Graham and MacArthur (1988) taught fifth- and sixth-grade students with LD the *SCAN* strategy for revising argumentative essays on a word processor. This strategy taught students to answer the following questions: Does it make *S*ense? Is it *C*onnected to my belief? Can I *A*dd more? Note *E*rrors. Before instruction, a minority of the revisions involved the addition of reasons for the writer's standpoint. After instruction, nearly two-thirds of the additions were reasons, and the postinstruction essays were longer and of higher quality. The criteria for revising argumentative essays embedded in the SCAN strategy included presenting a clear belief, providing reasons to support this belief, and removing mechanical errors. These criteria are appropriate for younger students and students with LD, but do not address the critical standards that should be used by more experienced writers to evaluate their arguments (Walton et al., 2008).

As we mentioned, critical standards provide the criteria against which students should evaluate the relevance of their argumentation strategies. Song and Ferretti (2013) conducted an SRSD strategy to teach critical standards of argumentation. College students were assigned to one of three conditions: the Ask and Answer Critical Questions (ASCQ) condition, the Argumentation Schemes (AS) condition, and an uninstructed control condition. In the ASCQ condition, students were taught to revise their essays by asking and answering critical questions about two argumentation strategies (argument from consequences and argument from example) that are commonly used to address controversial policies (Ferretti et al., 2007, 2009). In contrast, students in the AS condition were taught to revise their essays by using these strategies to elaborate their standpoint, but did not learn to apply the critical questions. Finally, students in the control condition received no instruction.

The ASCQ condition was expected to increase the students' responsiveness to alternative perspectives because they were taught to anticipate counterarguments and rebut the alternative standpoint. In contrast, students in the AS condition were taught to use argumentative strategies to bolster supporting reasons for their standpoint. In fact, students in the ASCQ condition wrote essays that were of higher quality, and they included more counterarguments, alternative standpoints, and rebuttals than those in the other conditions. Furthermore, the students who learned the AS strategy produced more reasons for their standpoints than those in the other conditions. Interestingly, these effects were also evident for students' first drafts. This is desirable because the acquisition of critical standards for revision should positively impact the quality of students' writing (MacArthur, 2012).

The evidence clearly shows that SRSD instruction can improve the planning and revision processes of novice writers, but there is less evidence about the efficacy of SRSD instruction for older writers (Graham et al., 2013).

MacArthur and Lembo (2009) provide some evidence about the benefits of SRSD instruction for older writers. They investigated the effectiveness of strategy instruction on the argumentative writing of three adult education students who were studying for their GED. The instruction focused on planning, writing, and revising students' argumentative essays. Before instruction, these students wrote essays that were unpersuasive and unelaborated, and showed little consideration of alternative perspectives. After instruction, students wrote higher-quality and better-organized essays that evidenced greater consideration of other perspectives.

Little is also known about the efficacy of the classroom-wide implementation of SRSD instruction because it is usually implemented in small-group or one-on-one instruction (De La Paz & Graham, 2005). De La Paz and Graham (2005) demonstrated the efficacy of delivering SRSD planning, drafting, and revision instruction in classroom settings for the expository and argumentative writing of seventh and eighth graders. In the experimental condition, students learned about five-paragraph expository essays and were then taught to use the SRSD *PLAN and WRITE* mnemonic to plan and draft their essays. This mnemonic encouraged students to *PLAN* (*P*ay attention to prompt; *L*ist main ideas; *A*dd supporting ideas; *N*umber your ideas) before drafting, and then to *WRITE* (*W*ork from you plan to develop your thesis statement; *R*emember your goals; *I*nclude transition words for each paragraph; *T*ry to use different kinds of sentences; add *E*xciting, interesting words). Students used these writing goals during the revision process to evaluate their essays in peer revising conferences. In the control condition, students were given the same general instruction about five-paragraph expository essays and wrote about the same topics as those in the experimental condition. However, their instruction focused on mechanics, idea generation, and organization. The authors found that experimental students created better developed writing plans and wrote essays that were significantly longer and of overall higher quality than those of control students. The effects were maintained 1 month after instruction.

MacArthur, Philippakos, and Ianetta (2015) provided compelling evidence about the efficacy of a comprehensive SRSD curriculum that was designed for postsecondary learners and delivered in college developmental classes. Students in the treatment classrooms were taught (1) strategies for planning, drafting, evaluating, and revising students' essays in several genres, (2) self-regulation strategies that focused on goal setting, task management, progress monitoring, and reflection, and (3) grammar, mechanics, and usage. Students in the business-as-usual control condition were taught using the extant instructional approaches in those classrooms. The experimental curriculum targeted many genres, but its effects were measured on the quality of students' persuasive essays and their use of grammar. In addition, the authors sought evidence about treatment-related changes in students' self-efficacy, goal orientation, beliefs about writing, and affect. In comparison to control students, those in the treatment classrooms wrote longer and more persuasive essays, and had a greater sense of self-efficacy and mastery goal orientation after instruction. Effects on students' use of grammar or beliefs and affect were not observed.

In conclusion, the evidence clearly shows that SRSD interventions improve the argumentative writing for younger students and those with LD. Students write longer essays, include more discourse elements, and show greater consideration of alternative perspectives after SRSD goal-setting and strategy interventions. Furthermore, they are able to use strategies to plan and revise their essays. Less is known about the effects of SRSD interventions on the writing of older students (see Graham et al., 2013). However, two studies (MacArthur & Lembo, 2009; MacArthur et al., 2015) showed positive effects of strategy instruction on older students' argumentative writing, and one other study (Song & Ferretti, 2013) demonstrated that strategy instruction that focuses on critical standards of evaluation has salutary effects on college students' written arguments.

ARGUMENT AS DIALOGUE

People usually engage in dialogue to resolve their differences of opinion. The possibility of a resolution usually depends on the dialogue's quality and the people's commitment to fulfilling their communicative obligations (van Eemeren & Grootendorst, 2004). When these obligations are met, dialogic interactions can improve the quality of argumentative discourse (Newell, Beach, Smith, & VanDerHeide, 2011). Not surprisingly, dialogic interventions have been designed to support planning, composing, and revising arguments in different contexts (Kuhn, Shaw, & Felton, 1997; Reznitskaya, Anderson, & Kuo, 2007). Well-designed dialogic interactions encourage perspective taking and support the development of argumentative writing skills (Kuhn & Crowell, 2011).

Kuhn et al. (1997) conducted one of the earliest experimental investigations of the effects of dialogue on argumentative writing. In the first study, seventh graders, eighth graders, and community college students, were randomly assigned to either a dyadic discussion (DD) condition or an uninstructed control condition. Students in the DD condition engaged in brief DDs over 5 weeks about capital punishment with peers who possessed varying perspectives about the issue. Prior to and after the DDs, students in both conditions wrote an argument about the same issue that had been discussed with their peers. Analyses of the essays focused on the presence of functional, nonfunctional, and nonjustificatory arguments (i.e., those either addressed or did not address the punishment's function, or lacked force because they appealed to sentiment), the degree to which arguments considered alternative perspectives, and qualitative changes in the types of arguments made before and after DDs.

Before instruction, the majority of students wrote functional arguments with a my-side bias, and a significant minority wrote nonjustificatory arguments. Statistical analyses were not reported, but it appeared that college students wrote more arguments that proposed alternative punishments than seventh and eighth graders. Analyses of the qualitative changes showed that DD students were more likely to show a positive progression (e.g., from nonfunctional or nonjustificatory to functional arguments) than the control condition. Furthermore, the most common types of change involved the use of metacognitive statements involving self- or other-reference, and a shift to the use of two-sided arguments. In the second study, Kuhn et al. (1997) sought to determine if a more limited intervention positively impacts students' written arguments. The experimental design paralleled the first study except that experimental students had a single telephone conversation and then collaborated over 5 days to write a 1- to 2-page paper about the issue. In short, there was no evidence about the benefits of this brief intervention for students' argumentative writing. Nevertheless, the findings from the first study suggest that more sustained DDs positively impact students' argumentative writing.

Reznitskaya et al. (2007) studied the effects of dialogic interaction on the argumentative writing of fourth- and fifth-grade students. Students in each grade were assigned to a collaborative reasoning (CR) condition, a CR-plus lessons condition, or the control condition. Students in the CR condition engaged in four face-to-face augmentative discussions about everyday social dilemmas. Students in the CR-plus lessons condition first received explicit instruction about argumentation delivered through two scripted lessons. During the lessons, they learned about the definition and purpose of arguments, as well as the use of reasons, counterarguments, and rebuttals. After the lessons, they participated in four sessions of CR. Students in the control condition received reading instruction. At the end of the intervention, all students were asked to respond to an interview about their argumentation knowledge, write an argumentative essay, and recall an argumentative text.

The researchers found that fourth and fifth graders in the CR condition wrote longer argumentative essays than students in the other two conditions. Additionally, fifth graders in the CR condition composed essays with more my-side reasons than students in the other conditions. In addition, fifth graders in the CR produced more counterarguments and rebuttals than those in the CR-plus lessons conditions, but paradoxically, those in CR and control conditions did not differ. Furthermore, the three conditions did not differentially affect the number of reasons in the fourth graders essays, although the direction of the effect was similar to that for fifth graders.

Reznitskaya's study seems to show that the CR-plus lessons condition did not improve students' written arguments. In fact, it appears that the lessons suppressed the production of counterarguments and rebuttals. However, the authors provided no information about the quality of the lessons or the degree to which they were implemented faithfully. Therefore, conclusions about their suppressive effects are speculative.

Kuhn and Crowell (2011) studied the implementation of a technology-supported dialogic debate intervention over 3 years. The researchers created argumentative topic cycles during which a topic was introduced, and students were then guided through dialogic activities designed to promote argumentative thinking. In the "pre-game" phase of the intervention, students worked with small same-side groups to generate, evaluate, and rank reasons for their side. At the end of year 1, students were also provided researcher-generated questions and answers to those questions for their topics. In years 2 and 3, students began asking their own questions, with coaches supplying answers to the questions. At the end of the pre-game phase, same-side groups would then focus on generating reasons for the alternative perspective and generate rebuttals for the alternative perspectives.

During the "game" phase of the intervention, pairs of students competed electronically against opposing-side students via Google Chat. The students debated each other and completed a reflection sheet between turns. These sheets guided students to identify and reflect on their arguments and their opponents' arguments, including possible counterarguments and rebuttals, in order to improve them. This was followed by the "endgame" phase of the intervention, during which students returned to their "pre-game" groups, reviewed their arguments, and participated in a "hot seat" debate during which each team member had 3 minutes to debate a team member from the opposing side. Students were then debriefed, and given points for effective argumentative moves and penalized for ineffective argumentative moves. The winning side was declared at the end of the activity. This phase ended with students writing individual argumentative essays on the topic.

Kuhn and Crowell (2011) analyzed the essays for the type and number of arguments that students produced and for whether the arguments addressed both perspectives. They also analyzed the number and types of students' questions during the pre-game phase of the intervention. Although control students engaged in teacher-led discussions about similar topics, and wrote significantly more essays on the topics over the course of the year than experimental students, the latter students wrote essays that contained significantly more arguments that addressed both perspectives. In fact, few control students wrote essays that addressed both sides. Additionally, experimental students generated significantly more questions related to the topics than those in the control group.

Moore and MacArthur (2012) studied whether evaluating other students' argumentative essays, as compared to observing other students evaluating the essays, impacted the fifth graders' revisions. Before the intervention, students wrote an argumentative essay about a controversial issue, and they were then randomly assigned to a reader, observer, or a control condition. In the reader condition, groups of four students read essays written by other fifth graders and engaged in discussions to evaluate their persuasiveness. In the observer condition, groups of four students first observed the reader group's discussions and then generated in discussion a list of criteria that made the essays persuasive. In both of these conditions, students were encouraged to answer specific questions about the essays' persuasiveness, and whether the writer gave good reasons for their standpoint and considered other perspectives. Finally, students in the control condition practiced writing persuasive essays. All students then revised their original essay, and next wrote and revised an argumentative essay about a different issue.

The authors found that the revised essays of students in the reader condition were of higher quality than those in the observer and control condition, which did not differ from each other. Furthermore, the revisions of students in the reader condition included more elements related to the alternative standpoint than the other conditions. These results suggest that reading an argumentative essay and discussing the qualities that make it persuasive support the revision process. It should be noted, however, that the treatment effect was not seen for either the first or second

drafts of an essay written to a different prompt; that is, the effect did not transfer. The authors speculated that the interventions' brevity might have been responsible for the absence of transfer.

Earlier we mentioned the importance of teaching students to apply normative standards to their written arguments and answering critical questions about the relevance of their argumentative strategies (Walton et al., 2008). Nussbaum and Edwards (2011) explored the effects of teaching seventh-grade social studies students to ask critical questions during dialogic interactions about controversial issues. Eight different controversies were discussed over the course of 20 weeks, and two additional controversies, for which there was no discussion, were used to assess the effects of the intervention. Three classrooms were involved in this study. In two of the classrooms, students were taught to use critical questions along with a graphic organizer to represent contrasting arguments about the controversies and to evaluate their strength. In the third classroom, students were taught to use the graphic organizer to represent different arguments, but they were not taught to ask the critical questions. The researchers were interested in whether the inclusion of critical questions led students to write more integrated arguments—that is, arguments that consider alternative perspectives and potential objections to their own perspective.

The researchers found that inclusion of the critical questions seemed to be associated with an increase in the number of arguments that weighed different perspectives. However, this effect did not always occur when the class discussions and the critical questions were unavailable. Furthermore, students in the critical questions condition did not seem to produce more arguments that explained how a resolution of a controversy should be designed to address different perspectives. The researchers expected to see greater use of design arguments by students in the critical questions condition because these arguments are inherently integrative. Finally, the researchers included a case study that illustrated how dialogic support with critical questions and the graphic organizer might impact one student's argumentative development. In total, the findings provide some evidence about the potential benefits of including critical questions in instruction for argumentative writing. However, instruction about using critical questions to evaluate the relevance of students' argumentative strategies was not provided. In fact, the argumentation strategies about which the critical questions could have been asked were not taught at all. In the absence of explicit instructional support, students may not acquire these skills (see Song & Ferretti, 2013).

On balance, the evidence suggests that dialogic support for argumentative writing can positively impact the quality of students' argumentative writing, including their ability to consider alternative perspectives. These effects are most clearly evident for older students who receive clear guidance about the discourse's purposes, information about the standards for evaluating the discourse, and extended opportunities to engage in dialogue about controversial issues. It appears that students begin to internalize this perspective-taking process when given multiple chances to consider other standpoints. In turn, this enables them to represent different viewpoints and to craft the constellation of propositions needed to increase the reasonableness of their arguments (van Eemeren et al., 1996).

CONCLUSIONS

We began by discussing some longstanding issues in the study of argumentation, drawing particular attention to its purposes, properties, and the critical standards that should be used to evaluate and improve its reasonableness. We noted that only a small fraction of American students write competent argumentative essays (National Center for Education Statistics, 2012). This finding is disappointing but unsurprising because argumentative writing is an intellectually challenging problem. Among other things, writers are expected to satisfy the context's rhetorical demands, draw on relevant knowledge, anticipate and address alternative perspectives, and apply critical standards to evaluate their arguments. The writer's ability to meet these challenges is further constrained by limitations on

processing capacities and the tendency to privilege one's perspective (my-side bias). Space limitations did not permit us to discuss other challenges, including limitations on discipline-specific knowledge. This is a serious omission because disciplinary contexts should frame students' discourse about academic controversies (Ferretti & De La Paz, 2011). Interested readers can consult Ferretti and Lewis (2013) for some empirical research about disciplinary arguments, and Klein, Arcon, and Baker (Chapter 16, this volume) for information about how writing can help students understand academic subjects (i.e., writing to learn). Despite this omission, the evidence we presented shows that capacity limitations and my-side bias can be mitigated by carefully designed interventions that include dialogic interactions and support for the writer's self-regulatory processes.

The self-regulatory and dialogic intervention research we reviewed shared many commonalities. These studies included experimental or quasi-experimental components in their research design. In general, these interventions were intended to support young and relatively naïve writers' production of argumentative essays that included genre-relevant elements and showed some consideration of alternative perspectives. Participants usually wrote in response to prompts about everyday controversies, that is, controversies about which the researcher presumed the writer's possession of relevant background knowledge. In most cases, students were given a persuasion goal, and the intended audience was a parent, teacher, principal, or some other adult authority figure. The possible influence of normative standards of critical argumentation on students' argumentative writing was rarely considered. This research rarely targeted the needs of older and more expert writers, or how interventions could be designed to support disciplinary argumentation.

Hopefully, the emphasis on the Common Core Standards will give impetus to research that addresses these issues because the Common Core draws attention to the importance of disciplinary argumentation. Researchers will surely wrestle with the challenges of supporting disciplinary argumentation, including how to ensure the acquisition of content knowledge and the discipline-specific standards that should be used to evaluate arguments. Research about disciplinary argumentation has a robust and relatively long history (e.g., Bazerman, 1988, 1992), and much of that research has used nonexperimental research paradigms. Researchers interested in designing self-regulatory and dialogic interventions for disciplinary argumentation would be wise to study that research.

We would be remiss if we concluded this chapter without commenting on some of the methodological features of the extant research about self-regulatory and dialogic interventions for argumentative writing. The self-regulatory studies were generally well designed, carefully implemented, and precisely measured. With few exceptions, the researchers' claims are supported by evidence collected under carefully controlled conditions. The dialogic intervention research we reviewed lacked the precision found in the self-regulation literature. Some studies assigned intact classes to conditions, but the data were analyzed at the student level. Many of the dialogic intervention studies failed to report data about quality of the discourse and its relationship to the quality of the argumentative writing. Finally, data about the fidelity of implementing dialogic interventions was never reported. We suspect this is because the dialogic research we reviewed generally did not employ instructional scripts, as is commonly done in self-regulatory intervention research. In fact, careful adherence to scripts may not always be possible with dialogic interventions because the participants should respond to their interlocutor's discursive moves. In short, dialogic interactions are difficult to control. For this reason, detailed analyses of the interlocutor's discourse moves will help inform conclusions about the impact of dialogic interventions on students' argumentative writing.

REFERENCES

Aristotle. (1991). *The art of rhetoric* (H. Lawson-Tancred, Trans.). London: Penguin Classics.

Bazerman, C. (1988). *Shaping written knowledge: The genre and activity of the experimental article in science.*

Madison: University of Wisconsin Press.

Bazerman, C. (1992). The interpretation of disciplinary writing. In R. H. Brown (Ed.), *Writing the social text: Poetics and politics in social science discourse* (pp. 31–38). New York: Walter de Gruyter.

Bereiter, C., & Scardamalia, M. (1987). *The psychology of written composition.* Hillsdale, NJ: Erlbaum.

Biancarosa, G., & Snow, C. E. (2006). *Reading next: A vision for action and research in middle and high school literacy: A report from the Carnegie Corporation of New York* (2nd ed). Washington, DC: Alliance for Excellent Education.

Common Core State Standards Initiative. (2010). *Common core state standards for English language arts and literacy in history/social studies, science, and technical subjects*. Retrieved from *www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf.*

De La Paz, S., & Graham, S. (1997). Strategy instruction in planning: Effects on the writing performance and behavior of students with learning difficulties. *Exceptional Children, 63*, 167–181.

De La Paz, S., & Graham, S. (2002). Explicitly teaching strategies, skills and knowledge: Writing instruction in middle school classrooms. *Journal of Educational Psychology, 94*, 687–698.

De La Paz, S., & Graham, S. (2005). Effects on historical reasoning instruction and writing strategy mastery in culturally and academically diverse middle school classrooms. *Journal of Educational Psychology, 97*, 139–156.

Dunn, J. (1988). *The beginnings of social understanding.* Cambridge, MA: Harvard University Press.

Felton, M. K., & Kuhn, D. (2001). The development of argumentative discourse skill. *Discourse Processes, 32*, 135–153.

Ferretti, R. P., Andrews-Weckerly, S., & Lewis, W. E. (2007). Improving the argumentative writing of students with learning disabilities: Descriptive and normative considerations. *Reading and Writing Quarterly, 23*, 267–285.

Ferretti, R. P., & De La Paz, S. (2011). On the comprehension and production of written texts: Instructional activities that support content-area literacy. In R. O'Connor & P. Vadasy (Eds.), *Handbook of reading interventions* (pp. 326–355). New York: Guilford Press.

Ferretti, R. P., & Lewis, W. E. (2013). Best practices in teaching argumentative writing. In S. Graham, C. A. MacArthur, & J. Fitzgerald (Eds.), *Best practices in writing instruction* (2nd ed., pp. 113–140). New York: Guilford Press.

Ferretti, R. P., Lewis, W. E., & Andrews-Weckerly, S. (2009). Do goals affect the structure of students' argumentative writing strategies? *Journal of Educational Psychology, 101*, 577–589.

Ferretti, R. P., MacArthur, C. A., & Dowdy, N. S. (2000). The effects of an elaborated goal on the persuasive writing of students with learning disabilities and their normally achieving peers. *Journal of Educational Psychology, 92*, 694–702.

Flower, L., & Hayes, J. R. (1980). The cognition of discovery: defining a rhetorical problem. *College Composition and Communication, 31*, 21–32.

Graham, S. (1990). The role of production factors in learning disabled students' compositions. *Journal of Educational Psychology, 82*, 781–791.

Graham, S. (1997). Executive control in the revising of students with learning and writing difficulties. *Journal of Educational Psychology, 89*(2), 223–234.

Graham, S., & Harris, K. R. (1989). Improving learning disabled students' skills at composing essays: self-instructional strategy training. *Exceptional Children, 56*, 201–214.

Graham, S., & Harris, K. R. (1997). It can be taught, but it doesn't develop naturally: Myths and realities in writing instruction. *School Psychology Review, 26*, 414–424.

Graham, S., & Harris, K. R. (2005). *Writing better: Effective strategies for teaching students with learning*

difficulties. New York: Brooks.

Graham, S., Harris, K. R., & McKeown, D. (2013). The writing of students with LD and a meta-analysis of SRSD writing intervention studies: Redux. In H. L. Swanson, K. Harris, & S. Graham (Eds.), *The handbook of learning disabilities* (2nd ed., pp. 405–438). New York: Guilford Press.

Graham, S., & MacArthur, C. (1988). Improving learning disabled students' skills at revising essays produced on a word processor: Self-instruction strategy training. *Journal of Special Education, 22*, 133–152.

Graham, S., MacArthur, C. A., Schwartz, S., & Page-Voth, V. (1992). Improving learning disabled students' compositions using a strategy involving product and process goal setting. *Exceptional Children, 58*, 322–334.

Graham, S., & Perin, D. (2007). *Writing next: Effective strategies to improve writing of adolescents in middle and high schools*. New York: Carnegie Corporation.

Harris, K. R., & Graham, S. (1985). Improving learning disabled students' composition skills: Self-control strategy training. *Learning Disability Quarterly, 8*, 27–36.

Harris, K. R., & Graham, S. (1992). Self-regulated strategy development: A part of the writing process. In M. Pressley, K. R. Harris, & J. T. Guthrie (Eds.), *Promoting academic competence and literacy is school* (pp. 277–309). San Diego, CA: Academic Press.

Harris, K. R., Graham, S., MacArthur, C. A., Reid, R., & Mason, L. (2011). Self-regulated learning processes and children's writing. In B. Zimmerman & D. H. Schunk (Eds.), *Handbook of self-regulation of learning and performance* (pp. 187–202). New York: Routledge.

Kiuhara, S. A., O'Neill, R. E., Hawken, L. S., & Graham, S. (2012). The effectiveness of teaching 10th-grade students *STOP, AIMS, AND DARE* for planning and drafting persuasive text. *Exceptional Children, 78*, 335–355.

Kuhn, D., & Crowell, A. (2011). Dialogic argumentation as a vehicle for developing young adolescents' thinking. *Psychological Science, 22*, 545–552.

Kuhn, D., Shaw, V., & Felton, M. (1997). Effects of dyadic interaction on argumentative reasoning, *Cognition and Instruction, 15*, 287–315

MacArthur, C. A. (2012). Evaluation and revision processes in writing. In V. W. Berninger (Ed.), *Past, present, and future contributions of cognitive writing research to cognitive psychology* (pp. 461–483). New York: Psychology Press.

MacArthur, C. A., & Lembo, L. (2009). Strategy instruction in writing for adult literacy learners. *Reading and Writing, 22*, 1021–1032.

MacArthur, C. A., Philippakos, Z. A., & Ianetta, M. (2015). Self-regulated strategy instruction in college developmental writing. *Journal of Educational Psychology*. Available at *http://dx.doi.org/10.1037/edu0000011*.

MacArthur, C. A., Schwartz, S., & Graham, S. (1991). Effects of a reciprocal peer revision strategy in special education classrooms. *Learning Disabilities Research and Practice, 6*, 201–210.

McCutchen, D. (2011). From novice to expert: Implications of language skills and writing- relevant knowledge for memory during the development of writing skill. *Journal of Writing Research, 3*, 51–68.

Midgette, E., Haria, P., & MacArthur, C. A. (2008). The effects of content and audience awareness goals for revision on the persuasive essays of fifth- and eighth-grade students. *Reading and Writing, 21*, 131–151.

Moore, N., & MacArthur, C. A. (2012). The effects of being a reader and of observing readers on fifth grade students' argumentative writing and revising. *Reading and Writing, 25*, 1449–1478.

National Center for Education Statistics. (2012). *The Nation's Report Card: Writing 2011* (NCES 2012-470). Washington, DC: Institute for Education Sciences, U.S. Department of Education.

Newell, G. E., Beach, R., Smith, J., & VanDerHeide, J. (2011). Teaching and learning argumentative reading and writing: A review of research. *Reading Research Quarterly, 46*, 273–304.

Nussbaum, E. M., & Edwards, O. V. (2011). Critical questions and argument stratagems: A framework for enhancing and analyzing students' reasoning practices. *Journal of the Learning Sciences, 20*, 443–488.

Nussbaum, E. M., & Kardash, C. M. (2005). The effects of goal instructions and text on the generation of counterarguments during writing. *Journal of Educational Psychology, 97*, 157–169.

Page-Voth, V., & Graham, S. (1999). Effects of goal-setting and strategy use on the writing performance and self-efficacy of students with writing and learning problems. *Journal of Educational Psychology, 91*, 230–240.

Perkins, D. N., Faraday, M., & Bushey, B. (1991). Everyday reasoning and the roots of intelligence. In J. F. Voss, D. N. Perkins, & J. W. Segal (Eds.), *Informal reasoning and education* (pp. 83–105). Hillsdale, NJ: Erlbaum.

Reznitskaya, A., Anderson, R. C., & Kuo, L. J. (2007). Teaching and learning argumentation. *Elementary School Journal, 107*, 449–472.

Sexton, M., Harris, K. R., & Graham, S. (1998). Self-regulated strategy development and the writing process: Effects on essay writing and attributions. *Exceptional Children, 64*, 295–311.

Scardamalia, M., & Bereiter, C. (1986). Research on written composition. In M. C. Wittrock (Ed.), *Handbook of Research on Teaching* (pp. 778–803). New York: Macmillan.

Shanahan, T., & Shanahan, C. (2008). Teaching disciplinary literacy to adolescents: Rethinking content-area literacy. *Harvard Educational Review, 78*, 40–59.

Song, Y., & Ferretti, R. P. (2013). Teaching critical questions about argumentation through the revising process: Effects of strategy instruction on college students' argumentative essays. *Reading and Writing, 26*, 67–90.

Torrance, M., & Galbraith, D. (2009). The processing demands of writing. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 67–80). New York: Guilford Press.

van Eemeren, F. H. (2010). *Strategic maneuvering in argumentative discourse*. Amsterdam: John Benjamins.

van Eemeren, F. H., & Grootendorst, R. (2004). *A systematic theory of argumentation: The pragma-dialectical approach*. Cambridge, UK: Cambridge University Press.

van Eemeren, F. H., Grootendorst, R., & Henkemans, F. S. (1996). *Fundamentals of argumentation theory: A handbook of historical backgrounds and contemporary developments*. Mahwah, NJ: Erlbaum.

van Eemeren, F. H., Grootendorst, R., & Henkemans, F. S. (2002). *Argumentation: Analysis, evaluation, presentation*. Mahwah, NJ: Erlbaum.

van Eemeren, F. H., Grootendorst, R., Jackson, S., & Jacobs, S. (1993). *Reconstructing argumentative discourse*. Tuscaloosa: University of Alabama Press.

van Eemeren, F. H., & Houtlosser, P. (2009). Strategic maneuvering: Examining argumentation in context. In F. H. van Eemeren (Ed.), *Examining argumentation in context* (pp. 1–24). Cambridge, UK: Cambridge University Press. Amsterdam: John Benjamins.

Walton, D. N. (1992). *Plausible argument in everyday conversation*. Albany, NY: State University of New York Press.

Walton, D., Reed, C., & Macagno, F. (2008). *Argumentation schemes*. New York: Cambridge University Press.

Zimmerman, B., & Risemberg, R. (1997). Becoming a self-regulated writer: A social cognitive perspective. *Contemporary Educational Psychology, 22*, 73–101.

CHAPTER 21

Computer-Based Writing Instruction

Laura K. Allen, Matthew E. Jacovina, and Danielle S. McNamara

The development of strong writing skills is a critical (and somewhat obvious) goal within the classroom. Individuals across the world are now expected to reach a high level of writing proficiency to achieve success in both academic settings and the workplace (Geiser & Studley, 2001; Powell, 2009; Sharp, 2007). Unfortunately, strong writing skills are difficult to develop, as they require individuals to coordinate a number of cognitive skills and knowledge sources through the process of setting goals, solving problems, and strategically managing their memory resources (Flower & Hayes, 1980; Hayes, 1996). Given the difficulty of this process, students frequently underachieve on national assessments of writing proficiency (National Assessment of Educational Progress, 2007, 2011).

The successful acquisition of this complex set of skills largely depends on the instruction and feedback provided to students as they develop. Previous research suggests that writing proficiency is best enhanced through strategy instruction (Graham & Perin, 2007), along with extended practice and individualized feedback (Kellogg & Raulerson, 2007). Importantly, curricula aimed to meet these goals can be extremely difficult to implement. This method of writing instruction demands a significant amount of time from teachers, ranging from the time required to prepare materials and instructional content to the process of reading, editing, and providing individualized feedback on students' essays. Unfortunately, teachers rarely have enough time to devote to this process, as they are faced with increasingly large class sizes and, as a consequence, have reduced time for classroom instruction and planning (The National Commission on Writing, 2004).

In response to these issues surrounding effective writing pedagogy, there has been an increased effort to develop computer-based systems for writing assessment and instruction (Shermis & Burstein, 2003, 2013). These systems vary widely in their primary purposes, from the automated scoring of student essays to the provision of formative feedback or the explicit instruction of writing knowledge and strategies (Dikli, 2006; Graesser & McNamara, 2012; Roscoe, Allen, Weston, Crossley, & McNamara, 2014; Weigle, 2013; Xi, 2010). Despite the importance of writing strategy *instruction* and *feedback*, the majority of research conducted on this topic has focused on the development of computer-based systems that can provide reliable and valid scores to students' essays. However, more recently, researchers have placed a stronger emphasis on the development of computer-based systems that incorporate more instructional materials, such as formative feedback and explicit instruction on the writing process (Roscoe et al., 2011). In this chapter, we provide an overview of computer-based tools and techniques that are currently being used to support writing instruction and practice. Additionally, we discuss more recent advances in this field with suggestions for future research and development.

AUTOMATED ESSAY SCORING

Automated essay scoring (AES) systems are the most prominent among computer-based writing tools. AES systems are technologies that allow computers to automatically evaluate the content, structure, and quality of written prose (Shermis & Barrera, 2002; Shermis & Burstein, 2003, 2013). In line with this goal, AES has been advertised as an efficient means through which large corpora can be rapidly scored, enabling writing instructors to assign more writing practice to their students without significantly adding to their workload (Dikli, 2006; Page, 2003; Shermis & Burstein, 2003, 2013). Further, large-scale testing services utilize AES systems to score writing tasks for high-stakes writing assessments, such as the Graduate Record Examination (GRE) or the Test of English as a Foreign Language (TOEFL; Dikli, 2006). Importantly, these systems do not provide formative feedback on students' essays, nor do

they include instructional materials. Rather, their sole purpose is to serve as a valid and reliable alternative to human scoring that is both cost and time effective (Bereiter, 2003; Myers, 2003; Page, 2003).

AES Techniques

AES systems employ a diverse set of techniques to assign holistic grades to students' writing, including statistical modeling, Bayesian text classification, natural language processing (NLP), artificial intelligence (AI), and latent semantic analysis (LSA) (Deane, 2013; Dikli, 2006; Shermis & Burstein, 2003). In general, these methods all rely on the extraction of linguistic and semantic characteristics of a text to calculate essay scores. However, each AES system differs slightly in terms of the specific scoring methods and techniques employed. In particular, the most common techniques used by AES systems are those that leverage NLP techniques and those that utilize LSA.

e-rater (Burstein, 2003), IntelliMetric (Rudner, Garcia, & Welch, 2006), and the Writing Pal (W-Pal) (McNamara, Crossley, & Roscoe, 2013) are a few examples of computer-based writing systems that employ AES algorithms that rely on NLP techniques to score essays. NLP approaches to essay scoring are based on the assumption that essay quality can be evaluated using specific and measurable linguistic features (e.g., lexical diversity, average sentence length, referential cohesion) that are calculated using automated text analysis tools. By using a corpus of essays that have been scored by expert raters, a statistical model is built that combines linguistic features to create algorithms that assign scores to essays. These computational algorithms are tuned to match the expert raters' scores for the essays in the training corpus using statistical techniques such as machine learning algorithms, regression techniques, or Bayesian probabilities. The resulting algorithm is then applied to essays outside the training corpus (which then need not be scored by expert raters) to assign essay scores automatically.

The e-rater system, for example, uses 11 features of student essays (9 features related to writing properties and 2 related to content appropriateness) to assign holistic scores to student essays (Ramineni, Trapani, Williamson, Davey, & Bridgeman, 2012). Each of these essay features encompasses at least one (but often more) underlying subfeature. For instance, the *style* feature contains subfeatures related to word repetition, as well as the use of inappropriate words and phrases. Within the e-rater system, each of these 11 features is assigned a weight that is determined either by its construct relevance or through the use of regression models that predict expert ratings of essays (Quinlan, Higgins, & Wolff, 2009). Holistic essay scores are then calculated using a weighted average of these feature scores (Enright & Quinlan, 2010).

Similarly, the AES engine within W-Pal assigns essay scores based on the calculation of numerous linguistic and semantic text features using Coh-Metrix (McNamara & Graesser, 2012; McNamara, Graesser, McCarthy, & Cai, 2014) and the Writing Analysis Tool (WAT; McNamara et al., 2013). These indices are related to both lower-level aspects of student essays, such as the number of words or number of paragraphs in a text, and higher-level text features, such as semantic cohesion or the use of certain rhetorical devices. The algorithms implemented within W-Pal have been based on a number of different techniques (McNamara et al., 2013), and can be changed based on context or the age range of the students. One difference between W-Pal and other approaches such as e-rater is that W-Pal algorithms are built to generalize across topics or essay prompts. That is, the algorithms do not include features that are specific to an essay prompt, such as keywords, and the algorithms are constructed using a corpus of essays that vary in terms of their topic.

Another novel approach used within W-Pal is the use of hierarchical classification (McNamara, Crossley, Roscoe, Allen, & Dai, 2015). Accordingly, different linguistic features are combined to classify essays at different levels. At the first level, essays are divided into two groups of longer and shorter essays. The underlying assumption is that different linguistic features should predict the quality of longer versus shorter essays. The quality of the essays is

then predicted by dividing the essays into subgroups or hierarchical levels. In the end, each essay score (e.g., 1–6) is based on a different set of algorithms that are iteratively applied, each using different linguistic features as well as different weights.

In contrast to NLP-based AES systems, the intelligent essay assessor (IEA; Landauer, Laham, & Foltz, 2003) utilizes LSA to score essays. LSA is a statistical technique that utilizes large corpora of documents to develop representations of world knowledge (Landauer, McNamara, Dennis, & Kintsch, 2007). Documents are represented in matrices, where each row represents a word and each column represents the context (i.e., the document) of that word. Accordingly, the individual cells represent the frequency of a word in a given context. A mathematical technique called singular value decomposition (SVD) is then used to reduce the number of columns in the matrix while maintaining the structure among the rows. Words can then be compared by calculating the cosine of the angle between the vectors formed by two rows. Cosine values approaching 1.0 represent high similarity between words, and values approaching 0 represent high dissimilarity.

The assumption of LSA-based scoring engines is that word meanings are determined by their co-occurrence with other words. Thus, it should be possible to extract semantic information from texts using word co-occurrence information from other texts. Similar to NLP-based scoring engines, IEA relies on a corpus of expert-scored essays to provide automated scores of new essays. The difference, however, is that the IEA system relies on *semantic similarity* among texts to assign essay scores, rather than linguistic text properties (Landauer et al., 2003; Rudner & Gagne, 2001; Streeter, Psotka, Laham, & MacCuish, 2004). Thus, essays are assigned high scores to the degree that they are semantically similar to other essays from the training set. Essays that are similar to higher-quality essays receive a high score, whereas essays that are more similar to lower-quality essays receive a lower score. One potential advantage of LSA-based scoring engines is that they do not require automated taggers and parsers, which are computationally heavy and difficult to implement. Further, these engines do not rely on weighted statistical models; instead, the original corpus serves as the model for essay quality. A disadvantage is that a corpus of scored essays is required for each essay prompt or essay topic, though this corpus can usually be much smaller than that required to construct a reliable statistical model using the linguistic features of the essays.

AES Reliability and Accuracy

Across these (and other) various techniques, AES systems tend to report fairly high reliability and accuracy (Attali, 2004; Landauer, Laham, Rehder, & Schreiner, 1997; Landauer et al., 2003; Warschauer & Ware, 2006). Specifically, expert human and computer scores tend to correlate between r = .80 and .85, which is similar to the range found between two human raters (Landauer et al., 2003; Rudner et al., 2006; Warschauer & Ware, 2006). For instance, Attali and Burstein (2006) assessed the reliability and true score correlations between human scores and e-rater scores. They found that e-rater was *more* reliable than a single human and exhibited a true score correlation with a human rater at rho = .97.

In addition to correlation analyses, the reliability and accuracy of AES systems are also evaluated according to the percent of agreement between raters. Percent agreement is commonly reported in two forms: perfect agreement and adjacent agreement. Perfect agreement refers to an exact match between human and automated scores, whereas adjacent agreement refers to scores that are within 1 point of each other. Studies examining the accuracy of AES systems tend to report perfect agreement between 40 and 60% and adjacent agreement between 90 and 100% (Attali & Burstein, 2006; Dikli, 2006; McNamara et al., 2013; Rudner et al., 2006). Rudner and colleagues (2006), for instance, examined the accuracy of IntelliMetric in two separate studies and reported perfect agreement between 42 and 65% and adjacent agreement between 92 and 100%. Attali (2008) compared the agreement between two human

raters to the agreement between e-rater and one human rater. He found that the two human raters had 56% perfect agreement and 97% adjacent agreement, whereas e-rater and one human rater had 57% perfect agreement and 98% had adjacent agreement. Overall, the results of these and other studies point to the strength of AES systems in their ability to provide reliable and accurate scores of essay quality.

Criticisms of AES

Despite the *accuracy* of many AES systems, the use of these systems on standardized assessments and in school classrooms has been met with a great deal of resistance (Condon, 2013; Deane, 2013). Some researchers have suggested that the systems do not assign scores with adequate accuracy, citing analyses that have shown systems to systematically over- or underestimate human ratings of essay quality (Wang & Brown, 2007). Further criticisms of AES systems have centered on students' ability to "game the system" by using their knowledge of the computerized scoring process. Powers, Burstein, Chodorow, Fowles, and Kukich (2002) explored this issue and found that students could cheat the e-rater system through the repetition of the same paragraph throughout the text, the use of complex sentence structures, and the inclusion of relevant content words. Thus, even if an essay was illogical, it could receive a high score if the linguistic features of the essay mirrored those in the algorithm.

Additional criticisms have centered on the content of the essays written in the AES systems. Importantly, not all genres of writing will be scored accurately using the same AES algorithms. For instance, essays that require students to integrate multiple assigned documents have specific scoring considerations that are different from argumentative SAT-style essays. Britt, Wiemer-Hastings, Larson, and Perfetti (2004) used several techniques to identify problems in students' source-based essays. As an example, they used LSA to determine if sentences from students' papers overlapped with any sentences from the assigned documents. If the LSA cosine threshold was not met for at least three different sources, students' papers were flagged as not integrating an appropriate number of sources—and those students would subsequently receive feedback on how to integrate sources. Although this approach presents a strong foundation on which to begin to study source-based writing, it is evident that the automated evaluation of certain writing genres may be more complex and thus require a great deal more research and analysis to be considered valid and reliable.

Perhaps the most significant criticism met by AES systems pertains to the validity of the essay quality assessments (Cheville, 2004, Clauser, Kane, & Swanson, 2002; Condon, 2013; Deane, 2013; Ericsson & Haswell, 2006). As previously mentioned, many AES systems rely heavily on the use of linguistic features to assess essay quality (McNamara, Crossley, & McCarthy, 2010). This list of potential features is expansive—ranging from lower-level text information, such as sentence length and word frequency, to high-level features, such as rhetorical strategies and semantic cohesion (Landauer et al., 2007; McNamara et al., 2014; Shermis & Burstein, 2003; Tausczik & Pennebaker, 2010). Using these tools, researchers have learned a great deal about the linguistic features that relate to higher essay quality, such as elaboration, organization, and lexical sophistication (Deane, 2013). However, AES systems do not currently have the capability of detecting more subtle and subjective features of students' essays. For instance, what can linguistic essay features tell us about students' creativity or the depth and development of their ideas and arguments? This and similar questions remain to be answered. In general, critics of AES tend to emphasize the point that these automated systems fail to measure *meaningful* aspects of text; rather, they only measure an extremely restricted portion of writing proficiency (Deane, 2013).

AUTOMATED WRITING EVALUATION

In contrast to AES systems, automated writing evaluation (AWE) systems provide students with feedback on their writing (Crossley, Varner, Roscoe, & McNamara, 2013; Grimes & Warschauer, 2010). The two major benefits of AWE systems is that they provide opportunities for students to practice writing, as well as to receive summative and formative feedback on their essays—all without the input of an instructor. AES elements of AWE systems provide the automated *scoring* of students' essays; however, AWE systems extend beyond this assessment purpose by providing writing instruction and feedback to students, as well as features for teachers that can aid in classroom management (e.g., class rosters or grade books). A number of these AWE systems have now been developed for use in writing classrooms, such as Criterion (scored by the e-rater AES system), MyAccess (scored by IntelliMetric), WriteToLearn (scored by Intelligent Essay Assessor), and WPP Online (scored by PEG).

Deliberate Writing Practice

One of the primary benefits of AES and AWE systems is that they provide more opportunities for students to practice writing. Engaging in extended deliberate practice (Ericsson, Krampe, & Tesch-Römer, 1993) is considered necessary for the development of successful writing skills (Johnstone, Ashbaugh, & Warfield, 2002; Kellogg & Raulerson, 2007), and, according to Kellogg and Raulerson (2007)'s review of the literature, this development takes approximately 10 years of practice. Further, Kellogg and Raulerson suggest that the *type* of writing practice students undertake is critical for their success. They warn against requiring "marathon" writing sessions. Instead, they suggest that writing practice must be *deliberate* in that students develop clear goals and receive formative feedback on their writing.

Unfortunately, given increasing class sizes, it is unreasonable to expect teachers to provide useful feedback to each student across multiple writing assignments. Given continued advancements in AWE scoring and feedback, computer-based writing systems may be able to act as supplements to traditional classroom instruction (Roscoe et al., 2014). Specifically in the case of AWE systems, students are afforded the opportunity to practice holistic essay writing. In these systems, students can complete as many writing assignments as they choose and, for each, receive feedback specific to the problems present in their essays. Further, students can take this feedback and revise their essays based on the suggestions provided by the system. This revision process allows students to engage in the iterative writing process without having to wait an extended period of time for input from the teacher (Roscoe et al., 2011; Roscoe, Varner, Crossley, & McNamara, 2013; Shute, 2008).

In addition to providing immediate scoring and feedback during practice, computer systems can help to promote students' persistence. Grimes and Warschauer (2010), for example, examined the use of the AWE MyAccess in middle schools over a 3-year period. Teachers reported that students using the system wrote more often, demonstrated greater autonomy in their writing development, and were more motivated to engage in writing practice. Among their explanations for these benefits, Grimes and Warschauer indicated that submitting early essay drafts to MyAccess had a lower risk than submitting an essay to the teacher. Instead of being judged by human graders—perhaps especially by the teacher who would be assigning the grade to the final product—the computer offered students helpful, yet unthreatening, feedback.

Formative Feedback

One of the most crucial components of computer-based writing instruction is the ability of the computer to provide accurate and formative feedback on students' writing. Because of the substantial effort required from instructors to provide writing feedback and guide students to effective practice activities based on that feedback, AWE systems

can be attractive educational tools. One important question, however, regards the degree to which computer-based writing assessments enhance students' writing quality in the context of classroom instruction. A recent meta-analysis by Graham, Hebert, and Harris (2015) investigated the benefits of formative writing assessments directly tied to classroom instruction. Their analysis indicated that providing automated feedback to students significantly enhanced the quality of their writing, yielding an average-weighted effect size of 0.38. These findings support the notion that computer-based writing systems have the potential to improve students' writing, particularly if they provide formative feedback that is directly tied to instruction.

An inherent advantage of computer-based systems is the speed with which feedback can be delivered to students. Providing immediate formative feedback in a computer-based system can help students identify their strengths and weaknesses, keep them engaged in the learning process, and improve their learning outcomes (Gikandi, Morrow, & Davis, 2011). By contrast, students often receive feedback only on finished work in the context of more traditional classroom instruction. When feedback is delivered after students have moved on to a new assignment or topic, they are less likely to devote attention to understanding how that feedback could usefully improve their future writing (Frey & Fisher, 2013). Despite the clear advantage of immediate feedback, however, several challenges face computer-based writing systems in providing students with beneficial writing feedback (Roscoe et al., 2011; Shute, 2008). Such systems must present appropriate types of feedback, and must also offer methods that can address student weaknesses. AWE systems must also be designed such that feedback messages clearly relate to a student's work. Systems that provide generic feedback messages in response to students' essays are less effective at guiding students' revision process and teaching skills that can be applied during future writing (Chen & Cheng, 2008).

Despite the *importance* of feedback in computer-based writing systems, little research has been conducted to examine the usability and most effective forms of automated feedback (Roscoe et al., 2011; Roscoe et al., 2014). Traditional computer-based writing software often provides low-level feedback by focusing on the mechanical and grammatical errors in student essays. Although this type of feedback may improve the readability of students' writing, it does little to improve their overall writing skills (Crossley, Kyle, Allen, & McNamara, 2014; Graham & Perin, 2007). In line with critiques concerning the validity of meaningfulness of automated essay scores, the provision of higher-level feedback can provide strategies and techniques for writing that should ultimately prove more useful than lower-level feedback, particularly for developing writers. To address concerns about the potential usefulness of feedback, the W-Pal system provides students with high-level feedback that focuses on actionable strategies that students can use to revise their essays (Roscoe, Varner, et al., 2013). For example, if W-Pal's feedback algorithm classifies a student's argumentative essay as being poorly structured, it might provide suggestions about how to organize an essay using flowcharts that can visualize the structure of an essay.

INTELLIGENT TUTORING SYSTEMS FOR WRITING

Intelligent tutoring systems (ITSs) currently provide the most sophisticated form of computer-based writing instruction. ITSs are computer-based programs that have been designed to provide individualized instruction and feedback to students based on their needs. In well-defined domains such as mathematics and physics, ITSs have had success in modeling what students need to know and what they (seem to) actually know, and in providing specific problem sets and feedback that adapt to their needs based on their performance (Beal, Arroyo, Cohen, & Woolf, 2010; Graesser et al., 2004). In fact, ITSs have had similar success in improving learning outcomes as human tutors (VanLehn, 2011). The architecture of a complete ITS includes an expert model, a student model, and tutorial strategies (Neuwirth, 1989). However, no system is perfectly adaptive, and even the most efficacious systems are

continuously working to improve the implementation of these three components. For an ill-defined domain, such as writing, the challenge to provide personalized and adaptive instruction and feedback becomes even greater. Creating an expert model for how to compose a well-reasoned argumentative essay, for instance, is more complex than creating an expert model for how to solve a system of equations. Likewise, determining where a student is failing is more difficult for composition than mathematical problem solving.

Our discussion of the current state of AWE systems has already forecasted the major advancements in ITSs designed to improve students' writing, as well as many of the weaknesses that future work will attempt to address. Algorithms are built using expertly graded writing samples that can allow the accurate scoring of student writing. Additionally, these algorithms can identify the strengths and weaknesses of a given student's work. Together, these capabilities can be used by ITSs to build expert and student models.

Whereas AWE software is often presented as standalone software providing the opportunity to write essays and receive feedback, an ITS can offer a suite of instructional and practice lessons, with the AWE embedded within the system. ITS software can respond to several challenges in the writing domain, namely, the need for increased use of strategy instruction and strategy practice. Because a primary goal of educators is to provide formative assessment, a successful ITS for writing must be able to provide students with information that can guide their future composition. Thus, beyond what an AWE offers, an ITS for writing aims to deliver a more complete tutorial experience, providing students with writing strategies and goals (Roscoe & McNamara, 2013).

In the following sections, we describe how an ITS for writing can provide strategy instruction, promote extended practice, provide higher-level feedback, and individualize instruction to each student. This is not a comprehensive list of the desirable features of an ITS for writing. However, they represent a synergistic set of features that highlight how an ITS can provide a valuable educational package for adolescent writers.

Strategy Instruction

A crucial component of writing instruction is teaching strategies to students. In meta-analyses, strategy instruction is consistently shown to be one of the most effective means of improving adolescent writing (Graham, 2006; Graham & Perin, 2007). The strategy instruction included in these meta-analyses focuses on teaching explicit strategies for planning, revising, and/or editing an essay. Fidalgo, Torrance, and García (2008), for example, developed an intervention called cognitive self-regulation instruction (CSRI) that taught strategies for planning and revising. Two years after completing the CSRI, students' writing products and writing process differed from that of control students who did not receive the intervention. Students who received the training produced higher-quality texts that were better structured, and they reported spending more time outlining their writing during planning. Moreover, CSRI students were less likely to report a lack of motivation, and seemed to have higher writing self-efficacy, making fewer negative comments about their writing. Overall, writing strategy instructions appears to support long-lasting benefits to writing, influencing not only the overall quality of students' essays, but also their writing process (Braaksma, Rijlaarsdam, van den Bergh, & van Hout-Wolters, 2004; Torrance, Fidalgo, & García, 2007) and motivation to write (Graham, Harris, & Mason, 2005).

ITSs that intend to act as an effective learning tool for the entire writing process should therefore include strategy instruction. One approach to this goal is to use pedagogical agents to deliver instructional lessons that explain writing strategies and provide examples of how the strategies can be used while planning, writing, or revising (Dai, Raine, Roscoe, Cai, & McNamara, 2011). In W-Pal, for example, animated agents explain several writing strategies throughout a series of eight modules corresponding to prewriting, writing, and revising. The conclusion building module presents the *RECAP* strategy, which advises writers to *r*estate their thesis, *e*xplain how their thesis was

supported, *c*lose the essay, *a*void new arguments, and *p*resent their ideas in an interesting way. For each piece of advice, an animated agent explains the strategy's purpose and meaning and provides an example of how it can be implemented. For example, the lesson on restating the essay's thesis suggests paraphrasing strategies to change particular thesis statements from the introduction to fit into the conclusion.

Providing computer-based strategy instruction on its own is likely to have a positive influence on students' writing, but an ITS affords instructional designers additional opportunities to increase its effectiveness. For example, students benefit when they are aware that learning the presented strategies is important and when they receive feedback about how well they have learned the strategies (Graham & Perin, 2007). An ITS is able to provide tests of strategy acquisition that emphasize strategies and provide performance feedback, in addition to the holistic writing practice provided by traditional AWE systems.

Strategy instruction also provides a context for which formative feedback can be delivered in a more meaningful way. To be effective, formative feedback should relate to information that students are learning (Graham et al., 2015), and ITSs can serve as an environment where this instruction and feedback can be integrated. W-Pal, for instance, provides essay feedback directly based on lesson videos and practice games. Students who are unsure about how to implement suggested strategies into their revisions and future writing are able to reengage with these materials. Students who receive feedback that their essay is unstructured might watch a lesson video on creating outlines and flowcharts, or play a practice game in which they unscramble pieces of someone else's outline, learning how to identify and organize important pieces of evidence.

Yet, even an ITS that provides timely, appropriate feedback that is supplemented by content within the system can be ineffective for certain learners. Some students are simply going to ignore feedback messages and will fail to adapt their writing (Wingate, 2010). But an ITS should not, in turn, ignore these students. Instead, a successful system should identify profiles of behavior and adjust instruction accordingly. Although no current ITS for writing instruction is able to do this satisfactorily, we discuss future avenues for this research later in this chapter. In particular, we define the goals for writing-based ITSs and describe how researchers might begin to approach such an overwhelming, yet clearly important, objective.

Specialized Modes of Writing Practice

A key component of ITSs is their ability to provide multiple forms of practice. Unlike AWE systems, which only provide holistic essay practice, ITSs can provide writing practice along with component-based practice to increase students' writing proficiency. In W-Pal, for example, students have the opportunity to engage in holistic essay practice, where they write entire SAT-style persuasive essays. Additionally, they are able to practice specific strategies they have learned in lesson videos in strategy-specific practice sections (Allen, Crossley, Snow, & McNamara, 2014; Roscoe & McNamara, 2013). After viewing instructional videos on conclusion building, students can engage in practice that requires them to identify problematic implementations of conclusion writing strategies, and to write conclusions to essays. In both cases, students receive feedback and are referred back to the lesson videos for additional help.

In addition to offering practice at multiple levels of specificity, ITSs can also add certain elements to increase motivation and persistence among students. Because students often become bored by extended practice in traditional ITSs, developers have begun to create game-based learning environments that leverage students' enjoyment of gaming (Jackson & McNamara, 2013). W-Pal uses game-based practice to encourage students' understanding of the writing strategies taught in the system (Allen, Crossley, et al., 2014; Roscoe, Brandon, Snow, & McNamara, 2013). For example, *Speech Writer* requires students to help a friend rewrite a speech he is giving for the debate team.

While doing so, students indicate which strategies they are using to fix the speech. Students then receive points based on how well they implemented the strategies while editing the speech. The simple narrative provides a context for writing practice, and the points system provides feedback and can motivate students to play again to improve their score. Findings from high school students demonstrated the efficacy of engaging with the entire W-Pal system, including game-based strategy practice such as Speech Writer, compared to engaging solely in holistic essay writing (Allen, Crossley, et al., 2014; see also Roscoe & McNamara, 2013). Game-based strategy practice offers a concrete motivation for students to understand and remember strategies, while providing frequent feedback and performance measures through game scores and achievements.

Mounting evidence across educational domains suggests that well-designed game-based practice can be effective at increasing students' learning outcomes (Wouters, van Nimwegen, van Oostendorp, & van der Spek, 2013). A successful educational game can promote a "game cycle" in which players interact with the game (e.g., editing a text in Speech Writer), receive feedback, and are motivated to reengage based on their favorable judgments of the game (Garris, Ahlers, & Driskell, 2002). Games that require students to write and use writing strategies can be used to help meet Kellogg and Raulerson's (2007) goal of extended writing practice. Thus, when educational games are combined with more traditional writing practice within an ITS, students are able to engage in a variety of practice modes to improve their understanding of writing strategies and their composition skills. Of course, for practice to be optimally effective, students must receive timely, accurate, and appropriate feedback and have resources available to remedy their weaknesses. Notably, however, determining the appropriateness of feedback for an individual student is a considerable challenge. Next, we discuss how an ITS might individualize students' experience within a system to provide more effective writing instruction.

Individualizing Instruction

According to VanLehn (2006), to be considered a true ITS, a system should offer access to content and assistance in a way that is suitable for each student's knowledge state and the system's task domain. Within a given task, the system should behave appropriately in terms of *what type* of feedback and assistance should be given to a student, *when* it should be given, and *how* it should be given. Above, we described how feedback might be tailored and delivered to individual students based on the content of their writing, but we posed the problem of students who disregard that feedback. This problem can be decomposed into two issues: how to identify students who are not benefiting from feedback, and how to present learning materials and feedback in an alternative format.

Although the complex nature of assessing writing compared to other domains (e.g., math) is often described as a challenge, writing samples also provides an abundance of information about students that can help guide the adaptive behavior of an ITS. As NLP algorithms are refined and become more successful at identifying weaknesses in students' writing, comparisons between drafts of an essay and its revision, and even between an essay and subsequent writing, can begin to assess the success students have in following suggestions from feedback messages. If students are not benefiting from the default method of feedback delivery, the system should try something else. Existing ITSs already have multiple formats of instruction, including lesson videos and practice activities; if a student fails to respond to written feedback messages but scores highly on practice games, the system might assign an appropriate strategy game instead.

Much additional research needs to be conducted before seemingly straightforward methods of individualizing writing instruction and feedback (such as above) can be effectively implemented. For example, forcing activities on students is likely to reduce their perceived control over the system, which could lead to fewer positive emotional responses (Pekrun, 2006). Therefore, researchers must first identify system designs that can subtly encourage

students to complete certain activities without overtly removing students' ability to control the system. Additional research must focus on how to analyze students' performance and behaviors within systems as a means to assess their learning styles and instructional needs in less intrusive ways (e.g., Snow, Likens, Jackson, & McNamara, 2013). Through such work, systems will be able to obtain vital information about students without disrupting instruction by asking students to complete surveys designed to capture individual differences such as motivation or cognitive flexibility.

To illustrate, a recent study examined 16 essays written by individual students in the W-Pal system, covering several different topics (Allen, Snow, & McNamara, 2014). An analysis of the degree of cohesion in each essay revealed that students were more or less flexible in their use of cohesion across different essays. More skilled writers demonstrated greater flexibility in their use of cohesion, whereas less skilled writers employed cohesion more rigidly across the wide array of essay topics. These results can inform the individualization of instruction. Specifically, when students do not vary their writing, they may benefit from instruction to change their approach based on the given prompt. More generally, analyses of students' writing patterns can be useful in determining appropriate essay feedback. Through analysis of students' behaviors and performance while using a system, profiles for each student can be built nonintrusively, and instruction can be more successfully individualized.

CONCLUSION

In this chapter, we have described a wealth of research that has been conducted to develop and test computer systems for writing instruction. In terms of small and large-scale assessments, computers can help teachers and testing services by providing valid and reliable ratings and feedback on students' essays. These automated systems can then provide students with significantly more opportunities to practice their writing along with suggestions and strategies for how to revise their essays and develop their writing skills. More recently, researchers and educators have moved toward using computers as methods for providing adaptive and personalized writing instruction. Intelligent tutoring systems can provide context for the scores and feedback that students receive on their essays and allow them to receive explicit instruction and practice in areas where they need the most help.

Despite these advancements in the field, many questions remain unanswered. For instance, can computers provide valid writing assessments when the *content* of the essays is the principal component of the essay (e.g., science reports or history papers)? Similarly, is computer-based language assessment limited to argumentative styles of writing, or can more subjective and creative forms of writing be similarly measured? These questions and many more remain to be explored in the future. As technology improves and as more research accumulates, we can begin to move toward finding answers to these questions and developing more sophisticated tools to support the successful development of students' writing skills.

ACKNOWLEDGMENTS

This work was supported by the Institute of Education Sciences (IES), United States Department of Education, through Grant R305A120707 to Arizona State University. The opinions, findings, and conclusions or recommendations expressed are those of the authors and do not necessarily represent the views of the IES.

REFERENCES

Allen, L. K., Crossley, S. A., Snow, E. L., & McNamara, D. S. (2014). L2 writing practice: Game enjoyment as a key to engagement. *Language Learning and Technology, 18*, 124–150.

Allen, L. K., Snow, E. L., & McNamara, D. S. (2014). The long and winding road: Investigating the differential writing patterns of high and low skilled writers. In J. Stamper, S. Pardos, M. Mavrikis, & B. M. McLaren (Eds.), *Proceedings of the 7th International Conference on Educational Data Mining* (pp. 304–307), London, UK.

Attali, Y. (2004, April). *Exploring the feedback and revision features of Criterion*. Paper presented at the National Council on Measurement in Education (NCME), San Diego, CA.

Attali, Y. (2008). *E-rater performance for TOEFL iBT independent essays*. Unpublished manuscript.

Attali, Y., & Burstein, J. (2006). Automated essay scoring with e-rater® v.2.0. *Journal of Technology, Learning and Assessment, 4* (np).

Beal, C., Arroyo, I., Cohen, P., & Woolf, B. (2010). Evaluation of AnimalWatch: An intelligent tutoring system for arithmetic and fractions. *Journal of Interactive Online Learning, 9*, 64–77.

Bereiter, C. (2003). Automated essay scoring's coming-of-age. In M. D. Shermis & J. Burstein (Eds.), *Automated essay scoring: A cross-disciplinary approach.* Mahwah, NJ: Erlbaum.

Braaksma, M. A. H., Rijlaarsdam, G., van den Bergh, H., & van Hout-Wolters, B. H. A. M. (2004). Observational learning and its effects on the orchestration of writing processes. *Cognition and Instruction, 22*, 1–36.

Britt, A., Wiemer-Hastings, P., Larson, A., & Perfetti, C. A. (2004). Using intelligent feedback to improve sourcing and integration in students' essays. *International Journal of Artificial Intelligence in Education, 14*, 359–374.

Burstein, J. (2003). The e-rater scoring engine: Automated essay scoring with natural language processing. In M. D. Shermis & J. Burstein (Eds.), *Automated essay scoring: A cross-disciplinary approach* (pp. 113–121). Mahwah, NJ: Erlbaum.

Chen, C. F. E., & Cheng, W. Y. E. (2008). Beyond the design of automated writing evaluation: Pedagogical practices and perceived learning effectiveness in EFL writing classes. *Language Learning and Technology, 12*, 94–112.

Cheville, J. (2004). Automated scoring technologies and the rising influence of error. *The English Journal, 93*, 47–52.

Clauser, B. E., Kane, M. T., & Swanson, D. B. (2002). Validity issues for performance-based tests scored with computer-automated scoring systems. *Applied Measurement in Education, 15*, 413–432.

Condon, W. (2013). Large-scale assessment, locally-developed measures, and automated scoring of essays: Fishing for red herrings? *Assessing Writing, 18*, 100–108.

Crossley, S. A., Kyle, K., Allen, L. K., & McNamara, D. S. (2014). The importance of grammar and mechanics in writing assessment and instruction: Evidence from data mining. In J. Stamper, Z. Pardos, M. Mavrikis, & B. M. McLaren (Eds.), *Proceedings of the 7th International Conference on Educational Data Mining* (pp. 300–303). London, UK.

Crossley, S. A., Varner, L. K., Roscoe, R. D., & McNamara, D. S. (2013). Using automated cohesion indices as a measure of writing growth in intelligent tutoring systems and automated essay writing systems. In H. C. Lane, K. Yacef, J. Mostow, & P. Pavlik (Eds.), *Proceedings of the 16th International Conference on Artificial Intelligence in Education (AIED)* (pp. 269–278). Heidelberg, Germany: Springer.

Dai, J., Raine, R. B., Roscoe, R., Cai, Z., & McNamara, D. S. (2011). The Writing-Pal tutoring system: Development and design. *Journal of Engineering and Computer Innovations, 2*, 1–11.

Deane, P. (2013). On the relation between automated essay scoring and modern views of the writing construct. *Assessing Writing, 18*, 7–24.

Dikli, S. (2006). An overview of automated scoring of essays. *Journal of Technology, Learning, and Assessment, 5*,

3–35.

Enright, M. K., & Quinlan, T. (2010). Complementing human judgment of essays written by English language learners with e-rater(R) scoring. *Language Testing, 27*, 317–334.

Ericsson, P. F., & Haswell, R. (Eds.). (2006). *Machine scoring of student essays: Truth and consequences.* Logan, UT: Utah State University Press.

Ericsson, K. A., Krampe, R. Th., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100*, 363–406.

Fidalgo, R., Torrance, M., & García, J. N. (2008). The long-term effects of strategy-focused writing instruction for grade six students. *Contemporary Educational Psychology, 33*, 672–693.

Flower, L., & Hayes, J. (1980). Identifying the organization of writing processes. In L. Gregg & E. Steinberg (Eds.), *Cognitive processes in writing* (pp. 3–30). Hillsdale, NJ: Erlbaum.

Frey, N., & Fisher, D. (2013). A formative assessment system for writing improvement. *English Journal, 103*, 66–71.

Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. *Simulation & Gaming, 33*, 441–467.

Geiser, S., & Studley, R. (2001). *UC and SAT: Predictive validity and differential impact of the SAT I and SAT II at the University of California*. Oakland: University of California.

Gikandi, J. W., Morrow, D., & Davis, N. E. (2011). Online formative assessment in higher education: A review of the literature. *Computers & Education, 57*, 2333–2351.

Graesser, A., Lu, S., Jackson, G., Mitchell, H., Ventura, M., Olney, A., & Louwerse, M. (2004). AutoTutor: A tutor with dialogue in natural language. *Behavior Research Methods, Instruments & Computers, 36*, 180–192.

Graesser, A. C., & McNamara, D. S. (2012). Reading instruction: Technology-based supports for classroom instruction. In C. Dede & J. Richards (Eds.), *Digital teaching platforms: Customizing classroom learning for each student* (pp. 71–87). New York: Teachers College Press.

Graham, S. (2006). Strategy instruction and the teaching of writing: A meta-analysis. In C. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 187–207). New York: Guilford Press.

Graham, S., Harris, K. R., & Mason, L. (2005). Improving the writing performance, knowledge, and self-efficacy of struggling young writers: The effects of self-regulated strategy development. *Contemporary Educational Psychology, 30*, 207–241.

Graham, S., Hebert, M., & Harris, K. R. (2015). Formative assessment and writing: A meta-analysis. *The Elementary School Journal, 115*, 523–547.

Graham, S., & Perin, D. (2007). A meta-analysis of writing instruction for adolescent students. *Journal of Educational Psychology, 99*, 445–476.

Grimes, D., & Warschauer, M. (2010). Utility in a fallible tool: A multi-site case study of automated writing evaluation. *Journal of Technology, Learning and Assessment, 8.* Retrieved January 5, 2012, from *www.jta.org*.

Hayes, J. R. (1996). A new framework for understanding cognition and affect in writing. In C. M. Levy & L. S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences and applications* (pp. 1–27). Hillsdale, NJ: Erlbaum.

Jackson, G. T., & McNamara, D. S. (2013). Motivation and performance in a game-based intelligent tutoring system. *Journal of Educational Psychology, 105*, 1036–1049.

Johnstone, K. M., Ashbaugh, H., & Warfield, T. D. (2002). Effects of repeated practice and contextual-writing experiences on college students' writing skills. *Journal of Educational Psychology, 94*, 305–315.

Kellogg, R. T., & Raulerson, B. (2007). Improving the writing skills of college students. *Psychonomic Bulletin &*

Review, 14, 237–242.

Landauer, T. K., Laham, R. D., & Foltz, P. W. (2003). Automated scoring and annotation of essays with the Intelligent Essay Assessor. In M. Shermis & J. Bernstein (Eds.), *Automated essay scoring: A cross-disciplinary perspective.* Mahwah, NJ: Erlbaum.

Landauer, T. K., Laham, D., Rehder, B., & Schreiner, M. E. (1997). How well can passage meaning be derived without using word order? A comparison of Latent Semantic Analysis and humans. In M. G. Shafto & P. Langley (Eds.), *Proceedings of the 19th Annual Meeting of the Cognitive Science Society* (pp. 412–417). Mahwah, NJ: Erlbaum.

Landauer, T. K., McNamara, D. S., Dennis, S., & Kintsch, W. (Eds.). (2007). *Handbook of latent semantic analysis*. Mahwah, NJ: Erlbaum.

McNamara, D. S., Crossley, S. A., & McCarthy, P. M. (2010). Linguistic features of writing quality. *Written Communication, 27*, 57–86.

McNamara, D. S., Crossley, S. A., & Roscoe, R. D. (2013). Natural language processing in an intelligent writing strategy tutoring systems. *Behavior Research Methods, 45*, 499–515.

McNamara, D. S., Crossley, S. A., Roscoe, R. D., Allen, L. K., & Dai, J. (2015). A hierarchical classification approach to automated essay scoring. *Assessing Writing, 23*, 35–59.

McNamara, D. S., & Graesser, A. C. (2012). Coh-Metrix: An automated tool for theoretical and applied natural language processing. In P. M. McCarthy & C. Boonthum (Eds.), *Applied natural language processing and content analysis: Identification, investigation, and resolution* (pp. 188–205). Hershey, PA: IGI Global.

McNamara, D. S., Graesser, A. C., McCarthy, P., & Cai, Z. (2014). *Automated evaluation of text and discourse with Coh-Metrix*. Cambridge, UK: Cambridge University Press.

Myers, M. (2003). What can computers contribute to a K–12 writing program? In M. D. Shermis & J. Burstein (Eds.), *Automated essay scoring: A cross-disciplinary approach* (pp. 3–20). Mahwah, NJ: Erlbaum.

National Assessment of Educational Progress. (2007). The Nation's Report Card: Writing 2007. Retrieved November 5, 2010, from *nces.ed.gov/nationsreportcard/writing*.

National Assessment of Educational Progress. (2011). The Nation's Report Card: Writing 2011. Retrieved January 5, 2012, from *nces.ed.gov/nationsreportcard/writing*.

The National Commission on Writing. (2004). *Writing: A ticket to work. Or a ticket out: A survey of business leaders.* Retrieved from *www.collegeboard.com/prod_downloads/writingcom/writing-ticket-to-work.pdf*

Neuwirth, C. (1989). Intelligent tutoring systems: Exploring issues in learning and teaching writing. *Computers and the Humanities, 23*, 45–57.

Page, E. B. (2003). Project Essay Grade: PEG. In M. D. Shermis & J. Burstein (Eds.), *Automated essay scoring: A cross-disciplinary perspective* (pp. 43–54). Mahwah, NJ: Erlbaum.

Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review, 18*, 315–341.

Powell, P. (2009). Retention and writing instruction: Implications for access and pedagogy. *College Composition and Communication, 60*, 664–682.

Powers, D. E., Burstein, J. C., Chodorow, M., Fowles, M. E., & Kukich, K. (2002). Stumping e-rater: Challenging the validity of automated essay scoring. *Computers in Human Behavior, 18*, 103–134.

Quinlan, T., Higgins, D., & Wolff, S. (2009). *Evaluating the construct coverage of the e-rater® scoring engine* (ETS Research Report No. RR-09-01). Princeton, NJ: Educational Testing Service.

Ramineni, C., Trapani, C. S., Williamson, D. M. W., Davey, T., & Bridgeman, B. (2012). *Evaluation of the e-rater® scoring engine for the TOEFL® independent and integrated prompts.* (ETS Research Report No. RR-12-06).

Princeton, NJ: Educational Testing Service.

Roscoe, R. D., Allen, L. K., Weston, J. L., Crossley, S. A., & McNamara, D. S. (2014). The Writing Pal intelligent tutoring system: Usability testing and development. *Computers and Composition, 34*, 39–59.

Roscoe, R. D., Brandon, R. D., Snow, E. L., & McNamara, D. S. (2013). Game-based writing strategy practice with the Writing Pal. In K. Pytash & R. Ferdig (Eds.), *Exploring technology for writing and writing instruction* (pp. 1–20). Hershey, PA: IGI Global.

Roscoe, R. D., & McNamara, D. S. (2013). Writing Pal: Feasibility of an intelligent writing strategy tutor in the high school classroom. *Journal of Educational Psychology, 105*, 1010–1025.

Roscoe, R. D., Varner, L. K., Cai, Z., Weston, J. L., Crossley, S. A., & McNamara, D. S. (2011). Internal usability testing of automated essay feedback in an intelligent writing tutor. In R. C. Murray & P. M. McCarthy (Eds.), *Proceedings of the 24th International Florida Artificial Intelligence Research Society (FLAIRS) Conference* (pp. 543–548). Menlo Park, CA: AAAI Press.

Roscoe, R. D., Varner, L. K., Crossley, S. A., McNamara, D. S. (2013). Developing pedagogically-guided algorithms for intelligent writing feedback. *International Journal of Learning Technology, 8*, 362–381.

Rudner, L., & Gagne, P. (2001). *An overview of three approaches to scoring written essays by computer* (ERIC Digest number ED 458 290).

Rudner, L. M., Garcia, V., & Welch, C. (2006). An evaluation of the IntelliMetric™ essay scoring system. *Journal of Technology, Learning, and Assessment, 4*(4).

Sharp, D. B. (2007). Learn to write. ISA Careers website. Retrieved September 20, 2011, from *www.isa.org/Template.cfm?Section=Careers&Template=/ContentManagement/ContentDisplay.cfm&ContentID=5328.*

Shermis, M. D., & Barrera, F. D. (2002). Automated essay scoring for electronic portfolios. *Assessment Update, 14*, 1–5.

Shermis, M., & Burstein, J. (Eds.). (2003). *Automated essay scoring: A cross-disciplinary perspective*. Mahwah, NJ: Erlbaum.

Shermis, M. D., & Burstein, J. (2013). *Handbook of automated essay evaluation: Current applications and future directions*. New York: Routledge.

Shute, V. J. (2008). Focus on formative feedback. *Review of Educational Research, 78*, 153–189.

Snow, E. L., Likens, A., Jackson, G. T., & McNamara, D. S. (2013). Students' walk through tutoring: Using a random walk analysis to profile students. In S. K. D'Mello, R. A. Calvo, & A. Olney (Eds.), *Proceedings of the 6th International Conference on Educational Data Mining* (pp. 276–279). Heidelberg, Germany: Springer.

Streeter, L., Psotka, J., Laham, D., & MacCuish, D. (2004). *The credible grading machine: Essay scoring in the DOD* [Department of Defense]. The Interservice/Industry Training, Simulation & Education Conference (I/ITSEC), Orlando, FL.

Tausczik, Y. R., & Pennebaker, J. W. (2010). The psychological meaning of words: LIWC and computerized text analysis methods. *Journal of Language and Social Psychology, 29*, 24–54.

Torrance, M., Fidalgo, R., & García, J. N. (2007). The teachability and effectiveness of cognitive self-regulation in sixth-grade writers. *Learning and Instruction, 17*, 265–285.

VanLehn, K. (2006). The behavior of tutoring systems. *International Journal of Artificial Intelligence in Education, 16*, 227–265.

VanLehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems. *Educational Psychologist, 46*, 197–221.

Wang, J., & Brown, M. S. (2007). Automated essay scoring versus human scoring: A comparative study. *Journal of*

Technology, Learning, and Assessment, 6. Retrieved September 6, 2013, from *www.jtla.org*.

Warschauer, M., & Ware, P. (2006). Automated writing evaluation: Defining the classroom research agenda. *Language Teaching Research, 10*, 157–180.

Weigle, S. C. (2013). English language learners and automated scoring of essays: Critical considerations. *Assessing Writing, 1*, 85–99.

Wingate, U. (2010). The impact of formative feedback on the development of academic writing. *Assessment & Evaluation in Higher Education, 35*, 519–533.

Wouters, P., van Nimwegen, C., van Oostendorp, H., & van der Spek, E. D. (2013). A meta-analysis of the cognitive and motivational effects of serious games. *Journal of Educational Psychology, 105*, 249–265.

Xi, X. (2010). Automated scoring and feedback systems: Where are we and where are we heading? *Language Testing, 27*, 291–300.

CHAPTER 22

The Role of Professional Development for Enhancing Writing Instruction

Sarah J. McCarthey and Cristin M. Geoghegan

Despite disagreement about the best programs to prepare teachers for today's diverse classrooms, there is remarkable agreement about the need for teachers to engage in ongoing professional development (Darling-Hammond & Lieberman, 2012; Kopp, 2013; National Council on Teacher Quality, 2013). The National Commission on Writing (2003) recommends that "state and local agencies provide comprehensive professional development for all teachers" (p. 32). Wei, Darling-Hammond, and Adamson (2010) suggest that effective professional development should consist of the following: focus on specific content; be part of a coherent schoolwide reform effort; engage teachers in active learning; be intensive, sustained, and ongoing; link to analysis of teaching and student learning; include coaching, modeling, and feedback; and connect to professional learning communities. Desimone's (2009) framework included similar features and suggested that professional development increases teacher knowledge and skills, leading to changes in beliefs and practices that, in turn, increase student achievement. How have these features been reflected in research on professional development (PD) in writing?

This chapter reviews research of PD by level (large networks, district implementations—such as professional learning communities [PLCs], and school level—such as coaching) as well as by type (interventions and online delivery). The chapter organization follows from the work of McCarthey, Woodard, and Kang (2012) who studied 20 teachers' access and perceptions of professional development in writing; they found that teachers valued university–school partnerships, including national networks and school-based models (such as coaching) over 1-day workshops or self-directed PD. While teachers' perceptions of effective PD fit Desimone's model, including having a content focus, containing active learning, coherence, duration, and collective participation, school context and teachers' relationships with the PD providers were also important factors affecting teachers' perceptions. The type and quality of professional development influenced teachers' discourses about writing instruction; intensive PD assisted teachers in going beyond the scripted writing curriculum (McCarthey, Woodard, & Kang, 2014).

NETWORKS OF PD

Two nationally recognized sites for professional development operate as networks for teachers to learn more about the teaching of writing. Both networks incorporate several components of Wei et al.'s (2010) successful PD, including focusing on specific content—writing; engaging teachers in active learning through writing and demonstrations (National Writing Project); making sustained efforts such as summer institutes with follow-up activities; linking to teacher and student learning; and connecting to professional learning communities.

National Writing Project

The most well-known site for professional development in writing is the National Writing Project (NWP). What began as a partnership between local schools and James Gray and his colleagues at the University of California at Berkeley for a Summer Institute with 24 teachers in 1974, the Bay Area Writing Project, has grown to over 200 sites in all U.S. states and beyond. Sites are housed in colleges or universities as partnerships to promote the leadership of teachers. The core principles of NWP include: Teachers K–college are agents of reform and university–school partnerships are key; writing should be taught, not assigned; professional development should allow teachers to work collaboratively; knowledge about writing should be gleaned from many sources; there is no one single way to teach writing, however, some practices prove better than others; well-informed teachers are successful in their practice; and NWP teacher–leaders are our greatest resource. The Summer Institute, a 20-day training session for 15 to 20 teachers, includes professional reading, demonstrations of successful teaching techniques, writing, and responding to other participants' writing. Some sites focus on technology integration, working with English language learners, rural education, or social justice as themes within the basic structure. After participation in the Summer Institute, teacher consultants provide in-service training to others in their schools and districts, and/or conduct writing camps for students, host conferences for teachers, parents, and administrators, and organize writing retreats.

Beyond the face-to-face professional development activities, the NWP's website (*www.nwp.org*) features publications from children's books to digital writing, leadership, and social change by authors affiliated with the NWP or through partnerships with other organization. The organization has its own journal, *The Quarterly of the National Writing Project*, and serves as a repository of all technical reports and occasional papers from the National Center for the Study of Writing and Literacy. Two books co-authored by the NWP and others, *Because Writing Matters* (2006) and *Because Digital Writing Matters* (2010), have been widely circulated.

Impact on Teachers

In their work on school reform, Lieberman and Wood (2003) revealed several key components of teachers' participation in the NWP: Teacher consultants lead writing groups, share demonstration lessons and successful strategies, and engage in reflective collaboration and inquiry. They argue that because teachers are embedded in the writing process themselves during the Summer Institute they are in a unique position to reflect on the learning process and apply new learning to their practice. Their 3-year national evaluation of the NWP reported that teachers who had participated in the project: Changed their philosophy of teaching in many ways; took on leadership roles; spent more time on writing instruction than teachers who had not participated in NWP; and gave assignments that included authentic writing for audiences. Students in these teachers' classrooms showed growth in construction of

knowledge of the writing process.

Partnerships between the NWP and other organizations have produced reports describing changes in teachers' practices through intensive writing and professional development. Robbins and Dyer (2005) included narratives from teachers who participated in the Kennesaw Mountain Writing Project, studied local communities, and then engaged students in similar research of their communities. The teacher narratives demonstrated how writing played a role in creating communities, the power of professional collaboration, the potential for interdisciplinary study of community life, and the opportunities for teachers to adapt new disciplinary frames.

In her qualitative study of five teachers who participated in the NWP, Whitney (2008) found that teachers described the Summer Institute as a transformational act in which they developed a strong sense of identity, agency, and stance toward themselves and writing. She named "triggers" (p. 155), purposes for engaging in the program, and feedback as two factors that led to success. In their interviews with eight teachers who participated in a collaborative NWP project in Missouri, Dierking and Fox (2012) found that teachers gained new knowledge, confidence in their teaching, and increased autonomy after participation in the institutes and having supportive school contexts. Studying a graduate course modeled on the NWP with 25 secondary teachers across content areas, Street and Stang (2009) reported that most teachers gained confidence in their own writing.

From a survey of 3,000 NWP teachers, Inverness Research (Stokes, Hirabayashi, Murray, & Senauke, 2011) found that NWP teachers were more likely to teach students from poverty and English language learners than non-NWP teachers. Participants (96%) reported that the quality of the Summer Institutes was better than other professional development they received, and that they were able to apply what they learned to classroom settings. Most teachers (75%) found the follow-up activities throughout the school year to be valuable. Teachers reported improving their practices by spending more time teaching planning (83%), having students self-assess (77%), meeting individually with students (71%), teaching a range of purposes for writing, and teaching students to use digital technology (62%). Teachers also reported that the Summer Institutes improved their efficacy in addressing national trends (e.g., 79% are more effective in teaching a wider range of students, 59% are more comfortable using technology than before the Summer Institute). Survey participants consistently reported willingness to take on leadership roles from being a leader in a local site (82%) to encouraging colleagues to participate (96%).

Whitney and Friedrich (2013) describe the legacy of the NWP as an orientation—a term that incorporates attitudes, values, lenses, and stances to classrooms, writers, and children that transcend time. From their interviews with 110 participants (taken from a larger sample from Phase 1 of 1,848 survey respondents) about the influence of the NWP on their teaching, Whitney and Friedrich identified three main legacies: Teachers clarified their purposes for writing, focusing on students' expressing ideas for an audience; they organized their classrooms to support workshop format with explicit support for improving writing; and teachers identified themselves as writers, linking their teaching of writing to their own experiences as writers. The authors noted that the legacy of the orientation toward writing has outlasted any specific strategies or techniques, and suggest that participation in a large network is more enduring than specific practices.

Studies have also indicated that the NWP has made an impact on teachers' leadership potential. Using interviews, observations, and artifacts, Shanton, McKinney, Meyer, and Friedrich (2009) chose three cases from Phase III of the Legacy Study to demonstrate how NWP teacher leaders inspired new learning in their schools by negotiating policy, using a lateral form of leadership, and sharing their own knowledge with others. Lieberman and Friedrich (2007) have also highlighted the leadership roles NWP teachers have taken on including initiating social action projects, fostering teacher collaboration, beginning professional learning communities, advocating for teacher-developed curriculum, and starting after-school writing clubs.

Impact on Students

In the last *Handbook of Writing Research*, Pritchard and Honeycutt (2006) synthesized the effects of NWP on student achievement, including findings that favored the NWP approach over traditional approaches; students of NWP trained teachers received the highest mean scores over two other conditions, and students in districts with healthy professional development practices obtained significantly higher mean writing achievement results than students in districts with low health. Included in Graham and Perin's (2007) meta-analysis of writing instruction in grades 4–12 were six studies using a process writing approach; five of the six studies included teachers who had participated in the NWP. The effect sizes for all six studies were positive, indicating that professional development associated with process approaches had a moderate effect on the quality of students' writing. Conversely, in the absence of professional development, process approaches had only a small effect on students in grades 4–6 and did not enhance writing in grades 7–12.

Two reports (Blau, Whitney, & Cabe, 2006; Blau, Cabe, & Whitney, 2011) examining the effects of the South Coast Writing Project used quasi-experimental designs to understand how the program impacted teachers of grades 4–8 and their students. Eight language arts teachers who received professional development involving inquiry, workshops, models, and coaching were matched with seven teachers who did not receive professional development. From interviews with teachers, observations of instruction, artifacts, and prompted writing responses, they found clear differences between program teachers' classrooms and comparison classrooms. Program teachers used student writing models, provided opportunities for students to choose topics, employed a wider range of prewriting strategies, and encouraged revision more often than comparison teachers. Program students produced better texts (not statistically significant) and increased their use of prewriting strategies (statistically significant), and took up revision strategies. The NWP (2008) conducted its own analysis of nine studies (including the South Coast Project) across five sites comparing students in NWP teachers with non-NWP counterparts. Using pre and postwriting assessments of 3,143 students from grades 3–12, the study found that students in NWP teachers' classrooms consistently outperformed students in comparison groups on content, structure, stance, sentence fluency, diction, and conventions. A follow-up synthesis (2010) of 16 studies of 141 schools, 409 teachers, and 5,408 students concluded that students of teachers in NWP classrooms outperformed others, with 8 of the 16 cases showing significance.

Hunt-Barron, Kaminski, and Tracy (2013) investigated the relationship between high-adopting teachers, who had been trained in a year-long NWP professional development, in two elementary schools and student achievement. As part of a larger study, the researchers identified three high-adopting teachers who received training in a writer's workshop approach with students in grades 3–5. From their analysis of surveys, videotapes, interviews, and student writing samples, Hunt-Barron et al. found that the high adopters shared a common vocabulary about writing, used authentic models and explicit instruction for writing, and had a workshop approach. High adopters also had positive views of professional development, valued student engagement, were thoughtful practitioners, and were willing to change previous instructional practices. Students in the high adapters' classrooms demonstrated the highest mean improvement rates in their schools compared to low adapters.

The Reading and Writing Project

The Teachers College Reading and Writing Project is housed at Teachers College, Columbia University, and is directed by its founder, Lucy Calkins. About 30 years ago the project focused primarily on writing and worked with New York City schools, providing professional development through a team of writers and teachers. According to Calkins, the demand for staff development increased across New York City to the nation and internationally. The

project now has a large team of senior staff, staff developers, specialists, and *The Units of Study* (Calkins, 2003, 2006) team (writers who have developed writing curriculum for grades K–8 published by Heinemann). The project offers weeklong institutes in the summer, a 3-day mid-February institute, as well as "Home Grown Institutes" staffed by project and local educators designed for specific communities. The project has specialized groups for literacy coaches and principals, and conference days to support the implementation of the *Units of Study* in schools across the United States. According to its website *http://readingandwritingproject.com*, over 150,000 teachers have attended the *week-long institutes*, and over 4,000 participants return each year to the annual *Saturday Reunions*.

Although the Reading and Writing Project website provides extensive resources, including curriculum, videos, DVDs, and recommended books for teachers (often written by project staff), the project does not conduct research on its programs. The authors queried Calkins by email about studies that might have been conducted on the effects of the professional development. Her response was that they had not done experimental research but had "lots of evidence of writing workshops leading to improvement in writing and in scores—that is, schools that are #1 in their state, etc.—but I don't have any illusions that this is due to our work alone. It's always the marriage of a strong curriculum, knowledgeable teachers, an effective leader, and time to learn" (email communication, October 2013).

Summary of Effectiveness

Across the studies, both quasi-experimental and qualitative, it seems clear that the NWP has had a major impact on teachers' philosophies of writing, willingness to take on leadership roles, efficacy, agency, and autonomy. Students in classrooms of NWP teachers have shown strong performance on writing assessments, and the data support the process approach to writing embedded within the network models. Implications for further research include the need for continued research on the effects of the NWP conducted by researchers who are not necessarily affiliated with the sites, and comparable studies on the effects of the Reading and Writing Project, which reaches a large number of teachers, on students.

PROFESSIONAL LEARNING COMMUNITIES

Wei et al. (2010) noted the importance of professional development occurring in learning communities where teachers can share knowledge. As Hargreaves (1992) asserted, teachers do not develop solely by themselves, but rather through interactions with others who are knowledgeable about teaching and learning. Effective learning communities consist of a group of individuals who work toward a shared goal, hold themselves accountable for the goal, assess their progress, and make connections (McLaughlin & Talbert, 2010). Lieberman and Miller (2011) suggest the following essential practices: (1) meeting regularly and building relationships grounded in trust; (2) developing a clear purpose and collective focus; (3) establishing routines and rituals that are supportive of discussions; (4) engaging in problem solving, peer teaching, observations, and advice giving; (5) organizing activities that impact learning for both students and adults; (6) using collaborative inquiry; (7) cultivating a theory of action; and (8) and developing core strategies that make connections between their learning and student learning. Although other researchers (e.g., Stoll, Bolam, McMahon, Wallace, & Thomas, 2006) have included a subset of these characteristics and noted that learning communities may vary in their form and context, proponents of PLCs agree that student learning can be enhanced when teachers collaborate, maintain a stance that all students can learn, and foster active engagement (McLaughlin & Talbert, 2006).

Although many of the studies of PLCs have examined literacy practices more generally, several have included a

focus on writing. PLCs have been designed to involve a large number of affiliated schools bringing in outside experts, follow up with NWP fellows in collaborations with several schools, or establish teams in a single school.

Multisite PLCs

Taylor, Pearson, Peterson, and Rodriguez (2005) examined the impact of school-level elements and classroom-level practices on students' reading and writing when implementing the CIERA School Change Framework. Thirteen schools formed leadership teams that included teachers, the principal, and an external facilitator to focus on school improvement and professional development. Teachers met in study groups to create action plans, were observed by team members, and reviewed their observations and student performance data. The study groups benefited teachers owing to the support and direction from leaders and engagement in focused activities such as data analysis to help improve instruction. To investigate the impact on students' reading and writing growth, students were given a standardized reading comprehension test, an index of fluency, and a directed writing assessment. Coaching accounted for 11% of the between-teacher variance (ES = .38) and was positively related to writing in grades 2–5, indicating that coaching can help teachers improve students' writing.

Teaching/Learning Centers (TLCs) were explored as a way to implement professional development grounded in classroom experiences. Mahn, McMann, and Musanti (2005) reported on a 2-year pilot project centered on building a school community where teachers had the opportunity to collaborate and develop effective language and literacy instruction for first- and second-language learners. The TLC model was piloted in five elementary schools where teachers observed, modeled, reflected, and supported one another after participation in an intensive 3-week seminar. A key component was examining students' texts to plan the next steps for writing instruction. The researchers found that the collaboration fostered ongoing professional conversations to improve writing instruction for English learners, resulting in teachers using specific strategies to address students' needs.

Using discourse and ethnographic analysis, Rogers et al. (2005) reported on a professional development group, the Literacy for Research Social Justice Teacher Research Group, comprising elementary, secondary, adult education teachers, and university professors who explored the relationship between social justice and literacy. The group met twice a month and followed a problem-posing/problem-solving model of inquiry in which they each collected and analyzed data to guide instruction. The authors found that the teacher research projects prompted them to focus on incorporating writing into classroom projects and to consider how to teach about social justice throughout the lifespan.

Limbrick, Buchanan, Goodwin, and Schwarcz (2010) investigated 20 teachers from six low-socioeconomic primary schools in New Zealand who were researching their own practices in teaching writing. Through analysis of teachers' goals and action plans, field notes from meetings with teachers, transcripts from focus groups, literacy leaders' reports, and a standardized writing assessment tool, the researchers found that teachers' close examination of student writing facilitated attending to students' needs as well as their own practices. Conversations among teachers helped them deepen their understanding of the writing process, and student data became the basis for teacher decisions. Through participation in the community, teachers became more knowledgeable about the next steps in writing instruction. After teachers had completed their learning circles, students' test scores showed improvement.

NWP Follow-Up PLCs

Several studies used PLCs as a follow-up to Summer Institutes by NWP sites. Córdova and Matthiesen (2010)

examined ways in which the Collaboratory, a partnership with the NWP, affected teachers' professional learning about literacy. Teachers from both urban and rural settings came together for an inquiry-based Summer Institute; they used video conferencing and digital technology to examine data and stay connected throughout the year. The study highlighted Amanda, a second-grade teacher, and Ralph, a university-based researcher, as they implemented a community map-making project that drew on students' lived experiences as resources for literacy learning. Students created maps of their classroom community that were digitized with voice recordings and published on the Collaboratory's website. Through watching the videos, the authors gained a deeper understanding of discourse patterns and developed research-based solutions to extend the curriculum.

Through interviews and observations, Meth and Azano (2012) investigated the outcomes of six teachers' participation in an 8-month NWP professional development initiative to support teachers' inquiry projects centered on improving student writing. Analyzing writing samples encouraged meaningful conversations on how to improve writing. The authors reported tensions among the participants' ideas, inquiry goals, structural limitations of the school day, and curricular constraints; however, participation in the continuity efforts fostered autonomy, leadership, and critical reflection. Although the teachers may have felt isolated at school or constrained by a curriculum, the PLC provided a space for belonging and collaboration.

O'Donnell-Allen (2004) conducted a 3-year ethnography of four teachers who participated in the Red River Writing Project Teacher Research Group. The participants reported the meetings as transformative as they borrowed strategies from each other, critiqued schooling practices, and viewed practice through an inquiry lens. The author recommended that the discourse practices, motives, and questions that guide inquiry groups must emerge over time to meet personal and collective goals.

Through investigations of four middle school language arts teachers who had been participants in the NWP, Pella (2011) examined the effects of collaborative inquiry on teaching writing. The participants met monthly and developed lessons, created writing scaffolds, observed delivery of lessons, debriefed and analyzed student work, and reflected throughout the process. From observations, interviews, email communication, written reflections, teacher-created materials and curriculum resources, Pella noted that the participants' diverse experiences and resources underscored divergent theories about writing. The study highlighted three transformed perspectives of teachers, including teaching against the grain, having higher expectations of students, and growth in confidence and self-efficacy for teaching writing.

Brooke, Coyle, and Walden (2005) reported that teachers were frustrated with curricular demands and high-stakes assessment and decided to form After-School Writing Circles for students. The monthly teacher study group, an outgrowth of the Nebraska Writing Project, was an alternative and voluntary space, where teachers discussed research and student data from the Writing Circles. The authors posit that these third spaces provided a space of resistance, motivation, engagement, and alternatives where colleagues were able to work together, question, and reflect to impact student learning.

Single-Site PLCs

Interdisciplinary teams of teachers in secondary schools have examined writing across disciplines. Helstad and Lund (2012) investigated a team of Norwegian upper secondary teachers as they negotiated and evaluated student writing across disciplines. Participants included 11 writing team members in one school and an expert who met once a month to discuss students' texts and writing issues across different disciplines. Ethnographic fieldwork from 13 meetings over a 2-year period as well as interviews, written logs, responses to questionnaires, and document analysis showed that teachers perceived writing as both subject-specific and interdisciplinary.

Curry (2008) investigated the Critical Friends Group (CFG), a professional community centered on increasing student achievement and learning through engaging in professional conversations in an urban high school over a school year. Employing a qualitative case study approach to analyzing eight videotaped observations, field notes, and participant interviews, the study showed that interdisciplinary membership helped to foster curricular coherence and raised teachers' awareness of rubric-based assessment and process writing. Participation in CFG helped teachers develop a common language of writing and assessment practices, but also reinforced ritualized patterns (e.g., using writing templates) that limited inquiry.

Summary of Effectiveness

The small-scale, mostly qualitative investigations have demonstrated that PLCs provide opportunities for collaboration, inquiry, and conversations about students, curriculum, and policies related to writing. Although they seem to have an impact on teachers' self-efficacy, can transform their views of writing and students, and help teachers solve problems, there is little evidence yet that these collaborations affect student learning. The challenges of linking intensive professional development experiences to student learning are large, given the importance of context (McCarthey, Woodard, & Kang, 2012). However, the paucity of studies focused on PLCs devoted to writing indicates the need for more studies using a variety of methodologies to investigate their impact on teachers and student learning.

INTERVENTION STUDIES

Intervention studies linking professional development to teacher change and/or student learning are relatively rare. However, both experimental and multimethodological studies have indicated the positive impact of such efforts. Interventions have also been conducted across multiple sites and within a single school.

Multiple Sites

Correnti (2007) studied the effects of professional development on both reading comprehension and writing using a sample 1,945 classrooms of 112 elementary schools identified as Accelerated Schools Project, America's Choice, or Success for All schools, which use a specific writing curriculum. Two cohorts of students from K–2 and 3–5 were studied over 3 years using teacher logs and were analyzed using propensity score stratification—comparing individuals with similar likelihoods of receiving intense PD on the basis of 94 pretreatment covariates, and estimating the treatment effect for individuals receiving intense PD compared with those not receiving intense PD. Teachers who received intensive PD were more likely to engage in five of nine effective writing strategies including editing, making substantive revisions, and genre study or direct instruction about writing with an overall 13% increase in writing instruction. Correnti also notes that school context was a predictor of teacher practice beyond the individual teacher effects.

A series of studies focused on the impact of professional development on English language learners (ELLs) demonstrated the efficacy of a cognitive strategies model with students in a large, urban district. Olson and colleagues (Kim et al., 2011; Olson et al., 2007, 2012) began the Pathway Project as part of an NWP site, but expanded the work to train teachers using a set of curricular materials during the school year. Olson and Land (2007) used a quasi-experimental design to study 55 secondary teachers and their students who used a cognitive

strategies approach to reading and writing instruction after participating in the Pathway Project for 8 years. Quantitative measures included a pre- and posttest direct writing assessment of an essay. Qualitative data consisted of students' logs and teachers' metacognitive reflections. Results show that Pathway students performed significantly better than control-group students on GPA, standardized tests, and high-stakes writing assessments for seven consecutive years. Qualitative data revealed that students recognized that they were exposed to a curriculum with high expectations, saw their own improvement in strategy use, and became more confident writers. Teachers also recognized the growing competence of their students.

The 2011 study conducted on the Pathway Project by Kim et al. reports Year 1 findings from a multisite, cluster-randomized controlled trial of a cognitive strategies approach to mainstreamed Latino ELLs. English teachers (103) in nine middle schools and six high schools were randomly assigned to the Pathway Project or control, and students were randomly assigned to classrooms. Pathway Project teachers received more intensive PD focused on helping mainstreamed ELLs to develop academic literacy than control teachers. Training included using the cognitive strategies toolkit, intervention activities, and coaching from more veteran teachers trained in the model. Multilevel models revealed significant effects on an on-demand writing assessment and the California Standards Test in English language arts.

In Year 2 of the study with 72 teachers, Olson et al. (2012) found that the average student taught by a Pathway teacher improved on both on-demand writing tests and standardized state tests, outperforming students in the control groups. Pathway teachers were more likely to use writing activities consistent with the intervention than teachers in the control group. This series of studies indicates consistently positive outcomes on multiple measures when teachers and students were exposed to a set of cognitive strategies over an extended period of time. The findings suggest the importance of high expectations for ELLs, exposure to a rigorous curriculum, and explicit teaching of strategies. In addition, the studies highlight the effectiveness of using the NWP as a starting point, but going beyond to include professional learning communities where teacher leaders helped develop specific curriculum using strategies. The experimental design captured the positive effects when expanding the Pathway model to new schools.

Harris and her colleagues (2012) conducted a randomized, controlled study with 20 second and third-grade teachers from three rural schools who were part of a university–school partnership. The team of researchers provided 2 days of intensive professional development in the fall for teachers to use the self-regulated strategies development (SRDS), a multicomponent intervention using explicit, interactive strategies for story writing and opinion essays. The PD sessions included collective participation, focus on characteristics of students, content knowledge of teachers, active learning, use of classroom-based materials, and feedback on performance. Small teams of teachers organized by genre (story writing or opinion essay) received materials for lesson planning as well as student materials. Teachers implemented the six strategies (develop background knowledge, discuss, model, memorize, support, independent practice) over 24 sessions and were observed by the researchers who provided feedback and support for implementation. The findings demonstrated that treatment integrity was high as reported by observers and self-reports by teachers. Both teachers and students rated the intervention positively, indicating social validity. Student outcomes indicated positive results: Students who received whole-class opinion writing SRSD scored higher in number and quality of opinion elements. Students who received whole-class story writing instruction improved in the number and use of elements; however, there was lack of an effect on overall story quality. The researchers have also developed books with lesson plans and strategies for teachers as an extension of their PD efforts (see Harris, Graham, Friedlander, & Land, 2013).

Single Site

Conducting a mixed multimethods design over one school year, Troia, Lin, Cohen, and Monroe (2011) investigated six teachers' knowledge, beliefs, and practices about writing instruction. As part of a schoolwide reform effort in a Seattle school, the professional development focused on implementation of writing workshops. The PD opportunities included bimonthly workshops; weekly individual coaching sessions, classroom demonstrations, and planning and debriefing meetings; trained volunteers to help students with writing; use of resident authors; and publishing opportunities for audiences. Using three rating scales for theoretical orientations, teaching efficacy, and instructional practices, as well as observations and interviews with teachers, the authors found that the teachers displayed the use of between 70 and 89% of 27 critical workshop elements including daily workshop time, student-centered assignments, and teacher modeling and feedback. However, there was variation in management procedures, student engagement tactics, and adaptive instructional supports. Teachers with higher levels of perceived competence used more key elements and adaptations for struggling writers than teachers with lower levels of efficacy.

Summary of Effectiveness

The intervention studies incorporated effective features of PD such as focusing on content, collective participation, and active learning; the findings support more general studies that highlight the importance of these features (Desimone, 2009; Wei et al., 2010). These studies indicate that focusing on specific cognitive strategies or those associated with writing workshop are likely to influence teachers' practices.

LITERACY COACHING

Literacy coaching has gained national attention as an integral component of school reform (Dole, 2004). Professional development is a central element of the Reading First program. As a result, the number of literacy coaches hired in schools has increased substantially (Moss, Jacob, Boulay, Horst, & Poulos, 2006; Peterson, Taylor, Burnham, & Schock, 2009). Coaches take on multiple roles and face challenges in addressing expectations (Riddle-Buly, Coskie, Robinson, & Egawa, 2006; Walpole & Blamey, 2008). Bean, Draper, Hall, Vandermolen, and Zigmond (2010) documented that 20 Reading First coaches allocated their time by working with teachers individually, assisting with management and school-related tasks, planning and organizing with groups of teachers, and working with students. Coaches engaged in discussions with teachers to plan interventions that occasionally examined writing instruction. The amount of time coaches spent with teachers had an impact on students' proficiency.

The body of work surrounding literacy coaching continues to grow (Biancarosa, Bryk, & Dexter, 2010; Elish-Piper & L'Allier, 2007; Neufeld & Roper, 2003; Rainville & Jones, 2008). Deussen, Coskie, Robinson, and Autio (2007) assert that literacy coaches should support teachers in making instructional changes in reading and *writing*. However, the research on literacy coaching largely focuses on the five focal reading areas described by the National Reading Panel Report (phonemic awareness, phonics, fluency, vocabulary, and comprehension). The area of writing is often embedded under the "literacy" umbrella or is included as a smaller component of the study. Nevertheless, we examined the literature for studies that included some coaching of writing.

Coaching Models

Biancarosa et al. (2010) reported on a 4-year longitudinal, multicohort, quasi-experimental study of the effects of the Literacy Collaborative (LC), a reform model designed to improve children's reading, writing, and language skills through school-based coaching. The six components that formed the LC for grade K–2 were shared reading, guided reading, interactive read alouds, word study, writer's workshop, and interactive writing. The coaches attended intensive, graduate-level training on how to lead PD sessions to introduce theory and instructional practices that would engage all students in reading and writing processes. Children in kindergarten through second grade in 17 schools were assessed two times annually using the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) and Terra Nova (reading comprehension subtest). The findings reported that significant gains were observed each year from the baseline period and the effects grew larger after each additional year. Although writing was part of the framework and training, student progress in writing was not specifically assessed.

Impact of Literacy Coaching

Coaching has also been a component of larger professional development efforts. Vanderburg and Stephens (2010) investigated coaches' impact on 35 teachers who took part in the South Carolina Reading Initiative (SCRI). The literacy coaches conducted bimonthly, site-based study groups with teachers (PreK–5) for 3 years and spent 4 days a week in their classroom helping them implement what they learned from the study groups. The teachers valued the collaboration and credit their coaches with helping them to try out new teaching practices, use authentic assessment, engage in professional literature, and create a more student-centered curriculum. All 35 teachers implemented new strategies, including shared reading and memoir writing, and many of them integrated writing conferences.

Changes in practice were also reported in Kinnucan-Welsch, Rosemary, and Grogan's (2006) report on the Literacy Specialist Project (LSP), a statewide PD initiative to disseminate foundational knowledge of literacy pedagogy and build capacity to sustain high-quality PD. During 2000–2013, participants included 14 field faculty from 10 universities, 353 literacy specialists, and 2,490 teachers in 122 school districts throughout the state of Ohio. The literacy specialists met with small groups of teachers for 2 to 3 hours 15 times during the school year and focused on analyzing oral language, reading, and writing samples from the teachers' classroom data. Statistically significant differences were found between beginning and end ratings on the survey data rating teachers' perceptions of literacy concepts taught. Data were also reported on a sample of teachers (six literacy coach and classroom teacher dyads) who participated in the Teacher Learning Instrument (TLI) study. The teachers taught lessons, audiotaped and transcribed segments, and then analyzed their instruction; the teachers also engaged in self-analysis and made instructional changes based on their observations of student learning, including writing.

Using a quasi-experimental design, Neuman and Cunningham (2009) explored the impact of PD and coaching on early childhood caregivers' knowledge of quality language and literacy practices in home- and center-based programs. The analysis of covariance indicated that were no significant differences between groups on teacher knowledge; however, a combination of coursework and PD improved the quality of language and literacy practices. In a follow-up, mixed-methods study, Neuman and Wright (2010) investigated the impact of two forms of PD (coursework and coaching) on PreK teachers' early language and literacy practices. One hundred and forty-eight teachers from six urban cities were assigned randomly to three groups: Group 1 (coursework), Group 2 (on-site coaching), or Group 3 (control group). Pre- and postassessments were administered to measure the growth in teachers' knowledge of language and literacy practices. Additional measures also included the Early Language and Literacy Classroom Observation (ELLCO) to assess the environmental and instructional supports for preschool.

Effect sizes were significant for coaching, whereas the coursework did not show improvements. Coaches were inclined to focus more on improving the environment (e.g., writing area, tools for writing) versus teaching the strategies that support developmental writing (e.g., writing stories).

Coaches as Learners

As part of the South Carolina Reading Initiative (SCRI), a team of university faculty led a PD initiative and worked directly with literacy coaches during the summer as well as 2 days during the month on both reading and writing. Through participating in writing (e.g., through writer's notebooks), creating lesson plans, and co-planning PD sessions, the coaches grew as researchers and developed a professional voice (Donnelly et al., 2005).

Summary of Effectiveness

Studies of coaching indicate a positive impact on teachers' practices, decision making, and interactions with colleagues. Intensive training and amount of time coaches spent with teachers seem to be important factors in coaching as a successful professional development model. Although writing might be embedded within the larger model on professional development and coaching, the emphasis is still heavily focused on reading. Writing is entering conversations between coaches and teachers; however, more research is needed on the training of coaches to guide and model writing strategies for teachers.

ONLINE NETWORKS AND TECHNOLOGY RESOURCES AS PD

Networks of professional development such as the NWP, Professional Learning Communities, school-level coaching, and specific interventions all require a major investment of professionals' time and money. Meeting in large or small groups requires physical space and providing release time take teachers away from their students. Many rural teachers have fewer opportunities to participate in high-quality, face-to-face professional development due to distance (McCarthey et al., 2012; Hunt-Barron, Kaminski, Howell, & Tracy, 2013). To address some of the challenges of face-to-face PD, researchers, including Beach (2012) and organizations such as National Council of Teachers of English (NCTE), have recommended the implementation of online learning communities that can be self-paced, asynchronous, and have distinct affordances.

Beach (2012) argues that online PD networks provide unique affordances for teachers to collaborate, plan with, and learn from other teachers. He outlines four major components: a central social networking and discussion forum for collaboration; teachers' personal learning networks; collecting students work online in blogs, wikis, podcasts for analysis; and creating schoolwide online repositories with lesson plans and units. Several of the resources Beach suggests are connected to organizations such as the Association for Supervision and Curriculum Development (ASCD) or NCTE. Typically, these organizations offer an array of online resources ranging from courses to webinars to lesson plans. ASCD offers an online course for the Common Core Writing Standards grades 6–12 to take teachers through the process of planning and implementing the writing standards. They also have a 2.0 social network and blog for teachers to provide ideas to one another.

NCTE's resources are the most extensive for online learning in writing, including Web seminars viewed live or downloaded; investigations (3–5 hours) of self-paced learning, and facilitated online courses that use videos and professional texts. ReadWriteThink, cosponsored by the International Literacy Association and NCTE, has an

extensive set of resources for teachers on writing. Organized by grade level, learning objective, theme, and resource type, the site provides strategy guides and lesson plans. A strategy guide, for example, on developing persuasive writing strategies is organized with a rationale from research followed by lesson plans. Lesson plans are submitted by teachers and reviewed by ReadWriteThink personnel; they consist of overviews, related resources, including standards and instructional plans, followed by opportunities for teachers to write about their experiences using the plans. According to Lisa Fink, Project Manager (email communication, December 17, 2013), they typically receive a large number of proposals for lesson plans that do not get submitted, turn down about 25% of the submitted proposals, and publish 40 to 60 new lesson plans a year. Through November 2013, ReadWriteThink had 18,630,320 visits through the year. Fink indicated that the Strategy Guides are one of the largest growing areas on the site: *www.readwritethink.org/professional-development/strategy-guides*.

Although these online sites are receiving increased attention and use, very little research has investigated this type of PD on teachers' writing practices. An exception is the randomized controlled study of 118 fourth-grade English language arts teachers who participated in online professional development (OPD) by Masters, de Kramer, O'Dwyer, Dash, and Russell (2010). Teachers participated for 7 weeks, spending 4–6 hours a week reading, doing activities, and discussing content focused on vocabulary, reading comprehension, and writing. The writing aspect included writing traits, criteria for evaluation, and instruction on narrative and informational writing, stages of the writing process, revision, and prompt selection. Instruments used were a knowledge survey and self-reported instructional practices pre- and post-PD. Findings suggest that the workshops had a significantly positive effect on teachers' knowledge and instructional practices in all three areas, with a large effect in writing on both knowledge and practices.

Zuidema (2012) presented a case study of an external, online network (Intern-Net) in which 36 new teachers participated in informal conversations through writing about issues. Analysis of textual patterns in online messages and interviews showed that novice teachers' participation in the online discussions fostered collaboration and provided a place to consider new possibilities and frameworks for teaching secondary English. Although online dialogues were reported to shape teachers' inquiries, the off-list activities (e.g., conducting further analysis after posing a question) were described as just as important. This study suggests that online conversations are important but insufficient–inquiry should continue in other spaces as well.

Hunt-Barron, et al. (2013) offer a potential solution to the dilemma of reaching rural teachers through a hybrid model of face-to-face and follow-up online discussions. Thirty-one teachers of grades 7–10 in three rural districts in the Southeast received 90 hours of face-to-face professional development through the Upstate Writing Project, an NWP affiliate, on effective strategies for teaching writing using a workshop model. Then teachers were encouraged to download resources and blog with one another using a Google site. Survey data indicate that many teachers reported changing their writing instruction; however, their use of the online site has been limited to downloading resources rather than asking questions or collaborating with peers. The study suggests that lack of access to high-speed Internet and lack of time for reflection are limiting factors in the success of online PD.

Summary of Effectiveness

Although online PD has the potential to address many of the problems associated with reaching rural teachers and affords teachers opportunities to work on their own time and communicate with a variety of peers, there is little research to support its effectiveness. The plethora of online sites available to writing teachers holds promise for writing researchers to devise large-scale, systematic studies of teachers' use of technology for professional development.

CONCLUSION

Most of the research conducted on professional development in writing has supported the models of Darling-Hammond and Lieberman (2012), Desimone (2009), and Wei et al. (2010), which highlight the importance of having a content focus, containing active learning, coherence, duration, and collective participation. The national affiliations such as the NWP, the PLCs at district or school levels, coaching models, and the interventions, including SRDC and writing workshop, were all long-term, sustained efforts that cohered around writing instruction with teachers as active participants. Researchers are employing a variety of methodologies, including large-scale quantitative studies, in-depth ethnographies, and mixed-method investigations to investigate changes in teachers' knowledge and practices and to understand the impact on student learning. Overall, the research demonstrates that professional development influences teachers' learning and practices, and there is increasing evidence that these practices have a positive impact on students' writing. However, much work remains to be done because there is a need for additional research on professional development in *writing*, as distinct from literacy, with continued use of multiple methodologies. In particular, PLCs and coaching models should include a stronger focus on writing instruction, especially as implementation of the Common Core Standards in writing will require teachers to have more expertise. The potential of online communities, which embrace effective features of professional development, are untapped and cry out for a large-scale investigation of teachers' access to and use of these resources.

REFERENCES

Beach, R. (2012). Can online learning communities foster professional development? *Language Arts, 89*(4), 256–262.

Bean, R. M., Draper, J. A., Hall, V., Vandermolen, J., & Zigmond, N. (2010). Coaches and coaching in Reading First schools: A reality check. *Elementary School Journal, 111*, 87–114.

Biancarosa, G., Bryk, A. S., & Dexter, E. (2010). Assessing the value-added effects of Literacy Collaborative professional development on student learning. *Elementary School Journal, 111*, 7–34.

Blau, S., Cabe, R., & Whitney, A. (2011) *Evaluating IIMPAC: Teacher and student outcomes through a professional development program in the teaching of writing*. South Coast Writing Project and University of California, Santa Barbara.

Blau, S., Whitney, A., & Cabe, R. (2006). *Evaluating IIMPAC: Teacher and student outcomes through a professional development program in the teaching of writing*. South Coast Writing Project and University of California, Santa Barbara.

Brooke, R., Coyle, D., & Walden, A. (2005). Finding a space for professional development: Creating thirdspace through after-school writing groups. *Language Arts, 82*, 367–377.

Calkins, L. M. (2003). *The units of study for primary writing: A yearlong curriculum*. Portsmouth, NH: Heinemann.

Calkins, L. M. (2006). *Units of study for teaching writing, grades 3–5*. Portsmouth, NH: Heinemann.

Córdova, R. A., & Matthiesen, A. L. (2010). Reading, writing, and mapping our worlds into being: Shared teacher inquiries into whose literacies count. *The Reading Teacher, 63*, 452–463.

Correnti, R. (2007). An empirical investigation of professional development effects on literacy instruction using daily logs. *Educational Evaluation and Policy Analysis, 29*(4), 262–295.

Curry, M. (2008). Critical friends groups: The possibilities and limitations embedded in teacher professional communities aimed at instructional improvement and school reform. *Teachers College Record, 110*, 733–774.

Darling-Hammond, L., & Lieberman, A. (Eds.). (2012). *Teacher education around the world: Changing policies and practices*. New York: Routledge.

Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher, 38*, 181–199.

Deussen, T., Coskie, T., Robinson, L., & Autio, E. (2007). *"Coach" can mean many things: Five categories of literacy coaches in Reading First*. Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Northwest. Retrieved September 25, 2013, from *http://ies.ed.gov/ncee/edlabs/regions/northwest/pdf/REL_2007005_sum.pdf.*

Dierking, R. C., & Fox, R. F. (2012). "Changing the way I teach": Building teacher knowledge, confidence, and autonomy. *Journal of Teacher Education, 64*(2), 129–144.

Dole, J. A. (2004). The changing role of the reading specialist in school reform. *The Reading Teacher, 57*, 462–471.

Donnelly, A., Morgan, D. N., Deford, D. E., Files, J., Long, S., Mills, H., et al. (2005). Transformative professional development: Negotiating knowledge with an inquiry stance. *Language Arts, 82*, 336–346.

Elish-Piper, L., & L'Allier, S. K. (2007, November). *Does literacy coaching make a difference? The effects of literacy coaching on reading achievement in grades K–3 in a Reading First district*. Paper presented at the 57th Annual Meeting of the National Reading Conference, Austin, TX.

Elish-Piper, L., & L'Allier, S. K. (2011). Examining the relationship between literacy coaching and student reading gains in grades K–3. *Elementary School Journal, 112*, 83–106.

Graham, S., & Perin, D. (2007). A meta-analysis of writing instruction for adolescent students. *Journal of Educational Psychology, 99*(3), 445–476.

Hargreaves, A. (1992). Cultures of teaching: A focus for change. In A. Hargreaves & M. B. Fullan (Eds.), *Understanding teacher development* (pp. 216–236). New York: Teachers College Press.

Harris, K. R., Graham, S., Friedlander, B., & Land, L. (2013). Bring powerful writing strategies into your classroom. *Language Arts, 66*(7), 536–542.

Harris, K. R., Lane, K. L., Graham, S., Driscoll, S. A., Sandmel, K., Brindel, M., et al. (2012). Practice-based professional development for self-regulated strategies development in writing: A randomized controlled study. *Journal of Teacher Education, 63*(2), 103–119.

Helstad, K., & Lund, A. (2012). Teachers' talk on students' writing: Negotiating students' texts in interdisciplinary teacher teams. *Teaching and Teacher Education, 28*, 599–608.

Hunt-Barron, S., Kaminski, R., Howell, E., & Tracy, K. (2013, December). *Conquering the divide: Infusing new literacies into professional development for the Common Core standards*. Paper presented at the Literacy Research Association, Dallas, TX.

Hunt-Barron, S., Kaminski, R., & Tracy, K. (2013). Professional development in writing instruction: Common factors among high-adopting teachers. In P. J. Dunston, S. K. Fullerton, C. C. Bates, P. M. Stecker, M. W. Cole, A. H. Hall, et al. (Eds.), *62nd Yearbook of the Literacy Research Association* (pp. 297–311). Altamonte Springs, FL: Literacy Research Association.

Kim, J. S., Olson, C. B., Scarcella, R., Kramer, J., Pearson, M., van Dyk, D., et al. (2011). A randomized experiment of a Cognitive Strategies Approach to text-based analytical writing for mainstreamed Latino English language learners in Grades 6 to 12. *Journal of Research on Educational Effectiveness, 4*(3), 231–263.

Kinnucan-Welsch, K., Rosemary, C. A., & Grogan, P. R. (2006). Accountability by design in literacy professional development. *The Reading Teacher, 59*, 426–435.

Kopp, W. (2013). Economic Club of Chicago. Available at *www.econclubchi.org.speakers*.

Lieberman, A., & Friedrich, L. (2007). Teachers, writers, leaders. *Educational Leadership, 65*(1), 42–47.

Lieberman, A., & Miller, L. (2008). *Teachers in professional communities: Improving teaching and learning*. New York: Teachers College Press.

Lieberman, A., & Miller, L. (2011). Learning communities: The starting point for professional learning is in schools and classrooms. *Journal of Staff Development, 32*(4), 16–20.

Lieberman, A., & Wood, D. R. (2003). *Inside the National Writing Project: Connecting network learning and classroom teaching*. New York: Teachers College Press.

Limbrick, L., Buchanan, P., Goodwin, M., & Schwarcz, H. (2010). Doing things differently: The outcomes of teachers researching their own practices in teaching writing. *Canadian Journal of Education, 33*, 897–924.

Mahn, H., McMann, D., & Musanti, S. (2005). Teaching/learning centers: Professional development for teaches of linguistically and culturally diverse students. *Language Arts, 82*, 378–387.

Masters, J., de Kramer, R., O'Dwyer, L., Dash, S., Russell, M. (2010). The effects of online professional development on fourth-grade English language arts teachers' knowledge and instructional practices. *Journal of Educational Computing Research, 43*(3), 355–375.

McCarthey, S. J., & Woodard, R., & Kang, G. (2012). Access and perceptions of professional development in writing. In C. Bazerman, C. Dean, J. Early, K. Lunsford, S. Null, P. Rogers, et al. (Eds.), *International advances in writing research: Cultures, places, measures* (pp. 41–59). Fort Collins, CO: WAC Clearinghouse.

McCarthey, S. J., Woodard, R., & Kang, G. (2014). Elementary teachers negotiating discourses in writing instruction. *Written Communication, 31*(1), 58–90.

McLaughlin, M. W., & Talbert, J. E. (2006). *Building school-based teacher learning communities: Professional strategies to improve student achievement.* Chicago: University of Chicago Press.

McLaughlin, M. W., & Talbert, J. E. (2010). Professional learning communities: Building blocks for school culture and student learning. *Voices in Urban Education, 27*, 35–45.

Meth, J. M., & Azano, A. (2012). Negotiating the rub between cultures: Teacher talk and sustained shifts in practice. *English Education, 44*, 354–374.

Moss, M., Jacob, R., Boulay, B., Horst, M., Poulos, J., et al. (2006). *Reading First implementation evaluation: Interim report*. Washington, DC: U.S. Department of Education. Retrieved October 1, 2013, from *http://files.eric.ed.gov/fulltext/ED492928.pdf.*

National Commission on Writing for America's Families, Schools, and Colleges. (2003). *The neglected "R": The need for a writing revolution*. New York: College Board.

National Council of Teachers of English and International Reading Association. Available at *http://readwritethink.org.*

National Council on Teacher Quality. (2013). *Teacher prep review*. Washington DC: National Writing Project. Available at *www.nwp.org*.

National Writing Project, DeVoss, D. N., Eidman-Aadahi, E., & Hicks, T. (2010). *Because digital writing matters: Improving student writing in online and multimedia spaces*. San Francisco: Jossey-Bass.

National Writing Project. (2008). Research Brief. Berkeley, CA: Author. Available at *Nwp@nwp.org*.

National Writing Project. (2010). Research Brief. Berkeley, CA: Author. Available at *Nwp@nwp.org*.

Neufeld, B., & Roper, D. (2003). *Coaching: A strategy for developing instructional capacity—Promises and practicalities*. Boston: Education Matters.

Neuman, S. B., & Cunningham, L. (2009). The impact of professional development and coaching on early language and literacy instructional practices. *American Educational Research Journal, 46*, 532–566.

Neuman, S. B., & Wright, T. (2010). Promoting language and literacy development for early childhood educators: A

mixed-methods study of coursework and coaching. *Elementary School Journal, 111*, 63–86.

O'Donnell-Allen, C. (2004). Raising our voices: Transformative discourse in a teacher research group. *English Education, 37*, 50–74.

Olson, C. B., Kim, J. S., Scarcella, R., Kramer, J., Pearson, M., van Dyk, D., et al. (2012). Enhancing the interpretive reading and analytical writing of mainstreamed English learners in secondary school: Results from a randomized field trial using a cognitive strategies approach. *American Educational Research Journal, 49*(2), 323–355.

Olson, C. B., & Land, R. (2007). A Cognitive Strategies Approach to reading and writing instruction for English language learners in secondary school. *Research in the Teaching of English, 41*(3), 269–303.

Pella, S. (2011). A situative perspective on developing writing pedagogy in a teacher professional learning community. *Teacher Education Quarterly, 38*(1), 107–125.

Peterson, D. S., Taylor, B. M., Burnham, B., & Schock, R. (2009). Reflective coaching conversations: A missing piece. *The Reading Teacher, 62*, 500–509.

Pritchard, R. J., & Honeycutt, R. L. (2006). The process approach to teaching writing: Examining its effectiveness. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of research on writing* (pp. 275–290). New York: Guilford Press.

Rainville, K. N., & Jones, S. (2008). Situated identities: Power and positioning in the work of a literacy coach. *The Reading Teacher, 61*, 440–448.

Riddle-Buly, M., Coskie, T., Robinson, L., & Egawa, K. (2006). Literacy coaching: Coming out of the corner. *Voices from the Middle, 13*, 24–28.

Robbins, S., & Dyer, M. (2005). *Classroom literacy and public engagement*. New York: Teachers College Press.

Rogers, R., Kramer. M. A., Moslet, M., Fuller, C., Light, R., Nehart, M., et al. (2005). Professional development as social transformation. *Language Arts, 82*, 347–358.

Shanton, K. D., McKinney, M., Meyer, T., & Friedrich, L. (2009). Composing literacy leadership in professional development: New meanings of practice and process. In K. M. Leander, D. W. Rowe, D. K. Dickinson, M. K. Hundley, R. T. Jimenez, et al. (Eds.), *58th Yearbook of the National Reading Conference* (pp. 294–311). Oak Creek, WI: National Reading Conference.

Stokes, L., Hirabayashi, J., Murray, A., & Senauke, L. (2011, November). *The enduring quality and value of the National Writing Project's Teacher Development Institutes: Teachers' assessments of NWP contributions to the classroom practice and development as leaders.* Inverness, CA: Inverness Research.

Stoll, L., Bolam, R., McMahon, A., Wallace, M., & Thomas, S. (2006) Professional learning communities: A review of the literature, *Journal of Educational Change, 7*(4), 1–38.

Street, C., & Stang, K. K. (2009). In what ways do teacher education courses change teachers' self confidence as writers? *Teacher Education Quarterly, 36*, 75–94.

Taylor, B. M., Pearson, P. D., Peterson, D. S., & Rodriguez, M. C. (2005). The CIERA School Change Framework: An evidence-based approach to professional development and school reading improvement. *Reading Research Quarterly, 40*(1), 40–69.

The Reading and Writing Project. Teachers College. Available at *http://readingandwritingproject.com*.

Troia, G. A., Lin, C. S., Cohen, S., & Monroe, B. W. (2011). A year in the writing workshop: Linking instructional practices and teachers' epistemologies and beliefs about writing instruction. *Elementary School Journal, 112*(1), 155–182.

Vanderburg. M., & Stephens, D. (2010). The impact of literacy coaches: What teachers value and how teachers change. *The Elementary School Journal, 111*, 141–163.

Walpole, S., & Blamey, K. L. (2008). Elementary literacy coaches: The reality of dual roles. *The Reading Teacher, 62*, 222–231.

Wei, R. C., Darling-Hammond, L., & Adamson, F. (2010). *Professional development in the United States: Trends and challenges*. Dallas, TX: National Staff Development Council.

Whitney, A. (2008). Teacher transformation in the National Writing Project. *Research in the Teaching of English, 43*(2), 144–187.

Whitney, A. E., & Friedrich, L. (2013). Orientations for the teaching of writing: A legacy of the National Writing Project. *Teachers College Record, 115*, 1–37.

Zuidema, L. A. (2012). Making space for informal inquiry: Inquiry as stance in an online induction network. *Journal of Teacher Education, 63*, 132–146.

PART IV

WRITING AND SPECIAL POPULATIONS

CHAPTER 23

Writing Development and Instruction for Students with Learning Disabilities

Using Diagnostic Categories to Study Writing Difficulties

Vince Connelly and Julie Dockrell

Producing accurate and effective written text is challenging. Over the school years children learn to master writing in order to communicate with others and to acquire and to integrate knowledge. Yet, it is now well documented that a significant minority of children struggle with the writing process (Graham & Harris, 2009). For some children their difficulties with writing may be attributed to poor instruction: The instruction may not be effective or have sufficient intensity to support progress or it may not target the correct skills (Myhill, Jones, Lines, & Watson, 2012). However, there will also be children and young people who experience barriers in learning to write because of specific learning disabilities they experience. In this chapter we consider the ways in which these specific learning disabilities impact the production of written text. To understand the effect of these learning disabilities, it is necessary to consider the skills that underpin written text production and the ways in which these skills interact both over time and in relation to the writing task at hand.

A FRAMEWORK FOR CONCEPTUALIZING THE WRITING TASK

In the early 1980s, Margaret Martlew described how any writing task involved the characteristics of the writer, the

characteristics of the text, and the processes relating the two. Subsequent developmental approaches examining writing skills have emphasised the importance of specific subskills in the writing process and have demonstrated the fundamental role that transcription skills play until they become automatic. As technology has developed, so that we can capture the writing process, it has become clearer how important the focus on the dynamic and interactive aspects of writing are. Even the beginning writer needs to switch focus between different aspects of the task. Recently, Hayes and Berninger (2014) captured this view in their cognitive framework of the writing process, which they argue is relevant to planning interventions. Essentially the framework is built on three levels: a resource, process, and control level, each with its own components (see Figure 23.1).

Framework		Components	Dyslexia	LLD	DCD
Resource level		Reading	Reciprocal relationship between poor reading and spelling.	Reciprocal relationship between poor reading and spelling.	
		Long-term memory	Limited exposure to written text may reduce information available to generate texts. Less precise lexical representations.	Poor expressive language skills. Less precise lexical representations. Limited exposure to written texts.	Motor memory retrieval or production difficulties.
		Attention	?	?	?
		Working memory	Some limited evidence this may be reduced.	Some limited evidence that this may be reduced.	
Process level	Writing processes	Proposer		?	
		Evaluator		?	
		Translator	page 353	page 355	
		Transcriber		page 356	page 357
	Task environment	Transcribing technology			
		Task materials			
		Text written so far	Problems related to reading and spelling.	Problems related to reading and spelling	
Control level		Task initiator			page 357
		Writing schemas	?	?	?
		Planner		?	

FIGURE 23.1. Hayes and Berninger's (2014) framework model of writing development and where children with dyslexia, LLD, and DCD may have difficulties. See page numbers in this chapter for more detailed explanation of potential difficulties with these factors. ?, limited evidence of difficulties in these areas that requires further investigation; blank box, likely developmentally appropriate for the skill level of writing attained and/or as yet unknown.

The model is developmental in that each component becomes more complex and more integrated with each other over time. The resource level comprises the general cognitive resources that writers require and may draw upon as they compose. The middle, or process, level details the classic cognitive processes identified as contributing to

composing such as translating, transcribing, proposing and evaluating. Finally, the control level allows for a task initiator to interact with a planning function, where, over time, writing schemas can be adopted as required.

Schemas become more elaborate over time in the framework. Schemas represent "the writer's beliefs about the properties that the text-to-be-produced should have (genre knowledge) and also beliefs about how to go about producing that text (strategic knowledge)" (Hayes & Berninger, 2014, p. 13). Schemas are supported by the writer's experience and interactions with the external environment. The integration of the writing schema, writing processes, and text structure help determines the final writing product. The process of writing is therefore an integration of skills in which, for strong writers, the product is greater than the sum of its parts.

By corollary, weaknesses in any of the key components may impact the text produced. The way in which these difficulties manifest themselves will depend on the demands of the writing task as well as on the ways in which texts are analyzed and evaluated. Hayes and Berninger (2014) provide an explanatory framework that offers the potential to examine profiles of strengths and difficulties experienced by children with writing problems. The framework also provides a basis to make predictions about the ways in which weaknesses in language, cognitive, or motor aspects of behavior will influence the development of writing. In this chapter we use the framework to illustrate and explain the ways in which dyslexia, language learning disorder (LLD), and developmental coordination disorder (DCD) impact on the writing process.

THINKING ABOUT LEARNING DISABILITIES

Many children experience difficulties in learning. The difficulty can either be specific, as occurs when a child experiences a problem with some particular task such as reading, or it can be general, as occurs when learning is slower than normal across a range of tasks. These difficulties are conventionally categorized using diagnostic criteria where children are placed in clinical groups. Both the groups and the criteria for classification are subject to change (DSM-V, 2013). In DSM-5 (American Psychiatric Association, 2013), "specific learning disorder" combines diagnoses of reading disorder, mathematics disorder, disorder of written expression, and learning disorder "not otherwise specified" and focuses on academic skills that must be well below the average range of scores, not explained by neurological, developmental, and sensory disorders, and that significantly interfere with performance. Descriptive features of disorders of written expression identified in DSM-5 include problems with spelling accuracy, grammar and punctuation accuracy, legible or fluent handwriting, and clarity and organization of written expression. These problems with written expression are also comorbid with other learning disability categories, including DCD, dyslexia, and LDD (see Connelly, Dockrell, & Barnett, 2011). Thus, it is to be expected that problems with written text production will be associated with a range of developmental problems (Dockrell, 2009).

One potential approach to understanding written expression difficulties is to use diagnostic categories and examine the extent to which particular patterns of difficulty can be linked to specific clinical groups. For example, do students who are diagnosed with DCD, dyslexia, or LLD experience unique or sometimes overlapping patterns of problems with written expression? New knowledge here would inform models of writing development, allow the identification of specific causal factors impacting on the difficulties with writing, and provide an indication of potential areas for intervention (Saddler & Asaro-Saddler, 2013).

Before we go on to illustrate the utility of this approach, three caveats need to be considered in interpreting data from such an approach for both developing theories and targeting interventions. First, despite the potential value of diagnostic approaches, diverse and heterogeneous populations are often identified. Second, the nature of students' difficulties may change over time as a result of a subtle interaction between the skills the student possesses, the

demands of the task, and the teaching environment. Development is dynamic, and small differences early in development can lead to larger differences later on. Behavior can also be shaped by causes that only become evident through time and thus require true longitudinal study. Third, the specific problems that are isolated will depend on the comparisons made with other students. Thus, the issue of identifying the relevant comparison groups for children with specific learning difficulties is extremely important for the development of both theory and practice.

DYSLEXIA

Dyslexia is a developmental learning disability characterized by a specific difficulty in learning to read and spell (Nation, 2011). A substantial literature has shown that the majority of children with dyslexia have difficulties with the phonological aspects of reading and spelling and that this disability may be related to problems in learning phonological forms (e.g., Litt & Nation, 2014). The coding of phonological information in memory and the translation of phonological information into orthographic codes are difficult for these children (Berninger, Nielsen, Abbott, Wijsman, & Raskind, 2008). Many individuals with dyslexia also have problems with rapid naming of letters, and their working memory spans appear to be smaller, although the extent to which these are the cause or the consequence of reading difficulties remains a matter of debate. However, most researchers argue that the difficulties faced by the majority of children with dyslexia when dealing with print have their impact specifically at the word or subword level (Berninger, Winn, et al., 2008). These word-level deficits in turn will affect production of written language.

There is strong evidence that children with dyslexia do not progress as well as their peers in writing. They find it difficult to do well in written timed assessments, achieving lower levels of success in these exams than other pupils (Richardson & Wydell, 2003). Moreover, writing continues as a long-term barrier to progress, with 80% of a childhood sample with dyslexia reporting difficulty with writing and spelling when they reach adulthood (Maughan et al., 2009). In general, university students with dyslexia also continue to do less well in written exams than their peers (Mortimore & Crozier, 2006). However, very high-achieving university students with dyslexia perform comparably to their peers on examinations (McKendree & Snowling, 2011).

Hayes and Berninger's (2014) framework provides the basis for predicting why these individuals struggle to write. First, according to the framework, reading is a key resource that supports the production of written text. Given that this resource is weakened in dyslexia, then this problem will have a significant impact on the process level and aspects of the control level. Difficulty reading words reflects problems with the phonological aspects of language and will impact on word decoding and spelling. Learning to read words also contributes to the development of reading comprehension, a complex vocabulary, and written grammatical knowledge and it allows for rapid reviewing of the written text and ultimately influences what is available in long-term memory. For example, reading back and forth through the text when writing has been shown to be a common occurrence for typically developing children and adults and rereading has been associated with increased text quality (Wengelin, Leijten, & Van Waes, 2010). Recent work with typically developing adolescents has argued that a higher amount of rereading is associated with more sophisticated sentence-level planning and text production schemas (Beers, Quinlan, & Harbaugh, 2010). Therefore, individuals with dyslexia will be slower at extracting the required words, as they will be slower at engaging with the text written so far.

Difficulties with Spelling

Poor spelling results in a double disadvantage for students with dyslexia, and, as such, they will experience constraints at both the resource and process level. For students with dyslexia, spelling knowledge contained in long-term memory is less fine-grained and less accurate than it is in typically developing peers and takes longer to extract (Ramus & Ahissar, 2012). When composing, the poorer representations will also have an impact on the transcriber, slowing down writing and using up cognitive resources (Berninger, Nielsen, et al., 2008). It would appear that many children with dyslexia literally struggle over words when writing.

As a consequence, the translator may also be affected because replacement words may have to be found for words that cannot be spelled. Children with dyslexia have been shown to produce an oral version of a narrative with no difference in lexical diversity than their same-aged peers. By contrast, in the equivalent written version, lexical diversity was poorer and was equivalent to children matched for spelling levels (Sumner, Connelly, & Barnett, 2014). By identifying an appropriate comparison, it was possible to demonstrate that the poorer written narratives were anchored to spelling ability, whereas oral narratives were age appropriate. There is also further evidence that adults with dyslexia show less lexical diversity in their writing compared to peers (Tops, Callens, van Cauwenberghe, Adriaens, & Brybaert, 2013; Wengelin, 2007).

Poor spelling also has an impact on writing tasks that do not require composition. Children with dyslexia in China were slower and less accurate at a dictation task (Cheng-Lai, Li-Tsang, Chan, & Lo, 2013), as were adults with dyslexia in Belgium (Callens, Tops, & Brysbaert, 2012). Over 50% of the variability in the performance of children with dyslexia on a sentence copying task was predicted by spelling ability, and the children were slower than their same-age peers (Sumner, Connelly, & Barnett, 2014). Thus, poor spelling can limit the efficiency of the transcriber even on simpler writing copying tasks where there are markedly fewer working memory demands.

Recent theoretical models of spelling have moved away from stage theories of development to those where children have been shown to access a number of strategies as they learn to spell (Bahr, Silliman, Berninger, & Dow, 2012). Successful spellers will use morphological and orthographic as well as phonological strategies to spell words. These multiple strategies become more important as spelling develops and words become more complex and demanding. The strategies rely on children learning that phonetic similarity is not the only determinant of spelling and that orthographic patterns and morphology can influence the spelling and perceived sounds of words and so can be used to help spell specific words (Dich & Cohn, 2013).

Students with dyslexia may find it difficult to develop these multiple strategies. For example, morphology is a particular area of spelling weakness for children with dyslexia, even in single-word dictation tasks (Deacon, Parrila, & Kirby, 2006). University students continued to show errors in syntactic accuracy where morphological aspects of words were misspelled or, as is common, missed out altogether (Tops, Callens, Lammertyn, Van Hees, & Brysbaert, 2012). A number of authors have considered that these difficulties arise from a paucity of representational detail in developing the required item-specific knowledge for individual words. This problem is not thought to arise from difficulties from associative learning items but from early developmental problems with dealing with phonological information (Litt & Nation, 2014). These phonological problems slow down the reading and spelling of words and make it a struggle to develop wider strategies. Spelling continues to be a demanding task for most individuals with dyslexia into adulthood. The demands have significant consequences for composition even at university level (Connelly, Campbell, MacLean, & Barnes, 2006).

In contrast to a good speller, a poor speller is slow and effortful in spelling (Sumner, Connelly, & Barnett, 2013, 2014). These difficulties mean that individuals with dyslexia typically produce very much less text than their peers (Puranik, Lombardino, & Altmann, 2007). Misspelling also can have a direct influence on ratings of text quality (Coleman, Gregg, McLain, & Bellair, 2009), and spelling is a key predictor of writing composition quality in both typical children and children with dyslexia into adolescence (Abbott, Berninger, & Fayol, 2010; Gregg, Coleman,

Davis, & Chalk, 2007).

DIFFICULTIES WITH HANDWRITING?

There has been a longstanding belief that children with dyslexia have slow handwriting (Rose, 2009). However, it has recently been noted that when general motor difficulty has been ruled out, children with dyslexia can be as fast in using the pen to form letters as same-aged peers and faster than children matched for spelling ability (Sumner et al., 2013, 2014). The slower text production of the participants with dyslexia in comparison with chronological age-matched peers instead reflected a greater number of pauses and longer pauses in their writing. Unlike their age-matched peers, the students with dyslexia made more within-word than between-word pauses. However, as the amount and length of pauses from the children with dyslexia were no different from those found in a group of children matched for spelling ability, it is likely that the slow writing of children with dyslexia compared to the same age peers derives from their poor and hesitant spelling skills.

Some recent evidence from China, however, may challenge this claim. It has been found that Chinese students with dyslexia do experience difficulties with the more subtle aspects of producing Chinese characters in terms of accuracy, size, and some elements of speed of writing characters (Lam, Au, Laung, & Li-Tsang, 2011). This evidence may indicate problems with motor execution, as the authors suggest, but because no detail was provided on the spelling ability of the poorest writers in the sample and no spelling match control was contrasted with the dyslexia group, results are not yet conclusive.

Further Issues

A number of important questions remain unanswered. For example, the literature continues to debate the subtypes of dyslexia but has reached some agreement that phonological (associated with decoding problems when reading) and surface dyslexia (associated more with semantic problems in reading and manifested perhaps in difficulty using semantics to help read irregular words) represent different ends of a distribution of difficulties (Peterson, Pennington, & Olson, 2013). For example, those with the surface dyslexia typology would tend to be able to read well through having a fairly intact phonological decoding strategy but would have trouble learning complex spellings where orthographic and morphological knowledge is required, including many irregular words. This may help explain why it has been reported that up to a third of the children with writing difficulties assessed in a UK classroom context presented with spelling problems but without any obvious reading difficulties. Sadly, very few of them had been referred for any special help in school since their reading was perceived to be intact (Montgomery, 2012).

LANGUAGE LEARNING DISORDER

Practitioners, policy makers, and researchers use a range of different terms to describe this population, such as *dysphagia* in Europe or *specific language impairment* (SLI) in North America. DSM-5 uses the term *language disorder*. These labels all refer to children who have difficulties with the acquisition and processing of oral language, characterized by a protracted rate of language development as well as difficulties with subcomponents of the language system. The most commonly used core criterion to identify children is that their language problems cannot be explained in terms of other cognitive, neurological, or perceptual deficits (Leonard, 1998). Although

conventionally identified by discrepancy between language levels and nonverbal ability, children with LLD are heterogeneous in their profile of language impairments and in terms of nonverbal ability (Conti-Ramsden & Botting, 1999). Thus, each child can present with a different profile of difficulties in terms of language problems (Dockrell, Ricketts, Palikara, Charman, & Lindsay, 2012) and there has been much debate over the identification of different subgroups (Botting, Faragher, Knox, Simkin, & Coti-Ramsden, 2001).

Children with an LLD are at a significant risk of literacy difficulties. They typically experience marked difficulties at school, and these difficulties persist into adulthood. Current evidence indicates that these language learning difficulties impact directly on the production of written text and these pupils rarely catch up with peers (Dockrell & Connelly, 2009). The written texts of children with LLD are shorter and more error prone than those of their typically developing peers (Bishop & Clarkson, 2003; Dockrell, Lindsay, & Connelly, 2009) and for some aspects of text production, their language-matched peers (Mackie, Dockrell, & Lindsay, 2013). Pupils with LLD perform poorly in writing in most areas commonly measured, including narrative quality (Broc et al., 2013), grammar (Scott & Windsor, 2000), spelling (Silliman, Bahr, & Peters, 2006; Larkin, Williams, & Blaggan, 2013), punctuation (Bishop & Clarkson, 2003), vocabulary (Dockrell, Lindsay, Connelly, & Mackie, 2007), and the number of ideas produced (Puranik et al., 2007).

In the Hayes and Berninger framework, language is a key resource for writing (encompassed under more general long-term memory resources) that is likely compromised for pupils with LLD. Studies have explored the correlations between oral-language measures and writing in typically developing children, and increased oral-language facility is associated with increased written language proficiency (Wagner et al., 2011). Relationships between oral language and writing are also reported to change over time, where text measures of written language may become more predictive than oral language (Shanahan, 2006). Specifying the relationships between oral language and writing in children with LLD is a challenge as the development of writing is constrained by the development of transcription skills; these can be a more powerful immediate constraint than wider language factors when beginning to learn to write (Puranik & Al Otaiba, 2012).

Children with LLD struggle with reading decoding and reading comprehension (Palikara, Dockrell, & Lindsay, 2011), and these problems will constrain their production of written text. Problems with decoding predict poor spelling skills (McCarthy, Hogan, & Catts, 2012), whereas problems in comprehension, but not decoding difficulties, are more likely to be associated with producing texts with less sophisticated story structure (Cragg & Nation, 2006). This difference is evident despite texts being of similar length and syntactic complexity. Therefore, poor language skills will have an impact on the other resource levels available to the developing writer, as well as directly impacting on the process level. This makes for a complex picture of difficulty. There has been little research to date on the interactions between factors influencing writing in children with language difficulties. One approach that has been used with some success is to consider separately the impact of nonphonological aspects of language, for example, semantic and syntactic factors, from the impact of phonological aspects on the development of the writing process (Dockrell & Connelly, 2009).

Problems with Nonphonological Aspects of Language

Problems at the resource level that reflect nonphonological aspects of oral language may affect the development of the translator (and presumably text generation within the transcription component) at the process level. A key component of translation is the selection of the appropriate words. For typically developing younger children, oral vocabulary provides a critical building block for written language. Many children with LLD have smaller vocabularies than matched peers and can experience difficulties retrieving words that they comprehend (Messer &

Dockrell, 2006). A longitudinal study of a group of children with LLD in the United Kingdom revealed that at age 16 the two most significant concurrent predictors of written text production were spelling and vocabulary, each with separable effects on written text quality. Vocabulary at age 8 was significantly associated with text quality at age 11 and at age 16. However, the impact of vocabulary on writing at age 16 was mediated through reading and spelling at age 14, demonstrating the complexity of relationships changing over time (Dockrell et al., 2007, 2009).

Children with LLD also have difficulties with the grammatical components of speech, and grammatical errors are evident in their writing (Mackie & Dockrell, 2004; Scott & Windsor, 2000). This would appear to provide confirmatory evidence of direct influences from language at the resource level to the process level. However, there are some difficulties interpreting results in this area due to interactions with spelling knowledge.

PROBLEMS WITH THE PHONOLOGICAL ASPECTS OF LANGUAGE

Indeed, one of the key impacts of phonological problems with language development is on the development of spelling. Spelling is a key constraint on text generation in children with LLD in a similar way that it is a continuing constraint in those with dyslexia and young typically developing children. Texts contain many spelling errors and can deviate from texts of both chronological- and language-matched peers (Mackie et al., 2013; Dockrell & Connelly, 2015), but differences between children with LLD and spelling-level matched peers are inconsistently found (Silliman et al., 2006). There is emerging evidence that poor spelling could be influenced by an interaction between patterns of language disabilities and poor reading skills and that the impact of poor spelling on writing is very similar to that found for those with dyslexia described earlier in this chapter (Cordewener, Bosman, & Verhoeven, 2012; McCarthy et al., 2012).

PROBLEMS COORDINATING TRANSCRIPTION AND TRANSLATION

Recent work has suggested that children with LLD find it difficult to coordinate text generation/translation and transcription at age 11 (Dockrell et al., 2007). Further studies on children with LLD showed that they were developmentally similar in their writing to younger children of the same language ability (LA). This finding suggests that the difficulty in coordination reflects their language level rather than any specific cognitive impairment (Dockrell et al., 2009).

One way to examine the coordination is by studying written language bursts where typical writers compose in bursts of writing activity broken by long production pauses (Hayes, 2009). Written language bursts are interesting because they may reflect translation and transcribing processes at work. When writers only transcribe, written language bursts are not produced (e.g., in a copying task), but bursts do occur when translating but no new proposing is required (e.g., in a sentence-combining task). Thus, bursts are hypothesized to be symptomatic of the translating process and not of proposing. Bursts are also highly associated with linguistic skill (Hayes, 2012), but in typically developing children bursts can also be constrained by transcription bottlenecks in processing such as slow handwriting or spelling (Alves, Branco, Castro, & Olive, 2012).

Using digital writing tablet data to capture online writing processes, Connelly, Dockrell, Walter, and Critten (2012) demonstrated that children with LLD produced sustained bursts of text when writing that were equivalent in length to language ability-matched children but significantly shorter than same-age peers. Spelling competence and language level were independent predictors of the length of the bursts of text writing. The pauses between bursts in children with LLD were associated with more misspellings than the same-aged peers, and the children with LLD

paused longer when writing. Shorter bursts of writing were associated with poorer text quality ratings. Thus, children with LLD appeared to find it difficult to simultaneously coordinate transcription and translation processes. Their spelling difficulties interrupt the writing process in a similar way as in children with dyslexia. However, children with LLD exhibit more extensive problems with language that impact on both the translation and transcription aspects of writing development.

DEVELOPMENTAL COORDINATION DISORDER

DCD is defined as a condition in which "the acquisition and use of coordinated motor skills is substantially below that expected" (American Psychiatric Association, 2013, p. 74) that cannot be explained by a sensory, neurological or general intellectual impairment. Children with DCD have difficulty in performing and learning everyday movement tasks, and very often this includes specific difficulties with handwriting (Miller, Missiuna, Macnab, Malloy-Miller, & Polatajko, 2001). The nature of the difficulties varies with age, but motor difficulties often persist into adulthood (Cousins & Smyth, 2003).

The Hayes and Berninger (2014) framework for writing would again suggest that children with DCD suffer from problems in the resource level relating to motor skills and planning, such that the transcribing process will be impaired relative to that of peers. Using the framework, we can hypothesize that this impairment will impact handwriting but will also have wider impacts on the whole writing process as the transcription process will require more processing resources to the detriment of the other writing processes. Thus, when handwriting difficulties occur, they can influence the overall writing process in terms of the amount of text produced and have a negative impact on the overall quality of written composition (Graham, Berninger, Abbott, Abbott, & Whitaker, 1997). Some studies have reported wider writing difficulties in children with DCD, and there are many studies showing that children with DCD do have difficulties with handwriting where handwriting is generally reported as being slower and output is reduced compared to peers and that these difficulties persist into adulthood (Chang & Yu, 2010; Connelly et al., 2011; Rosenblum & Livneh-Zirinski, 2008). However, there are very few studies of the writing of children with DCD beyond the detailed examinations of letter formation and copying. Therefore, it is difficult to ascertain if children with DCD bear costs that extend beyond transcription when writing.

Online Studies of Writing in Students with DCD

Recent studies have used digital writing tablets to identify where any differences in writing speed may occur. For example, 30 children with DCD in the United Kingdom completed some writing tasks, including copying and text writing, and the results were compared to same-age controls using a digital writing tablet (Prunty, Barnett, Wilmut, & Plumb, 2013). As expected, the children with DCD were found to perform more slowly on the tasks compared to control in terms of letters copied and words written. However, it was found that this difference could be accounted for by the excessive amount of long pauses within the overall task time and not because of a slower handwriting execution speed. In fact, surprisingly there was no difference in handwriting execution speed between children with DCD and their same-age peers. Children with DCD could also alter their speed as required during a copy fast task. The authors argued that the excessive pausing may be due to a lack of automaticity in the transcription process with explanations in terms of possible slow movement time, difficulties with the perceptual aspect of the movement, difficulties with motor memory for letter formation, and/or difficulties in visualizing the letters prior to forming them. Interestingly, research in Israel with children with DCD has identified similar issues with an excess of "in air"

pauses from children with DCD when writing in Hebrew (Rosenblum & Livneh-Zirinski, 2008). Despite this corroboration across languages, it is surprising that no difference in the speed of the pen was found in children with DCD, as it has been reported that they commonly demonstrate slower movement time during the performance of manual motor tasks (Wilmut, Byrne, & Barnett, 2013).

Recent work in French and Spanish on linguistic influences on handwriting speed demonstrates that transcription is more complex than originally modeled by theorists such as van Galen (1991). For both adults and children, higher-order linguistic units can modulate the timing of handwriting movements (Kandel, Herault, Grosjacques, Lambert, & Fayol, 2009). Based on the results of this research, it is theorized that orthographic representations activated during handwriting production are not single, linear letter strings but that letters are grouped into "linguistically coherent units, such as graphemes, syllables and morphemes" (Kandel et al., 2009). This insight suggests that additional intermediate linguistic processes have a direct impact on motor programming. Perhaps this requirement to coordinate linguistic and motor processes could help explain the longer pauses shown by children with DCD when writing.

SUMMARY ACROSS DIAGNOSTIC GROUPS

The profiles of difficulties exhibited by students with dyslexia, LLD, and DCD lead to differing problems in the production of written text. Nonetheless, there is considerable overlap in the areas in which these students experience difficulty. Problems with the development of reading and spelling significantly impact the development of writing across the diagnostic groups discussed here. It would also seem that all the students produce a pattern of long pauses associated with slow writing. Current work demonstrates a relationship between these pauses, spelling difficulties, and the selection of appropriate vocabulary. However, interpreting this data further requires corroboration with other measures and a developmental framework for understanding the writing process.

Significant difficulties in writing are evident when children have problems with the phonological and nonphonological aspects of oral language, a common pattern in many children with LLD. For example, in absolute terms it was found that a sample of children with LLD in differing educational provisions made no progress in a writing assessment from age 11 to age 16 (Dockrell et al., 2009). However, the growing proportion of students with dyslexia in higher education, reflecting the more specific problems of this group, show that problems can be overcome and successful outcomes achieved (McKendree & Snowling, 2011).

INTERVENTIONS FOR CHILDREN WITH WRITING DIFFICULTIES

The children we have described present with a profile of writing difficulties that hinders progress in writing compared to their same-aged peers. However, the problem for the classroom teacher is that on examining the final writing product most will appear to be weak across most areas of assessment. Given the integrated nature of writing, this is not unexpected but does give rise to challenges in supporting children with potentially different profiles. Lack of clarity over the diagnosis of dyslexia, LLD, and DCD contributes to this difficulty, as do complications arising from comorbidity across many developmental disorders. As such, diagnostic labels may provide indicative information about the difficulties pupils have with producing written text (Berninger & May, 2011), but they are not yet necessary or sufficient to indicate which students are at risk or guide individual intervention. The extent to which particular patterns of difficulty with writing can be linked to specific diagnostic categories of learning difficulty can be illuminating but can also be both complex and problematic. To date, the evidence suggests that writing

difficulties experienced are similar across individuals with and without disabilities and that the diagnostic approach, while useful, theoretically has not yet sufficiently matured to design writing interventions.

One finding, however, is consistent across all diagnostic categories in that all students who have writing problems seem slow to write, even when improving. Therefore, accommodations such as extra time to complete written summative assessment can allow these students time when other children have typically already completed the task. Even those individuals in higher education have, for example, some persisting difficulties with time-limited assessments such as exams, and adult students with dyslexia do better with extra time for exams (Gibson & Leinster, 2011).

Spelling would also appear to present a difficulty for all the students considered in this chapter and has an impact on writing beyond the single word. A number of successful spelling interventions can achieve some success with children diagnosed with dyslexia (Brookes, 2013), and explicit spelling instruction leads to gains in spelling performance that are maintained over time and generalize to writing and reading (Graham & Hebert, 2010). Furthermore, formal spelling instruction was good for all learners and at all grades and level of literacy skills (Graham & Santangelo, 2014).

Fluent and legible handwriting is another necessary but insufficient factor for developing good writing skills (Pontart et al., 2013). A number of studies show that interventions to improve the fluency of handwriting can help remove a key constraint on the development of quality composition (Christensen, 2005).

Over recent years, Graham and his colleagues have completed a range of meta-analyses listing effective approaches to teaching pupils with writing difficulties (e.g., Graham & Perin, 2007; Morphy & Graham, 2012). Clearly, the teaching of explicit writing strategies with a self-regulated strategy development approach for planning, revising, and editing provides a powerful boost to all genres of writing. Teachers may find that additional scaffolding opportunities are required for pupils with LLD as they find it difficult to generalize the knowledge taught in one context to another situation (Fuchs & Fuchs, 1998).

In order to implement effective writing strategies for pupils with writing difficulties, teachers require a sound knowledge of the processes that underpin writing development and an understanding of the specific difficulties that will challenge pupils. Teachers need also to flexibly respond to pupils' needs in an evidence-informed manner and develop an awareness of how to monitor slow and halting progress (see Correa, 2014). Teachers should also have a clear awareness of how poor spelling and handwriting can negatively affect their perceptions of the quality of written work (Meadows & Billington, 2005). This can be a potential barrier for students with writing problems in secondary and tertiary education when being taught by subject-specific teachers who are using writing for learning.

CONCLUSIONS AND FURTHER DEVELOPING THE WRITING FRAMEWORK

We have used the framework developed by Hayes and Berninger (2014) to test our ideas about the difficulties that children with dyslexia, LLD, and DCD demonstrate when learning to write. This framework was developed to explain typical writing development. However, comprehensive models of writing development can also help us understand and support struggling writers. By corollary, developmental models of writing need to account for the specific difficulties in written text production experienced by these struggling writers. Thus, we can ask some interesting questions of the framework, given the pattern of findings we have described.

For example, the resource level in the framework may be underspecified in terms of resource packages such as long-term memory, which is likely to have a major influence on writing by providing "knowledge of facts, events, motor planning, control, and execution skills, letter form access and production skills, and language including

vocabulary, spelling, grammar/syntax, and discourse schema" (Hayes & Berninger, 2014, p. 5). As we have explained, a number of these factors can impact writing development both separately and jointly. Grouping these factors together may serve to conceal the complex interactions that can exist between them and how these interactions may relate to the development of writing skills. For example, although we have seen that both nonphonological aspects of language and phonological problems with spelling can constrain writing, research has shown that spelling development itself can also be influenced by nonphonological aspects of language such as vocabulary (San Francisco, Mo, Carlo, August, & Snow, 2006) and grammatical awareness (Kim, 2010). Thus, a network of interconnected relationships may develop within the resource of "long-term memory" in the framework that can impact on writing. This is related to the concept of proximal and distal causes of difficulties previously debated in reading research (Jackson & Coltheart, 2001). For example, we may find in the future that the influence of poor grammatical development in LLD may constrain writing through constraining spelling in the early phases of development (a distal impact), while later in writing development there may be a more direct and proximal impact on the grammatical structure of written sentences.

To begin to understand these complex relationships we need a developmental approach to studying writing development and writing difficulties. This approach would necessitate that we use more complex measures of analyzing the writing product so that both macro- and microstructure measures are considered simultaneously. This would allow the evaluation of the interaction between different aspects of the resource components of the framework (Hall-Mills & Apel, 2013). The continued use of online measurements of writing will also allow us to tease out the complex interactions between the resource level and the process level. The studies reported in this chapter showing that pauses account for most of the slowness of writing in children with difficulties demonstrates the usefulness of such an approach. Further work on what predicts these pauses and how they relate to the cognitive profiles of the students will be required.

This chapter has considered difficulties that children with dyslexia, LLD, and DCD have with written expression. Although many children experience writing difficulties, these groups of children are particularly vulnerable to problems with writing. However, the constraints on text production do not seem to be qualitatively different to their younger peers in the classroom. Problems at the resource level in low levels of oral language, phonological coding, reading, and motor skills can constrict the development of the writing processes for all children. Through the specification of accurate developmental models, we can begin to design effective interventions for children. However, much still remains to be done to meet this challenge.

REFERENCES

Abbott, R., Berninger, V., & Fayol, M. (2010). Longitudinal relationships of levels of language in writing and between writing and reading in grades 1 to 7. *Journal of Educational Psychology, 102*, 281–298.

Alves, R. A., Branco, M., Castro, S. L., & Olive, T. (2012). Effects of handwriting skill, output modes and gender of fourth graders on pauses, written language bursts, fluency and quality. In V. W. Berninger (Ed.), *Past, present, and future contributions of cognitive writing research to cognitive psychology* (pp. 389–402). New York: Psychology Press.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: Author.

Bahr, R. H., Silliman, E. R., Berninger, V. W., & Dow, M. (2012). Linguistic pattern analysis of misspellings of typically developing writers in grades 1–9. *Journal of Speech Language and Hearing Research, 55*(6), 1587–1599.

Beers, S. F., Quinlan, T., & Harbaugh, G. (2010). Adolescent students' reading during writing behaviours and relationships with text quality. *Reading and Writing, 23*, 743–775.

Berninger, V., & May, M. (2011). Evidence-based diagnosis and treatment for specific learning disabilities involving impairments in written and/or oral language. *Journal of Learning Disabilities, 44*, 167–183.

Berninger, V. W., Nielsen, K. H., Abbott, R. D., Wijsman, E., & Raskind, W. (2008). Writing problems in developmental dyslexia. *Journal of School Psychology, 46*(1), 1–21.

Berninger, V. W., Winn, W. D., Stock, P., Abbott, R. D., Eschen, K., Lin, S. J., et al. (2008). Tier 3 specialized writing instruction for students with dyslexia. *Reading and Writing, 21*, 95–129.

Bishop, D. V. M., & Clarkson, B. (2003). Written language as a window into residual language deficits. *Cortex, 39*(2), 215–237.

Botting, N., Faragher, B., Knox, E., Simkin, Z., & Conti-Ramsden, G. (2001). Predicting pathways of SLI. *Journal of Child Psychology and Psychiatry, 42*(8), 1013–1020.

Broc, L., Bernicot, J., Olive, T., Favart, M, Reilly, J., Quémart, P., et al. (2013). Lexical spelling in children and adolescents with SLI: Variations with the writing situation. *Research in Developmental Disabilities, 34*, 3253–3266.

Brookes, G. (2013). *What works for children and young people with literacy difficulties* (4th ed.). London: Dyslexia SPLD Trust.

Callens, M., Tops, W., & Brysbaert, M. (2012). Cognitive profile of higher education students with an indication of dyslexia. *PLoS One*.

Chang, S., & Yu, N. (2010). Characterization of motor control in handwriting difficulties in children with or without DCD. *Developmental Medicine and Child Neurology, 52*(3), 244–250.

Cheng-Lai, A., Li-Tsang, C. W., Chan, A. H., Lo, A. G. (2013). Writing to dictation and handwriting performance among Chinese children with dyslexia. *Research in Developmental Disabilities, 34*, 3372–3383.

Christensen, C. (2005). The role of orthographic–motor integration in the production of creative and well-structured written text for students in secondary school. *Educational Psychology, 25*, 441–453.

Coleman, C., Gregg, N., McLain, L., & Bellair, L. W. (2009). A comparison of spelling performance across young adults with and without dyslexia. *Assessment for Effective Intervention, 34*, 94–105.

Connelly, V., Campbell, S., MacLean, M., & Barnes, J. (2006). Contribution of lower order skills to the written composition of college students with and without dyslexia. *Developmental Neuropsychology, 29*(1), 175–196.

Connelly, V., Dockrell, J. E., & Barnett, A. (2011). Children challenged by writing due to language and motor difficulties. In V. Berninger (Ed.), *Cognitive psychology of writing handbook: Past, present, and future contributions of cognitive writing* (pp. 217–246). New York: Psychology Press.

Connelly, V., Dockrell, J. E., Walter, K., & Critten, S. (2012). Predicting the quality of composition and written language bursts from oral language, spelling and handwriting skills in children with and without SLI. *Written Communication, 29*, 278–302.

Conti-Ramsden, G., & Botting, N. (1999). Classification of children with SLI: longitudinal considerations. *Journal of Speech, Language and Hearing Research, 42*, 1195–1204.

Correa, J. (2014). The Writing development of Brazilian children with dyslexia. In B. Arfe, J. Dockrell, & V. Berninger (Eds.), *Writing development in children with hearing loss, dyslexia, or oral language problems: Implications for assessment and instruction* (pp. 228–243). Oxford: Oxford University Press.

Cousins, M., & Smyth, M. (2003). Developmental coordination impairments in adulthood. *Human Movement Science, 22*(1), 443–459.

Cordewener, K. A. H., Bosman, A. M. T., & Verhoeven, L. (2012). Specific language impairment affects the early

spelling process quantitatively but not qualitatively. *Research in Developmental Disabilities, 33,* 1041–1047.

Cragg, L., & Nation, K., (2006). Exploring written narrative in children with poor reading comprehension. *Educational Psychology, 26*, 55–72.

Deacon, S. H., Parrila, R., & Kirby, J. R. (2006). Processing of derived forms in high-functioning dyslexics. *Annals of Dyslexia, 56*, 103–128.

Dich, N., & Cohn, A. C. (2013). A review of spelling acquisition. *Lingua, 133,* 213–229.

Dockrell, J. E. (2009). Causes of delay and difficulty in the production of written text. In R. Beard, M. Nystrand, & J. Riley (Eds.), *The Sage handbook of writing development* (pp. 489–505). London: Sage.

Dockrell, J. E., & Connelly, V. (2009). The impact of oral language skills on the production of written text. *British Journal of Educational Psychology* (monograph), *6*, 45–62.

Dockrell, J. E., & Connelly, V. (2015). The role of oral language in underpinning the text generation difficulties in children with specific language impairment. *Journal of Reading Research, 38*, 18–34.

Dockrell, J. E., Lindsay, G., & Connelly, V. (2009). The impact of specific language impairment on adolescents' written text. *Exceptional Children, 75*(4), 427–446.

Dockrell, J. E., Lindsay, G., Connelly, V., & Mackie, C. (2007). Constraints in the production of written text in children with SLI. *Exceptional Children, 73*, 147–164.

Dockrell, J. E., Ricketts, J., & Lindsay, G. (2012). *Understanding speech, language and communication needs: Profiles of need and provision*. London: DfE.

Dockrell, J. E., Ricketts, J., Palikara, O., Charman, T., & Lindsay, G. (2012). *Profiles of need and provision for children with language impairment and autism spectrum disorders in mainstream schools: A prospective study.* London: DfE.

Fuchs, L. S., & Fuchs, D. (1998). Treatment validity: A unifying concept for reconceptualizing the identification of learning disabilities. *Learning Disabilities Research and Practice, 13*, 204–219.

Gibson, S., & Leinster, S. J. (2011) How do students with dyslexia perform in extended matching questions, short answer questions and observed structured examinations? *Advances in Health Science Education*, Epub ahead of print.

Graham, S., Berninger, V., Abbott, R., Abbott, S., & Whitaker, D. (1997). The role of mechanics in composing of elementary school students: A new methodological approach. *Journal of Educational Psychology, 89*(1), 170–182.

Graham, S., & Harris, K. R. (2009). Evidence-based writing practices: Drawing recommendations from multiple sources. *British Journal of Educational Psychology* (monograph), *6*, 95–111.

Graham, S., & Hebert, M. (2010). *Writing to read: Evidence on how writing can improve reading.* Washington DC: Carnegie Trust.

Graham, S., & Perin, D. (2007). A meta-analysis of writing instruction for adolescent students. *Journal of Educational Psychology, 99*(3), 445–476.

Graham, S., & Santangelo, T. (2014). Does spelling instruction make students better Spellers, readers, and writers? A meta-analytic review. *Reading and Writing*, Online First

Gregg, N. G., Coleman, C., Davis, M., & Chalk, J. C. (2007). Timed essay writing: Implications for high-stakes test. *Journal of Learning Disabilities, 40*, 306–318.

Hall-Mills, S., & Apel, K. (2013). Narrative and expository writing of adolescents with language-learning disabilities. *Communication Disorders Quarterly, 34*(3), 135–143.

Hayes, J. R. (2009). From idea to text. In R. Beard, D. Myhill, M. Nystrand, & J. Riley (Eds.), *Handbook of writing development* (pp. 65–79). London: Sage.

Hayes, J. R. (2012). Modelling and re-modelling writing. *Written Communication, 29*, 369–388.

Hayes, J. R., & Berninger, V. (2014). Cognitive process in writing: A framework. In B. Arfé, J. E. Dockrell, & V. W. Berninger (Eds.), *Writing development in children with hearing loss, dyslexia or oral language problems: Implications for assessment and instruction* (pp. 3–15). New York: Oxford University Press.

Jackson, N. E., & Coltheart, M. (2001). *Routes to reading success and failure*. New York: Psychology Press.

Kandel, S., Herault, L., Grosjacques, G., Lambert, E., & Fayol, M. (2009). Orthographic vs. phonologic syllables in handwriting production. *Cognition, 110*(3), 440–444.

Kim, Y. S. (2010). Componential skills in early spelling development in Korean. *Scientific Studies of Reading, 14*, 137–158.

Lam, S. S. T., Au, R. K. C., Laung, H. W. H., & Li-Tsang, C. W. P. (2011). Chinese handwriting performance of primary school children with dyslexia. *Research in Developmental Disabilites, 32*, 1745–1756.

Larkin, R. F., Williams, G. J., & Blaggan, S. (2013). Delay or deficit? Spelling processes in children with specific language impairment. *Journal of Communication Disorders, 46*, 401–412.

Leonard, L. B. (1998). *Children with SLI*. Cambridge, MA: MIT Press.

Litt, R. A., & Nation, K. (2014). The nature and specificity of paired associate learning deficits in children with dyslexia. *Journal of Memory and Language, 71*, 71–86.

Mackie, C., & Dockrell, J. E. (2004). The nature of written language deficits in children with SLI. *Journal of Speech Language and Hearing Research, 47*(6), 1469–1483.

Mackie, C. J., Dockrell, J., & Lindsay, G. (2013). An evaluation of the written texts of children with SLI: The contributions of oral language, reading and phonological short-term memory. *Reading and Writing, 26*(6), 865–888.

Maughan, B., Messer, J., Collishaw, S., Pickles, A., Snowling, M., Yule, W., et al. (2009). Persistence of literacy problems: Spelling in adolescence and at mid-life. *Journal of Child Psychology and Psychiatry, 50*(8), 893–901

McCarthy, J. H., Hogan, T. P., & Catts, H. W. (2012). Is weak oral language associated with poor spelling in school-age children with specific language impairment, dyslexia or both? *Clinical Linguistics and Phonetics, 26*(9), 791–805.

McKendree, J., & Snowling, M. J. (2011). Examination results of medical students with dyslexia. *Medical Education, 45*, 176–182.

Meadows, M., & Billington, L. (2005). *A review of the literature on marking reliability.* Manchester, UK: AQA.

Messer, D., & Dockrell, J. E. (2006). Children's naming and word-finding difficulties: Descriptions and explanations. *Journal of Speech Language and Hearing Research, 49*(2), 309–324.

Miller, L., Missiuna, C., Macnab, J., Malloy-Miller, T., & Polatajko, H. (2001). Clinical description of children with DCD. *Canadian Journal of Occupational Therapy, 68*, 5–15.

Montgomery, D. (2012). The contribution of handwriting and spelling remediation to overcoming dyslexia. In T. Wydell & L. Fern-Pollak (Eds.), *Dyslexia—A comprehensive and international approach* (pp. 109–146). Rijeka, Croatia: InTech.

Morphy, P., & Graham, S. (2012). Word processing programs and weaker writers/readers: A meta-analysis of research findings. *Reading and Writing, 25*, 641–648.

Mortimore, T., & Crozier, W. R. (2006). Dyslexia and difficulties with study skills in higher education. *Studies in Higher Education, 31*, 235–251.

Myhill, D. A., Jones, S. M., Lines, H., & Watson, A. (2012). Re-thinking grammar: The impact of embedded grammar teaching on students' writing and students' metalinguistic understanding. *Research Papers in Education, 27*, 139–166.

Nation, K. (2011). Disorders of reading and writing. In P. C. Hogan (Ed.), *The Cambridge encyclopaedia of the language sciences* (pp. 267–269). New York: Cambridge University Press.

Palikara, O., Dockrell, J. E., & Lindsay, G. (2011). Patterns of change in the reading decoding and comprehension performance of adolescents with specific language impairment (SLI). *Learning Disabilities: A Contemporary Journal, 9*(2), 89–105.

Peterson, R. L., Penington, B., & Olson, R. K. (2013). Subtypes of developmental dyslexia: Testing the predictions of the dual-route and connectionist frameworks. *Cognition, 126*, 20–38.

Pontart, V., Bidet-Ildei, C., Lambert, E., Morisset, P., Flouret, L., & Alamargot, D. (2013). Influence of handwriting skills during spelling in primary and lower secondary grades. *Frontiers in Psychology, 4*, 818.

Prunty, M., Barnett, A., Wilmut, K., & Plumb, M. (2013) Handwriting speed in children with DCD: Are they really slower? *Research in Developmental Disabilities, 34*(9), 2927–2936.

Puranik, C. S., & Al Otaiba, S. (2012). Examining the contribution of handwriting and spelling to written expression in kindergarten children. *Reading and Writing, 25*(7), 1523–1546.

Puranik, C. S., Lombardino, L. J., & Altmann, L. J. (2007). Writing through retellings: An exploratory study of language-impaired and dyslexic populations. *Reading and Writing, 20*(3), 251–272.

Ramus, F., & Ahissar, M. (2012). Developmental dyslexia: The difficulties of interpreting poor performance and the importance of normal performance. *Cognitive Neuropsychology, 29*(102), 104–122.

Richardson, J. T. E., & Wydell, T. N. (2003) The representation and attainment of students with dyslexia in UK higher education, *Reading and Writing, 16*, 475–503.

Rose, J. (2009). *Identifying and teaching children and young people with dyslexia and literacy difficulties.* London: DCSF Publications.

Rosenblum, S., & Livneh-Zirinski, M. (2008). Handwriting process and product characteristics of children diagnosed with DCD. *Human Movement Science, 27*, 200–214.

Saddler, B., & Asaro-Saddler, K. (2013). Response to Intervention in writing: A suggested framework for screening, intervention, and progress monitoring. *Reading and Writing Quarterly, 29*, 20–43.

San Francisco, A. R., Mo, E., Carlo, M. S., August, D., & Snow, C. (2006). The influences of language of literacy instruction and vocabulary on the spelling of Spanish–English bilinguals. *Reading and Writing, 19*(6), 627–642.

Scott, C. M., & Windsor, J. (2000). General language performance measures in spoken and written narrative and expository discourse of school-age children with language learning disabilities. *Journal of Speech Language and Hearing Research, 43*, 324–339.

Shanahan, T. (2006). Relations among oral language, reading and writing development. In C. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 171–183). New York: Guilford Press.

Silliman, E., Bahr, R., & Peters, M. (2006). Spelling patterns in preadolescents with atypical language skills. *Developmental Neuropsychology, 29*, 93–123.

Sumner, E., Connelly, V., & Barnett, A. (2013). Children with dyslexia are slow writers because they pause more often and not because they are slow at handwriting execution. *Reading and Writing: An Interdisciplinary Journal, 26*(6), 991–1008.

Sumner, E., Connelly, V., & Barnett, A. (2014). The influence of spelling ability on handwriting production: Children with and without dyslexia. *Journal of Experimental Psychology: Learning Memory and Cognition, 40*(5), 1441–1447.

Tops, W., Callens, M., van Cauwenberghe, E., Adriaens, J., & Brysbaert, M. (2013). Beyond spelling: The writing skills of students with dyslexia in higher education. *Reading and Writing, 26*, 705–720.

Tops, W., Callens, M., Lammertyn, J., Van Hees, V., & Brysbaert, M. (2012). Identifying students with dyslexia in

higher education. *Annals of Dyslexia, 62*(3), 186–203.
van Galen, G. P. (1991). Handwriting: Issues for a psychomotor theory. *Human Movement Science, 10*, 165–247.
Wagner, R. K., Puranik, C. S., Foorman, B., Foster, E., Wilson, L. G., Tschinkel, E., et al. (2011). Modelling the development of written language. *Reading and Writing, 24*(2), 203–220.
Wengelin, A. (2007). The word-level focus in text production by adults with reading and writing difficulties. In M. Torrance, L. Van Waes, & D. Galbraith (Eds.), *Writing and cognition research and applications* (Studies in Writing) (pp. 67–82). London: Elsevier.
Wengelin, A., Leijten, M., & Van Waes, L. V. (2010). Studying reading during writing: New perspectives in research. *Reading and Writing, 23*, 735–742.
Wilmut, K., Byrne, M., & Barnett, A. L. (2013) To throw or to place: Does onward intention affect how a child reaches for an object? *Experimental Brain Research, 226*(3), 421–422.

CHAPTER 24

Writing Development and Instruction for English Language Learners

Alister Cumming

This chapter is organized around three major issues that have featured in publications over the past decade (2003–2013) about the teaching and learning of writing in English among English language learners (ELLs) in the United States and Canada: organizing educational practices to support ELLs' writing development, promoting writing competencies in multiple languages, and adjusting L2 writing assessments. Focusing the review is complicated, however, for several important reasons. First, as with chapters in the handbook overall, the focus is on children's and adolescents' writing in and outside of schools, but the vast majority of research on writing in second or additional (L2) languages, and therefore much of the relevant theorization and principles, has involved studies of adults writing in English in academic contexts or, to a lesser extent, students writing in schools internationally. North American educators have over the past decade described educational practices for a population now conventionally called ELLs (i.e., children and adolescents from immigrant, migrant, or refugee backgrounds dominant in a language other than English who are improving their English abilities while studying in programs of English-medium education in English-dominant societies). But discussion of L2 writing inevitably involves ideas and references related to diverse educational contexts and populations around the world where English is also taught and studied as a foreign or international language (Cummins & Davison, 2007; Manchón, 2009). The designation ELL has to be appreciated as a social construction formulated through school and assessment policies in particular situations of cultural and linguistic diversity in English-dominant societies (Harklau, 2000; Hawkins, 2005; Shapiro, 2012). Indeed, the terms *ELL* and *L2 writing* remain contentious politically and morally for imposing, from the viewpoint of authorities in dominant positions of institutional power, essentialist, potentially stigmatizing, and logically indeterminate categories on groups of others (Atkinson, 2013; Guitiérrez & Orellana, 2006; Shapiro, 2012, 2014).

Second, and relatedly, there is no universally agreed-upon definition of ELLs or of L2 writers across educational or geographical contexts (Leki, Cumming, & Silva, 2008). Populations called ELL are not a uniform group but

rather are heterogeneous and vary regionally. Educators working with ELLs in the southwestern United States, for example, may encounter mostly students from Spanish-dominant families and heritages, whereas in schools in cities such as New York or Toronto populations of ELLs tend to be visibly diverse from dozens of different language and cultural backgrounds. Within the United States, the policies for defining and providing services, funding, and assessments for ELLs differ greatly from jurisdiction to jurisdiction (Rivera & Collum, 2006). As much could be said about ELL writing in schools in English-dominant societies such as Australia, the United Kingdom, or New Zealand as it could be about the United States and Canada. Internationally, many varieties of English have been established not only regionally but also as different standard varieties (e.g., North American, British, Australian, etc.) or as vernaculars or functioning as the international lingua franca (Cummins & Davison, 2007; Seidelhofer, 2011). Moreover, English is but one of many human languages, and the factors associated with the development of biliteracy (i.e., two or more languages in and around writing) as a general phenomenon are far more complex, variable, and contestable than most research or educational policies recognize. Hornberger's (2003) continua of biliteracy provides a framework to analyze the complex bases on which biliteracy varies with individual maturation, language systems, communication media, and language status in societies around the world, but educational policies related to biliteracy are easily confused by applying findings from one context that are not suitable in another. Further complicating the identification of students as ELLs (or "struggling," "at risk," or "linguistically and culturally diverse" learners) on the basis of individual skills and knowledge of English discourse often proves, upon analysis, to arise from complex combinations of macrosocietal forces such as intergroup differences in sociocultural practices and norms or poverty, racism, economic migration, and institutional barriers (Bigelow, 2010; Callahan, 2005; Cummins, 2001; Dressman, Wilder, & Connor, 2005; Franzak, 2006; Gunderson, 2007; Pucell-Gates, 2013; Snow, Porsche, Tabors, & Harris, 2007).

Third, studies of ELL writing have mostly been conducted in—and with the purpose of better understanding and improving—natural educational and related home or community contexts. The research on ELLs in North American schools has tended to combine discussions of theories, research methods and findings, and instructional implications together through in-depth case studies (of individual students, select classrooms, or innovative programs) or longitudinal analyses of programs—rather than many experiments, surveys, or the formulation of unique theories for ELL populations (cf. Franzak, 2006; Manchón, 2012)—even though diverse methods of research do feature in studies of adults' L2 writing internationally (Leki et al., 2008). Accordingly, I have assumed that basic issues about writing, research methods, and theories of learning and literacy are addressed in other chapters in this volume and so are not taken up here. In turn, much research on education with ELLs generally has produced recommendations for instruction that apply usefully to promoting their development of writing as much as other academic abilities. For instance, Freeman and Freeman (2007, pp. 354–359) pointed out four "keys for success": Engage students in a challenging, theme-based curriculum to develop academic concepts; draw on students' backgrounds—their experiences, cultures, and languages; organize collaborative activities and scaffold instruction to build students' academic English proficiency; and create confident students who value school and value themselves as learners. Haneda and Wells (2012, pp. 298–299) similarly offered educators four "pedagogic principles" from their research: Provide frequent opportunities to talk and write; connect curriculum to students' lives; select engaging topics; and work toward a tangible outcome.

In view of these three complexities, in this chapter I have reviewed studies to exemplify prevalent issues rather than attempting to account comprehensively for all published research, for example, through searches of library databases (cf. Norris & Ortega, 2006). The present chapter follows from, aligns with, and extends the focus and content in chapters by Fitzgerald (2006) and by Ball (2006) in the first edition of this handbook as well as syntheses of research on L2 writing in English by Leki et al. (2008) and on English language teaching internationally in

Cummins and Davison (2007). Interested readers may usefully consult all four of these publications for authoritative analyses and references up to the mid-2000s, as well as recent perspectives in volumes on ELLs writing in secondary schools in the United States by de Oliveira and Silva (2013) and by Ortmeier-Hooper and Enright (2011) and on educating ELLs in schools in the United States by Faltis and Valdés (2010).

EDUCATIONAL PRACTICES TO SUPPORT ELLS' WRITING DEVELOPMENT

Nine interrelated approaches to support ELLs' writing development have been relatively well documented in recent research in the United States and Canada, as described in the following subsections: regular routines to scaffold writing tasks; strategy instruction and practice; collaborative writing; content-based teaching; development of metalanguage, genres, and vocabulary; teacher development; supporting literacies outside of school; dual-language programs; and tutoring. The extent of research on any one of these approaches is limited, however, and complicated in that several of these approaches have been combined in multiyear studies with groups of ELLs and other culturally diverse learners. These studies document students' developmental trajectories in response to explicit instruction, modeling, and scaffolding, while also finding great individual differences among students, seemingly related to varied cultural and family backgrounds, prior educational experiences, and uses of literacy: Cumming (2012); Olson and Land (2007); Snow, Porsche, Tabors, and Harris (2007).

MODELING AND SCAFFOLDING WRITING STRATEGIES

Almost all pedagogically oriented studies have converged on the value of teachers establishing *regular classroom routines* for ELLs that progressively model, scaffold, engage students in, and practice multiple drafts of writing. Various approaches to such activities have been described in longitudinal research on particular students and teachers interacting: Cumming (2012), Haneda and Wells (2012), Kong and Pearson (2003), Nassaji and Cumming (2000), and Parks, Huot, Hamers, and Lemonnier (2005). Olson and Land (2007) offered an extensive analysis of the long-term effects with ELLs of explicit modeling and practice of cognitive *strategies for composing*, providing a rare example of sustained inquiry of this type with young learners. *Collaborative writing* tasks have been shown to provide contexts for language students to support one another, articulate their ideas with, and learn language from their peers (Haneda & Wells, 2012; Storch, 2013; Swain, 2010). Of course, supporting ELLs to write effectively in their academic courses is "the" routine of ultimate importance. To this end, *content-based instruction* aims to help to integrate and socialize rather than isolate ELL students (Callahan, 2005; Kibler, 2011; Leung, 2007a; Short, Echevarria, & Richards-Tutor, 2011). Theoretically, most researchers have conceptualized the acquisition of literacy for learners of English in schools as a long-term process of socialization into academic discourses (Duff, 2010).

Promoting Academic Language

In addition to establishing routines for writing frequently and purposefully, numerous researchers have demonstrated the importance of supporting ELLs explicitly to develop their metalanguage, that is, *knowledge of language and discourse structures*. Researchers following the principles of System-Functional Linguistics have shown how ELLs benefit from developing metalanguage to talk and think about their writing for school tasks: Gebhard, Harman, and Seger (2007), Schleppegrell (2004, 2013), Schleppegrell and O'Hallaron (2011), and de Oliveira (2008). Others have emphasized the importance of ELLs developing skills in conventional genres of academic discourse expected

in writing for academic purposes, such as description, reporting, analysis, comparison, narration, or argumentation: Hyland (2004), Kibler (2014), Mohan (2007), Schleppegrell (2004), and Tardy (2009).

The development of *academic vocabulary* is an outstanding, conspicuous need for the writing of English learners everywhere (Albrechtsen, Haastrup, & Henriksen, 2008; Li, 2010; van Gelderen, Oostdam, & van Schooten, 2011; Schoonen, van Gelderen, Stoel, Hulstijn, & van Glopper, 2011; Snow & Uccelli, 2009), particularly the acquisition of the many formulaic phrases expected in academic writing (Boers & Lindstromberg, 2012; Macqueen, 2012). To this end, engaging ELLs in reading extensively seems a vital behavior to promote (Grabe & Zhang, 2013; Hirvela, 2004), and to motivate and situate their writing, for example, through book clubs (Kong & Pearson, 2003; Polleck, 2010), as are strategic uses of electronic tools such as computer corpora (for collocations) or dictionaries (for word translations) while writing (Li, 2010; Yoon, 2011). A few studies have shown that developing morphological skills to analyze and generate academic word forms help language learners to expand their vocabulary and syntactic repertoires: Lyster, Quiroga, and Ballinger (2013) and Reynolds (2005).

Collectively, these language and discourse-oriented studies affirm that the development of writing abilities in an additional language involves the acquisition of many interrelated, multifaceted, dynamic, and complex aspects of language systems and discourse practices (Cumming, 2013; Verspoor, Schmid, & Xu, 2012). A consequential challenge in supporting ELLs to be able to develop their writing is organizing initial *teacher education* and ongoing professional development to ensure that all their teachers have the relevant knowledge and abilities to be able to do so (Bunch, 2013; Early, Potts, & Mohan, 2005; Kristmanson, Dicks, & Bouthillier, 2009; Gebhard, Demers, & Castillo-Rosenthal, 2008; de Oliveira & Silva, 2013; Schleppegrell, 2013). To this end, key pedagogical elements have been synthesized in various books to educate teachers about English learners, for example, by Davies Samway (2006) or Gibbons (2002).

Organizing Supplementary Support

A consistent finding from case study research on ELLs' writing concerns the extent to, and ways in which, youth practice *literacies outside of schools*, leading to the recommendation that educators need to acknowledge, build on, and support these contexts—in students' families and local communities (Cumming, 2012; Kibler, 2014; King & Hornberger, 2005; Perry & Moses, 2011; Wilson, 2013); among student peers (McCarthey & Garcia, 2005; Villalva, 2006; Yi, 2013); and for students to develop literate identities through writing in new media (Lam, 2000; Yi, 2010).

Two ways of extending educational opportunities to contexts beyond ordinary instruction to support ELLs' literacy development have come to the fore where the concentration of populations permit, communities commit to the innovation, and appropriate organizational steps are made. One is *dual-language programs*, which provide "literacy and content instruction to all students through two languages" to "promote bilingualism and biliteracy, grade-level academic achievement, and multicultural competence for all students" (Howard, Sugarman, Christian, Lindholm-Leary, & Rogers, 2007, p. 1). Perez (2004) produced an in-depth analysis of literacy development in such programs, which are usually organized in elementary schools where populations with a specific language (e.g., Chinese, Korean, or Spanish in some parts of the United States) are of a sufficient size locally to make feasible instruction in a language in addition to English.

Another well-documented approach to supporting ELLs' English writing development is *tutoring*, which may be organized in numerous ways to supplement regular schooling (Jun, Ramirez, & Cumming, 2010; Richards & Lassonde, 2009). Notably effective and sustainable have been programs of cross-age tutoring, where older students tutor younger ones (Jun et al., 2010), and, in situations of poverty and cultural diversity, community-based initiatives for after-school tutoring and mentoring (Cumming, 2012; Rowen & Gosine, 2006).

Differences between Educational Contexts and Students' Ages

Fitzgerald (2006), Leki et al. (2008), and Belcher (2012) have each observed how the research on ELL writing in North America has grouped around one of two educational contexts related to the developmental ages of students (as children or adolescents) and to their positions in school programs (in primary, intermediate, or secondary education). Research on the writing of ELL children has mostly reported images of "success and increasing power, self-confidence, and flexibility in writing" (Leki et al., 2008, p. 11), facilitated through the establishment of multiliterate identities (e.g., McCarthey, Guo, & Cummins, 2005), supportive families (e.g., Buckwalter & Lo, 2002), and school programs emphasizing bilingualism (e.g., Perez, 2004)—in spite of sometimes daunting experiences at school (Harklau, 2000; Hawkins, 2005).

Research on adolescent ELL writers, in contrast, has produced "a consistently pessimistic portrait of the overall predicament of high school L2 learners and writers" (Leki et al., 2008, p. 18), often revealing the culmination of limitations in prior literacy development and the consequences of macrosocietal prejudices and family migrations (Bigelow, 2010; Cummins, 2001; Valdés, 2001), teenage struggles with personal and group identity (Cumming, 2012; Harklau, 2007; Kibler, 2014; Yi, 2013), and financial pressures to neglect school in favor of employment (Gunderson, 2007). That almost all of the research on ELLs in schools has involved case studies of minority-background students in English-dominant societies in North America raises questions, however, about the scope and sampling of the student populations investigated in view of the sociolinguistic diversity in learners of English that exist internationally.

PROMOTING WRITING COMPETENCIES IN MULTIPLE LANGUAGES

A fruitful focus of recent publications has been to promote students' development of literacies in their home or other languages as a worthy goal of education and of also fostering ELL students' writing abilities in English. The value of the linguistic resources of children's home languages and cultures has been a central claim since the earliest studies of children's writing in innovative programs of bilingual education (e.g., Edelsky, 1986; Moll, 1989), and it was the focus of Lo Bianco's (2000) chapter in Cope and Kalantzis's influential volume on multiliteracies. Recently, Gentil (2011), Ortega and Carson (2010), and Shapiro (2012) have produced compelling arguments to reframe the whole conceptualization of L2 writing—away from deficit or subtractive views of biliteracy and toward additive conceptualizations that foster students' uses and development of literacy competencies in multiple languages.

Educational practices in contexts of marginalized, immigrant communities and low socio-economic status need particularly to valorize students' linguistic and cultural identities and status (Cummins, 2001, 2014). Education only in English disregards and undermines the knowledge resources and self-concepts of ELLs, reflecting either explicitly or implicitly the forces and prejudices of macrosocietal structures and media of communication. To counter these systemic tendencies, the concept of "identity texts," articulated and exemplified in Cummins and Early (2011) and Taylor and Cummins (2011), puts forward a viable set of educational practices in which young students from diverse language backgrounds write, share, translate, and analyze stories and other texts written in and about their homes, families, and cultural experiences and knowledge. The logic of identity texts for children's multilingual writing follow from Moll's (1989; Gonzalez, Moll, & Amanti, 2005) arguments for educators to build on and develop (rather than discredit) students' existing "funds of knowledge," provide a means to overcome the frequently cited home–school literacy divide (King & Hornberger, 2005), address directly the centrality of multiple identities in literacy development (Cummins, 2001; Harklau, 2007), and relate as well to practices of reading and sharing dual-language books (Naqvi, Thorne, Pfitscher, Nordstokke, & McKeough, 2013).

Bilingual students inevitably use their biliterate abilities while they write, so arguments from several theoretical perspectives have also asserted that educators should encourage and teach learners how to do so strategically and effectively (rather than shunning or neglecting home languages and literacy practices). From a sociolinguistic perspective, Hornberger and Link (2012), Kibler (2014), and Martinez (2010) have demonstrated that educators need to acknowledge and extend the sophisticated, literate functions that bilingual students already practice in their lives and interactions in their homes and among peers to help them transfer and adapt these functions through "translanguaging" (Garcia, 2009) with English at school. From a psycholinguistic perspective, studies across various language combinations have affirmed that skilled composing among bilinguals involves strategic switching between first and second languages, particularly to search for and verify appropriate words (Cumming, 2013; Murphy & Roca de Larios, 2010; Tullock & Fernández-Villanueva, 2013). Recent studies of cognitive neurolinguistics suggest that the mental processes of switching languages appear spontaneously while composing because both of the bilinguals' languages are neurolinguistically active while performing verbal tasks (Cumming, 2013). Various applied linguists, many adopting the tenets of sociocultural theory, have concluded that students' thinking and talking purposefully and earnestly, in first and/or second languages, while writing is an optimal means for language learners to deliberate over, refine, and extend their linguistic and knowledge resources (Cumming, 2013; Haneda & Wells, 2012; Pavlenko, 2011; Swain, 2006, 2010; Williams, 2012). A related point, supporting the promotion of students' writing abilities in first and second languages and dispelling notions of the dangers of "interference" from first languages on second languages, is that cross-linguistic studies in countries with widespread success in foreign language education have tended to show that school-age students in these settings internationally compose in English (as a foreign language) in ways that are fundamentally similar (albeit with limitations in vocabulary and grammatical accuracy) to the ways they write in comparable tasks in first languages such as Danish (Albrechtsen et al., 2008), Dutch (Schoonen et al., 2011), and Swedish (Lindgren & Stevenson, 2013).

ADJUSTING ASSESSMENTS

Assessments of writing are consequential issues for ELLs in the contexts of formal, standardized tests as well as in formative, classroom-based assessments (Crusan, 2010; Leki et al., 2008). The message from research is that for both contexts conventional expectations (for majority-background students) should be modified for ELLs.

Assessing students who, by definition, are in the process of developing English writing defies the logic of norm referencing that underpins large-scale, high-stakes literacy tests, so the information they produce is inaccurate for purposes of monitoring educational systems (Solórzano, 2008) and of assessing individual abilities (Cummins, 2001). In addition, the testing practice produces undue personal challenges for ELL students (Cheng, Klinger, & Zheng, 2007; Gonzalez, 2012), involves questionable assumptions about appropriate linguistic norms and varieties (Canagarajah, 2006), and prompts instruction for test preparation that tends to reduce learning and writing to rote formulas (McCarthey, 2008). For young ELL students, it is uncertain whether formal writing assessments have any merits at all (Bailey, 2008; McKay, 2005). One conventional response to this dilemma is to provide accommodations for ELLs while writing standardized tests, such as additional time, writing in first languages, or tools such as bilingual dictionaries, but none of these accommodations appear to be demonstrably effective or feasible under conditions of standardized testing (Gonzalez, 2012; Kieffer, Lesaux, Rivera, & Francis, 2009; Solórzano, 2008). A more productive, conceptually-justified response, under development now in many jurisdictions, is to establish standards for performance and then produce unique versions of literacy tests for ELLs based on normative trajectories for their literacy development (e.g., Cook, Linquanti, Chinen, & Jung, 2012; Council

of Chief State School Officers, 2012; Jang, Cummins, Wagner, Stille, Dunlop, et al., 2015). This approach follows the initiatives developed from the World-Class Instructional Design and Assessment consortium (WIDA, 2014) for ELLs for tests on academic subjects in schools, which in turn follows from the recognition internationally that educational systems require unique curriculum standards and achievement expectations for ELLs distinct from those for majority populations (McKay, 2007).

Classroom assessments of ELLs' writing have purposes of informing teaching and learning. To this end, educators have advocated assessing L2 writing in classroom contexts as a process of and for learning, following research on and theories of formative assessment generally (Lee, 2007), principles of dynamic assessment (Lantolf & Poehner, 2008; Leung, 2007b), connections to established curriculum standards (McKay, 2005; Piccardo, Berchoud, Cignatta, Mentz, & Pamula, 2011), and purposes of diagnosing achievements and future needs (Knoch, 2009). Research on the implementation or effects of these principles in classroom practices for ELLs in schools, however, remains remarkably sparse. The exception is various studies in Hong Kong, which have revealed striking discrepancies between teachers' practices, educational policies, assessment principles, and societal traditions and expectations (Carless, 2012; Lee, 2008; Lee & Coniam, 2013). An extensive research literature (and much controversy) has accumulated regarding how teachers should respond to the writing of language learners, but almost all of the research has been conducted with adults in such a diverse range of contexts and different languages in higher education internationally that only general recommendations can be made for instructional practices for ELLs (or any other population of language learners). Viable recommendations focus on teachers relating their responses to students' writing to: the local curriculum, content taught, and opportunities to revise drafts; the intentions, abilities, and resources of individual students; the value of communicating ideas in appropriate genres; praise for accomplishments; and systemically teachable aspects of English rather than idiosyncratic errors or slips (Andrade & Evans, 2013; Bitchener & Ferris, 2011; Goldstein, 2005; Hyland & Hyland, 2006; Leki et al., 2008). A further important assessment concern with ELLs is for educators and psychological specialists to know how to distinguish natural progressions of language and literacy development from genuine learning disabilities (Cummins, 2001; Geva & Wiener, 2014).

CONCLUSION AND AGENDA FOR FUTURE RESEARCH

Much knowledge has accumulated about writing development and instruction for ELLs since Edelsky's (1986) and Moll's (1989) initial studies in the 1980s while confirming principles established in their seminal studies. The focus of research and educational issues has expanded since Fitzgerald's (2006) review of research about multilingual writing in school contexts in the previous edition of the present handbook, though the three "contentions" she asserted (on p. 350) have been supported by recent studies (and those reviewed in Leki et al., 2008): young students develop L2 writing in ways similar to English L1 writers; writing skills transfer between languages for primary and intermediate students; and for secondary and intermediate students, writing processes have both similarities and differences across L1 and L2.

To advance productively in the coming years, three areas can be recommended for future research. The first follows from the dilemma that almost all of the available research on child or adolescent ELLs' writing has involved case studies of individual students or programs, adopting a local or regional focus, and thus potentially biases in representation or extensions beyond the particular cases. There is a distinct need to understand ELLs' writing on a comprehensive and comparative scale, both nationally and internationally, in order to be able to describe with confidence student populations and characteristics, current and needed teaching practices, and appropriate

assessment approaches as well as to evaluate and distinguish the major sources of variability on writing development in English. Large-scale, systematic, comparative surveys are needed, using theoretically informed concepts, principled methods of sampling populations, and coordinated analytic techniques (e.g., as in Applebee & Langer, 2011 for English writing in the United States). Hopefully, this step will be realized in the upcoming IEA (2014) study of English teaching and learning internationally and also extend from the assessment initiatives to develop performance standards and tests for ELLs described earlier. Research on English should usefully be related, as well, to studies of writing among child and adolescent learners of other languages—such as Arabic, Chinese, French, Italian, and Spanish—in societies around the world with large migrant populations so as to obtain a theoretically grounded conceptualization of biliteracy universally, not just in reference to one language or society as the term ELL implies.

Second, researchers need to evaluate in greater focus and depth many aspects of the relations between teaching and learning writing for ELLs—to establish with precision and confidence the value and effects of particular approaches to instruction and supports provided in schools and communities. The present review has observed certain promising indications and directions, but the available research is limited in scope and has tended to combine many supportive educational practices together rather than to evaluate specific approaches to teaching ELL writing independently. Are there specific approaches, or is it a combination of many relevant approaches, to instruction that make(s) a difference in ELLs' writing development?

Third, the uses, affordances, and constraints of new technologies need to be investigated systematically—for students' learning and development of intergroup relations and identities (Cummins, Brown, & Sayers, 2007) as well as for relating assessments, writing and language development, and teaching effectively (Chapelle & Douglas, 2006; Shermis & Burstein, 2013). Several case studies show individual ELLs writing in multimedia frequently and more earnestly and profoundly outside of school than they do for school tasks (Lam, 2000; Yi, 2010), but the value of these communications for learning, literacy development, personal identity, and pedagogical practices remains poorly understood and seemingly underutilized by educators.

In conclusion, it must be said that the sheer diversity of ELL populations and programs defy the present formulation of many general, authoritative conclusions about writing development or instruction for ELLs. Recognition of this diversity also makes it vital for educators and researchers to identify, understand, and act upon the particular characteristics, backgrounds, and future potentials of students who are learning English writing in local settings.

REFERENCES

Albrechtsen, D., Haastrup, K., & Henriksen, B. (2008). *Vocabulary and writing in first and second languages: Processes and development*. Houndmills, UK: Palgrave Macmillan.

Andrade, M., & Evans, N. (2013). *Principles and practices for response in second language writing*. New York: Routledge.

Applebee, A., & Langer, J. (2011). A snapshot of writing instruction in middle schools and high schools. *English Journal, 100*(6), 14–27.

Atkinson, D. (Ed.). (2013). Disciplinary dialogues. *Journal of Second Language Writing, 22*(4), 425–450.

Bailey, A. (2008). Assessing the language of young learners. In E. Shohamy & N. Hornberger (Eds.) *Encyclopedia of language and education*, (2nd ed., pp. 379–398). New York: Springer.

Ball, A. F. (2006). Teaching writing in culturally diverse classrooms. In C. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 293–310). New York: Guilford Press.

Belcher, D. (2012). Considering what we know and need to know about second language writing. *Applied Linguistics Review, 3*(1), 131–150.

Bigelow, M. (2010). *Mogadishu on the Mississippi: Language, racialized identity, and education in a new land*. Supplement 1 to *Language Learning, 60*.

Bitchener, J., & Ferris, D. (2011). *Written corrective feedback in second language acquisition and writing.* New York: Routledge.

Boers, F., & Lindstromberg, S. (2012). Experimental and intervention studies on formulaic sequences in a second language. *Annual Review of Applied Linguistics, 32*, 83–110.

Buckwalter, J. K., & Lo, Y. G. (2002). Emergent biliteracy in Chinese and English. *Journal of Second Language Writing, 11*(4), 269–293.

Bunch, G. C. (2013). Pedagogical language knowledge: Preparing mainstream teachers for English learners in the new standards era. *Review of Research in Education, 37*, 298–341.

Callahan, R. (2005). Tracking and high school English learners: Limiting opportunity to learn. *American Education Research Journal, 42*(2), 305–328.

Canagarajah, S. (2006). Changing communicative needs, revised assessment objectives: Testing English as an international language. *Language Assessment Quarterly, 3*(3), 229–242.

Carless, D. (2012). *From testing to productive student learning*: *Implementing formative assessment in Confucian-heritage settings*. New York: Routledge.

Chapelle, C. & Douglas, D. (2006). *Assessing language through computer technology*. Cambridge, UK: Cambridge University Press.

Cheng, L., Klinger, D., & Zheng, Y. (2007). The challenges of the Ontario Secondary School Literacy Test for second language students. *Language Testing, 24*(2), 185–208.

Cook, G., Linquanti, R., Chinen, M., & Jung, H. (2012). *National evaluation of Title III implementation supplemental report—Exploring approaches to setting English language proficiency performance criteria and monitoring English learner progress*. Washington, DC: American Institutes for Research.

Council of Chief State School Officers. (2012). *Framework for English Language Proficiency Development Standards corresponding to the Common Core State Standards and the Next Generation Science Standards.* Washington, DC: CCSSO.

Crusan, D. (2010). *Assessment in the second language writing classroom.* Ann Arbor, MI: University of Michigan Press.

Cumming, A. (Ed.). (2012). *Adolescent literacies in a multicultural context*. New York: Routledge.

Cumming, A. (2013). Multiple dimensions of academic language and literacy development. *Language Learning: A Journal of Research in Language Studies, 63*(1), 130–152.

Cummins, J. (2001). *Negotiating identities: Education for empowerment in a diverse society*. Los Angeles: California Association for Bilingual Education.

Cummins, J. (2014). Beyond language: Academic communication and student success. *Linguistics and Education, 26*, 145–154.

Cummins, J., Brown, K., & Sayers, D. (2007). *Literacy, technology and diversity: Teaching for success in changing times*. Boston: Pearson Education.

Cummins, J., & Davison, C. (Eds.). (2007). *International handbook of English language teaching, Vols. 1 and 2*. New York: Springer.

Cummins, J., & Early, M. (Eds.). (2011). *Identity texts: The collaborative creation of power in multilingual schools*. London: Trentham Books.

Davies Samway, K. (2006). *When English language learners write: Connecting research to practice, K–8*. Portsmouth, NH: Heinemann.

de Oliveira, L. C. (2008). A linguistic approach in culturally and linguistically diverse classrooms: A focus on teacher education. *Linguistics and the Human Sciences, 4*(2), 101–133.

de Oliveira, L., & Silva, T. (Eds.). (2013). *L2 writing in secondary classrooms: Student experiences, academic issues, and teacher education.* New York: Routledge.

Dressman, M., Wilder, P., & Connor, J. (2005). Theories of failure and the failure of theories: A cognitive/sociocultural/macrostructural study of eight struggling students. *Research in the Teaching of English, 40*, 8–61.

Duff, P. (2010). Language socialization into academic discourse communities. *Annual Review of Applied Linguistics, 30*, 169–192.

Early, M., Potts, D., & Mohan, B. (2005). Teachers' professional knowledge in scaffolding academic literacies for English language learners. *Prospect, 20*, 63–76.

Edelsky, C. (1986). *Writing in a bilingual program: Habia una vez*. Norwood, NJ: Ablex.

Faltis, C., & Valdés, G. (Eds.). (2010). *Education, immigrant students, refugee students, and English learners*. National Society for the Study of Education 109th Yearbook, 2. New York: Teachers College Press.

Fitzgerald, J. (2006). Multilingual writing in preschool through 12th grade. In C. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 337–354). New York: Guilford Press.

Franzak, J. (2006). "Zoom": A review of the literature on marginalized adolescent readers, literacy theory, and policy implications. *Review of Educational Research, 76*, 209–248.

Freeman, Y., & Freeman, D. (2007). Four keys for school success for elementary English learners. In J. Cummins & C. Davison (Eds.), *International handbook of English language teaching, Vols. 1 and 2* (pp. 349–364). New York: Springer.

García, O. (2009). *Bilingual education in the 21st century: A global perspective*. Malden, MA: Wiley-Blackwell.

Gebhard, M., Demers, J., & Castillo-Rosenthal, Z. (2008). Teachers as critical text analysts: L2 literacies and teachers' work in the context of high-stakes school reform. *Journal of Second Language Writing, 17*, 274–291.

Gebhard, M., Harman, R., & Seger, W. (2007). Reclaiming recess: Learning the language of persuasion. *Language Arts, 84*(5), 419–430.

Gentil, G. (2011). A biliteracy agenda for genre research. *Journal of Second Language Writing, 20*, 6–23.

Geva, E., & Wiener, J. (2014). *Psychological assessment of culturally and linguistically diverse children.* New York: Springer.

Gibbons, P. (2002). *Scaffolding language, scaffolding learning: Teaching second language learners in the mainstream classroom*. Portsmouth, NH: Heinemann.

Goldstein, L. (2005). *Teacher written commentary in second language writing classrooms*. Ann Arbor: University of Michigan Press.

Gonzalez, N., Moll, L., & Amanti, C. (2005). *Funds of knowledge: Theorizing practices in households, communities, and classrooms.* Mahwah, NJ: Erlbaum.

Gonzalez, V. (2012). Assessment of bilingual/multilingual Pre-K—Grade 12 students: A critical discussion of past, present, and future issues. *Theory into Practice, 51*, 290–296.

Grabe, W., & Zhang, C. (2013). Reading and writing together: A critical component of English for academic purposes teaching and learning. *TESOL Journal, 4*(1), 9–24.

Guitiérrez, K., & Orellana, M. (2006). The "problem" of English learners: Constructing genres of difference. *Research in the Teaching of English, 40*, 502–507.

Gunderson, L. (2007). *English-only instruction and immigrant students in secondary schools*: *A critical examination*. Mahwah, NJ: Erlbaum.

Haneda, M., & Wells, G. (2012). Some key pedagogic principles for helping ELLs to succeed in school. *Theory into Practice, 51*(4), 297–304.

Harklau, L. (2000). From the "good kids" to the "worst": Representations of English language learners across educational settings. *TESOL Quarterly, 34*(1), 35–67.

Harklau, L. (2007). The adolescent English language learner: Identities lost and found. In J. Cummins & C. Davison (Eds.), *The International handbook of English language teaching* (pp. 639–654). New York: Springer.

Hawkins, M. (2005). Becoming a student: Identity work and academic literacies in early schooling. *TESOL Quarterly, 39*, 59–82.

Hirvela, A. (2004). *Connecting reading and writing in second language writing instruction.* Ann Arbor: University of Michigan Press.

Hornberger, N. (Ed.). (2003). *Continua of biliteracy: An ecological framework for educational policy, research, and practice in multilingual settings*. Clevedon, UK: Multilingual Matters.

Hornberger, N., & Link, H. (2012). Translanguaging in today's classrooms: A biliteracy lens. *Theory into Practice, 51*(4), 239–247.

Howard, E., Sugarman, J., Christian, D., Lindholm-Leary, K., & Rogers, D. (2007). *Guiding principles for dual language education* (2nd ed.). Washington, DC: Center for Applied Linguistics.

Hyland, K. (2004). *Genre and second language writing*. Ann Arbor: University of Michigan Press.

Hyland, K., & Hyland, F. (2006). Feedback on second language students' writing. *Language Teaching, 39*(2), 83–101.

IEA (International Association for the Evaluation of Educational Achievement). (2014). *English teaching and learning study 2017*. Retrieved May 13, 2014, from *www.iea.nl/fileadmin/user_upload/Studies/ETLS/ETLS_leaflet.pdf*.

Jang, E. E., Cummins, J., Wagner, M., Stille, S., Dunlop, M., & Starkey, J. (2015). Assessing school-aged English language learners in Ontario curriculum learning contexts using Steps to English Proficiency. *Language Assessment Quarterly, 12*, 87–109.

Jun, S. W., Ramirez, G., & Cumming, A. (2010). Tutoring adolescents in literacy: A meta-analysis. *McGill Journal of Education, 45*, 219–238.

Kibler, A. (2011). "I write it in a way that people can read it": How teachers and adolescent L2 writers describe content area writing. *Journal of Second Language Writing, 20*(3), 211–226.

Kibler, A. (2014). From high school to the *Noviciado*: An adolescent linguistic minority student's multilingual journey in writing. *Modern Language Journal, 98*(2), 629–651.

Kieffer, M. J., Lesaux, N. K., Rivera, M., & Francis, D. (2009). Accommodations for English language learners taking large-scale assessments: A meta-analysis on effectiveness and validity. *Review of Educational Research, 79*(3), 1168–1201.

King, K., & Hornberger, N. (2005). Literacies in families and communities. In N. Bascia, A. Cumming, A. Datnow, K. Leithwood, & D. Livingstone (Eds.), *International handbook of educational policy, Vol. 2* (pp. 715–734). Dordrecht, The Netherlands: Springer.

Knoch, U. (2009). *Diagnostic writing assessment: The development and validation of a rating scale*. Frankfurt: Peter Lang.

Kong, A., & Pearson, P. D. (2003). The road to participation: The construction of a literacy practice in a learning community of linguistically diverse learners. *Research in the Teaching of English, 38*(1), 85–124.

Kristmanson, P., Dicks, J., & Bouthillier, J. (2009). Pedagogical applications of a second language writing model at elementary and middle school levels. *Writing and Pedagogy, 1*(1), 37–62.

Lam, W. (2000). L2 literacy and the design of the self: A case study of a teenager writing on the Internet. *TESOL Quarterly, 34*, 457–482.

Lantolf, J., & Poehner, M. (2008). Dynamic assessment. In E. Shohamy & N. H. Hornberger (Eds.), *Encyclopedia of language and assessment, volume 7. Language testing and assessment* (2nd ed., pp. 273–284). New York: Springer.

Lee, I. (2007). Assessment for learning: Integrating assessment, teaching, and learning in the ESL/EFL writing classroom. *The Canadian Modern Language Review, 64*(1), 199–213.

Lee, I. (2008). Understanding teachers' written feedback practices in Hong Kong secondary classrooms. *Journal of Second Language Writing, 17*(2), 69–85.

Lee, I., & Coniam, D. (2013). Introducing assessment for learning for EFL writing in an assessment of learning examination-driven system in Hong Kong. *Journal of Second Language Writing, 22*(1), 34–50.

Leki, I., Cumming, A., & Silva, T. (2008). *A synthesis of research on second language writing in English*. New York: Routledge.

Leung, C. (2007a). Integrating school-aged ESL learners into the mainstream curriculum. In J. Cummins & C. Davison (Eds.), *International handbook of English language teaching* (pp. 249–269). New York: Springer.

Leung, C. (2007b). Dynamic assessment: Assessment *for* and *as* teaching. *Language Assessment Quarterly, 4*, 257–278.

Li, J. (2010). Learning vocabulary via computer-assisted scaffolding for text processing. *Computer Assisted Language Learning, 23*(3), 253–275.

Lindgren, E., & Stevenson, M. (2013). Interactional resources in the letters of young writers in Swedish and English. *Journal of Second Language Writing, 22*(4), 390–405.

Lo Bianco, J. (2000). Multiliteracies and multilingualism. In B. Cope & M. Kalantzis (Eds.), *Multiliteracies: Literacy learning and the design of social futures* (pp. 92–105). London: Routledge.

Lyster, R., Quiroga, J., & Ballinger, S. (2013). The effects of biliteracy instruction on morphological awareness. *Journal of Immersion and Content-Based Language Education, 1*, 169–197.

Macqueen, S. (2012). *The emergence of patterns in second language writing*. Bern, Switzerland: Peter Lang.

Manchón, R. (Ed.). (2009). *Writing in foreign language contexts: Learning, teaching, and research*. Clevedon, UK: Multilingual Matters.

Manchón, R. (Ed.). (2012). *L2 writing development: Multiple perspectives*. Berlin: de Gruyter.

Martinez, R. A. (2010). *Spanglish* as literacy tool: Toward an understanding of the potential role of Spanish-English code-switching in the development of academic literacy. *Research in the Teaching of English, 45*(2), 124–149.

McCarthey, S. (2008). The impact of No Child Left Behind on teachers' writing instruction. *Written Communication, 25*, 462–505.

McCarthey, S., & Garcia, G. (2005). English language learners' writing practices and attitudes. *Written Communication, 22*, 36–75.

McCarthey, S., Guo, Y., & Cummins, S. (2005). Understanding changes in elementary Mandarin students' L1 and L2 writing. *Journal of Second Language Writing, 14*, 71–104.

McKay, P. (2005). *Assessing young language learners*. New York: Cambridge University Press.

McKay, P. (2007). The standards movement and ELT for school-aged learners. In J. Cummins & C. Davison (Eds.), *International handbook of English language teaching* (pp. 439–456). New York: Springer.

Mohan, B. (2007). Knowledge structures in social practices. In J. Cummins & C. Davison (Eds.), *International*

handbook of English language teaching (pp. 303–315). New York: Springer.

Moll, L. (1989). Teaching second language students: A Vygotskian perspective. In D. Johnson & S. Roen (Eds.), *Richness in writing* (pp. 55–69). New York: Longman.

Murphy, E., & Roca de Larios, J. (2010). Searching for words: One strategic use of the mother tongue by advanced Spanish EFL learners. *Journal of Second Language Writing, 19*(2), 61–81.

Naqvi, R., Thorne, K., Pfitscher, C., Nordstokke, D., & McKeough, A. (2013). Reading dual language books: Improving early literacy skills in linguistically diverse classrooms. *Journal of Early Childhood Research, 11*, 3–15.

Nassaji, H., & Cumming, A. (2000). What's in a ZPD? A case study of a young ESL student and teacher interacting through dialogue journals. *Language Teaching Research, 4*(2), 95–121.

Norris, J., & Ortega, L. (Eds.). (2006). *Synthesizing research on language learning and teaching*. Amsterdam: John Benjamins.

Olson, C., & Land, R. (2007). A cognitive strategies approach to reading and writing instruction for English language learners in secondary school. *Research in the Teaching of English, 41*(3), 269–303.

Ortega, L., & Carson, J. (2010). Multicompetence, social context, and L2 writing research praxis. In T. Silva & P. K. Matsuda (Eds.), *Practicing theory in second language writing* (pp. 48–71). West Lafayette, IN: Parlor Press.

Ortmeier-Hooper, C., & Enright, K. (2011). Mapping new territory: Toward an understanding of adolescent L2 writers and writing in US contexts. *Journal of Second Language Writing, 20*, 167–181.

Parks, S., Huot, D., Hamers, J., & Lemonnier, F. (2005). "History of theatre" websites: A brief history of the writing process in a high school ESL language arts class. *Journal of Second Language Writing, 14*, 233–258.

Pavlenko, A. (2011). Thinking and speaking in two languages: Overview of the field. In A. Pavlenko (Ed.), *Thinking and speaking in two languages* (pp. 237–257). Bristol, UK: Multilingual Matters.

Perez, B. (2004). *Becoming biliterate: A study of two-way bilingual immersion education*. Mahwah, NJ: Erlbaum.

Perry, K., & Moses, A. (2011). Television, language, and literacy practices in Sudanese refugee families: "I learned how to spell English on Channel 18." *Research in the Teaching of English, 45*(3), 278–307.

Piccardo, E., Berchoud, M., Cignatta, T., Mentz, O., & Pamula, M. (2011). *Pathways through assessing, learning and teaching in the CEFR/Parcours d'évaluation, d'apprentissage, d'évaluation à travers le CECR*. Graz, Austria: Council of Europe.

Polleck, J. N. (2010). Creating transformational spaces: High school book clubs with inner-city adolescent females. *High School Journal, 93*(2), 50–68.

Purcell-Gates, V. (2013). Literacy worlds of children of migrant farmworker communities participating in a migrant Head Start program. *Research in the Teaching of English, 48*(1), 68–97.

Reynolds, D. (2005). Linguistic correlates of second language literacy development: Evidence from middle-grade learner essays. *Journal of Second Language Writing, 14*(1), 19–45.

Richards, J. C., & Lassonde, C. A. (Eds.). (2009). *Literacy tutoring that works: A look at successful in-school, after-school, and summer programs*. Newark, DE: International Reading Association.

Rivera, C., & Collum, E. (Eds.). (2006). *A national review of state assessment policy and practice for English language learners.* Mahwah, NJ: Erlbaum.

Rowen, N., & Gosine, K. (2006). Support that matters: A community-based response to the challenge of raising the academic achievement of economically vulnerable youth. In D. Armstrong & B. McMahon (Eds.), *Inclusion in urban educational environments: Addressing issues of diversity, equity, and social justice* (pp. 277–299). Charlotte, NC: Information Age Publishing.

Schleppegrell, M. (2004). *The language of schooling.* Mahwah, NJ: Erlbaum

Schleppegrell, M. (2013). The role of metalanguage in supporting academic language development. In L. Ortega, A. Cumming, & N. Ellis (Eds.), *Agendas for language learning research*. Supplement 1 to *Language Learning, 63*, 153–170.

Schleppegrell, M. J., & O'Hallaron, C. (2011). Teaching academic language in L2 secondary settings. *Annual Review of Applied Linguistics, 31*, 3–18.

Schoonen, R., van Gelderen, A., Stoel, R., Hulstijn, J., & de Glopper, K. (2011). Modeling the development of L1 and EFL writing proficiency of secondary school students. *Language Learning, 61*, 31–79.

Seidelhofer, B. (2011). *Understanding English as a lingua franca*. Oxford, UK: Oxford University Press.

Shapiro, S. (2012). Citizens vs. aliens: How institutional policies construct linguistic minority students. In Y. Kanno & L. Harklau (Eds.), *Linguistic minority immigrants go to college: Preparation, access, and persistence* (pp. 238–254). New York: Routledge.

Shapiro, S. (2014). "Words that you said got bigger": English language learners' lived experiences of deficit discourse. *Research in the Teaching of English, 48*(4), 386–406.

Shermis, M., & Burstein, J. (Eds.). (2013). *Handbook of automated essay evaluation: Current applications and new directions*. New York: Routledge.

Short, D., Echevarria, J., & Richards-Tutor, C. (2011). Research on academic literacy development in sheltered instruction classrooms. *Language Teaching Research, 15*(3), 363–380.

Snow, C., Porsche, M., Tabors, P., & Harris, S. (2007). *Is literacy enough? Pathways to academic success for adolescents.* Baltimore, MD: Brookes.

Snow, C., & Uccelli, P. (2009). The challenge of academic language. In D. Olson & N. Torrance (Eds.), *The Cambridge handbook of literacy* (pp. 112–33). Cambridge, UK: Cambridge University Press.

Solórzano, R. (2008). High stakes testing: Issues, implications, and remedies for English language learners. *Review of Educational Research, 78*(2), 260–329.

Storch, N. (2013). *Collaborative writing in L2 classrooms*. Bristol, UK: Multingual Matters.

Swain, M. (2006). Languaging, agency and collaboration in advanced second language proficiency. In H. Brynes (Ed.), *Advanced language learning: The contribution of Halliday and Vygotsky* (pp. 95–108). London: Continuum.

Swain, M. (2010). "Talking-it-through": Languaging as a source of learning. In R. Batstone (Ed.), *Sociocognitive perspective on language use/learning* (pp. 112–130). Oxford, UK: Oxford University Press.

Tardy, C. (2009). *Building genre knowledge*. West Lafeyette, IN: Parlour Press.

Taylor, S., & Cummins, J. (Eds.). (2011). *Identity texts, literacy engagement and multilingual classrooms.* Special issue of *Writing and Pedagogy, 3*, 2.

Tullock, B., & Fernández-Villanueva, M. (2013). The role of previously learned languages in the thought processes of multilingual writers at the Deutsche Schule Barcelona. *Research in the Teaching of English, 47*(4), 420–441.

Valdés, G. (2001). *Learning and not learning English: Latino students in American schools*. New York: Teachers College Press.

van Gelderen, A., Oostdam, R., & van Schooten, E. (2011). Does foreign language writing benefit from increased lexical fluency? Evidence from a classroom experiment. *Language Learning, 61*, 281–321.

Verspoor, M., Schmid, M., & Xu, X. (2012). A dynamic usage based perspective on L2 writing. *Journal of Second Language Writing, 21*(3), 239–263.

Villalva, K. (2006). Hidden literacies and inquiry approaches of bilingual high school writers. *Written Communication, 23*, 91–129.

Williams, J. (2012). The potential role(s) of writing in second language development. *Journal of Second Language*

Writing, 21, 321–331.
Wilson, J. S. (2013). The role of social relationships in the writing of multilingual adolescents. In L. de Oliveira & T. Silva (Eds.), L2 *writing in secondary classrooms: Student experiences, academic issues, and teacher education* (pp. 87–103). New York: Routledge.
World-Class Instructional Design and Assessment (WIDA). (2014). *The WIDA standards framework and its theoretical foundations.* Madison, WI: WIDA Consortium and Board of Regents of the University of Wisconsin System.
Yi, Y. (2010). Adolescent multilingual writers' transitions across in- and out-of-school writing contexts. *Journal of Second Language Writing, 19*, 17–32.
Yi, Y. (2013). Adolescent multilingual writer's negotiation of multiple identities and access to academic writing: A case study of a Jogi Yuhak student in a US high school. *Canadian Modern Language Review, 69*(2), 207–231.
Yoon, C. (2011). Concordancing in L2 writing class. *English for Academic Purposes, 10*, 130–139.

CHAPTER 25

Teaching Writing in Culturally and Linguistically Diverse Classrooms

Valerie Kinloch and Tanja Burkhard

It was a Wednesday morning in February, and we were gathered in our senior-level English class at Perennial High School on the eastside of Harlem. The clock that hung above the door indicated that it was almost 10 A.M. Twenty-seven out of a total of 47 minutes remained before students would head to their next destination. On this day, students were working in self-selected peer writing groups. The students brought to class a writing sample (e.g., essay, collection of poetry, critical commentary, short story) they had previously written and on which they had already received my (Valerie's) initial evaluation. In groups, they talked about their intentions—regarding the argument, purpose, and evidence (e.g., textual, oral, visual) in their writing—with the hope of revising and sharing it with the class at a later date.

As the English teacher, I circulated from group to group, listened to students' ideas, and helped them map out ways to revise. When I approached "Group Fire," a name the four students working at a table in the rear of the room had given themselves, it was Aureliano, a 17-year-old Latino student, who asked for my feedback on his poem, "Untitled." He read:

Why waste my time

Looking

At the one I love

Looking

To not be looked upon in return.

Aureliano explained that he was drawn to Mora's (1986a) poem, "First Love," especially the lines, "her brown eyes circle/round me, circle" and "I hide watching her/eyes circle, circle." He was fascinated by how Mora captured the intricacies of someone being watched and doing the watching. After reading the five lines that comprise "Untitled," Aureliano asked me to describe how I felt. I replied, "You're a writer not wanting to give up on love and not wanting to get tired of looking. It seems to me that you're starting to feel like you're wasting time. Is it having too much patience or giving in to being impatient that's the issue?"

Instead of responding, Aureliano asked if he could share another poem titled, "Black Valentine," which was influenced by Mora's (1986b) "Border Town: 1938." I asked the class if they wanted to hear Aureliano's poem, and when they said yes, he read it aloud:

Oh, Black Valentine,

This day

Is the loneliest of my life.

It builds up sorrow and pain.

It started by a stab from a knife

Which drives any mind insane.

Caused by betray[al],

This made my life,

Any life,

One of misery.

I can't stand the lies,

Worse than all the birds singing

When they cry.

Why can't all these people

Stop pretending?

My world is sad, my world is ending.

This is my valentine, how I started.

This is my valentine, every one is cold hearted.

I was the first to respond, “Aureliano, you’re a writer,” to which he said, “I’m not a writer. I don’t know how many times I’ve said that.” In fact, on the first day of class, Aureliano said that he is “not a writer” and he does not write. Yet here he was sharing his poem in an effort to get suggestions to “make it stronger” and to hear how his poetic words “stir emotions in people.”

Jasmine, a 17-year-old African American student, shook her head in disappointment and said, “That boy don’t think he a writer?” After glancing around the room, Jasmine asked Aureliano, “What’s wrong with you? Why you don’t see yourself as a writer? Is there something about being a writer you’re afraid of?” Jasmine was not the only person who wanted to know. Damya, Christina, Rosa, Robert—who, himself, was a self-confessed *nonwriter*—and many of Aureliano’s other peers wanted to know why he did not see himself as a writer. I, too, wanted to know the motivating factors for his ongoing resistances to being a writer and being seen as one.

Aureliano talked about how people who are writers “throw words together and have something happen where people look for more.” He knew how to put words together, how to use writing to express his feelings, and how to voice his perspectives in ways that left listeners sitting on edge, holding on, and asking for more. Yet he had convinced himself that he could not do these things well because of his fear to succeed and because of the larger discourses that circulate in U.S. public schools about what it means to write and about who gets to write “well.”

Because he did not believe he was a writer, he reluctantly shared drafts of his writings with peers and often submitted writing assignments after the due date with the preface, “This is still not good.” He also took seriously the idea that “students like me don’t get taught how to write.” When I pushed back, he said, “students like Latino and Black students, urban kids, like diverse students,” to which Jasmine asserted, “white students or whoever, you know, without the experiences we got . . . who a lot of people automatically think is smart.” Aureliano agreed and added that he was not a writer because “putting words on paper don’t make me a writer.”

During this same discussion, Robert, a 17-year-old African American student, said, “I’m not a writer either. That’s just something many of us don’t do.” I was aware that Robert’s use of the phrase, “many of us,” which was similar to Aureliano’s expression, “students like me,” referred to students attending Perennial High School, a school in which 98% of the students, at the time of this study, identified as “Hispanic” or “Black.” I was also aware of the need to disrupt “mainstream” discourses circulating among students about what it means to write, who can write, and who gets to be a writer. Such discourses, to borrow Paris’s (2012) words, reflect “a monocultural and monolingual society based on White, middle-class norms” (p. 95). These discourses had already positioned students in this class—who were multilingual or bi-dialectical and culturally and racially diverse—as nonwriters. It was important to disrupt these discourses by teaching writing in this culturally and linguistically diverse (CLD) classroom.

This brief example derives from a year-long qualitative study of the literacy practices of young people attending an urban high school where Valerie served as a teacher–researcher (Kinloch, 2012). It suggests several reasons why it is important to place attention on the teaching of writing in CLD classrooms. First, it alludes to tensions some students feel about being writers, particularly in comparison to their white peers. For Aureliano, this tension came across in his comment, “students like me don’t get taught how to write” and for Jasmine, it was revealed in her belief that white students have an unfair advantage over students of color. They have both begun to internalize negative messages that circulate throughout society about the schooling experiences and writing engagements of many students of color. As Ball and Ellis (2008) claim, “If students receive messages from schools assuming that they will be successful writers, then it will be exceedingly difficult for them to discard those assumptions and identities as they grow” (p. 509). In all classrooms, particularly CLD classrooms, students must be taught and must

believe that they are writers with valid voices, perspectives, and experiences.

Additionally, the example highlights students' resistances to writing and being seen as writers in schools. There is no question that Aureliano writes. However, because of the rigidity of the teaching of writing he has encountered throughout his K–12 schooling experiences, his resistance to seeing himself as a writer is connected to larger narratives about writing and contexts, and writing, language, and identities. The environment in which he is asked to write, the languages he is invited to use, and the identities he feels comfortable revealing all influence how, why, what, when, and whether he writes at all. Therefore, it is imperative that larger narratives about writing are interrogated within CLD classrooms in ways that examine connections among writing, context, language, identity, and praxis. Doing so would mean that writing is viewed as a socially constructed, meaningful, and meaning-making activity.

As Blommaert (2008) notes, "writing is a very complex set of semiotic practices" that occur under various temporal–spatial conditions. As such, a focus on writing research and praxis must consider "social, cultural, historical, economic, and political contexts" (p. 4). If writing is a set of socially constructed semiotic practices that produce meaning, then those of us who teach writing must inquire, "what counts as writing for people who write and read" (p. 5)? Asking students this question might encourage them to examine their resistances to writing, view writing as a meaning-making activity, and see themselves as writers who can negotiate who they are in school and nonschool contexts. This was the case for Aureliano, who began to repurpose writing assignments (e.g., form, structure, intended meaning), include in his writings familiar frames of references (e.g., pop culture, personal and cultural artifacts, Spanish), and call into question those discourses and codes of power that had initially convinced him he was not a writer.

What might the example of Aureliano and his peers mean for how the teaching of writing in CLD classrooms gets framed and taken up in current research and praxis? What theoretical models provide a strong grounding for research in this area? What methodological approaches are being used in studies on writing in CLD classrooms? What are major findings from studies on the teaching of writing in CLD classrooms? What additional research is needed?

To address these questions, we make the following claims:

1. Contexts—where students write, how they navigate/participate in those spaces, and how they negotiate the contextual factors they encounter—influence the teaching and learning of writing in CLD classrooms. *For instance, Aureliano's writings (e.g., performances, processes, and products) were impacted by how he participated in certain spaces.*
2. Students' identities and cultures play significant roles in what/why they write in a variety of school and nonschool contexts. *In many of his other writings, Aureliano relied on his Spanish language and cultural referents to nuance his own, his peers', and "mainstream" dispositions.*
3. Instructional methods/teaching ap-proaches must attend to the realities of students' lives, histories, and diverse backgrounds in ways that support how writing is taught as a humanizing social activity. *Valerie's invitation for students to exchange their writings, utilize a variety of linguistic registers, repurpose assignments, co-facilitate class sessions, and refigure the classroom space point to a potentially humanizing approach to teaching and learning.*

These guiding claims build upon arguments by other researchers (Ball, 2006; Haddix, 2012; Kinloch, 2012) who insist that because of visible increases in cultural, linguistic, racial, and ethnic diversities within U.S. schools and communities, the need for writing researchers and practitioners to place more attention on the teaching of writing in

CLD classrooms is great. It is Ball (2006) who contends that in the last 45 years writing research has experienced major shifts that range from studies focused on "academic and nonacademic tasks" to studies that emphasize "how language and writing differs among subcultures" to those that highlight how "culture manifests itself within classrooms and in the cultural lives of students from diverse backgrounds" (p. 293). In this chapter, we account for some of these shifts. We situate the above claims in discussions of theories, methods, and literature related to teaching writing in CLD classrooms.

THEORETICAL MODELS

We focus on three ideas about teaching writing in CLD classrooms: (1) writing is a socially constructed activity, (2) the teaching of writing is connected to power and ideology, and (3) the teaching of writing is best supported by culturally relevant and sustaining perspectives.

Writing as Socially Constructed

As a socially constructed, meaningful, and meaning-making activity, writing is situated within broader contexts, socially, culturally, historically, and politically, and is mediated by the utility of language. Vygotsky's (1978) sociocognitive theories of language and learning assert that values, knowledge, and skills are constructed because of different ways of thinking and because of the social interactions people have with others. For Bakhtin (1986), the dialogic nature of children's learning relates to existing social discourses within classrooms and communities, which are influenced by social speech genres. He believed children are agentive beings whose engagements (e.g., thoughts, behaviors, stances) are not separate from their interactions with others (see also Kinloch & San Pedro, 2014).

The theoretical ideas posited by Vygotsky (1978) and Bakhtin (1986) inform the perspectives of researchers (Barton & Hamilton, 2000; Gee, 2001) who view writing as socially constructed. Scholars working in the tradition of New Literacy Studies, for example, believe it is necessary to engage in an "analysis of the interplay between the meanings of local events and a structural analysis of broader cultural and political institutions and practices" (Hull & Schultz, 2002, p. 585). Engaging in such an analysis means that writing—and literacy, more generally—is historically, ideologically, and socially situated within shifting contexts, by a variety of events, because of multiple social interactions, and through diverse cultural and political factors.

New Literacy Studies scholars and others who rely on sociocultural, sociocognitive, and sociohistorical framings (Schultz, 2002; Street, 2003) understand that writing and other literacy practices are influenced by relationships among power, contexts, and lived conditions. Important in this framing is a sociolinguistic understanding of the relationship between literacy and language. Barton (1994) views literacy events as grounded in speech events. Heath (1982) believes such events signify occasions in which writing is "integral to the nature of the participants' interactions and their interpretive processes" (p. 93), and Blommaert (2008) turns to Hymes (1996) to consider, "What is the particular place of writing in the sociolinguistic repertoire of people" (Blommaert, 2008, p. 5). These perspectives account for how writing is "rooted in conceptions of knowledge, identity, and being" (Street, 2003, pp. 77–78).

For the teaching of writing in CLD classrooms, the aforementioned perspectives suggest a need to focus on the interplay among writing and spoken language, writing and context, and writing, participation, and agency. As with the example of Aureliano, how students write, think about writing, and are taught writing are connected to social contexts, identities, and power.

Writing, Power, and Ideology

To examine power and ideology in the teaching of writing in CLD classrooms, we turn to critical pedagogy. Born out of a desire to provide "coherence to the theoretical landscape of racial principles, beliefs, and practices that contributed to an emancipatory idea of democratic schooling in the United States during the twentieth century," Darder, Baltodano, and Torres (2003) argue that critical pedagogy "bring[s] an array of divergent views" into conversation (p. 2). For McLaren (2003), critical pedagogy is "a politics of understanding and action, an act of knowing that attempts to situate everyday life in a larger geo-political context" (p. 7). Darder et al. (2003), and McLaren (2003), understand that sociohistorical and sociocultural contexts, identity, and politics impact teaching and learning at macro and micro levels.

According to Jocson and Cooks (2010), critical pedagogues do not believe schools "provide equal access and opportunities to or serve the interests of minority groups" (p. 149). Instead, these theorists have distinct characterizations for what schooling and education mean: Schooling is "the mere transfer of existing knowledge and a mode of social control," whereas education is "a more dynamic process involving active subjects who are committed to transforming society" (p. 149). They frame curricula as "shaped by problems that face teachers and students in their effort to live just and ethical lives" (Kincheloe, McLaren, & Steinberg, 2011, p. 164). These theorists question how knowledge is constructed, identities are positioned, and histories are represented in classrooms and communities through reflexive methods and dialogic engagements.

Giroux and McLaren (1989) believe that critical pedagogy provides a language of possibility, hope, and critique that contributes to the reinvention of self. Freire (2000) frames this reinvention as "begin[ning] always anew." In relation to teaching and learning, beginning anew parallels Womack's (2013) affective critical pedagogy. Examining the emotive components of critical pedagogy in relation to black female adolescents, Womack understands "*affective critical pedagogy* as an approach to teaching and learning that promotes critical consciousness along with therapeutic kinds of dialogue." She continues, "It considers the naming of pain (hooks, 1993) as significant as the naming of power. Likewise, it is an approach to teaching and learning that is concerned with making progress" (p. 89). Womack's theorization of affective critical pedagogy expands upon conceptualizations of critical pedagogy as transformative.

What is the connection between critical pedagogy and teaching writing in CLD classrooms? How can a focus on power and ideology align with teaching writing as a humanizing social activity? Theoretically, critical pedagogy calls into question inequitable schooling practices and critiques power in schools that have historically operated as sites of reproduction. Teaching writing must attend to contexts, identity, and power by encouraging students to write and by interrogating monolithic expectations placed upon them.

Writing and Culturally Relevant and Sustaining Practices

According to Ladson-Billings (1994), culturally relevant pedagogy (CRP) "empowers students intellectually, socially, emotionally, and politically by using cultural referents to impart knowledge, skills, and attitudes" (pp. 17–18). CRP acknowledges students' diverse identities with regard to academic excellence and insists that teachers encourage students to employ prior knowledge in schools to make sense of educational requirements. It also serves as a framework to increase students' connectedness to learning and teachers' knowledge of students' cultural identities. CRP encourages teachers to have high expectations for students, engage in critical teaching methods, and be facilitators of learning (Ladson-Billings, 1994).

CRP parallels Gay's (2000) emphasis on culturally responsive teaching that is *validating, comprehensive,*

multidimensional, empowering, transformative, and *emancipatory* (pp. 31–37). Gay (2002) insists: "Teachers have to care so much about ethnically diverse students and their achievement that they accept nothing less than high-level success from them and work diligently to accomplish it" (p. 109). In this way, teachers must embody a discourse of care and examine how their pedagogies build on students' languages, literacies, and identities in ways that support achievement. All teachers, particularly in CLD classrooms, must "recognize social inequities and their causes" in order to help students critique the status quo, or white, middle-class values, that minimize students' linguistic, cultural, and racial identities. Critiquing the status quo "encourages academic success and cultural competence" (Ladson-Billings, 1995, pp. 476–477).

Relatedly, culturally sustaining pedagogy (CSP) recognizes the value of multiculturalism and multilingualism for students and teachers, and "seeks to perpetuate and foster—to sustain—linguistic, literate, and cultural pluralism as part of the democratic project of schooling" (Paris, 2012, p. 95). As a critical stance that supports meaningful and sustaining practices, CSP—as connected to teaching writing in CLD classrooms—helps teachers and researchers question whether they are working to ensure "maintenance of the languages and cultures of African American, Latina/o, Indigenous American, Asian American, Pacific Islander American, and other longstanding and newcomer communities" (Paris, 2012, pp. 94–95). The work of CSP, guided by a theoretical model of cultural relevance (Ladson-Billings, 1994, 1995), cultural modeling (Lee, Rosenfeld, Mendenhall, Rivers, & Tynes, 2004), and critically conscious research (Willis, Montavon, Hunter, Hall, Burkle, & Herrera, 2008), has important consequences for how students write and see themselves as writers in CLD classrooms and society, writ large.

Questions that emerge from theories of cultural relevance and sustainability for the teaching of writing in CLD classrooms include: How are students being encouraged to use and sustain familial referents (e.g., heritage/home/community languages) as they acquire new and extended ones? How do students interrogate the status quo in ways that support their critical consciousness, linguistic dexterity, and existing repertories of practice? How can teachers use CRP and CSP to motivate students to write and see themselves as writers?

Collectively, sociocultural theories, critical pedagogy, and culturally relevant and sustaining perspectives interrogate relations of contexts, identities, and power in ways that influence the teaching of writing. They recognize that students' lived experiences and cultural ways of being impact how students learn in schools and navigate the larger social world.

RESEARCH METHODOLOGIES

Current research in the teaching of writing in CLD classrooms has raised various questions: What are responsible, ethical, and humanizing ways to teach writing? How can/how do practitioners frame student achievement and success in their pedagogical practices and stances? What are the roles played by language, culture, and identity? How are these factors central to teaching and assessment? How are students positioned as writers and readers, thinkers and doers, within classrooms, schools, and societies? What does it mean for writing to be a dynamic process? And how, why, and under what conditions are students *doing* writing?

To take up these and other related questions, researchers who focus on the writing activities, engagements, and practices of CLD populations rely on a variety of methodologies, including historical, ethnography, narrative inquiry, autoethnography, teacher–research, (critical) discourse analysis, racial methodologies, cognitive research, feminist writing research, and, among others, participatory action research. They also employ multiple methods and analytic procedures that are qualitative, quantitative, and/or mixed methods such as classroom observations, interviews, surveys, audio and video data, the collection of student writings, digital narratives, and curricular plans,

and small- and large-scale statistical data sets. These methodologies and methods allow writing researchers and practitioners to consider how the teaching of writing can be approached from interactive and collaborative directions that foster mutually beneficial relations between teachers and students.

These methodologies and methods also allow writing researchers and practitioners to consider, as Richardson (1994) notes, "writing as a method of inquiry, a way of finding out about yourself and your topic" (p. 516). In discussing writing as a way of knowing, Richardson posits that writing involves questioning, analyzing, and discovering things about self and others. She writes: "By writing in different ways, we discover new aspects of our topic and our relationship to it. Form and content are inseparable" (p. 516). Similarly, Pelias (2011) contends that writers "realize what they believe in the process of writing, in the act of finding the language that crystallizes their thoughts and sentiments. It is a process of "writing into" rather than "writing up" a subject." Pelias continues, "When *writing up* a subject, writers know what they wish to say before the composition process begins. When *writing into* a subject, writers discover what they know through writing. It is a process of using language to look at, lean into, and lend oneself to an experience under consideration" (p. 660).

Writing as a method of inquiry implies that the interactions and dialogic engagements of writers are contingent upon their languages, identities, positionalities, and interactions. For writing to be positioned as a method of inquiry and a way of knowing, writing researchers and practitioners "maintain a shared understanding of research as situated, systematic, and reflective investigation of literate activity with the goal of deepening our understanding of why, how, when, where, and what writers write" (Sheridan & Nickoson, 2012, p. 1). For this chapter, we argue that "writing up" is an important methodological framing for the teaching of writing.

The studies included in the review of literature (below) utilize various methodological approaches to examine the teaching of writing in CLD contexts. They position writing as a social activity grounded in diverse ways of knowing, and they inquire into discourses of power to nuance what we know about writing, the teaching of writing, and connections among writing, identity, and context. The majority of the studies included are qualitative by design; however, we recognize the need for ongoing research that focuses on quantitative and mixed methods approaches.

REPRESENTATIVE LITERATURE

The three primary topics of interest in the research literature emphasize contexts, identity, and instructional methods/teaching approaches. Research on these topics contributes insights into factors that impact student learning and student writing. In this section, we review current literature conducted since the publication of Ball's (2006) chapter on teaching writing in culturally diverse classrooms, which appeared in the first *Handbook of Writing Research.*

Contexts

Ball (2006) positions *context* as a focal point of research on teaching writing in culturally diverse classrooms. Teachers' pedagogical approaches, engagements with students, and teachers and students' identities impact how, why, and under what conditions students write. Contextual factors such as students' lived and historical experiences, communities, and cultural practices also influence the teaching and practice of writing. According to Orellana (2007), there is a "cultural mismatch" between discourses in schools and homes, and between some teachers and students' ideological views and cultural ways of knowing. This mismatch can create tension for students who must learn to negotiate their cultural, linguistic, and racial identities within the mainstream contexts and discourses (e.g.,

culture, language, ways of being) of schools.

A singular focus on this mismatch can contribute to deficit-narratives about CLD students, particularly if they are forced to abandon their cultural practices to enact the social and linguistic codes of schools. This mismatch can reflect a narrow understanding of what counts as contexts. For Orellana (2007), research on literacy and context often reinforces limited conceptualizations of contexts by regarding them as static, independent, and not bound to people's cultural, social, and linguistic ways of being. Reframing what counts as contextual factors can impact research questions about cultural mismatch, about how CLD students navigate disparate contexts, and about how contexts can be reshaped to support student learning and recognize students' multiple identities.

What counts as context is not limited to the individual classrooms in which writing is taught. Tatum (2008) outlines contextual factors that influence writing instruction and, consequently, the research on writing in CLD classrooms in the United States. In addition to race, social class, difference, and diversity, he notes that one of the primary factors influencing the teaching of writing is accountability, which is reflected by national educational efforts (e.g., No Child Left Behind, National Assessment of Educational Process results, etc.). A number of state and/or federal standards, including the Common Core State Standards Initiative, influence public school writing instruction. Implied by the endless drive to implement educational standards and mandates is the idea that the achievement gap will be narrowed. For Ladson-Billings (2006), the achievement gap refers to "the disparities in standardized test scores between Black and White, Latina/o and White, and recent immigrant and White students" (p. 3). Tatum believes that schools increasingly gauge their success by their ability to close the literacy achievement gap between students of color and white students.

Research on closing the literacy achievement gap between white students and students of color focuses on different linguistic codes between, for example, African American Language (AAL) and Dominant Academic English (DAE). In a quantitative study comparing story probes taken from 18 black and 15 white third graders (four with disabilities or special rights per group) across one academic year, Nelson (2010) found that regardless of socioeconomic status, race, or special rights, students made comparable improvements at discourse and word levels. Students were instructed in a writing laboratory designed collaboratively by speech-language pathologists, special educators, and general educators. Students with disabilities participated in the same activities as students without disabilities, but were supported by work with speech–language pathologists. The approach included the use of computer software to support all students throughout the writing process. Differences between racial groups could only be found with respect to the use of AAL, whose structures black students used more than white students in the beginning of the instruction. Findings from this study suggest that it is advantageous for research on writing to focus on engaging in diverse writing instruction that attends to students' specific academic needs and interests instead of relying on standardized measures to close a literacy achievement gap. Findings also emphasize the necessity for cross-disciplinary writing research that combines the expertise of educators and other professionals, such as speech–language pathologists.

In addition, teacher education programs and professional development opportunities play important contextual roles, given that teaching writing in CLD classrooms requires teachers to have a particular set of skills, dispositions, and knowledge. This is important if, as Kells (2007) notes, educators are committed to determining "how writing matters to students and helping students find out how writing matters in the university, in the work place, and in their diverse communities of belonging" (p. 88). Thus, preservice teachers in teacher education programs and practicing teachers participating in professional development settings should be committed to innovative curricula, culturally relevant and sustaining instructional approaches, and to recognizing context as important in the teaching of writing.

Only a few contemporary studies on writing instruction for CLD students have addressed the intersection of race,

gender, and context. A case study conducted by Piazza and Duncan (2012) analyzed the role played by an after-school literacy program for black adolescent males who had one incarcerated parent and who did not do well with reading and writing in school. The goal of the study was to increase the relevance of reading and writing in their lives without placing an explicit focus on testing. Instruction was designed to engage students' critical thinking and foster their identities as resilient writers and human beings. Contextually, this nonrequired program, the racial and linguistic identities of the teachers, and the program's emphasis on cultural relevance encouraged students to excel at reading and writing in ways not available within their traditional classrooms. Piazza and Duncan's study is important because it places attention on the intersections of race, gender, and context in the writing lives of black adolescent males. It emphasizes the need to look beyond schools (e.g., to after-school programs, community initiatives, etc.) to determine how the literacy practices of CLD students are supported. On this point, Tatum (2008) argues that out-of-school contexts, of which many black students are a part, should not be ignored in the planning of curricula.

Another contextual factor that negatively impacts the teaching of writing in CLD classrooms is the use of deficit-oriented language such as "struggling reader/writer," "academic underachiever," and "marginal learner." Kennedy's (2006) case study of five first-grade English as a second language (ESL) students found that some schools label ESL students as "at risk" of repeating a grade because of the writing scores they receive when tested in Dominant Academic English. The study found that CLD students may experience emotional and cognitive difficulty in their approaches to writing when placed in monolingual classrooms. Students who appeared to not make progress in their writing (based on the Lamme/Green Scale) received instruction through an approach Kennedy (2006) calls "writing onto the page," in which students were encouraged to write in their own voices and use their home languages. This approach resulted in notable progress for all students. In addition to highlighting the important role of student voice and home languages in writing instruction, the study also examined the negative impact of deficit-oriented language on the identities, languages, and writing abilities of CLD students. Tatum (2008) and Tatum and Gue (2012) insist that some CLD students internalize deficit narratives in ways that hinder how they view writing and how they view themselves as writers. Equally problematic, they note, is that some teachers have failed to teach writing in ways that challenge, motivate, and inspire CLD students to succeed.

On this same topic, Tatum and Gue (2012) explored the writing environment and the sociocultural benefits of writing for a group of black adolescent males. Each student received explicit writing instruction and an adult writing mentor, with the hope that they would build a strong capacity for writing success, reject internalized deficit narratives about their academic abilities, and engage with others. Their findings highlight that the environment in which students are asked to write impacts how they see themselves as writers or nonwriters and how they participate or do not participate in writing activities.

As stated in our first claim that guides this chapter, context—where students write, how they navigate/participate in those spaces, and how they negotiate contextual factors—influences writing in CLD classrooms. Further research is needed on how contexts impact writing and intersect with race and gender in ways that influence writing instruction and practice, and how contextual factors interfere with the uptake of writing by teachers and students in CLD spaces.

Identity

The various theoretical approaches to, and assumptions about, writing have influenced what we know about writing instruction in CLD classrooms. Although a focus on context is important, so, too, is an emphasis on identity. Questions related to what identity is, how it is developed, what role power plays in identity formation, and how

identity affects writing dominate some of the literature. A number of researchers insist that for teachers to engage in meaningful teaching with students, they must first get to know who students are (identities).

Gee (2001) distinguishes four ways to theorize identity. The first is the *nature perspective*, which stipulates that people have little to no control over who they are because of their biological makeup. The second, the *institutional perspective*, derives from the position one holds in an institution (e.g., student, patient, doctor, etc.). *Discursive perspective* is the third, and it represents character traits that are discursively constructed and imposed onto others to mark individuality. Lastly, Gee writes about *affinity identities*, which are created through one's allegiance to and participation in larger groups that have shared practices (e.g., social clubs, sororities, fraternities, etc.). Based on these four perspectives, Gee contends that identities are highly predicated on interactions among people and the ways people navigate contexts, discourses, and institutions. Thus, the previously discussed examples of how students of color see themselves as nonwriters may result from deficit-oriented narratives that get reproduced in schools and society about the identities of CLD students.

Lee and Anderson (2009) recognize the problematic nature of identity labels, or categories, "when they are essentialized as absolute truths about persons and when they impose limitations on potential actions or conceptions" (p. 189). They continue, "When labels such as *English learner*, *learning disabled*, *underachiever*, and *gifted* are consistently used across contexts and institutional discourses, the terms become tools to shape students' identities" (p. 189). Citing the scholarship of Bucholtz and Hall (2004), Bernard (2005), and Orellana and Bowman (2003), Lee and Anderson conclude that identity categorizations can perpetuate stereotypical views of students which can impact how they are treated inside schools. Therefore, we must value "the cultural and linguistic identities of all students in ways that treat difference not as a cause of risk but as a resource and as sites of opportunities for the negotiation of linguistic and cultural identity potentials" (p. 204).

How might the above conceptualization of identity connect to the teaching and practice of writing in CLD contexts? Or, as Freire (2000) so poignantly inquires, what are connections among identity formation, liberation, and self-affirmation? To address these questions, many educational researchers have nuanced the idea that traditional conceptualizations of identity are closely tied to the local (e.g., contexts, situations, experiences). Rouse (1995), for example, argues that many immigrant students have developed multilocal and transnational affiliations that have lasting effects on their identities. It is important to consider these affiliations and how they affect students' identities in the teaching of writing in CLD classrooms, especially because of the increasing presence of students who identify as immigrants or the children of immigrants. Equally important is that the teaching of writing in CLD contexts serves multiple purposes: as a medium for students to express ideas and experiment with process and product, form and function; as a social activity for students to explore how they view themselves, others, and the contexts in which they write; as an opportunity for students to excel, academically and socially; and as a culturally relevant/sustaining practice for students to critique inequitable structures.

In her study of a 4-week summer writing institute for black boys in grades 5 through 8 who were "at risk" of repeating their respective grade levels, Haddix (2012) discusses how the program helped students develop their identities as writers by focusing on critical thinking skills and academic writing. Students wrote in response to personal questions, such as, "Who is the most influential person in your life and why," and "What special contribution has this person made to the world" (p. 117). Haddix's examination of students' writings helped her understand how they came to embrace their identities as writers, how their sense of belonging and reliance on familial language and cultural practices in academic spaces increased, and how they demonstrated resilience and confidence when interacting with teachers. Her observations led her to conclude that it is important "to rebuild and reclaim the writer identities of Black boys and support their agency and individual choice" (p. 129). Haddix's findings and conclusions parallel those of Wissman and Vasudevan (2012).

In their research with CLD female students within a school context, and with CLD male students in an alternative to incarceration setting, Wissmann and Vasudevan (2012) describe the significance of "educational research and teaching spaces for knowing adolescents beyond the stock stories that circulate about them" (p. 178). Analyzing how students used poetry, drama, and photography to challenge deficit renderings of their identities led them to conclude that when students are invited to write within supportive, explorative contexts, practices emerge that are "performative, social, and embodied" (p. 178). Wissmann and Vasudevan's study and Haddix's (2012) research highlight why/how identities impact the practice of writing in CLD contexts.

Related studies that highlight connections between identities and writing rely on culturally relevant instruction. García and Gaddes (2012) conducted an 18-month qualitative study in an after-school writing workshop with 12 students who self-identified as Latina. The researchers selected literature they deemed relevant to the students' lives, such as culturally authentic short stories and poems, to which students wrote in response. They created writing assignments that invited students to share collective and individual experiences about their transnational identities, such as reflecting on notions of cultural values and taboos. The writing workshop teachers created a space that encouraged students to code-switch orally and in print. Although the scope of the study did not allow for an exploration of the long-term effects of this approach, the students reported that their participation helped shape their academic goals. The researchers concluded, however, that it is not enough to simply create hybrid spaces that merge students' home and academic lives. Students must "own" these spaces if they are to learn that their identities are multidimensional.

Similarly, Wessels and Herrera (2014), in their case study of three elementary students participating in a family literacy program, discuss the creation of a space for CLD students to use writing to reflect on their identities. The students initially expressed anxiety about writing and self-identified as nonwriters. After observing the families' after-school practices, Wessels and Herrera concluded that because the students and their families spent a considerable amount of time watching telenovelas, it would be best to pair students' writing assignments with visual tasks (e.g., drawing storyboards, coloring images). In this way, writing instruction was scaffolded by culturally relevant experiences and students became less anxious about writing in English and more invested in seeing themselves as writers.

Students' identities and cultures, as stated in our second claim that guides this chapter, play significant roles in what, how, and why they write in school and nonschool contexts. The examples in this section point to the need for writing researchers and practitioners to account for who students are as they invite students into writing within CLD contexts.

Practice

Exploring the roles played by contexts and identities in relation to the teaching of writing in CLD classrooms necessarily implies a focus on instructional methods, approaches, and underlying assumptions that influence learning. As previously discussed, culturally relevant pedagogies seek to disrupt deficit-oriented approaches to teaching and learning and foster meaningful relationships between students and teachers (Ladson-Billings, 1995; Jiménez & Rose, 2010). Although some researchers argue that there is little empirical evidence that a culturally relevant approach affects outcomes (Goldenberg, Rueda & August, 2006), a number of studies have found that students' academic engagements improved as a result of their involvement in classrooms that utilized culturally relevant instructional approaches.

Dworin (2006) conducted an 8-week study with students from a transitional bilingual fourth-grade classroom in which the writing goals explicitly aligned with learning standards. He collaborated with the classroom teacher to

develop a project that allowed students to engage in literacy practices that engaged both of their languages outside the classroom. The project was designed to complement writing instruction that was focused primarily on meeting state standards and specific formulaic writing conventions, often at the exclusion of students' home cultures, languages, and lived experiences. Thus, to combine a culturally relevant approach while keeping in mind the narrative requirement of the state standards, students collected, wrote about, edited, and published family stories by using a variety of modalities. In addition to bringing their family narratives into the classroom, students wrote their stories in English and translated them into Spanish. The assignment invited students to collaborate with others, engage writing as a meaningful social activity, utilize cultural practices, and rely on multiple oral and print forms of communication. Dworin's study shows that it is possible to tap into students' funds of knowledge without sacrificing compliance with standards.

Instructional approaches for teaching writing in CLD classrooms have also been framed by a cultural ecological perspective. In their respective studies, Guerra (2008) and Kells (2007) approach writing instruction by viewing students as global, or transcultural, citizens who learn to write productively, ethically, critically, and responsively in classrooms and throughout the world, and who situate their ways of writing within global discourses. According to Guerra (2008), writing researchers/practitioners can "create an environment in which children across the PreK–16 spectrum can combine in very sophisticated ways the cultural and linguistic resources they bring to school with those they learn in our classrooms." Doing so could mean that students are moving "across the cultural spaces that too often separate us from one another" (p. 304).

To do the work described by Dworin (2006), Guerra (2008), and Kells (2007), those who teach writing in CLD classrooms should engage in instructional practices that attend to who students are and what they need. Stewart (2010), who conducted action research in her adult ESOL classroom, believes writing instruction must be relevant to, and meaningful for, students. She observed how students were orally expressive when discussing their encounters with immigration; however, that same level of expressiveness was not reflected in their writings. Therefore, Stewart encouraged students to write response papers, essays, and journals on the texts they studied by including their perspectives on the topic. Similar to Dworin (2006), Stewart concluded that there are major limitations to how teachers teach writing and how students engage in writing activities when the audience is a singular person (typically, the teacher).

Therefore, instructional approaches, especially in CLD classrooms, must center not only on contexts and student identities, but also on audience (e.g., who students are writing to, who gets to read student writings, and the interactions that occur between writer and receiver). In this way, the teaching of writing—whether from culturally relevant and cultural ecological instructional approaches, and whether through the teaching of argumentative writing, narrative writing, or writing that involves critical reader-response—must be transformative for students (who should come to view themselves, if they do not already, as writers) and for teachers (who rely on culturally relevant and sustaining practices) across school and nonschool contexts.

In terms of additional instructional approaches, Martinez-Roldan and Malave (2010) believe that narratives that get positioned as cultural resources can be "used to support students who are children of immigrants in the process of negotiating meanings" (p. 68). Teachers, especially at the early grades level, should create classroom opportunities "for conversational storytelling," for students to "bring in their experiences and narratives," for the study of multiple texts "that is culturally specific," and that incorporate "language as a cultural tool that mediates thinking and identity development" (pp. 68–69). Similarly, Jocson and Cooks (2010), in their study of CLD high school students, suggest a number of approaches that can stimulate writing. From "the use of skits and provocative writing topics explicitly linked to literacy and power" to a focus on the ways writing is "a site of struggle where meanings [are] created and positionalities named" to engaging in pedagogical practices that utilize "community

resources" (pp. 156–157), teachers can encourage students to write and to see themselves as writers.

Kinloch's (2012) study with students attending an urban high school reveals the multiple ways students initially resisted writing and being seen as writers. Over time, students questioned what it means to be a writer, and they refigured classroom spaces in ways that support writing activities. They examined codes of power that operate within schools and that negatively position CLD students as nonwriters. Kinloch's teaching approaches, which relied on culturally relevant and sustaining practices, invited students to co-design writing assignments, engage in small and whole-group writing and reading discussions, utilize popular culture and other familiar cultural referents in their writings, and determine ways to align their writing assignments with larger learning goals that they came to name for themselves.

As stated in our third claim that guides this chapter, instructional methods and classroom approaches in CLD classrooms must attend to the realities of students' lives, histories, and diverse backgrounds in ways that support the practice of writing as a humanizing social activity. As we make this claim, we also acknowledge the need for additional research that examines how the design of curricula and the teaching of writing align with the realities of who students are (their identities/lived conditions) and the environments in which they live (contexts/contextual factors). Such studies would serve to complement the studies we discuss in this review—studies that recognize the value of contexts, identities, and practices for CLD students.

IMPLICATIONS AND CONCLUSIONS

The theoretical framings, methodologies, and research literature included in this chapter reflect a broad understanding of the teaching of writing in CLD classrooms. That understanding is grounded in the realities of who CLD students are, the contexts in which they are made to feel comfortable and capable of writing, and the instructional approaches that are utilized to support their writing activities. Such understandings are integral components of the movement toward writing practices, pedagogies, and policies that honor and position as central the lives, languages, and literacies of students in schools and the larger social world.

Key in the work of teaching writing in CLD contexts is the responsibility that we all have—teachers, researchers, administrators, parents, stakeholders, and others invested in the success of diverse students—to ensure that what we know about writing research and praxis gets taken up in schools and gets framed as culturally relevant, sustaining, and socially just work in global conversations about education. There is no question that in order to ensure the (writing) success of diverse students, we need to focus on contextual factors, identities, and instructional approaches. Our theoretical framings must align with the pedagogies that get enacted in actual classrooms, and our pedagogies must adhere to the realities of who students are and how they see themselves in schools against pervasive discourses that circulate about them. We need more research that examines the practice and teaching of writing in CLD classrooms from rigorous qualitative, quantitative, and mixed methods approaches.

As we conclude, we return to the brief scene that opens this chapter about Aureliano's perceptions of writing. In relation to the theoretical framings, methodological perspectives, and review of current literature included in this chapter, that scene convinces us of the ongoing need to examine why CLD students resist academic writing, how they critique codes of power that circulate about their academic achievement, and what it means when they see themselves as writers within schools. These needs, which we believe are connected to larger narratives about writing and contexts, and writing, language, and identities, can encourage Aureliano and other CLD students to believe that they are writers and that their writings matter in schools.

REFERENCES

Bakhtin, M. (1986). *Speech genres and other late essays.* Austin: University of Texas Press.

Ball, A. (2006). Teaching writing in culturally diverse classrooms. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research.* New York: Guilford Press.

Ball, A., & Ellis, P. (2008). Identity and the writing of culturally and linguistically diverse students. In C. Bazerman (Ed.), *Handbook of research on writing* (pp. 499–513). New York: Erlbaum.

Barton, D. (1994). *Literacy: An introduction to the ecology of written language.* Oxford, UK: Blackwell.

Barton, D., & Hamilton, M. (2000). Literacy practices. In D. Barton, M. Hamilton, & R. Ivanic (Eds.), *Situated literacies: Reading and writing in context* (pp. 7–15). London: Routledge.

Bernard, T. J. (2005). On multiple identities and educational contexts: Remarks on the study of inequalities and discrimination. *Journal of Language, Identity, and Education, 4*, 67–76.

Blommaert, J. (2008) *Grassroots literacy: Writing, identity and voice in Central Africa.* London: Routledge.

Bucholtz, M., & Hall, K. (2004). Language and identity. In A. Duranti (Ed.), *A companion to linguistic anthropology* (pp. 369–394). Malden, MA: Blackwell.

Darder, A., Baltodano, M., & Torres, R. D. (2003). Critical pedagogy: An introduction. In A. Darder, M. Baltodano, & R. D. Torres (Eds.), *The critical pedagogy reader* (pp. 1–21). New York: Routledge Falmer.

Dworin, J. E. (2006). The family stories project: Using funds of knowledge for writing. *Reading Teacher, 59*(6), 510–520.

Freire, P. (2000). *Pedagogy of the oppressed*. New York: Continuum.

Garcia, A., & Gaddes, A. (2012). Weaving language and culture: Latina adolescent writers in an after-school writing project. *Reading and Writing Quarterly, 28*(2), 143–163.

Gay, G. (2000). *Culturally responsive teaching: Theory, research, and practice.* New York: Teachers College Press.

Gay, G. (2002). Preparing for culturally responsive teaching. *Journal of Teacher Education, 53*(2), 106–116.

Gee, J. P. (2001). Identity as an analytic lens for research in education. *Review of Research in Education, 25*, 99–125.

Giroux, H. A., & McLaren, P. (1989). Introduction: Schooling, cultural politics, and the struggle for democracy. In H. A. Giroux & P. L. McLaren (Eds.), *Critical pedagogy, the state, and cultural struggle* (pp. xi–xxxv). Albany: State University of New York Press.

Goldenberg, C., Rueda, S., & August, D. (2006). Sociocultural contexts and literacy development. In D. August & T. Shanahan (Eds.), *Developing reading and writing in second-language learners: Lessons from the report of the national literacy panel on language-minority children and youth* (pp. 95–131). New York: Routledge.

Guerra, J. C. (2008). Writing for transcultural citizenship: A cultural ecology model. *Language Arts, 85*(4), 296–304.

Haddix, M. (2012). Reclaiming and rebuilding the writer Identities of Black adolescent males. In D. E. Alvermann & K. A. Hinchman (Eds.), *Reconceptualizing the literacies in adolescents' lives: Bridging the everyday/academic divide*. New York: Routledge.

Heath, S. B. (1982). Protean shapes in literacy events: Ever-shifting oral and literate traditions. In D. Tannen (Ed.), *Spoken and written language: Exploring orality and literacy* (pp. 91–118). Norwood: NY: Ablex.

Hull, G., & Schultz, K. (Eds.). (2002) *School's out: Bridging out-of-school literacies with classroom practice.* New York: Teachers College Press.

Hymes, D. (1996). *Ethnography, linguistics, narrative inequality: Toward an understanding of voice.* London: Taylor & Francis.

Jiménez, R., & Rose, B. (2010). Knowing how to know: Building meaningful relationships through instruction that meets the needs of students learning English. *Journal of Teacher Education, 61*(5), 403–412.

Jocson, K., & Cooks, J. (2010). Writing as a site of struggle: Popular culture, empowerment, and politics of invisibility. In V. Kinloch (Ed.), *Urban literacies: Critical perspectives on language, learning, and community* (pp. 145–159). New York: Teachers College Press.

Kells, M. H. (2007). Writing across communities: Deliberation and the discursive possibilities of WAC. *Reflections, 11*(1), 87–108.

Kennedy, E. (2006). Literacy development of linguistically diverse first graders in a mainstream English classroom: Connecting speaking and writing. *Journal of Early Childhood Literacy, 6*(2), 163–189.

Kincheloe, J. L., McLaren, P., & Steinberg, S. R. (2011). Critical pedagogy and qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative research* (4th ed., pp. 163–177). Los Angeles: Sage.

Kinloch, V. (2012). *Crossing boundaries—Teaching and learning with urban youth.* New York: Teachers College Press.

Kinloch, V., & San Pedro, T. (2014). The space between listening and storying: Foundations for Projects in Humanization. In D. Paris & M. Winn (Eds.), *Humanizing research: Decolonizing qualitative inquiry with youth and communities.* New York: Sage.

Ladson-Billings, G. (1994). *The dreamkeepers: Successful teachers of African American children.* San Francisco: Jossey-Bass.

Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal, 32*, 465–491.

Ladson-Billings, G. (2006). From the Achievement Gap to the educational debt: Understanding achievement in U.S. schools. *Educational Researcher, 35*(7), 3–12.

Lee, C. D., Rosenfeld, E., Mendenhall, R., Rivers, A., & Tynes, B. (2004). Culturally modeling as a frame for narrative analysis. In C. Daiute & C. Lightfoot (Eds.), *Handbook of research on multicultural education* (pp. 39–62). Thousand Oaks, CA: Sage.

Lee, J. S., & Anderson, K. T. (2009). Negotiating linguistic and cultural identities: Theorizing and constructing opportunities and risks in education. *Review of Research in Education, 33*(1), 181–211.

Martinez-Roldan, C. M., & Malave, G. (2010). Identity construction in the Borderland: The Acosta family. In V. Kinloch (Ed.), *Urban literacies: Critical perspectives on language, learning, and community* (pp. 53–71). New York: Teachers College Press.

McLaren, P. (2003). *Life in schools: An introduction to critical pedagogy in the foundations of education* (4th ed.). Boston: Allyn & Bacon.

Mora, P. (1986a). First love. In P. Mora, *Borders* (p. 68). Houston, TX: Art Publico Press.

Mora, P. (1986b). Border town: 1938. In P. Mora, *Borders* (p. 68). Houston, TX: Art Publico Press.

Nelson, N. W. (2010). Changes in story probes written across third grade by African American and European American students in a writing lab approach. *Topics in Language Disorders, 30*(3), 223–252.

Orellana, M. F. (2007). Moving words and worlds: Reflections from “the Middle.” In C. Lewis, P. Enciso, & E. B. Moje (Eds.), *Reframing sociocultural research on literacy: Identity, agency, and power* (pp. 123–136). Mahwah, NJ: Erlbaum.

Orellana, M., & Bowman, P. (2003). Cultural diversity research on learning and development: Conceptual, methodological, and strategic considerations. *Educational Researcher, 32*(5), 26–32.

Paris, D. (2012). Culturally sustaining pedagogy: A needed change in stance, terminology, and practice. *Educational*

Researcher, 41(3), 93–97.

Pelias, R. (2011). Writing into position: Strategies for composition and evaluation. In N. K. Denzin & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative research* (4th ed., pp. 659–668). Los Angeles: Sage.

Piazza, S. V., & Duncan, L. E. (2012). After-school literacy engagements with struggling readers. *Reading and Writing Quarterly, 28*(3), 229–254.

Richardson, L. (1994). Writing: A method of inquiry. In N. Denzin & Y. Lincoln (Eds.), *Handbook of qualitative research* (1st ed., pp. 516–529). Thousand Oaks, CA: Sage.

Rouse, R. (1995). Questions of identity: Personhood and collectivity in transnational migration to the United States. *Critique of Anthropology, 15*(4), 351–380.

Schultz, K. (2002). Looking across space and time: Reconceptualizing literacy learning in and out of school. *Research in the Teaching of English, 36*, 356–390.

Sheridan, M. P., & Nickoson, L. (2012). Introduction: Current conversations on writing research. In L. Nickoson. & M. P. Sheridan (Eds.), *Writing studies research in practice: Methods and methodologies* (pp. 1–12). Carbondale: Southern Illinois University Press.

Stewart, M. A. (2010). Writing with power, sharing their immigrant stories: Adult ESOL students find their voices through writing. *Tesol Journal, 1*(2), 269–283.

Street, B. (2003). What's "new" in New Literacy Studies? Critical approaches to literacy in theory and practice? *Current Issues in Comparative Education, 5*(2), 77–91.

Tatum, A. W. (2008). Toward a more anatomically complete model of literacy instruction: A focus on African American male adolescents and texts. *Harvard Educational Review, 78*(1), 155–180.

Tatum, A., & Gue, V. (2012). The sociocultural benefits of writing for African American adolescent males. *Reading and Writing Quarterly, 28*(2), 123–142.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Wessels, S., & Herrera, S. G. (2014). Drawing their way into writing: Culturally and linguistically diverse students finding voice through mini-novelas. *Tesol Journal, 5*(1), 105–119.

Willis, A. I., Montavon, M., Hunter, C., Hall, H., Burkle, L., & Herrera, A. (2008). *On critically conscious research: Approaches to language and literacy research.* New York: Teachers College Press.

Wissman, K., & Vasudevan, L. (2012). Re-writing the stock stories of urban adolescents. Autobiography as a social and performative practice at the intersections of identities. In D. E. Alvermann & K. A. Hinchman (Eds.), *Reconceptualizing the literacies in adolescents' lives: Bridging the everyday/academic divide* (3rd ed., pp. 160–180). New York: Routledge.

Womack, E. (2013). *Uncovering the literate lives of black female adolescents.* Unpublished dissertation. Columbus, OH.

PART V

ANALYTIC TOOLS FOR WRITING RESEARCH

CHAPTER 26

Automated Writing Evaluation

An Expanding Body of Knowledge

Mark D. Shermis, Jill Burstein, Norbert Elliot, Shayne Miel, and Peter W. Foltz

The chapter on machine scoring for the first edition of this *Handbook* focused almost exclusively on the use of automated writing evaluation (AWE) technologies to provide information about writing ability in summative assessment contexts. Since that time, AWE has developed its own body of knowledge, building out from its origins in natural language processing and sociocognitive approaches to construct modeling (Shermis, Burstein, & Bursky, 2013). To demonstrate the depth of contemporary knowledge about AWE, in this chapter we present AWE in terms of the categories of evidence used to demonstrate that these systems are useful in the instruction and assessment of writing.

Defining the documentation of such usefulness in terms of validation (Kane, 2006), Williamson, Xi, and Breyer (2012) proposed a unique conceptual framework for AWE focusing on *explanation* (construct, task, and scoring investigation); *evaluation* (human and automated score relationships); *generalization* (generalizability across alternate tasks and test forms); *extrapolation* (external measure relationships); and *utilization* (score use and consequences). In an adaptation and reuse of their framework, we discuss the AWE body of knowledge as follows: The *Explanation* section offers descriptions of how four different AWE systems provide information that may be used to draw relationships between systems and construct relevance; the *Evaluation* section provides descriptions of the scoring and evaluation functions of AWE systems; the *Generalization* section discusses empirical studies that use AWE to assess student performance; the *Extrapolation* section argues for the development of AWE systems that can evaluate writing task types beyond the genre of the academic essay; and the *Utilization* section focuses on the application of AWE in the context of decision making.

EXPLANATION

Although the point may seem obvious, AWE systems do *not* use the same processes as humans for reading text and comprehending the content. AWE systems *cannot* evaluate the cognitive, intrapersonal, and interpersonal domains employed by writers in order to master genres and address specific audiences. However, when seen on their own terms, the systems do have value. Current AWE systems have demonstrated the ability to (1) produce numeric scores related to writing quality that are comparable to human rater scores, allowing for the inclusion of writing tasks that can be efficiently and reliably scored on large-scale assessments; and (2) support instructors in formative settings to provide feedback to student writers.

In the case of instruction and assessment of writing, a student's progress in English language arts (broadly defined as the ability to write compellingly in a variety of genres to a variety of audiences) is related to exposure to best practices in writing instruction. Receiving ample and significant feedback in time to improve writing performance is closely related to improved levels of writing performance (Biber, Nekrasova, & Horn, 2011; Landauer, Lochbaum, & Dooley, 2009). Recent meta-analyses of high-quality research studies have identified writing instruction practices that can best improve student reading and writing performance. The studies—*Reading Next* (Biancarosa & Snow, 2004), *Writing Next* (Graham & Perin, 2007), *Writing to Read* (Graham & Hebert, 2010), *Informing Writing*

(Graham, Harris, & Hebert, 2011), and *The Effectiveness of Feedback for L1-English and L2-Writing Development* (Biber et al., 2011)—provide a range of practices—as well as the statistical effect size (an estimate of the magnitude of the instruction) on student learning—that may serve as a guide to best instructional practices: providing feedback; developing inquiry activities for a particular writing task; encouraging self-assessment; using student evaluation of writing using scales; fostering sentence combining instruction; monitoring writing progress by the instructor; study and emulation of good models of writing; and promoting free writing. There are also cautions regarding allowing students to write using paper and pencil when they are inexperienced in word processing and exclusive use of grammar instruction that has not been demonstrated to be an effective treatment. Such empirical findings have allowed the development of a set of best principles for writing instruction: the creation of a supportive writing environment; instruction in writing strategies; knowledge acquisition of effective writing; and attention to foundational skills (Graham, MacArthur, & Fitzgerald, 2013).

Together, the three initiatives below provide a general framework for the cognitive, intrapersonal, and interpersonal domains related to education for life and work (National Research Council, 2012). Informed by studies such as those mentioned above, (1) the *U.S. Common Core State Standards Initiative* (CCSS; 2012) highlights the need for incorporating such practices in the classroom. The standards require students to develop more rigorous writing skills, with a stronger emphasis on the ability to synthesize and summarize informational text, formulate arguments, and respond appropriately to source documents. The CCSS especially emphasizes writing for a purpose, with students linking ideas to texts and argumentation. Seeking to bridge high school and college writing, (2) the *Framework for Success in Postsecondary Writing* (O'Neill, Adler-Kassner, Fleischer, & Hall, 2012)—endorsed by the Council of Writing Program Administrators, the National Council of Teachers of English, and the National Writing Project—provides a framework for writing, reading, and critical analysis experiences that are key to college success. In an attempt to bridge college and workplace writing, (3) the Society for Technical Communication has produced its own *Body of Knowledge* (BOK) project related to workplace writing (Coppola, 2010; Coppola & Elliot, 2013).

Aligned with instructional and assessment frameworks provided by meta-analyses and national consensus statements—and when seen on their own terms—AWE supports best principles for writing instruction. When embedded in an online instructional platform, AWE systems can serve as one of many tools for teachers to help monitor and track student performance. Teachers can assign more writing while being able to focus on more nuanced instructional goals.

The following descriptions of three systems offer readers a look inside these systems and provide explanations of how the systems work in terms of providing both numerical scores and detailed feedback.[1]

The Intelligent Essay Assessor

The Intelligent Essay Assessor (IEA) was initially developed for scoring writing in content domains and was first used operationally in 1995 for scoring high school and entry-level undergraduate writing prompts (i.e., constructed-response writing tasks) in such fields as history, science, introduction to psychology, and language arts (Foltz, Laham, & Landauer, 1999; Landauer, Laham, & Foltz, 2001). Since that time, the IEA has been enhanced and expanded, and it is now used for such summative writing assessments as the State of Maryland's Science assessment and the new GED, as well as for K–12 formative assessments such as Holt Online Scoring, WriteToLearn, WritingCoach, and iLit products. On the postsecondary level, IEA is used for the College Board's Accuplacer writing test (for placement purposes), as well as in college-level formative products such as MyWritingLab, MyPsychLab, and MyHistoryLab.

IEA scores student essays and reading comprehension summaries by measuring a range of features of writing that are related to constructs of writing. These features include (1) lexical sophistication; (2) grammar, mechanics, style, coherence, organization; and (3) content. Measures of lexical sophistication include the developmental maturity (Landauer, Kireyev, & Panaccione, 2011) as well as the variety of types of words used. To measure grammar and mechanics, these systems use natural language processing-based approaches (computational techniques) that identify and extract features from electronic texts to analyze linguistic features of the writing related to these measures. Such measures detect knowledge of conventions and note problems with run-on sentences, subject–verb agreement, sentence fragments, and use of possessives. For assessing mechanics, other measures are used that examine appropriate spelling, punctuation, and capitalization. Content-based features are assessed using latent semantic analysis—a statistical modeling approach that uses large corpora of words (such as those found in textbooks) to model word usage in a given subject domain (see Foltz, Gilliam, & Kendall, 2000; Foltz, Kintsch, & Landauer, 1998; Landauer et al., 2001). The technologies allow the analysis of content to assess aspects such as ideas, coherence, and quality of text summaries compared to gold-standard texts (Foltz et al., 2000).

IEA uses a machine learning-based approach to determine the optimal set of features and the weights for each of the features in order to best model the scores for each essay. From these comparisons, scoring models are derived to predict the scores that the human scorers would assign to any new responses. Depending on the kind of writing task, these models can be developed for scoring specific writing traits (e.g., organization, ideas, mechanics) for individual writing prompts or for generalized scoring that can be used across a variety of writing prompts. Based on the scoring model, new essays can be immediately scored by analysis of the features weighted according to the scoring model. IEA further provides advisories to instructors, detecting off-topic essays as well as common forms of attempts to enhance the overall score using construct-irrelevant elements (e.g., padding of essays with inappropriate vocabulary, repetition, and plagiarized material).

Because instructors and their students will encounter AWE systems such as IEA, as they are embedded in digital learning environments, a detailed explication of one such system will be useful to readers of the *Handbook*. The WriteToLearn® system is used in this chapter to illustrate how a paradigmatic scoring and evaluation engine such as IEA is used in the classroom.

WriteToLearn is implemented as a digital, web-based platform and incorporates empirical instructional and assessment frameworks and national consensus statements such as the CCSS for writing and reading. WriteToLearn consists of two components, each incorporating a unified instruction and assessment framework designed to address different writing and comprehension skills. One component teaches reading comprehension through writing summaries in response to readings. The other component teaches writing skills through writing responses to prompts. In each case, students write and then receive immediate and specific feedback that helps them practice writing. Students can then revise and resubmit their essays through repeated edit and critique cycles. For teachers, WriteToLearn is designed as a tool allowing real-time monitoring of students' performance as well as maintenance of a digital portfolio of student writing.

In writing to specific prompts, students receive feedback using standard traits and rubrics similar to those used to score state writing assessments. The rubrics are typically designed to yield holistic scores on a 4- or 6-point scale, as well as specific trait scores on elements of writing such as ideas, organization, conventions, word choice, and sentence fluency. In addition, grammatical and spelling errors are flagged, as is unnecessary repetition.

Within the essay feedback system, students can click on the links associated with each trait to receive feedback tied to their specific trait score. This feature opens up a separate window with information about what students can do to their essay to improve writing on that trait. The feature further includes access to a sample essay (on a different topic, but same genre) that provides examples of good and poor writing for that specific trait and for the score that

the student received. The student can then view writing examples of another essay topic to see how the essay could be rewritten to achieve a better score. Based on this feedback, a student may then revise and resubmit any essay.

Summary writing within WriteToLearn is used to train reading comprehension skills as well as other skills in learning to write. In the summary writing component, students are assigned a text from over a thousand online readings in science, social studies, history, and general interest that range from fourth grade to high school levels. After reading the text, students are asked to write a summary and then click “submit” to receive feedback.

The system feedback includes an assessment of how well the student covered the content in each major section of the reading and hints on how to improve content coverage for particular sections. Since summary writing involves distilling the essence of the important information from a text, students also receive information on the length of their essay and feedback if they included unimportant and repeated information, as well as mention of any direct copying from the original text. Teachers are able to set thresholds to limit the amount of direct copying students can integrate into their summaries. For those elements of writing requiring more work, students are able to click on a “hints” option—this raises questions about the text which are intended to help them think more deeply about particular parts of the passage. Students are also able to click on section headings which will bring up the original text for them to reread so that they may improve their summary on subsequent revisions. This read-write-revise cycle encourages the students to reread and reexpress those parts of the text they have not understood.

Although supporting a student with feedback is critical to improving performance, it is further critical to support instructors in monitoring students throughout the writing process. One of the limitations in teaching writing is the amount of time required to edit and evaluate student work. This process of instructor feedback limits the number of assignments that can be given as well as how much detailed response can be provided to each individual student. Within automated scoring implementations, students may be asked to write and revise regularly, with the computer providing the majority of the feedback while a teacher continues to score selected essays. More generally, computer-based scoring also allows teachers to monitor closely student performance as the students make revisions over multiple assignments. In the context of WriteToLearn, the system provides a number of “scoreboards” showing student performance by trait, including types of grammatical and spelling errors, amount of time on tasks, number of revisions attempted, and change in scores over revisions in order to track student growth. The scoreboards are updated in real time and allow teachers to view a student essay and edit and provide comments, which then appear on the student’s writing interface.

The two other systems to which we now turn have similar instructional orientations; however, the design of each scoring system is unique.

PROJECT ESSAY GRADE

Ellis Page created the first automated essay scoring engine, Project Essay Grade (PEG), as a teacher’s helper (Page, Truman, & Lavoie, 1994). Page began his career as a high school English teacher and argued that one of the deterrents to more writing in the classroom was that the teacher had to grade each essay. PEG was originally designed to process the majority of the common mechanical mistakes that appeared in student writing, thus allowing Page to focus his attention on aspects of writing beyond mere knowledge of conventions. By lightening the grading load, Page hoped to be able to ask for more student writing that could be evaluated for such elements of writing as content, voice, and tone—thus allowing the software to do what it could best do and the teacher to do the same (Ajay, Tillett, & Page, 1973). Page’s insight, which ignited interest in AWE, was that there were certain features of a written text that could be measured by a computer and that served as indicators of the quality of the text (Page,

1996). Since acquiring the technology in 2003, Measurement Incorporated (MI) has redesigned and enhanced the scoring engine, and it is now being used in multiple high-stakes, statewide summative assessments. It is used to model the mechanical aspects of writing as well as the more complex aspects of tone, voice, elaboration, organization, and content. PEG is also employed widely as an AI engine for MI's suite of formative writing practice websites (which provide information about trait scoring), including Educational Records Bureau's *Writing Practice Program (WPP)*, Utah State Office of Education's *Utah Write*, Connecticut State Department of Education's *CBAS Write*, North Carolina's *NC Write*, Learning Express's *Learning Express Advantage*, and MI's own *PEG Writing*.

The purpose of PEG is to provide fast, reliable scores and, when used in a formative setting, instructional feedback about the student's writing. To do this, PEG uses a data-driven approach, where the "knowledge" imbued in a scoring model comes directly from the scores that either expert readers or teachers have given to the responses in a set of training data. PEG measures a very diverse set of features on every response in the training set to determine what elements of the student writing those readers were implicitly identifying when assigning scores and feedback. At a conceptual level, these features can be divided into three categories: explicit, implicit, and similarity-based.

Explicit features measure those elements of writing that can be explicitly described prior to examining the set of essays being modeled. Syntactic features such as errors in grammar and spelling fall into this category, as do character, syllable, word, phrase, sentence, and paragraph statistics. PEG uses rule-based and statistical methods to measure thousands of explicit features that capture elements of the response such as cohesion, readability, language specificity, stylistic devices, and richness of vocabulary.

In contrast, implicit (or latent) features are features that may not have any specific meaning a priori, but that may still hold predictive power when used to score essays. An example of this type of feature is the set of topic probabilities for each essay generated by a latent Dirichlet allocation (LDA) model. LDA is a topic model that assumes the words in a set of documents are attributable to a finite set of topics (Blei, Ng, & Jordan, 2003). After running the algorithm, an essay can be represented as a vector of probabilities, each of which represents a particular topic's contribution to the essay. Because the topics are inferred from the data through the LDA process rather than being explicitly defined, the vector of probabilities are considered implicit features of the essay. Another example of implicit features is the feature set generated by transforming a set of explicit and/or implicit features through principal component analysis (PCA), a transformation that maps a set of features to a new set of linearly uncorrelated features in such a way that the maximum amount of variance in the data is explained by each successive feature in the new set. These new features cannot be defined prior to examining the data and are therefore considered implicit features. A third example of a set of PEG's implicit features is the set of character and word *n*-grams present in the training data. An *n*-gram is an ordered sequence of *n* characters or words that may or may not be contiguous. Each possible *n* length sequence of characters or words is mapped to a feature that represents how often and how compactly (in the case of noncontiguous sequences) that sequence appears in the essay. Although these features do have explicit meaning prior to being measured, they are so numerous that it would not make sense to explicitly list each one. In fact, the four-gram character sequences alone generate almost 4.3 billion features (assuming standard ASCII text). When the feature space is this large, PEG will often not store a representation of the features themselves, but instead use them as a stepping stone to generate similarity-based features.

PEG's third conceptual class of features, similarity-based features, is technically a subset of implicit features, in that they have no meaning prior to examination of the data. Roughly speaking, these features allow PEG to determine how similar a given essay is to each of the essays in the training set. In order to measure similarity, PEG considers each essay as a point in the feature space defined by a subset of the explicit and implicit features measured on that essay. Once projected into this space, two feature vectors can be compared by either distance (Euclidean,

Manhattan, etc.) or other measures of similarity (inner product, cosine, etc.). The single number obtained from this operation becomes a new implicit feature for the essay being compared. In the case of essays in the training set, each essay is compared with all of the other essays.

PEG then takes all of the explicit, implicit, and similarity-based features measured on the essays in the training data and uses a collection of well-established machine learning algorithms to discover an association between the measured features and the human scores for those essays. Once the association is discovered, new essays can be given scores that mimic the scoring done by the human experts. This data-driven approach allows PEG to be a general-purpose engine, such that the same codebase is being used in production to score items as such as long essays for mechanics, tone, and voice; source-based essays for content; and short answer constructed-response items in Math and English Language Arts.

In addition to the raw scores on a variety of traits, PEG also offers targeted feedback about the student's writing and links to tutorials designed to help improve the student's skill in deficient areas. The targeted feedback highlights spelling and grammar errors with instructional messages about how to correct them, as well as more holistic feedback, which notes attributes of the essay such as the student's word choice and detail specificity, the organizational structure of the text, and the overall tone of the essay. In addition, it provides links to specific interactive tutorials designed to address these issues. When used in conjunction with MI's formative writing practice websites, this feedback is seamlessly combined with teacher and peer review feedback to create an integrated instructional environment for the students.

E-RATER

E-rater® is an automated essay evaluation and scoring system that was developed by researchers at the Educational Testing Service (Attali & Burstein, 2006; Burstein, Tetreault, & Madnani, 2013). E-rater first became operational in 1999 when it was deployed to provide one of two scores for essays on the writing section of the Graduate Management Admissions Test, a high-stakes, large-scale assessment. In conjunction with human ratings, e-rater is also presently used for the computer-based Test of English as a Foreign Language® iBT™ (TOEFL iBT) and as a check score for the Graduate Record Examination (GRE). In the *Criterion*® Online Writing Evaluation service—a web-based writing tool that helps students plan, write, and revise their essays—e-rater is used to foster best instructional and assessment practices.

One of a family of scoring engines used at the Educational Testing Service (ETS), e-rater aligns a defined writing construct with natural language processing (NLP) methods in order to identify linguistic features in student and test-taker writing for the purpose of scoring and evaluation (e.g., diagnostic feedback). Consideration of aspects of the writing construct in earlier system development (Attali & Burstein, 2006; Burstein et al., 1998) and more recent research and development support the enhancement of the system's construct coverage with regard to the structure of argumentation (Beigman-Klebanov, Madnani, & Burstein, 2013; Burstein, Beigman-Klebanov, Madnani, & Faulkner, 2013), discourse coherence (Burstein, Beigman-Klebanov, et al., 2013; Burstein, Tetreault, Chodorow, Blanchard, & Andreyev, 2013), and vocabulary usage (Beigman-Klebanov & Flor, 2013). Using statistical and rule-based NLP methods, the e-rater software currently identifies and extracts several feature classes for model building and essay scoring (Attali & Burstein, 2006; Burstein, Chodorow, & Leacock, 2004; Burstein, Tetreault, & Madnani, 2013). Feature development and reevaluation is dynamic, and specific feature variables may vary as the system is updated with new releases. Individual feature classes represent an aggregate of multiple features. The feature classes —the variables of writing that constitute the construct model developed for score prediction—include the following:

(1) grammatical errors (e.g., *subject–verb agreement errors*), (2) word usage errors (e.g., *their* versus *there*), (3) errors in writing mechanics (e.g., *spelling*), (4) presence of essay-based discourse elements (e.g., *thesis statement, main points, supporting details*, and *conclusions*), (5) development of essay-based discourse elements, (6) style weaknesses (e.g., *overly repetitious use of vocabulary*), (7) two content vector analysis-based (CVA) features to evaluate topical word usage, and (8) a feature that considers *correct usage* of prepositions and collocations (e.g., *powerful computer* vs. *strong computer*) (Futagi, Deane, Chodorow, & Tetreault, 2008) and sentence variety. The set of features in (8) represent positive features rather than errors in conventions. Because proper usage of English prepositions and collocations is especially difficult for English learners, the addition of these features also expands e-rater's ability to recognize characteristics of writing important for assessing nonnative writers. More details about specific features aggregated within a feature class may be found in Attali and Burstein (2006).

Human-assigned holistic scores are used to build *e-rater* models. A randomly selected training sample of at least 250 human-scored essays is processed through *e-rater*, which extracts the features described above. Features are aggregated into conceptually related groups and converted to a vector (list) of numerical feature values. Employing a regression modeling approach, one can use the values from this sample to determine an appropriate weight for each feature (Attali & Burstein, 2006; Burstein, Tetreault, & Madnani, 2013; Davey, 2009). To score a new, unseen essay during a test administration, the same process is performed vis-à-vis feature extraction and conversion of features to a vector format. To compute the final score prediction, these values are then multiplied by the weights associated with each feature, and a sum of the weighted feature values is computed (Attali, Bridgeman, & Trapani, 2010). In addition to providing holistic scores using construct-aligned language features, e-rater provides advisories for detecting such construct-irrelevant elements and attempts to enhance the overall score (Higgins, Burstein, & Attali, 2006). Many features used for e-rater scoring are also used for feedback in *Criterion*. These include the grammar, usage, mechanics, and styles features, as well as the organization and development features described earlier.

Both e-rater and *Criterion* use advisories that flag essays as being "off-topic" or otherwise anomalous (Higgins et al., 2006). These essays may not be scored by e-rater, but the user, instead, receives an advisory flag. In a high-stakes assessment, the score user will decide how to handle flagged responses; in *Criterion*, users will need to revise essays appropriately before the essay receives a score.

EVALUATION

From the perspective of a user of the AWE systems described above, a distinction needs to be made between scoring and evaluation: In the case of scoring, the system provides *only* a score on a scale; in the case of evaluation, the system offers diagnostic feedback. Many of the citations in the previous *Explanation* section can be referenced to review detailed evaluations completed for each of the system scoring and feedback. This section presents a recent large-scale evaluation for "scoring" that provides readers with a detailed description to offer an understanding of the kinds of analyses conducted for system evaluations.

As a large-scale scoring study, the Hewlett Trials (Shermis, 2014; Shermis & Hamner, 2012, 2013) addressed assessment demands of the CCSS and were performed at the behest of the Race-to-the-Top consortia the Partnership for Assessment of Readiness for College and Careers (PARCC) and Smarter Balanced. The trials consisted of a vendor demonstration that incorporated the scoring engines from eight commercial vendors and one university laboratory to evaluate current high-stakes writing assessments and a prize competition that included competing teams of data scientists, internationally, to evaluate a shared set of human-score, high-stakes essays. The studies employed eight different essay sets drawn from six U.S. states representing the regional consortia.

In the first study, four of the prompts (writing task questions) were source-based, and four represented traditional forms of discourse (narrative, descriptive, persuasive). Over 17,000 essays were randomly divided into two sets: a training set (n = 13,336) in which the vendors had one month to model the data and make score predictions for an independent test set (n = 4,343) within a constrained time period (59 hours). The training set consisted of two human rater scores, a "resolved" score, and the text of the essay. The resolved score reflected the final score assigned by the state. To resolve differences between the two human raters, states applied a set of adjudication rules (e.g., ask a third rater to evaluate the essay) that may or may not have reflected the judgments of the original human raters. Accuracy rates of transcription were estimated to be over 98%. The challenge to the nine teams was to predict scores that matched the resolved score ratings.

Performance on the first study was evaluated on five different measures of a single evidentiary criterion, specifically, agreement with human raters. One set of measures focused on agreement at the distributional level and the other set on agreement at the individual response level. The individual-response-level measures included exact agreement, exact + adjacent agreement, kappa, quadratic weighted kappa, and the Pearson product moment correlation. The automated essay scoring engines performed well on the distributional measures. With a high degree of consistency, all nine demonstrators were able to replicate the means and standard deviations for the scores assigned by the states. With regard to agreement measures, there was some variability, but the automated essay scoring engines performed well on three of the five measures (exact + adjacent agreement, quadratic weighted kappa, correlation). On the two measures where the performance was not as high (exact agreement and kappa), there was also high variability among the performance of operational human raters. In addition, scaling artifacts attributable to the way the state scores were adjudicated may have contributed to the relative lack of precision on predicted scores. In sum, on five of the seven measures, machine scores reasonably approximated those of human raters and on a few of the datasets, even performed better than their human counterparts based on evaluations reported in Shermis and Hamner (2012).

The second study was similar to the first, but with some minor exceptions. The international competitors had 2½ months to create their scoring engines, the code for which is now available in the public domain. *This was a first attempt to include the collective talent to build knowledge around automated evaluation of written responses.* During the course of the 2½ months, an additional set of randomly selected essays was utilized to establish a public *leaderboard* which was used to monitor and display competitors' progress. Personal identifiers were removed from the writing samples used in the public competition. The group of international competitors had 2 weeks to submit their final entries rather than the shorter time limit established for the commercial vendors. Results showed that human raters established a benchmark of reliability, as measured by quadratic weighted kappa of .75. The best of the commercial vendors was able to achieve a quadratic weighted kappa of .78. The public competitors, working on a different, but equivalent dataset, were able to achieve a quadratic rated kappa of .81. Because the average quadratic weighted kappa had met and exceeded the .70 threshold, the study authors concluded that automated essay scoring held the potential to be a viable method to scoring writing samples in situations where scores were to be used to make inferences about the writing of individual students in summative assessment contexts. The conclusion was based on the assumption that additional research on score validity would be conducted.

GENERALIZATION

Studies of generalization provide information about the association of AWE systems with other independent measures. As a result of such studies, evidence can be gathered regarding the implementation of AWE systems in

specific educational settings. These studies can examine learning as well as look at usage based on log files of student usage and teacher reports. Two studies are discussed in this section. The first study uses WriteToLearn and is described in some detail. The second study was smaller, and a brief description is provided.

One large study examined the use of WriteToLearn within a statewide implementation across multiple grade levels in South Dakota (Foltz, Lochbaum, & Rosenstein, 2011). As part of a statewide formative writing requirement, teachers assigned multiple writing prompts from WriteToLearn and incorporated the writing into their lesson plans. During a 5-month period, 21,137 students wrote to 72,051 assignments (an average of almost four assignments per student), with 107 different unique writing prompts assigned. For each assignment, students were required to submit at least one attempt per prompt, but they could submit multiple revisions. Overall, this resulted in 255,741 essays submitted and scored over the period of analysis. For each submission, students received feedback and scores on their overall essay quality, as well on six different writing traits: ideas, organization, conventions, word choice, sentence fluency, and voice. On average, students would revise an assignment four times—likely more revision practice than could or would occur in a conventional classroom with teacher grading. Analysis of changes in student scores over revisions demonstrated that students had the greatest statistically significant improvement in scores for ideas, voice, and organization and less for sentence fluency and writing conventions ($p < .001$ to $p < .01$). Although the analyses looks at the computer-based scores rather than external measures, the finding still indicates that writing feedback can be helpful for detecting changes in multiple types of writing skill as measured by the system.

Such *in situ* studies may also be undertaken to investigate specific forms of writing. In the genre of summary writing, for example, there have been controlled studies examining reading comprehension and writing skill using the IEA system as it is embedded in the WriteToLearn formative assessment platform. These studies have examined the effects of automated evaluation of writing as well as how they generalize to other criterion measures of student performance. In one study, 60 students in two sixth-grade English language arts classes each wrote two texts, one class receiving automated summary feedback and the other using a standard text editor. Results indicated that the students using the automated feedback received higher grades on their summaries, spent more than twice as much time on writing and revising, and managed to retain the skills they learned (Wade-Stein & Kintsch, 2004).

In a second study, four eighth-grade classes received 4 weeks of training on summarization. Half of the students received automated summary feedback, while the other half was a control group who received the same training but did their summary writing on word processors, without automated feedback (Franzke, Kintsch, Caccamise, Johnson, & Dooley, 2005). Results in Franzke et al. (2005) showed that students receiving feedback improved their summary writing by an overall effect size of $d = 0.9$ compared to the control students. (An effect size of 1.0 corresponds to approximately a one grade-level difference). One key finding is that the use of the system had greater impact on the lower performing students. The low- and medium-ability students (those in the lower 75% of the distribution) showed an effect size of $d = 1.5$ for the most difficult materials.

In a third study, researchers from the University of Colorado conducted a large evaluation of 2,851 students in grades 5–9 across nine Colorado school districts over two years (Caccamise, Franzke, Eckhoff, & Kintsch, 2007). Classes of students were assigned to either use the summarization tools of WriteToLearn or receive traditional teacher-provided summarization instruction. Each group summarized approximately six texts in a year. Results in Caccamise et al. (2007) showed that students receiving automated summarization feedback performed at levels significantly higher than those of the control groups over both years of the study. Improvement in summarization was also highly related to the number of texts a student studied during the year, as well as the amount of time students spent using the tool. Although the results showed that the tools supported summarization skills, evidence from the independent Test of Reading Comprehension (TORC) also showed significant effects of student

improvement ($p < .002$) based on the number of texts for which students had to write summaries.

A series of related studies pertinent to the postsecondary level was conducted to gather extrapolation evidence of e-rater as it is used within the *Criterion*® Online Writing Evaluation service. Based on a study of 1,482 first-year writing students, it was demonstrated that e-rater offered a defined writing construct congruent with established models, achieved acceptance among students and instructors, showed no statistically significant differences between ethnicity groups of sufficient sample size, and correlated at statistically significant levels ($p < .01$) with other writing measures (Klobucar et al., 2012; Klobucar, Elliot, Deess, Rudniy, & Joshi, 2013). Student essays scored by e-rater achieved moderate correlations in their relationship to the SAT Writing section (r =0.41) holistic score (r = 0.39) and course grades (r = 0.29). Outcomes of the study enabled instructors to identify at-risk students to increase their course success (Klobucar et al., 2013).

Establishing the relationship between AWE scores and other measures of writing proficiency becomes important if the costs and benefits of competing systems—from scores on limited response multiple-choice tests to portfolio scores noted to be a robust measure of the writing construct—are to be empirically determined. Determination of the usefulness of AWE systems as they are related to improved student performance remains an important area of future research.

EXTRAPOLATION

Strong writing proficiency is broadly associated with a writer's ability to respond to a variety of tasks using standard writing conventions, task-relevant appropriate vocabulary, text structures, and stylistic elements—as well as to negotiate various genres (or forms) of writing. At the time that this chapter was written, AWE systems mostly handled traditional summary writing and the essay genre. As AWE systems evolve, they will need to be able to offer meaningful and accurate writing evaluation for a greater breadth of writing genres. The availability of systems that can evaluate multiple writing genres would enable instruction and assessment across more writing types, thus offering evaluation for a greater variety of task types, providing evaluations for multiple-task types, and, ultimately, supporting generalizability across tasks and test forms.

Ideally, the research and development around AWE systems should be aligned with initiatives, such as CCSS, that aim to prepare students for college and the workplace. Such work entails systematic investigations of K–12, college, and workplace settings to evaluate the current landscape and what is needed to prepare students appropriately. Burstein et al. (2014) conducted a descriptive, baseline survey study with educators (n = 451), workplace participants (n = 266), and college interns (n = 51). A survey was designed to collect information regarding the background of the respondent, perceptions of student preparation for and comfort with writing tasks, and genres of regularly assigned tasks. A primary goal was to gain a clearer understanding of *commonality* and *disjuncture* between academic and nonacademic settings for writing. Results revealed that, among *commonalities*, the essay genre was seen across K–12 and college; executive summaries, memos, and user manuals remain constant in the array of genres practiced across college and workplace.

By contrast, survey results showed *disjuncture* and indicated that in educational settings respondents (instructors) reported that their students were generally not well-prepared for required writing assignments. This result suggests a need for increased practice in K–12 with genres that are more likely to be required in college. More specifically, of all the types of writing reported as required by college educators, two genres stood out at statistically significant levels (p = .000) with regard to a reported lack of preparedness in college settings: the *annotated bibliography* and the *research proposal*. This finding suggests that more attention needs to be paid to these genres in K–12, and with

regard to AWE, researchers should consider developing evaluation software that can offer feedback about construct elements that play a large role in these genres (e.g., structure of argumentation, summarization, and elements of presentation).

In workplace settings, respondents (members of the workforce who were not teachers or college instructors) reported confidence in gaining proficiency with genres of workplace writing through workplace experiences. This report suggests that genre diversity and encounters with nonacademic forms (e.g., memos and executive summaries) of writing are associated with relative comfort and preparedness in workplace writing. These findings also indicate that in college at least some attention should be given to the constructs associated with nonacademic writing to prepare students for workplace writing. This should be another consideration in the development of AWE systems.

Such findings raise questions regarding both the limits of building AWE systems around the sole genre of the academic essay and the ability to address a fuller range of writing performance in the AWE body of knowledge. If a continuum of writing from kindergarten through workplace writing is, for the first time in American educational history, within our grasp, then AWE must increase its usefulness by expanding its capability to be of use to those seeking entrance to professions that use genres of writing such as proposals and reports—genres that extend beyond that of the academic essay. Along with establishing the relationship between AWE scores and other measures of writing proficiency through large-scale field studies, expanding the AWE repertoire of construct representation remains a needed area of research.

UTILIZATION

As Deane (2013) has discussed, concern over AWE *use* continues to be the subject of controversy. Criticism has focused predominantly on the following: scoring (technical inadequacies resulting in false information); construct underrepresentation (the methods of scoring cannot interpret meaning or provide information on advanced aims of discourse); and signaling effects (the ways that the scoring and evaluating processes themselves impact the testing situation since the knowledge that essays will be machine-scored may lead to changes in behavior that undermine best instructional practices). With the Race-to-the Top[2] assessment program as a backdrop, Bennett (2011) has proposed that a set of considerations for AWE development and use that would support desired outcomes if AWE were to be used for evaluating responses to writing tasks be administered on consortia assessments. Bennett's considerations include the following (those in *italics* are directly related to system development considerations): *construct-based scoring designs*; integrated assessments in which both automated scores and human scores serve interrelated roles; *strengthen operational human scoring to support modeling of AWE systems*; augmented use of human scores to broaden construct representation; enhanced understanding of human scoring processes; disclosure of scoring approaches; and use of a variety of evidential categories to justify score use.

Although attention has been paid to the consequences of educational measurement since Messick (1989) welded together interpretation and use, present work by Slomp, Corrigan, and Sugimoto (2014) has focused on a range of evidential sources to argue for a highly delineated way to evaluate the consequences of score use: design processes; construct definition; construct irrelevance; scoring procedures; sampling plan analysis; population disaggregation; response processes; and unintended and intended impact. In proposing to integrate *consequence* into each category of evidence supporting validity (Kane, 2013; Williamson et al., 2012), such conceptual frameworks promise to address what remains a central question to AWE users: *What is the impact of these systems on instructional setting*? As discussed in the *Extrapolation* section, work has been conducted that examines the impact of feedback in instructional settings. A few smaller-scale studies that investigate automated feedback can be found in Shermis,

Burstein, and Bliss (2004), Attali (2004), Rock (2007), and Lipnevich and Smith (2009). However, larger-scale studies with AWE instructional systems still need to be conducted to gain a more comprehensive understanding of the impact of feedback that can guide best-use practices.

CONCLUSION

In the chapter we wrote for the first edition of this *Handbook*, we predicted developments in both the summative and formative uses of AWE. We also suggested that there would be an increase of interest in the technology as the demands for assessment enlarged with the advent of No Child Left Behind. These demands *have* intensified with the widespread adoption of the Common Core State Standards, the assessments for which require extensive writing to demonstrate mastery in both English language arts and in science. We had postulated that widespread acceptance of the technology would occur only if it could be adequately adapted for formative writing.

Early models of AWE were based primarily on their statistical relationships with artifacts that approximated underlying latent constructs of writing. This was supplemented by advances in natural language processing that gave the technology the ability to evaluate grammar, mechanics, syntax, genre-specific discourse structure, and style. Additional developments have taken place as well in the area of content evaluation, where the technology can now determine the degree to which a writer is "on-topic." The technology cannot yet accurately forecast that a writer has made a "good" argument, though the need for evaluation in this area has motivated a strong need for research in this area (Beigman-Klebanov et al., 2013; Burstein, Beigman-Klebanov, et al., 2013; Burstein, Tetreault, Chodorow, et al., 2013). Further system development is necessary to support *Evaluation*, *Generalization*, *Extrapolation*, and *Utilization* of systems, especially as system use in large-scale formative and assessments settings becomes more widespread.

Advances in the technology have brought with them new ways of thinking about the constructs so that they can be evaluated with regard to their application to formative writing. In their proposal for a promising future for AWE systems, Elliot and Klobucar (2013) suggested attention to innovation, identification of barriers, and estimate of capability as dimensions to which we should attend. In line with their vision, future development of the body of knowledge associated with AWE will surely focus on the ways that system developers explain how their systems work, with special attention to construct coverage and the technical innovations that drive the systems; the ways that these systems enhance instruction and support assessment; the methods that can be used to capture writing in other genres; and the consequences of AWE use in educational settings. All of these steps will, of course, continue to engage in a cross-disciplinary approach to system development and use, guided by continued collaboration and discussion among the dynamic stakeholders in communities including, but not limited to, computational linguistics, educational measurement, and writing research.

ACKNOWLEDGMENTS

This work was completed while Mark D. Shermis was at the University of Akron and Shayne Miel was at Measurement, Inc. Shayne Miel would like to thank Dr. Kirk Ridge, David Vaughn, and Dr. Trish Martin for their assistance in drafting his sections of the text.

REFERENCES

Ajay, H. B., Tillett, P. I., & Page, E. B. (1973). *Analysis of essays by computer* (AEC-II). Washington, DC: U.S. Department of Health, Education, and Welfare, Office of Education, National Center for Educational Research and Development.

Attali, Y. (2004, April). Exploring the feedback and revision features of Criterion. In *Proceedings of National Council on Measurement in Education*, San Diego, CA.

Attali, Y., Bridgeman, B., & Trapani, C. S. (2010). Performance of a generic approach in automated essay scoring. *Journal of Technology, Learning, and Assessment, 10*, Available from *http://jtla.bc.edu.*

Attali, Y., & Burstein, J. (2006). Automated essay scoring with e-rater V.2. *Journal of Technology, Learning, and Assessment, 4*, Available from *http://jtla.bc.edu*.

Beigman-Klebanov, B., & Flor, M. (2013, August). Word association profiles and their use for automated scoring of essays. In *Proceedings of 51st Meeting of the Association for Computational Linguistics*, Sofia, Bulgaria.

Beigman-Klebanov, B., Madnani, N., & Burstein, J. (2013). Using pivot-based paraphrasing and sentiment profiles to improve a subjectivity lexicon for essay data. *Transactions of the Association for Computational Linguistics*. Available from *www.transacl.org/papers*.

Bennett, R. E. (2011). Automated scoring of constructed-response lteracy and mathematics items *Advancing Consortium Assessment Reform (ACAR)*. Washington, DC: Arabella Philanthropic Advisors.

Biancarosa, G., & Snow, C. E. (2004). *Reading next: A vision for action and research in middle and high school literacy: A report from Carnegie Corporation of New York*. New York: Alliance for Excellent Education.

Biber, D., Nekrasova, T., & Horn, B. (2011). *The effectiveness of feedback for L1-English and L2-writing development: A meta-analysis (RR-11-05).* Princeton, NJ: Educational Testing Service.

Blei, D. M., Ng, A. Y., & Jordan, M. I. (2003). Latent Dirichlet allocation. *Journal of Machine Learning Research, 3*, 993–1022.

Burstein, J., Beigman-Klebanov, B., Madnani, N., & Faulkner, A. (2013). Sentiment analysis detection for essay evaluation. In M. D. Shermis & J. Burstein (Eds.), *Handbook of automated essay evaluation: Current applications and new eirections* (pp. 281–297). New York: Routledge.

Burstein, J., Chodorow, M., & Leacock, C. (2004). Automated essay evaluation: The Criterion Online writing service. *AI Magazine, 25*(3), 27–36.

Burstein, J., Holtzman, S., Lentini, J., Molloy, H., Shore, J., Steinberg, J., et al. (2014). *Genre research and automated writing evaluation: Using the lens of genre to understand exposure and readiness in teaching and assessing school and workplace writing*. Paper presented at the National Council on Measurment in Education, Philadelphia, PA.

Burstein, J., Kukich, K., Wolff, S., Lu, C., Chodorow, M., Braden-Harder, L., et al.(1998). Automated scoring using a hybrid feature identification technique. In *Proceedings of the 17th International Conference on Computational Linguistics-Volume 1*.

Burstein, J., Tetreault, J., Chodorow, M., Blanchard, D., & Andreyev, S. (2013). Automated evaluation of discourse coherence quality in essay writing. In M. D. Shermis & J. Burstein (Eds.), *Handbook of automated essay evaluation: Current applications and new directions*. New York: Routledge.

Burstein, J., Tetreault, J., & Madnani, N. (2013). The e-rater® automated essay scoring system. In M. D. Shermis & J. Burstein (Eds.), *Handbook of automated essay evaluation: Current applications and new directions* (pp. 55–67). New York: Routledge.

Caccamise, D., Franzke, M., Eckhoff, A., & Kintsch, W. (2007). Automated tutor for teaching summarization and deep comprehension. In D. S. McNamara (Ed.), *Reading comprehension strategies: Theory, interventions, and technologies* (pp. 375–396). Mahwah, NJ: Erlbaum.

Common Core State Standards. (2012). Introduction to the Common Core State Standards. Retrieved June 2, 2012, from *www.corestandards.org/assets/ccssi-introduction.pdf*.

Coppola, N. W. (2010). The technical communication body of knowledge initiative: An academic–practitioner partnership. *Technical Communication, 57*(1), 11–25.

Coppola, N. W., & Elliot, N. (2013). Conceptualizing the technical communication body of knowledge: Context, metaphor, and direction. *Technical Communication, 60*(4), 267–278.

Davey, T. (2009). *Principles for building and evaluating e-rater models*. Paper presented at the National Council on Measurement in Education, San Diego, CA.

Deane, P. (2013). On the relation between automated essay scoring and modern views of the writing construct. *Assessing Writing, 18*, 7–24.

Elliot, N., & Klobucar, A. (2013). Automated essay evaluation and the teaching of writing. In M. D. Shermis & J. Burstein (Eds.), *Handbook of automated essay evaluation: Current applications and new directions* (pp. 16–35). New York: Routledge.

Foltz, P. W., Gilliam, S., & Kendall, S. (2000). Supporting content-based feedback in online writing evaluation with LSA. *Interactive Learning Environments, 8*(2), 111–127.

Foltz, P. W., Kintsch, W., & Landauer, T. K. (1998). The measurement of textual coherence with Latent Semantic Analysis. *Organizational Process, 25*(2–3), 285–307.

Foltz, P. W., Laham, D., & Landauer, T. K. (1999). The intelligence essay assessor: Applications to educational technology. *Interactive Multimedia Electronic Journal of Computer-Enhanced Learning, 1*(2). Retrieved from *http://imej.wfu.edu/articles/1999/2/04*.

Foltz, P. W., Lochbaum, K., & Rosenstein, M. (2011). *Analysis of student writing for a large scale implementation of formative assessment*. Paper presented at the National Council for Measurement in Education, New Orleans.

Franzke, M., Kintsch, E., Caccamise, D., Johnson, M., & Dooley, S. (2005). Summary Street®: Computer support for comprehension and writing. *Journal of Educational Computing Research, 33*(1), 53–80.

Futagi, Y., Deane, P., Chodorow, M., & Tetreault, J. (2008). A computational approach to detecting collocation errors in the writing of non-native speakers of English. *Computer Assisted Language Learning, 21*, 353–367.

Graham, S., Harris, K., & Hebert, M. (2011). *Informing writing: The benefits of formative assessment.* A report from Carnegie Corporation of New York. New York: Carnegie Corporation of New York.

Graham, S., & Hebert, M. (2010). *Writing to read: Evidence for how writing can improve reading: A report from Carnegie Corporation of New York*. New York: Carnegie Corporation of New York.

Graham, S., MacArthur, C. A., & Fitzgerald, J. (2013). *Best practices in writing instruction*. New York: Guilford Press.

Graham, S., & Perin, D. (2007). *Writing next: Effective strategies to improve writing of adolescents in middle and high schools: A report to Carnegie Corporation of New York*. New York: Alliance for Excellent Education.

Higgins, D., Burstein, J., & Attali, Y. (2006). Identifying off-topic student essays without topic-specific training data. *Natural Language Engineering, 12*(2), 145–159.

Kane, M. T. (2006). Validation. In R. L. Brennan (Ed.), *Educational measurement* (4th ed., pp. 17–64). Westport, CT: American Council on Education/Praeger.

Kane, M. T. (2013). Validating the interpretations and uses of test scores. *Journal of Educational Measurement, 50*(1), 1–73.

Klobucar, A., Deane, P., Elliot, N., Ramineni, C., Deess, P., & Rudniy, A. (2012). Automated essay scoring and the search for valid writing assessment. In C. Bazerman, C. Dean, J. Early, K. Lunsford, S. Null, P. Rogers, et al. (Eds.), *International advances in writing research: Cultures, places, measures* (pp. 103–119). Fort Collins, CO:

WAC Clearninghouse.

Klobucar, A., Elliot, N., Deess, P., Rudniy, O., & Joshi, K. (2013). Automated scoring in context: Rapid assessment for placed students. *Assessing Writing, 18*(1), 62–84.

Landauer, T. K., Kireyev, K., & Panaccione, C. (2011). Word maturity: A new metric for word knowledge. *Scientific Studies of Reading, 15*(1), 92–108.

Landauer, T. K., Laham, D., & Foltz, P. W. (2001). The intelligent essay assessor: Putting knowledge to the test. In *Proceedings of Association of Test Publishers Computer-Based Testing: Emerging Technologies and Opportunities for Diverse Applications Conference*, Tucson, AZ.

Landauer, T. K., Lochbaum, K. E., & Dooley, S. (2009). A new formative assessment technology for reading and writing. *Theory into Practice, 48*(1), 44–52.

Lipnevich, A. A., & Smith, J. K. (2008). *Response to assessment feedback: The effects of grades, praise, and source of information*. Princeton, NJ: Educational Testing Serice.

Lipnevich, A. A., & Smith, J. K. (2009). "I really need feedback to learn:" Students' perspectives on the effectiveness of the differential feedback messages. *Educational Assessment, Evaluation and Accountability, 21*(4), 347–367.

Mayfield, E., & Rosé, C. (2014). LightSIDE: Open source machine learning for text. In M. D. Shermis & J. C. Burstein (Eds.), *Handbook of automated essay evaluation: Current applications and new directions* (pp. 124–135). New York: Routledge.

Messick, S. (1989). Meaning and values in test validation: The science and ethics of assessment. *Educational Researcher, 18*(2), 5–11.

Messick, S. (1993). Validity. In R. L. Linn (Ed.), *Educational measurement* (3rd ed., pp. 13–103). New York: American Council of Education.

National Research Council. (2012). *Education for life and work: Developing transferable knowledge and skills in the 21st century*. Washington, DC: National Academies Press.

O'Neill, P., Adler-Kassner, L., Fleischer, C., & Hall, A. M. (2012). Symposium: On the framework for success in postsecondary writing. *College English, 74*(6), 520–533.

Page, E. B. (1996, April). Grading essays by computer: Why the controversy? In *Proceedings of Annual Meeting of the National Council on Measurement in Education*, New York.

Page, E. B., Truman, D. L., & Lavoie, M. J. (1994). "*Teacher's Helper": Proposed use of Project Essay Grade for the English classroom.* Paper presented at the South Atlantic Modern Language Association, Baltimore, MD.

Rock, J. L. (2007). *The Imapct of short-term use of Criterion on writing skills in ninth grade*. Princeton, NJ: Educational Testing Service.

Shermis, M. D. (2014). State-of-the-art automated essay scoring: A United States demonstration and competition, results, and future directions. *Assessing Writing, 20*, 53–76.

Shermis, M. D., Burstein, J., & Bliss, L. (2004, April). The impact of automated essay scoring on high stakes writing assessments. In *Proceedings of Annual Meetings of the National Council on Measurement in Education*, San Diego, CA.

Shermis, M. D., Burstein, J., & Bursky, S. A. (2013). Introduction to automated essay evaluation. In M. D. Shermis & J. Burstein (Eds.), *Handbook of automated essay evaluation: Current applications and new directions* (pp. 1–15). New York: Rouledge.

Shermis, M. D., & Hamner, B. (2012). Contrasting state-of-the-art automated scoring of essays: Analysis. In *Proceedings of National Council of Measurement in Education*, Vancouver, BC, Canada.

Shermis, M. D., & Hamner, B. (2013). Contrasting state-of-the-art automated scoring of essays. In M. D. Shermis &

J. Burstein (Eds.), *Handbook of automated essay evaluation: Current applications and new directions* (pp. 313–346). New York: Routledge.

Slomp, D. H., Corrigan, J. A., & Sugimoto, T. (2014). A framework for using consequential validity evidence in evaluating large-scale writing assessments: A Canadian study. *Research in the Teaching of English, 48*(3), 276–302.

Wade-Stein, D., & Kintsch, E. (2004). Summary Street: Interactive computer support for writing. *Cognition and Instruction, 22*(3), 333–362.

Williamson, D. M., Xi, X., & Breyer, F. J. (2012). A framework for the evaluation and use of automated essay scoring. *Educational Measurement: Issues and Practice, 31*(1), 2–13.

---

[1] In general, the explanation of three systems provided in this chapter may be used to understand the designs of other systems currently in use: AutoScore (developed by American Institutes for Research); Mosaic™ (developed by McGraw-Hill); CRASE™ (developed by Pacific Metrics); Intellimetric® (developed by Vantage Learning); and Lexile® Writing Analyzer (developed by MetaMetrics). Unique among these systems is LightSIDE, an open-source platform (Mayfield & Rosé, 2013) that allows users themselves to employ existing models and add new features to them to expand the AWE body of knowledge.

[2] The Race-to-the Top assessment program was a U.S. Department of Education program intended to support the development and design of the next-generation assessment system.

CHAPTER 27

Keystroke Logging in Writing Research

Analyzing Online Writing Processes

Luuk Van Waes, Mariëlle Leijten, Eva Lindgren, and Åsa Wengelin

Over the past decade writing has become an everyday activity for most people around the globe. Indeed, there seems to be a movement away from reading as the main literacy activity, *mass reading*, into what Brandt (2001) has described as an era of *mass writing*. The affordances of digital media for writing are enormous, and the impact of writing for communication, presentation, and forming identities has increased rapidly over the past few years. Young people, in particular, communicate, often simultaneously, through various media, such as smartphones, computers, and tablets, in a combination of writing, reading, browsing, searching, and increasingly also speaking and listening. Much of the reading that is undertaken on digital media is not done for the pleasure of reading but in order to support writing.

Since the first studies on writing processes in the 1980s, not only have we changed our ways of text production considerably, but also the technical possibilities for studying writing have improved substantially. Thanks to technological evolution, keystroke logging, handwriting registration, and eye tracking have become instrumental in identifying writing strategies and understanding cognitive processes. Moreover, techniques such as functional magnetic resonance imaging (fMRI), galvanic skin response (GSR), and electroencephalography (EEG) have been

used to gain full understanding of the processes involved in writing. In this chapter, we specifically focus on keystroke logging as a means to explore and analyze writing processes as they evolve in real time.

One of the main advantages of keystroke logging is that it is an unobtrusive research technique that hardly interferes with the natural writing process. In addition, it is also possible to combine it with complementary observation techniques, such as thinking aloud or eye tracking. Moreover, keystroke logging enables researchers to collect fine-grained pause and revision data, opening possibilities to analyze writing processes from a wide range of perspectives. In writing research, Scriptlog and Inputlog are the most widely used programs. For more information, we refer to the programs' websites: *www.scriptlog.net* and *www.inputlog.net*. On *www.writingpro.eu* a matrix is presented to compare the characteristics of a wide range of keystroke logging programs.

In this chapter, we present a brief overview of studies in which keystroke logging has been used. It is our aim to illustrate how this research technique is used to better understand both lower and higher level cognitive processes, as well as to illustrate and explore how these processes are intertwined with social contexts in education and at the workplace. Each section is based on a general research question.

1. What do pauses tell us about cognitive writing processes?
2. How does the writing process develop across ages, and how can awareness about the process be used to promote writing development?
3. What are the challenges of writing for struggling writers, and what strategies do they use to meet those challenges?
4. What kind of writing strategies characterize professional writing?

Keystroke logging is a relatively new research technique that allows for large-scale data collection. Recent developments have opened a wide range of new research perspectives. However, the underlying framework is not yet fully articulated and needs more theoretical grounding. Therefore, in the last section of this chapter we outline some of the challenges and opportunities that are on our research agendas to further illustrate how keystroke logging can contribute theoretically and methodologically to a better understanding of writing processes, and where we could be heading next.

PAUSES AND COGNITIVE WRITING PROCESSES

Disfluency in writing is characterized by pauses and revisions, or a combination of both. In writing process research, these disfluencies are considered to be indicative of important cognitive processes underlying written text production (Matsuhashi, 1981; Wengelin, 2006). In this section, we focus on pause characteristics derived from and interpreted with keystroke logging programs.

The framework for analyzing pauses in written communication mainly stems from research on spoken language. (For a discussion about filled and unfilled pauses in speech, we refer to, e.g., Grabowski, 1996; Heldner & Edlund, 2010; Swerts, 1998.) However, there are some fundamental differences between pausing in oral and written language production. First, pauses in speech often have a rhetorical function that directly affects the speaker–listener interaction, whereas in most written communication, pauses are not visible when the reader is presented with a final text. Consequently, pauses during the writing process do not influence the interaction with the reader, as most written interaction is asynchronous. Second, in spoken language pauses are almost exclusively oriented toward forward planning; in writing, on the other hand, pauses might be both anticipatory and reflective (Fayol & Lété, 2012). At any stage in the writing process, writers can engage in forward planning, but also in rereading the text-

produced-so-far as part of the evaluation process (Van Waes, Leijten, & Quinlan, 2010). Finally, keyboard text production is slower (Johansson, 2013) and is characterized by within-word pauses that relate to the mechanical transitions between keys. In spoken language, however, words are in general fluently produced as one unit, and pauses are mainly situated between words and on higher discourse levels. In typing, each character is a discrete unit, and there will always be at least a minimal pause between keystrokes. Deviating patterns at this within-word pauses level are an important indicator of underlying cognitive processes, in particular, for research questions that focus on a micro level of writing (e.g., spelling and typing errors, dyslexia).

The main function of pausing in written language production is evaluation for planning, translating, or revision purposes (Hayes, 2012). (Re)reading, skimming, and identifying clues in the text-produced-so-far or in source materials are some characteristic activities that writers undertake during pausing. One complication in pause research is that during one pause a combination of these cognitive processes can be activated (Olive, 2010). Of course, we should also consider that pauses are sometimes related to simple distraction. In this section, we explore the possibilities of keystroke logging programs to analyze pauses on a micro level. We start with a technical definition; next we discuss the characteristics of bigrams and words that influence pausing behavior at the micro level.

Technical Definition

In keystroke logging programs such as Inputlog and Scriptlog, every event is situated on a continuous time line where the beginning and the end of each action are identified. This enables us to define a pause time and an action time for each action. A pause time between two characters is calculated as the latency between pressing the previous key and the activation of the next key. The action is defined as the latency between pressing a key and the release of the same key. For instance, if we type a simple sentence such as “This is a test.”, the keystroke logging program logs the following sequence of events and related action/pause information shown in Figure 27.1. The figure provides an example of a horizontal and a vertical output of the production of this sentence.

Horizontal linear representation (Inputlog linear file):

[778]T[549]h[297]i[109]s[140]•[765]i[109]s[156]•[452]
a[343][827]t[78]e[187]s[141]t[312].[843]

Vertical linear representation (Inputlog general file):

Event	Action time	Pause time	Location
T	453	778	BEFORE WORDS
h	47	549	WITHIN WORDS
i	62	297	WITHIN WORDS
s	47	109	WITHIN WORDS
SPACE	63	140	AFTER WORDS
i	62	765	BEFORE WORDS
s	47	109	WITHIN WORDS
SPACE	62	156	AFTER WORDS
a	47	452	BEFORE WORDS
SPACE	63	343	AFTER WORDS
t	47	827	BEFORE WORDS
e	47	78	WITHIN WORDS
s	78	187	WITHIN WORDS
t	47	141	WITHIN WORDS
.	437	312	AFTER SENTENCE

FIGURE 27.1. Horizontal and vertical log representation of sentence production.

As mentioned earlier, the pause length is an important indicator of cognitive effort. Writers mostly use pauses that are longer than the normal latency between characters to carry out the most demanding operations, such as revising the text-produced-so-far or structuring new ideas (Olive & Kellogg, 2002). If we look at the frequency distribution of pauses in general, the histogram shows a left skewed plot. Figure 27.2 shows the frequency distribution of a log corpus that consisted of 138 short expository texts (representing about 160,000 key/mouse-actions; Van Waes & Leijten, 2015). The plot shows a median pause time of 156 ms; 75% of the pauses in this corpus are shorter than 250 ms. A logarithmic transformation of the histogram shows a corrected distribution of the pauses (see also Baaijen, Galbraith, & de Glopper, 2012).

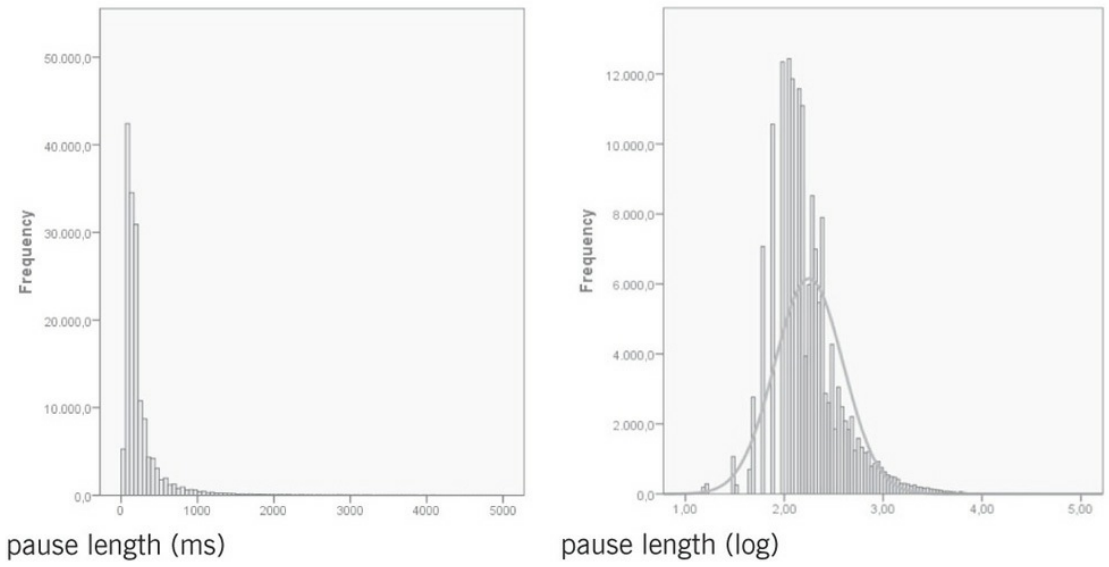


FIGURE 27.2. Histograms of pause length plotted on a linear scale (left) and on a logarithmic base-10 scale (right).

The main reason for this distribution is that 77.1% of the pauses are situated within words and 20.8% between words. These locations are usually characterized by shorter pauses than pauses on a higher linguistic level (Van Waes & Schellens, 2003; Wengelin, 2006). Figure 27.3 illustrates how pauses at the word level—in expository texts—account for more than 90% of the total pause time, and about half of the total pause time is spent within words, mostly representing mechanical key transition time.

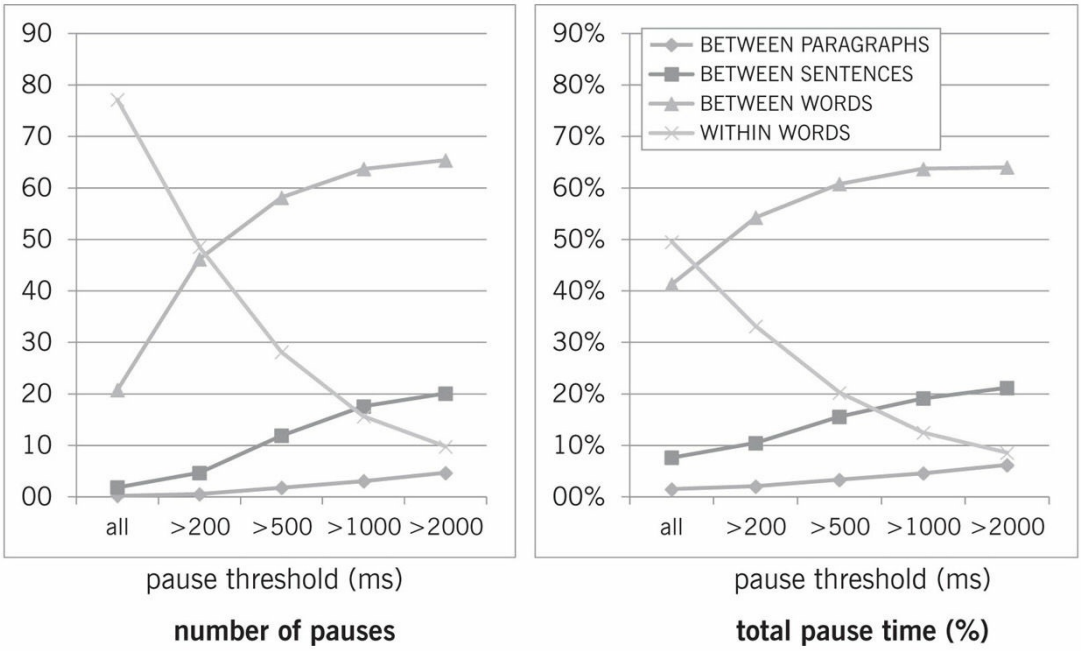


FIGURE 27.3. Proportion of number of pauses (left) and total pause time (right) in function of location at different pause threshold levels (milliseconds [ms]).

The conception of what constitutes a pause, that is, how long the dwell time between two characters should be to

be considered a pause, is not as straightforward as it might seem. In writing research, a pause threshold of 2 seconds has been common practice for a long time (e.g., Hayes & Chenoweth, 2006; Leijten, Van Waes, & Janssen, 2010; Sullivan & Lindgren, 2002). However, in Figure 27.3 we illustrate how the pause threshold can affect the analysis of pauses. When increasing the pause time from 1 millisecond to the commonly used 2-second threshold, the proportion of pauses between words increases from 20 to 65%, while pauses within words only represent 10% at this level. About 25% of the total number of pauses longer than 2 seconds are situated above word level, representing 27% of the total pause time.

Pause Thresholds and Copy Tasks

Taking all these elements into account, it is important—now that logging tools allow accurate measuring—to determine which pause threshold best suits your research goals. The main reason for defining a pause threshold is to avoid "mechanical noise" in pause analyses, and focus on those transitions that indicate more high-level cognitive writing activities. For a better understanding of motor-related micro-pauses, researchers have created a writing setting that allows them to better isolate cognitive activities from motor execution: so-called "copy/dictation tasks" (Alves, Castro, & Olive, 2008; Grabowski, 2008; Lambert, Alamargot, & Fayol, 2012). For copy or dictating tasks, participants get a visual or oral prompt that they have to transcribe, or they have to type a text from memory (e.g., a nursery rhyme). Wallot and Grabowski (2013) convincingly showed that these kinds of tightly controlled writing tasks are systematically relatable to more complex writing setups.

In one keystroke logging study, Alves et al. (2008) used a copy task in combination with narratives to investigate whether typing skill had an impact on concurrent activation of writing processes. The occurrences of writing processes were assessed through directed verbalization, and their cognitive demands were measured through interference in reaction times. Although pauses signal the interruption of text production when high-level writing processes could not be carried out simultaneously with typing, their study shows that writers engage in parallel processing. In particular, the more experienced typists seemed to engage in both planning and revision processes during motor execution. Their results show that especially planning and revising were activated during pauses (both about 17%), but that translating processes also accounted for 15% of the pause time. Moreover, they found that "during execution, translating dominated (36%), but planning and revising were also activated, even if to limited extent (around 7%)" (p. 976). Although motor execution was more demanding for slow typists than for fast typists, the study showed that typing skills did not influence concurrent processing. Both groups were able to activate high-level writing processes during typing.

This concept of parallel versus serial processing could also be related to a study by Maggio, Lété, Chenu, Jisa, and Fayol (2012). They examined the dynamics of cognitive processes during narrative writing by concentrating on pause duration before and within words, together with the writing rate of a word. Their research shows that the writing rate of a word and the intraword pause measures show both immediacy and anticipatory effects. However, the between-word-pause durations show only delayed effects. So, when a certain word is being written, not only do lexical and grammatical characteristic of the next word(s) influence the pausing behavior, but also between-word pauses are influenced by properties of words preceding the currently transcribed word (i.c., an effect of neighborhood frequency). This combination of anticipatory and delayed effects has also been studied on a lower level (Van Waes & Leijten, 2010). In the analysis of typing errors spontaneously elicited during a copy task, the researchers identified a significant decrease of within-word latency situated about three characters ahead of the actual typo and a significant increase of the pause length in the error bigram itself and the consecutive one. This is in line with the fact that, in professional typists, the fixated letter in the original text is on average three letters ahead of

the concurrently typed letter (Inhoff & Gordon, 1997): a function of the biomechanical constraints of typing (see also Inhoff & Wang, 1992).

Word-Level Characteristics

On the word level, linguistic characteristics also seem to influence the temporal aspects of writing. As an example, Table 27.1 shows the mean pausing time before and after adjectives and nouns. Data are taken from a pilot study in which the writing process of twitter messages (n = 68) was analyzed (Leijten, Macken, Hoste, van Horenbeeck, & Van Waes, 2012). This was a small-scale example with limited text production, but it still showed the possibilities for exploring writing process data from a linguistic perspective.

TABLE 27.1. Example of Process Data Analyzed on the Basis of Linguistic Information

	Mean pause before	Mean pause after	Mean pause within
ADJ	1,880	671	148
NOUN	728	1,455	232
B |beginning of chunk	1,412	1,174	164
E |end of chunk	685	1,353	148
I |inside chunk	730	1,034	144

Note. Time in milliseconds.

In this example, the mean pausing time before adjectives is twice as long as that before nouns. The pausing time after these words showed the opposite proportion, which might indicate that adjective–noun combinations are transcribed as integrated bursts. The fact that pauses in the beginning of chunks are generally more than twice as long as in the middle of a chunk points in the same direction.

The current version of InputLog provides a client–server architecture that enables exchange of logged data with external linguistic packages developed for the natural language processing (NLP) framework (Leijten et al., 2012; Leijten, van Horenbeeck, & Van Waes, 2015). This analysis returns the results from a part-of-speech tagger, a lemmatizer, a chunker, the syllable boundaries, and word frequencies. Revisions (i.e., deletions and insertions) are given at the word level together with their action time and pause time (Leijten et al., 2012). Bringing together linguistic and cognitive concepts in writing research is an important step in deepening our understanding of writing complexity. The fact that new tools facilitate this type of research enables us to explore this perspective on a larger scale with larger data collections.

These large datasets show that micro-pauses are determined by location, mechanical, and linguistic aspects. The use of a pause threshold creates a filtering perspective that enables us to focus more on either low- or high-level writing processes. However, other factors also affect pausing behavior. In this section, we have focused on the micro context. More general aspects that relate to both textual (e.g., genre), personal characteristics (e.g., development, writing fluency, and writing disabilities), and contextual settings (e.g., educational and professional contexts) are discussed in the following sections.

WRITING DEVELOPMENT

For most of us, our parents and teachers have been the main driving forces behind our literacy development; they have been our literacy sponsors (Brandt, 2001). Today, in an era of mass writing, we can also see how other actors

or sponsors use the Internet to create literacy spaces for social interaction and presentation. More than ever, writing can be described as a truly multifaceted activity that goes on in a plethora of contexts in combination with other means of expression, such as sound, signs, and other visuals. Children need to develop their writing in relation not only to genre and reader, but also to the media of presentation. And, perhaps most importantly, they need to be able to critically evaluate textual presentations they meet in order to adequately react to them in written communication.

As almost every child and adult (in the Western world) use digital devices such as computers, tablets, and/or smartphones on a daily basis, keystroke logging has become a useful and valid method to study as well as to enhance writing development. Writers, except for small children, know their way around the keyboard and feel comfortable using the computer for writing.

Studying Writing Development

As mentioned earlier, keystroke logging and similar tools for recording writing processes have sprung from the cognitive line of research on writing. As keystroke logs allow for the study of traces of writing subprocesses in such detail, they have not only been used to study the writing process per se, but also to better understand how writing develops longitudinally, in additional languages, and in relation to spoken language. Studies have often combined keystroke logging with additional data collection methods such as stimulated recall, think-aloud protocols, or eye tracking. Following are a few examples of studies in which keystroke logging has been used.

In a comprehensive cross-sectional study of writing development, Johansson (2009) compared speech and writing in four age groups (10, 13, 17, and adults) using both product and process analyses. One of her results points to the transition between speech and writing and how, for example, young writers make use of their narrative oral skills when producing written text. She also found that the percentage of pause time to total writing time did not differ either between ages or between genres. She proposes, however, that writers may use their time differently. On the surface, writers could produce similar patterns, but a closer look using keystroke logging can reveal important differences (Farrington, 2003).

In a recent study of electronic outlining, De Smet, Brand-Gruwel, Leijten, and Kirschner (2014) used keystroke logging to investigate whether the use of electronic outlining as opposed to no outlining made a difference for writers' pauses and revisions during writing. They concluded that the most important factor was not whether writers used outlining, but rather whether or not writers used the same strategies between writing tasks (i.e., got the opportunity to practice strategies). De Smet (2013) concludes that "practice in using a specific writing strategy (i.e., repeated electronic outlining, repeated direct writing) enhanced writing fluency in terms of total process time, words produced per minute, total number of pauses, total pause time and perceived mental effort" (pp. 91–92).

A number of studies have used keystroke logging to study the temporal aspects of writing processes in first (L1) and foreign language (FL) writing. Van Weijen and colleagues (Van Weijen, van den Bergh, Rijlaarsdam, & Sanders, 2009) found that students varied their writing processes less between tasks in FL than in L1. They explain how writers' higher cognitive load in the FL would be reduced by applying uniform writing behaviors across tasks. In a series of studies of text quality in teenagers' L1 (Dutch) and FL (English) writing, Tillema and her colleagues (Tillema, Van den Bergh, Rijlaarsdam, & Sanders, 2011) used keystroke logging in combination with think-aloud protocols. Among other things they looked into the relationship between temporal distribution of cognitive writing processes and text quality in the final text. They concluded that even though the cognitive activities were distributed similarly during writing L1 and FL, their contribution to text quality differed between the two languages.

In two longitudinal studies of the development of fluency and revision in L1 Swedish and FL English, Lindgren, Spelman Miller, and Sullivan (2008) followed teenaged writers over a period of 3 years. Results showed that fluency

was strongly connected with text quality in both languages and that fluency increased over the period. Interestingly, it also revealed that even though writers revised more formal aspects in FL than in L1, they did not revise less on a conceptual level. Time on task was longer in the FL, which indicates that the writers' concepts of what constitutes a good text floated between their languages, and they were able to use time as a tool to compensate for lack of linguistic resources in the FL.

Enhancing Writing Development

Writing development has been studied from different and sometimes opposing perspectives. Cognitively oriented studies highlight issues such as cognitive development and working memory maturation as important (Kellogg, 2008). Sociocultural perspectives, on the other hand, focus on the impact of society, school, and parents as some of the main driving forces behind learning. Attempts have been made to widen the view on writing by merging both cognitive and social aspects of writing into a sociocognitive stance. During writing, decisions are shaped by experiences, culture, social norms, and expectations at the same time as this social context is filtered through the cognition of the writer (Geisler, 2004). Observation and analysis of the writing process with keystroke logging or other recording tools allow writers and researchers to view, discuss, and reflect on detailed traces of cognitive activities, how culture may have shaped writers' actions, at the same time that it provides a social context for the discussion and development of writing.

Observational learning in general has the advantage of both reducing cognitive load for writers because they can observe instead of produce text, and giving the opportunity to reflect on and discuss what they observe with someone else (Braaksma, Rijlaarsdam, & Van den Bergh, 2002). Using your own text for observation, for example, through replay of keystroke logging observations, screen recorders, or videos has an additional advantage to that of using any model writer. When writers are replaying their own text (i.e., the text they just produced), it is transformed into new input (see the output hypothesis in Swain, 2000). Writers are then provided with an opportunity to notice, reflect on, and discuss issues about their writing (process) that they do not yet fully grasp, which are in their zone of proximal development (Vygotsky, 1998).

Keystroke logging has been used to promote awareness of both translation from one language to another and writing processes for student and teachers. After a writing session, the text is typically replayed and discussed by the writer and an interlocutor (for a detailed description, see Van Waes, Leijten, Wengelin, & Lindgren, 2012). Using this method, Hansen (2006) found that the replay of logfiles helped translation students to detect disturbances in the translation process such as structural problems and inappropriate changes (p. 27). Adolescent as well as adult writers showed positive effects of the observation and discussion of their FL writing processes (e.g., Lindgren, Sullivan, & Stevenson, 2008; Sullivan & Lindgren, 2002). However, the role of the interlocutor and the structure of the reflective session are important and need further investigation in order to more fully understand the underlying learning processes (Sabbaghan, 2013). Keystroke logging has also been used for self-assessment of writing or translation processes (Angelone, 2013) or as a diagnostic tool for students and teachers in translation (Schrijver, van Vaerenbergh, Leijten, & Van Waes, 2014).

As illustrated in this section, keystroke logging has been used in several studies of multilingual writing. Results point both at differences and similarities between how writers approach writing in their different languages. It thus seems that keystroke logging can be a useful tool to study and develop theory about how writing develops not only between languages but within writers across languages. Ortega and Carson (2010) suggest a view on multilingual writing in which writers' competence is viewed not in relation to native L1 writers but as "a psycholinguistically distinct form of multi-competence" (p. 50). Recently, Kobayashi and Rinnert (2013) investigated the concept of

multicompetence (Cook, 2008) in relation to writing. They suggest that writers gradually develop a joint mental space for writing knowledge that they can apply to writing in any language. In future studies, keystroke logging could target similarities between writing in different languages instead of differences and thus contribute to the understanding of multilingual writing through the lens of multicompetence.

In this section, we have focused on keystroke logging in relation to general aspects of writing development. We will now take a closer look at how keystroke logging can be applied to describe and understand the situation for writers who struggle more than most of us with the composition of text.

STRUGGLING WRITERS

All writers struggle at one time or another. Some struggle to generate ideas, others to find the right words or to formulate sentences; some struggle to create coherence, others to spell words correctly. Beginning writers generally struggle with all of the aforementioned aspects, but in time most of them develop into more fluent writers. Some writers, however, continue to struggle with writing throughout the school years and in some cases throughout their whole life (cf. Connelly & Dockrell, Chapter 23, this volume). These writers can be found among children with dyslexia or other specific language impairments (SLI). In addition, children with hearing impairments frequently experience difficulties with literacy acquisition. Others acquire disorders later in life that can impair writing. Among those we find people with aphasia or Alzheimer's disease. So far very little research has been done on the writing processes of these groups (Behrns, Ahlsén, & Wengelin, 2010; Behrns, Hartelius, & Wengelin, 2009; Leijten et al., 2015). In this section, we focus on how keystroke logging can contribute to our knowledge about writing by people diagnosed with language disorders: dyslexia, SLI, and aphasia. People with hearing impairments and people with Alzheimer's disease also frequently display language difficulties, but these difficulties are not the main symptom of the disorder. For all of the above-mentioned language disorders, writing is the least investigated aspect of the linguistic processes.

Keystroke Logging and Struggling Writing Due to Language Disorders

By using keystroke logging, we may be able to disentangle the relations between the challenges encountered by writers with different language disorders, the strategies they use to meet these challenges, and finally how their specific process characteristics relate to their final text products.

Let us illustrate this with an example from Philip, a 15-year-old Swedish boy with dyslexia. One common feature of the writing of people with dyslexia is that it is very slow, and it has been debated whether this difficulty is due to poor motor skill development or other factors. By using keystroke logging, we can investigate how writers distribute their time across the writing process.

The example below shows a sentence out of a text Philip produced when he participated in a Swedish study on writing (Johansson, Johansson, & Wengelin, 2008). During a 30-minute writing session, he produced a text of 57 words with the title "Dyslexi" (Dyslexia). His first sentence read:

[Final Text]
Läraren bör engagera sig mer i elevernas arbete.
(The teacher should get more involved in the work of his/her students.)
[Linear ScriptLog file]

Läraren bör eng<4.9>a<9.3><BACKSPACE2>
ga<2.5><20.5><BACKSPACE 4>äng<2.8>
agera<2.2><BACKSPACE 8>
eng<4.7>agera<2.6><135.590> sig

He started out by (slowly) writing "Läraren bör" [*The teacher should*], then he continued to the reflexive verb "engagera sig" [*get involved*] and the production of that progressed as follows. First, he wrote "eng." Then he paused for 4.9 seconds, after which he continued with the "a" and paused again, this time for 9.3 seconds. After that pause, he erased the "g" and the "a" but immediately rewrote them. This was followed by a 23-second pause, after which he erased all four letters and changed the "e" to the similar-sounding letter "ä" followed by the "n" and the "g." So far he had produced "äng," which sounds just like "eng." At that point he paused for 2.8 seconds again and then finished the word by writing "agera" so that he had "ängagera." He paused for 2.2 seconds and then changed his mind. He erased the whole word and wrote "eng" again, made a pause of 4.7 seconds, and finally finished the word "engagera." He paused for another 2.2 seconds before pressing the space bar then and another 135.5 seconds before writing the reflexive pronoun "sig."

This example serves to illustrate results reported in other studies. Wengelin (2002) used keystroke logging to explore the writing processes of adults with dyslexia. Not surprisingly, the writers in her study were very slow, and this was mainly due to frequent pausing. Furthermore, they paused significantly more within words than other writers. In a later paper (Wengelin, 2007), she explored the relation between this type of writing behavior and the final text product and showed that together with spelling-related revisions the proportion of intraword pauses predicted 55% of the variance in lexical diversity of the texts produced by the writers with dyslexia. Similar results have been found for 15-year-olds by Wengelin, Johansson, and Johansson (2014), and by Summer, Connelly, and Barnett (2014). Wengelin et al. showed that the proportion of pause time for poor spellers—but not for good spellers—correlated with the number of words produced and with lexical diversity. Sumner, Connelly, and Barnett (2014) showed that the primary school children were slow writers due to pausing more frequently than their peers rather than to limited motor skills (cf. Connelly & Dockrell, Chapter 23, this volume).

Together these results indicate that pause patterns in text production by writers with dyslexia are explained largely by spelling difficulties. As pointed out by Sumner et al. (2014), this may reflect problems in response to high cognitive load through having to deal with spelling and composing concurrently, and this in turn would affect the characteristics of the final texts. Interestingly, similar results have been found in studies on handwriting by children with SLI.

Connelly, Dockrell, Walter, and Critten (2012) used writing tablets and the software *Eye and Pen* to investigate burst length in the production of handwritten narratives by 11-year-olds with SLI. They produced significantly shorter bursts than their age-matched peers, and their burst length was predicted by spelling accuracy. We do not claim that the nature of the writing difficulties displayed by writers in the two groups can be explained in exactly the same way, but it is clear that keystroke logging and other techniques that display writers' distribution of time across the writing process can contribute to our understanding of struggling writing.

Another contribution of keystroke logging to the study of writing processes by struggling writers is that it records all revisions made by a writer. If we return to Philip's writing, we see that he finally produced the word "engagera" correctly spelled. In fact, his final text only included two minor spelling errors, so by only studying the final text we would never have known that he struggled with spelling throughout the entire writing process. Revisions were also studied by Behrns, Ahlsén, and Wengelin (2008) in order to understand the writing processes of writers with aphasia. They found that the writers with aphasia deleted as much as writers without aphasia, but they made almost

only word-level revisions. Moreover, they started revising the word as soon as they hesitated about a letter or the whole word. This strategy was successful in that their final texts contained very few erroneous words, but the writing process was extremely effortful and resulted in short—and often incoherent—texts, some of them consisting of only one sentence.

As a result of this knowledge about the writing processes of writers with aphasia, an intervention study was carried out (Behrns, Hartelius, & Wengelin, 2009). Writers were taught to use word-level writing aids, such as spelling correction and word prediction, in order to reduce the cognitive load of their word-level difficulties. After the intervention, they produced texts that were longer, more coherent, and more syntactically correct. In other words, knowledge about the writing process contributed to a successful intervention that could reduce the cognitive load when finding and spelling words for writers with aphasia.

Contemporary Professional Writing

In this final section, we focus on the use of keystroke logging in a completely different domain of writing research—professional writing and, more specifically, the use of multiple sources. Schriver (2012) describes professional communication as "creative activities that adults engage in as they compose purpose-driven communications on the job" (p. 276), which encompass a range of advanced writing and visual design activities. In professional writing, the focus is on more than just text: Aspects of both writing and visual design have to be carefully integrated. In order to cater for the increased importance of visual literacy, professionals make use of multiple sources when writing (Lauer & Sanchez, 2011; Leijten, Van Waes, Schriver, & Hayes, 2014; Schriver, 2012).

Another reason for the increased use of multiple sources is the digitalization of information, both locally (availability of digital reports, presentations, multimedia) and globally through the enormous amounts of information available on the Internet. Writing from and searching for information in multiple digital sources have fundamentally changed the way in which professionals approach communication design. For the most part, teachers and researchers have been interested in the writer's transformation of knowledge and have explored writing from sources as a way to learn about subject matter and gain facility in critical thinking (Jakobs, 2003). In contrast, workplace research has not focused on the writer's personal transformation and growth as they write from sources. Research on professional communication tends to examine how writers transform and summarize other writers' content as they draw on various papers or digital sources, and on how doing so requires sensitivity to the rhetorical situation. It is suspected that when professionals employ digital resources, they do not do so with an eye toward summary, though summarizing could be part of what they do (Leijten et al., 2014; Slattery, 2007; Solé, Miras, Castells, Espino, & Minguela, 2013).

Although it is difficult to specify exactly how expert information designers accomplish what they do, research has started to profile some of the cognitive and social processes professionals engage in as they work within organizational settings. This also holds for other areas of expertise such as journalism and translation studies (Ehrensberger-Dow & Perrin, 2013; Perrin, 2013; Schrijver et al., 2014). Finally, writing at the workplace is characterized by multiple domains, contexts, types, and genres (Alamargot, Tellier, & Cellier, 2007).

Professionals

A recent study on professional writing has been conducted by Leijten et al. (2014). They characterize the process by which professionals construct texts using multiple digital sources and present a framework that depicts this process. In their study, they present a thorough case study of how a professional writer, Aiden, creates a proposal using

multiple sources. They used a combination of methods: participative observation, keystroke logging via Inputlog, (retrospective) interviews, and logbooks. As Aiden worked on the proposal, his writing process was tracked over an 8.5-hour period (spread over several days), totaling roughly 55,000 lines of keystroke data.

The case study revealed that Aiden searched extensively through multiple sources for content and ideas. He regularly chose to leave his text in search of suitable information elsewhere. Based on the Inputlog data, 280 unique so-called focus events were identified, that is, external documents. These focus events were grouped into nine main categories based on software or program types. For instance, various programs for email (Outlook, Webmail, etc.) were grouped into the main category "mail." For a great part of the writing process, Aiden constructed his text by intensely searching for textual bits that he could reuse in his proposal (*task-related sources*). He inserted text parts that comprised general boilerplate content. Consequently, he proceeded to revise some of this recycled writing and formatted each of these text segments in succession. He used various reformulation strategies in order to integrate the texts from multiple sources: changing the wording, modifying the text for cohesion, and changing the layout. In crafting his text, he aimed to realize his goals and adapt the content and phrasing to the readers and their context (Kellogg, 2008).

Furthermore, Aiden produced visual content as well as verbal content. His activities underscored the importance of visual design as part of the professional communication process. Quite some time of his writing process was spent searching for suitable visuals that he used to emphasize his verbal communication and show the company's expertise in the field.

Finally, the analyses showed that Aiden's searching behavior was not always focused on the main task. About 9% of his writing time could be described as "downtime," often caused by search actions that distracted him to unrelated activities. Research by Coker showed that taking downtime was beneficial if employees devoted no more than 12% to it (Coker, 2011). However, downtime could also cause restarting costs that are negative for the flow of production. Further research could shed more light on the potential benefits and disadvantages of going off-task by taking downtime during writing.

In order to encompass the phenomena observed in the work of skilled professional communicators, the authors elaborated on Hayes's model of the writing process (Hayes, 2012). The most important component added was related to "search processes." Leijten et al. (2014) state: "Because most writing activity (whether at school or work) requires the processing of both long-term memory and external sources of information, we have explicitly added a *searcher* that looks for information in external sources as one of the basic writing processes. The searcher operates for any type of writing, whether academic, creative, or professional" (p. 325)

Translators

Another area of professional communication that heavily draws on the use of multiple sources is translation (i.e., translation from one language into another). In translation, writers need to divide their attention between the source text and the target text on the one hand, and digital sources such as dictionaries or parallel texts on the other hand. Traditionally, writing and translation are treated as two different objects of study. However, recently the two disciplines have started to approach each other (Dam-Jensen & Heine, 2013; Schrijver, 2014). The parallels between writing research and translation process research range from the object of study (text producers and texts) to methodology. Similarly to writing research, translation studies have recently moved from an almost exclusive focus on products toward considering the workplace, cognitive processes, and the effects of processes on the quality of products (Ehrensberger-Dow & Massey, 2013, p. 103; Ehrensberger-Dow & Perrin, 2013). Whereas in the writing field, Inputlog (Leijten & Van Waes, 2013) and Scriptlog (Wengelin et al., 2009) are the most common keystroke

logging tools, in translation studies, Translog is also commonly used (Jakobsen, 2006). Recent studies have dealt with a variety of aspects that relate to writing and translation. For instance, in a study by Robert and Van Waes (2014), different revision procedures that translators use in their day-to-day working practice are compared. They investigated the impact of these revision procedures on both the revision product and the revision process. Another example is an experimental study by Schrijver, Van Vaerenbergh, & Van Waes (2012) in which they observed student translators with keystroke logging and think aloud while they translated a patient information leaflet. Their main focus was on the trans-editing process, that is, the combination of translation and editing.

In this section, we describe a study by Ehrensberger-Dow and colleagues in more detail (Ehrensberger-Dow & Massey, 2013; Ehrensberger-Dow & Perrin, 2013). They set up a longitudinal research project about the relationship between translation competence and the translation process. The topic was studied via another multimethod approach: progression analysis. Progression analysis was originally developed for newswriting by Daniël Perrin (2013) and operates on three levels: situation, performance, and conceptualization. First, the work situations in which writers operate are thoroughly described. Then direct observations of the writing performance are logged, and finally the writers reflect, through retrospective protocols, on a reconstruction of their writing process.

The main aim of the project was to investigate how methods common to writing research and newswriting research can be applied to investigate translators' understanding of their roles and responsibilities as text producers. Through a case study, Ehrensberger-Dow and Perrin (2013) described the process of a female translator (L1: German, L2: English) translating a German journalistic source text into English (length: 115 words). After she finished translating the text, the translator viewed and commented on the recording of her writing. The authors selected one sentence to illustrate translation difficulties. Eye-tracking data showed that the translator constantly shifted her attention between the sentence in the source text and the emerging translation on the screen. Afterward, she reread the particular sentence two more times. In the retrospective interview, she stated that she mainly had difficulties translating the adverbs of time; she hesitated whether to put them at either the beginning or the end of the sentence ("I find it difficult to place all these adverbials in English"). The richness of this observation made the researchers aware that shifting attention could be different for professionals as opposed to students. So, they went on to observe the same sentence/adverbial in the full dataset ($N = 19$) and found that professionals used a broader range of their linguistic possibilities than the students. The students did not seem to deviate from the source text structure, whereas the professionals showed greater confidence in exploiting their linguistic resources. This perceived problem would not have come to the surface if only final products had been analyzed. The revisions shown in the keystroke logs, the eye movements in the replay, and the awareness shown via the retrospective interview were necessary to understand the complexity of this translation problem as they pinpointed the more diverse linguistic knowledge of the professionals.

In summary, multimethod approaches or progression analyses enable the description of numerous strategies in both writing and translation research: the impact of revision procedures on both the revision product and the revision process (Robert & Van Waes, 2014); the effect of genre knowledge on the product and process characteristics of student and professional translators (Schrijver et al., 2014); translators' self-concepts and translation of titles (Ehrensberger-Dow & Massey, 2013); and multidimensional characteristics of translation profiles (Dragsted & Carl, 2013).

CONCLUSION

In this chapter, we hope to have convinced the reader that keystroke logging is a powerful tool for gaining insight

into the cognitive activities of various types of writers in various phases/stages of their writing and in various research fields. Furthermore, we hope to have clarified that analyzing online writing process data needs to be handled with care. Researchers have to be careful in interpreting the automatically generated results and in defining and calculating measures based on large sets of data. Albeit—or perhaps because—keystroke logging is a very powerful and flexible tool, it requires the researcher to define clear questions and operationalize the units of analysis. These cannot always be given directly by the tools. For example, the chapter has addressed the question of what pauses can tell us about cognitive processes and has illustrated that we cannot speak of "a pause" as something unambiguous. Researchers need to determine what a pause is, depending on the specific research goals of a particular project. Pause thresholds create a filtering perspective that enables researchers to focus more on either low- or high-level writing processes. Further research to define "best practices" is needed here.

Keystroke logging has traditionally been used mostly in relation to quantitative analyses. However, the logs provide excellent tools for in-depth qualitative and linguistic analyses (Leijten et al., 2015) of, for example, the textual context of writers' pauses and revisions. As the intervention study in the section on struggling writers showed, traces in the logs could be taken a step further and be connected with, for example, provision of writing instruction in policy and practice as well as language use in and outside formal education. For example, studies of fluency in L1 and FL writing show that fluency is lower in FL than in L1 and lower in writing by writers with language disorders than by writers without disorders. This finding is expected, but how can we understand and explain these differences? Are there certain structures or domains of vocabulary that are more or less fluently retrieved in different languages, or for writers with different types of disorders? If so, how can that be explained?

In order to explain the complex processes of writing and writing development, we propose that analyses of cognitive processes need to be combined with linguistic analyses and discourse analyses. During the last decades, several areas of writing research have emerged, and researchers from various disciplines use a variety of different methods and tools in writing research. To a certain extent, these areas and disciplines are coming closer to each other, but it is our view that these disciplines can benefit more from each other. Keystroke logging could, for example, be combined with other methods of recording data and with various types of text-based analyses. Looking at different areas of writing research, such as developmental writing and professional writing, we find that processes have changed considerably over the years—and so have research methods. The focus partly shifted from the text production in a narrow sense to a perspective that more explicitly takes into account the (extended) *context* in which the texts are produced.

The activity of writing has changed rapidly from being a monologue offline text production activity to encompassing various interactive types of writing, Internet searches, and so on. Such activities—and the availability of tools for them—are determining the living and working situation for writers physically, geographically, and socially. Some questions that could be raised here are: How is writing fluency affected by these digital sources and by the online situation where the interlocutor(s) is available online more or less constantly and possibly expecting fast interaction? What is the influence on the fragmentation of the writing process? How do writers incorporate preformulated texts and translations into a newly written text? Keystroke logging tools can no doubt facilitate the investigation of research questions like these. The fast development of writing (as an everyday activity) will inevitably have both theoretical and methodological implications.

Finally, as we have seen, visual content is highly important in the communication of young adults and in professional writing. However, very little writing research and writing instruction focus on this visual aspect, representing a disconnect between instruction and demands of the workplace (Lauer & Sanchez, 2011). In the future, research should not only focus on visuals as merely an illustration of written text but also on how visuals communicate the message and interact with the verbal text. The most likely implication is that new models of

writing will have to take multimodality into account to a larger extent. Keystroke logging in combination with other methods, such as eye tracking and stimulated recall, can contribute to this development. Such combinations will produce even vaster datasets and require the researcher to make even more informed choices than today. With future datasets that are larger than the ones described in this chapter, we will also need to incorporate more sophisticated methods for data mining and statistical modeling of process data (Leijten & Van Waes, 2013, and find ways to combine these with qualitative analyses of the linguistic and social aspects of writing processes.

REFERENCES

Alamargot, D., Tellier, P., & Cellier, J. M. (Eds.). (2007). *Written documents in the workplace* (Vol. 21). Bingley, UK: Emerald.

Alves, R. A., Castro, S. L., & Olive, T. (2008). "Execution and pauses in writing narratives: Processing time, cognitive effort and typing skill. *International Journal of Psychology, 43*(6), 969–979.

Angelone, E. (2013). Watching and learning from "virtual professionals": Utilising screen recording in process-oriented. In D. Kiraly, S. Hansen Shirra, & S. M. Karin (Eds.), *New prospects and perspectives for educating language mediators* (pp. 121–139). Tübingen, Germany: Gunter-Narr Verlag.

Baaijen, V. M., Galbraith, D., & de Glopper, K. (2012). *Keystroke analysis: Reflections on procedures and measures*. Available at *http://wcx.sagepub.com/content/early/2012/07/02/074/088312451108.*

Behrns, I., Ahlsén, E., & Wengelin, Å. (2008). Aphasia and the process of revision in writing a text. *Clinical Linguistics and Phonetics, 22*(2), 95–110.

Behrns, I., Ahlsén, E., & Wengelin, Å. (2010). Aphasia and text writing. *International Journal of Language and Communication Disorders, 45*(2), 230–243.

Behrns, I., Hartelius, L., & Wengelin, Å. (2009). Aphasia and computerised writing aid supported treatment. *Aphasiology, 23*(10), 1276–1294.

Braaksma, M. A. H., Rijlaarsdam, G., & van den Bergh, H. (2002). Observational learning and the effects of model–observer similarity. *Journal of Educational Psychology, 94*(2), 405–415.

Brandt, D. (2001). *Literacy in American lives*. New York: Cambridge University Press.

Coker, B. L. S. (2011). Freedom to surf: The positive effects of workplace Internet leisure browsing. *New Technology, Work and Employment, 26*(3), 238–247.

Connelly, V., Dockrell, J. E., Walter, K., & Critten, S. (2012). Predicting the quality of composition and written language bursts from oral language, spelling, and handwriting skills in children with and without specific language impairment.*Written Communication, 29*(3), 278–302.

Cook, V. (2008). Multi-competence: Black hole or wormhole for second language acquisition research. In Z. Han & E. S. Park (Eds.), *Understanding second language process* (Vol. 25, pp. 16–26). Frankfurt, Germany: Multlingual Matters.

Dam-Jensen, H., & Heine, C. (2013). Writing and translation process research: Bridging the gap. *Journal of Writing Research, 5*(1), 89–101.

De Smet, M. (2013). *Composing the unwritten text: Effects of electronic outlining on students' argumentative writing*. Heerlen, The Netherlands: Open Universiteit.

De Smet, M. J., Brand-Gruwel, S., Leijten, M., & Kirschner, P. A. (2014). Electronic outlining as a writing strategy: Effects on students' writing products, mental effort and writing process. *Computers and Education, 78*, 352–366.

Dragsted, B., & Carl, M. (2013). Towards a classification of translation styles based on eye-tracking and keylogging data. *Journal of Writing Research, 5*(1), 133–158.

Ehrensberger-Dow, M., & Massey, G. (2013). Indicators of translation competence: Translators' self-concepts and the translation of titles. *Journal of Writing Research, 5*(1), 103–131.

Ehrensberger-Dow, M., & Perrin, D. (2013). Applying a newswriting research approach to translation. *Target, 25*(1), 77–92.

Farrington, D. P. (2003). Methodological quality standards for evaluation research. *Annals of the American Academy of Political and Social Sciences, 587*, 49–68.

Fayol, M., & Lété, B. (2012). Contributions of online studies to understanding translation from ideas to written text. In M. Fayol, D. Alamargot, & V. W. Berninger (Eds.), *Translation of thought to written text while composing: Advancing theory, knowledge, research methods, tools, and applications* (pp. 289–313). New York: Psychology Press.

Geisler, C. (2004). How ought we to understand the concept of rhetorical agency? Report from the ARS. *Rhetoric Society Quarterly, 34*(3), 9–17.

Grabowski, J. (1996). Writing and speaking: Common grounds and differences towards a regulation theory of written language production. In C. M. Levy & S. E. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences, and applications* (pp. 73–92). Mahwah, NJ: Erlbaum.

Grabowski, J. (2008). The internal structure of university students' keyboard skills. *Journal of Writing Research, 1*(1), 27–52.

Hansen, G. (2006). Retrospection methods in translator training and translation research. *Journal of Specialised Translation, 5*(1), 2–41.

Hayes, J. R. (2012). Modeling and remodeling writing. *Written Communication, 29*(3), 369–388.

Hayes, J. R., & Chenoweth, N. (2006). Is working memory involved in the transcribing and editing of texts? *Written Communication, 23*(2), 135–141.

Heldner, M., & Edlund, J. (2010). Pauses, gaps and overlaps in conversations. *Journal of Phonetics, 38*(4), 555–568.

Inhoff, A. W., & Gordon, A. M. (1997). Eye movements and eye-hand coordination during typing. *Current Directions in Psychological Science, 6*(6), 153–157.

Inhoff, A. W., & Wang, J. (1992). Encoding of text, manual movement planning, and eye-hand coordination during copytyping. *Journal of Experimental Psychology: Human Perception and Performance, 18*(2), 437–448.

Jakobs, E. M. (2003). Reproductive writing—writing from sources. *Journal of Pragmatics, 35*(6), 893–906.

Jakobsen, A. L. (2006). Translog: Research methods in translation. In K. P. H. Sullivan & E. Lindgren (Eds.), *Computer keystroke logging:Methods and applications* (Vol. 18, pp. 95–105). Oxford, UK: Elsevier.

Johansson, R., Johansson, V., & Wengelin, Å. (2008). Reading during writing: Four different groups of writers *Lund Working Papers* (Vol. 53, pp. 43–59). Lund, Sweden: University of Lund.

Johansson, V. (2009). *Developmental aspects of text production in writing and speech.* PhD dissertation, University of Lund, Lund.

Johansson, V. (2013). Writing—it's like learning a new language! In A. F. Mattsson & C. Norrby (Eds.), *Language acquisition and use in multlingual contexts: Theory and practice* (pp. 70–79). Lund, Sweden: Media-Tryck, University of Lund.

Kellogg, R. T. (2008). Training writing skills: A cognitive developmental perspective. *Journal of Writing Research, 1*(1), 1–26.

Kobayashi, H., & Rinnert, C. (2013). L1/L2/L3 writing development: Longitudinal case study of a Japanese multicompetent writer. *Journal of Second Language Writing, 22*(1), 4–33.

Lambert, E., Alamargot, D., & Fayol, M. (2012). Why use a copy task to study spelling in handwriting? In M. Fayol, D. Alamargot, & V. W. Berninger (Eds.), *Translation of thought to written text while composing: Advancing*

theory, knowledge, research methods, tools, and applications (pp. 339–356). New York: Psychology Press.

Lauer, C., & Sanchez, C. A. (2011). Visuospatial thinking in the professional writing classroom. *Journal of Business and Technical Communication, 25*(2), 184–218.

Leijten, M., Macken, L., Hoste, V., van Horenbeeck, E., & Van Waes, L. (2012). From character to word level: Enabling the linguistic analyses of Inputlog process data. In M. Piotrowski, C. Mahlow, & R. Dale (Eds.), *Linguistic and cognitive aspects of document creation and document engineering* (pp. 1–8). *Proceedings of the Second Workshop on Computational Lingustics and Writing*. Stroudsburg, PA: ACL.

Leijten, M., van Horenbeeck, E., & Van Waes, L. (2015). Analyzing writing process data: A linguistic perspective. In G. Cislaru (Ed.), *Writing(s) at the crossroads: the process/product interface*. Philadelphia: John Benjamins Publishing Company.

Leijten, M., & Van Waes, L. (2013). Keystroke logging in writing research: Using Inputlog to analyze and visualize writing processes. *Written Communication, 30*(3), 358–392.

Leijten, M., Van Waes, L., & Janssen, D. (2010). Error correction strategies of professional speech recognition users: Three profiles. *Computers in Human Behaviour, 26*, 964–975.

Leijten, M., Van Waes, L., Schriver, K., & Hayes, J. R. (2014). Writing in the workplace: Constructing documents using multiple digital sources. *Journal of Writing Research, 5*(3), 285–337.

Lindgren, E., Spelman Miller, K., & Sullivan, K. (2008). Development of fluency and revision in L1 and L2 writing in Swedish High School years eight and nine. ITL *International Journal of Applied Linguistics, 156*, 133–151.

Lindgren, E., Sullivan, K. P. H., Lindgren, U., & Spelman Miller, K. (2007). GIS for writing: applying geographical information systems techniques to data mine writings'cognitive processes. In M. Torrance, L. Van Waes, & D. Galbraith (Eds.), *Writing and cognition: Research and applications* (Vol. 20, pp. 83–96). Oxford, UK: Elsevier.

Lindgren, E., Sullivan, K. P. H., & Stevenson, M. (2008). Supporting the reflective language learner with computer keystroke logging. In B. Barber & F. Zhang (Eds.), *Handbook of research on computer enhanced language acquisition and learning* (pp. 189–204). Hershey, NY: Information Science Reference, IGI Global.

Maggio, S., Lété, B., Chenu, F., Jisa, H., & Fayol, M. (2012). Tracking the mind during writing: Immediacy, delayed, and anticipatory effects on pauses and writing rate. *Reading and Writing, 25*(9), 2131–2151.

Matsuhashi, A. (1981). Pausing and planning: The tempo of written discourse production. *Research in the Teaching of English, 15*(2), 113–134.

Olive, T. (2010). Methods, tools and techniques for the on-line study of the writing process. In N. L. Mertens (Ed.), *Writing: Processes, tools and techniques* (pp. 1–18). New York: Nova.

Olive, T., & Kellogg, R. T. (2002). Concurrent activation of high- and low-level production processes in written composition. *Memory and Cognition, 30*, 594–600.

Ortega, L., & Carson, J. G. (2010). Multicompetence, social context, and L2 writing research praxis. In T. Silva & P. K. Matsuda (Eds.), *Practicing theory in second language writing* (pp. 48–71). West Lafayette, IN: Parlor Press.

Perrin, D. (2013). *The linguistics of newswriting*. Amsterdam: John Benjamins.

Robert, I. S., & Van Waes, L. (2014). Selecting a translation revision procedure: Do common sense and statistics agree? *Perspectives: Studies in Translatology, 22*(3), 304–320.

Sabbaghan, S. (2013). How noticing is affected by replay of writing process during stimulated recall. *Procedia-Social and Behavioral Sciences, 83*, 629–633.

Schrijver, I. (2014). *The translator as a text producer: The effects of writing training on transediting and translation performance*. Antwerp, Belgium: University of Antwerp.

Schrijver, I., van Vaerenbergh, L., Leijten, M., & Van Waes, L. (2014). *The translator as a writer: Measuring the effect of writing skills on the translation product*. Bern, Switzerland: Peter Lang.

Schrijver, I., van Vaerenbergh, L., & Van Waes, L. (2012). An exploratory study of transediting in students' translation processes. *Hermes, 49*, 99–117.

Schriver, K. (2012). What we know about expertise in professional communication. In V. W. Berninger (Ed.), *Past, present, and future contributions of cognitive writing research to cognitive psychology* (pp. 275–312). New York: Psyhology Press.

Slattery, S. (2007). Undistributing work through writing: How technical writers manage texts in complex information environments. *Technical Communication Quarterly, 16*(3), 311–325.

Solé, I., Miras, M., Castells, N., Espino, S., & Minguela, M. (2013). Integrating information: An analysis of the processes involved and the products generated in a written synthesis task. *Written Communication, 30*(1), 63–90.

Sullivan, K. P. H., & Lindgren, E. (2002). Self-assessment in autonomous computer-aided L2 writing. *ELT Journal, 56*(3), 258–266.

Sumner, E., Connelly, V., & Barnett, A. (2014). The influence of spelling ability on handwriting production: Children with and without dyslexia. *Journal of Experimental Psychology: Learning Memory and Cognition, 40*(5), 1441–1447.

Swain, M. (2000). The output hypothesis and beyond: Mediating acquisition through collaborative dialogue. In J. P. Lantolf (Ed.), *Sociocultural theory and second language learning* (pp. 97–114). Oxford, UK: Oxford University Press.

Swerts, M. (1998). Filled pauses as markers of discourse structure. *Journal of Pragmatics, 30*(4), 485–496.

Tillema, M., van den Bergh, H., Rijlaarsdam, G., & Sanders, T. (2011). Relating self reports of writing behaviour and online task execution using a temporal model. *Metacognition and Learning, 6*(3), 229–253.

Van Horenbeeck, E., Pauwaert, T., Van Waes, L., & Leijten, M. (2012). *S-notation: S-notation markup rules* (Technical Report). Antwerp, Belgium: University of Antwerp.

Van Waes, L., & Leijten, M. (2010). *The dynamics of typing errors in text production.* Paper presented at the SIG Writing 2010, 12th International Conference of the Earli Special Interest Group on Writing, Heidelberg.

Van Waes, L., & Leijten, M. (2015). Fluency in writing: A multidimensional perspective on writing fluency applied to L1 and L2. *Computers and Composition: An International Journal, 37.*

Van Waes, L., Leijten, M., & Quinlan, T. (2010). Reading during sentence composing and error correction: A multilevel analysis of the influences of task complexity. *Reading and Writing, 23*(7), 803–834.

Van Waes, L., Leijten, M., Wengelin, Å., & Lindgren, E. (2012). Logging tools to study digital writing processes. In V. W. Berninger (Ed.), *Past, present, and future contributions of cognitive writing research to cognitive psychology* (pp. 507–533). New York: Taylor & Francis.

Van Waes, L., & Schellens, P. J. (2003). Writing profiles: The effect of the writing mode on pausing and revision patterns of experienced writers. *Journal of Pragmatics, 35*(6), 829–853.

Van Weijen, D., Van den Bergh, H., Rijlaarsdam, G., & Sanders, T. (2009). L1 use during L2 writing: An empirical study of a complex phenomenon. *Journal of Second Language Writing, 18*(4), 235–250.

Vygotsky, L. S. (1998). The problem of age *The collected works of LS Vygotsky* (Vol. 5, pp. 187–205).

Wallot, S., & Grabowski, J. (2013). Typewriting dynamics: What distinguishes simple from complex writing tasks? *Ecological Psychology, 25*(3), 267–280.

Wengelin, Å. (2002). *Text production in adults with reading and writing difficulties*. Unpublished manuscript, Göteborg University, Gothenburg, Sweden.

Wengelin, Å. (2006). Examining pauses in writing: Theories, methods and empirical data. In K. P. H. Sullivan & E. Lindgren (Eds.), *Computer key-stroke logging and writing: methods and applications* (Vol. 18, pp. 107–130). Oxford, UK: Elsevier.

Wengelin, Å. (2007). The word level focus in text production by adults with reading and writing difficulties. In D. Galbraith, M. Torrance & L. Van Waes (Eds.), *Writing and cognition*. Oxford, UK: Elsevier.

Wengelin, Å., Johansson, V., & Johansson, R. (2014). Expressive writing in Swedish 15-year-olds with reading and writing difficulties. In B. Arfé, J. Dockrell, & V. Berninger (Eds.), *Writing development in children with hearing loss, dyslexia or oral language problems* (pp. 244–256). New York: Oxford University Press.

Wengelin, Å., Torrance, M., Holmqvist, K., Simpson, S., Galbraith, D., Johansson, V., et al. (2009). Combined eye-tracking and keystroke-logging methods for studying cognitive processes in text production. *Behavior Research Methods, 41*(2), 337–351.

CHAPTER 28

Linguistic Analysis Tools

Pablo Pirnay-Dummer

Investigating writing is a very complex task with a multitude of different aspects. One reason for this complexity is that writing research often deals with the product of writing: text written in natural language. Text comes with a multitude of different features—choice of words, style, genre, messages, and goals. Approaching text systematically is challenging for any reader, even if the text is quite simple. A single and very simple sentence can have many meanings, some of them encoded into the text, others requiring specific or common world knowledge or even expertise of some kind to be unfolded to the reader. In typical reading, much of this happens implicitly. This implicit understanding is in fact one of the strengths of natural language (not even to begin to talk about all the different functions of communication in written speech). However, some research on writing needs a more in-depth analysis of all the different aspects of text. Linguistic analysis tools can help in two ways: They can facilitate routine word analysis, search, and context elicitation, and they can facilitate an ever deeper digging into micro- and macro-aspects of written text or spoken language. Automated computer-linguistic methods can help to identify recurring patterns both within and between those parts. These patterns can be as simple as the use of single words or as complex as particular phrase structures in the context of others, for example, the use of the adverbial phrase “literally speaking,” which can express a surprise, point out a metaphor or the metaphor’s relation to its literal counterpart, underline a certain meaning, exclude a certain meaning, and many more, depending on the context.

Linguistic tools can help reduce the complexity of the process of analysis to increase the complexity of research questions that can be answered. Single linguistic analysis tools can only very rarely (if at all) constitute the whole analysis necessary for conducting research on writing, but they can help, sometimes tremendously, with the task.

Figure 28.1 shows some of the possible constituents of research on writing in relation to the research object: text. All the metafunctions of writing and their processes, including the audience (readers) and all the processes involved, can be part of writing research, including but never limited to entertaining, remembering, learning, teaching, informing, communicating in any sense, reflecting, arguing, and persuading. From this point, I assume that the subject of research can be anything from text, the writer, the writing process, all of its metafunctions, or the subsequent audience of the text—or anything else connected with writing. The object of the research is, however, always text, and the goal of the analysis is its description and comparison.

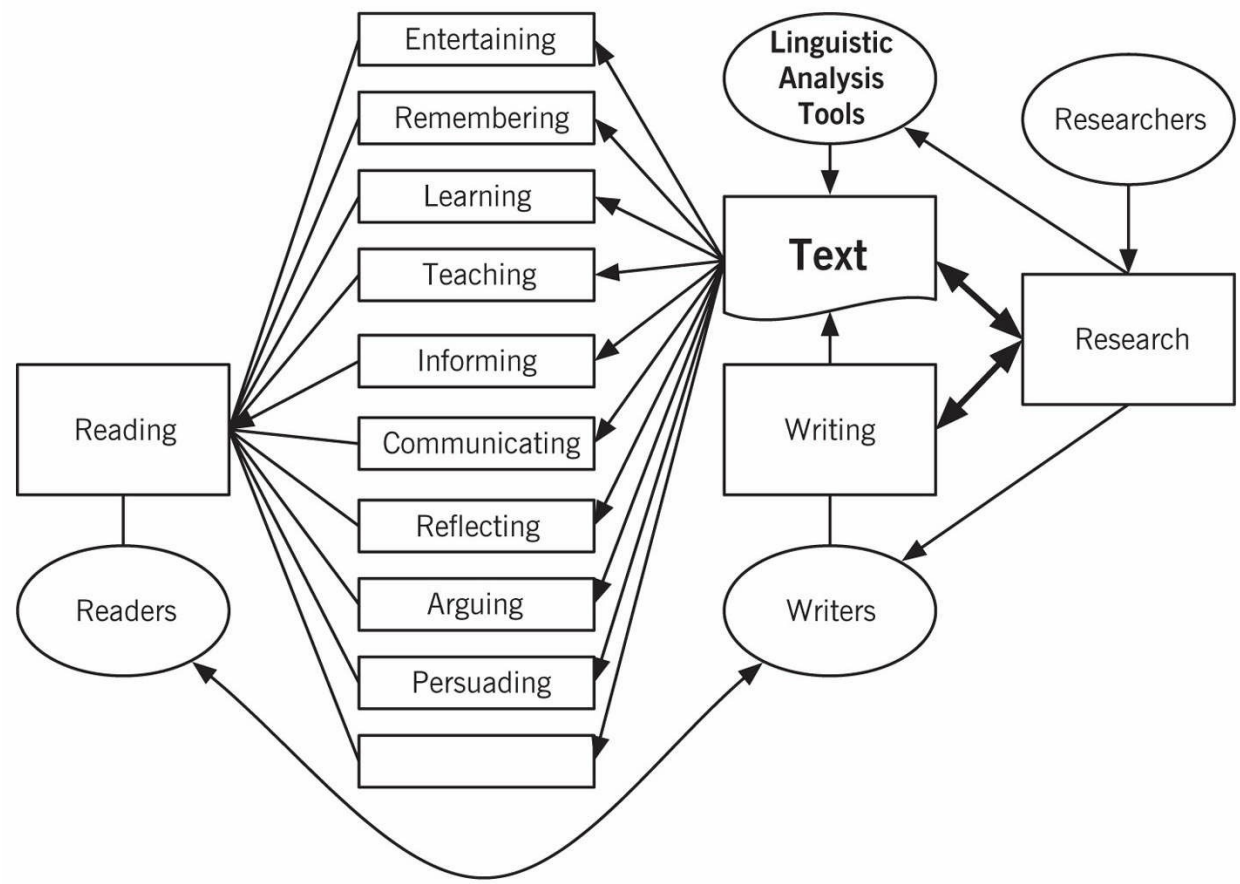


FIGURE 28.1. Constituents and ranges of writing research.

Large numbers of both simple, focused tools and more complex tools are available to perform a variety of linguistic analysis tasks, and many more are emerging, along with technology, computer science, and methodology from the social sciences. Most of the modern tools come from computer linguistics and related fields. It is not possible to discuss more than a few of them in this chapter. Therefore, I have selected a few across different linguistic areas as well as across well-established and emerging technologies, with the goal of introducing some of the key concepts, terminology, and tools in the fascinating field of linguistic analysis of writing. The linguistic tools described in this chapter will help with the analysis of text alone. However, this linguistic analysis can support understanding aspects of writing beyond the text, including learning, knowledge, understanding, and many more.

TASKS AND OTHER REASONS TO WRITE

One very important methodological prerequisite for linguistically analyzing text content is knowing the reason why a person writes a text. In field research, it is important to know and track why a text was written. Moreover, if one wishes to compare different texts to each other later on, it is important that the texts have either been written under highly similar circumstances, including the reason to write, or that these aspects are controlled for. Especially with higher-order semantic analysis, uncontrolled reasons to write can and will produce standard errors if quantitative comparison measures are implemented.

Essentially, the “just write something about X approach” would not work. Known or unknown to us, texts will

always have a target for the writer. The target is who the text is for and who is supposed to read and understand it later on. This can, of course, be the writer him- or herself. If there is no target, the writer may still produce content, but any fuzzy understanding he or she may create to make the content meaningful will be created by the context of the task or reason. Within an experiment, the subjects may write very little, just enough to fulfill the task. Within graded assessment, they may write what they believe somebody wants to read, or they may follow the assumption that associating as many ideas as possible with the topic will lead to the impression that they just know a lot—although this approach may lead to digressions and very little coherence.

Before linguistic analysis tools are applied to text, researchers should make sure that the tasks or reasons are known and, in cases of comparison, controlled for. Specific research questions may of course lead to more prerequisites.

INDICES FOR READABILITY

The easiest point of entry for analyzing text with linguistic tools is to look for readability indices. They can be applied easily to any digitally available text to estimate the ease of reading. Their theoretical foundation has been around for quite some time (Flesch, 1948; Klare, 1975). Traditional metrics compute singular estimates of readability by using measures such as lengths of words, number of syllables per word, and lengths of sentences, or number of parentheses within a text. New developments in readability improve on the traditional metrics by including measures that refer to the function of words (e.g., number of conjunctions) and vocabulary diversity. They also add cognitive access and discourse measures to complement the surface-level linguistic features (i.e., counting the occurrence and co-occurrence of things), and may automatically or semiautomatically estimate cohesion (Crossley, Greenfield, & McNamara, 2008).

Cognitive access is the likelihood that a text resembles the language use of a target group: If the language use is similar to the commonly used language of a target group (e.g., ways to bind sentences, use of common terms, types of explanation of terms), then it is considered to be easier to read by this group. For instance, a text written in a style and use of language comparable to a newspaper will be easier to access by readers of newspapers. In contrast to that, people who rarely read (although capable) and usually listen to the radio or watch TV instead will have more difficulties reading the text. And vice versa: Text that is written in a storyline style (e.g., with shorter sentences, fewer synonyms, and smaller paragraphs and slightly more redundancy) will be better accessed by people who are used to listening to the radio. For newspaper readers, the radio would be less easy to access.

Discourse measures represent ways that functional entities refer to each other. A functional entity can, for instance, consist of three sentences that present an argument, and a following functional entity can then react to that argument by a counterargument or give an example. For some purposes and audiences, it may be easier to present smaller bits of arguments and counterarguments iteratively within a chapter. In other contexts, it may be easier to first present one side completely, and then the other. The impression that either style makes can also differ due to the reader's expectations: If the reader expects the short, iterative style for some reason, he or she may reject the contents of the whole essay just because it seems less readable or accessible. If the reader expects examples after each argument directly, he or she may be disappointed (or "somehow lost") when they can only be found in a later paragraph. At the same time, more philosophically trained readers could reject the small iterations because they would expect the whole model of the argument first before any clarifying ("disturbing") example.

Cohesion describes if and how parts of the texts are bound together to allow for an integrated understanding of the text. Sentences have a meaning by themselves, but they are also bound to each other. Cohesion can be created

grammatically and lexically. Grammatical cohesion is created by substitutions (like pronouns) that help to refer subjects and objects between sentences: “The teacher had a bad mood. She went outside” has more cohesion than: “The teacher had a bad mood. The cat went outside.” It can also be created by ellipses: “What are you carrying behind your back? Nothing” has more cohesion than “What are you carrying behind your back? Your attitude,” where “nothing” stands for “I am carrying nothing” and binds the two parts together. Other ways to create cohesion between sentences are to use transitions such as “hence, however, consequently, thus, moreover, in fact,” which grammatically have the function of conjunctions. There are also more complex grammatical cohesion elements where function and context are bound together—for instance, in “Curiously she looked in the box. Nothing happened.” In fact, “nothing happened” refers to the contextual expectation of the reader and binds it to the situation. From “She tied her shoes. Nothing happened” (which does not work as well), we can see that this cohesion is not syntactical but contextual. In traditional and automated coherence measures, only syntactical and grammatical information can currently be processed. Contextual and more complex grammatical cohesion is not algorithmically solved.

Cohesion is an important and yet comparably easy way to find aspects of coherence. Coherence is the means of language to create the overall impression that a text is meaningful to a reader. Coherence also binds parts of meaning to each other. Currently, linguistic tools can automatically access only parts of cohesion.

A package for the statistical software *R* (R Core Team, 2014) called “koRpus” (Michalke, 2014) includes most of the currently existing readability indices. It can also connect to a common word tagger, which I will explain later on.

The scope of use for readability indices ranges from providing feedback on writing to estimating the necessary reading skills of the target audience. Ease of access is, however, not the only feature of text to consider. More complex texts can very well have better effects, for instance, for learning. If a text has an appropriate readability index compared to the language use of a reference group, it can shed light into questions like: “When and why will a rater (e.g., a peer reviewer) find a text acceptable?” “Can (bad) readability get into the way of exploring content of text (because peers judge implicitly)?” “Can aiming at a better readability score help writers to be more accepted/better understood?.”

CONCORDING

Concording is a term from corpus linguistics and is strongly connected to that particular linguistic approach. A corpus is a (usually large) set of texts that represent a certain use and type of language—for instance, all issues of a daily newspaper from the last 30 years. The way in which language is used in such a corpus allows corpus linguists to descriptively derive aspects of language use and also how it changes over time. Concording is a methodological approach that shows the frequencies of words in a corpus and their most frequent contexts of use (e.g., common neighboring words).

Corpus linguistic tools usually go beyond simple frequency analysis to help with structuring and finding the occurrences and contexts of word forms, words, word stems, or other parts of speech in digital linguistic corpora. Essentially, they help with finding multiple contexts of similar things within a text, making it possible to search for their use within and between different texts. They also help with filtering the search in many ways (e.g., word context, excluding specific inflections) to narrow down the search in larger corpora. This process is called concordance (text searching).

There is specific software for working with specifically formatted digital corpora, but there is also generic software that can handle any plain text sources for analysis. A good place to start is WordSmith (Scott, 2012) or

MonoConc Pro (Barlow, 2000), probably two of the most popular software products around. See Wiechmann and Fuhs (2006) for more examples of software and a wider overview.

Concordance tools are interesting to look at when one is particularly interested in the specific use of language, phrasing, word contexts, or word use. This could be the case if a misconception appears repeatedly in different parts of a text or if a term is usually accompanied by specific (or many) adjectives that may hold clues for emotional connotation—for instance, if "risk" is very often accompanied by "unnecessary" and "necessary" in different parts of an essay. In writing research, concordance tools can help if the context of word use or overall use of language has to be explored, for instance, in questions such as, "How does a particular group or subsample express the ideas? Do they use different terms for the same thing? Do they use different metaphors or a different style?" A concordance tool will then help to discover patterns within the writing either within or between different groups. The tools will not fulfill this task automatically. The researcher will have to search the surroundings of a word, a syllable, or an idiom and derive conclusions from the findings, maybe by discovering patterns. This is essentially what corpus linguists do, but with a focus on a specific set of texts, perhaps from a specific task assigned to a specific group of writers (or a specific writing occasion).

TOOLS FOR QUALITATIVE DATA ANALYSIS

As a way to follow up on finding interesting aspects in a text, it can make sense to annotate the interpretation of the linguistic treasures one has found and also to view the aforementioned aspects in the context of the individual text. Sometimes a more in-depth analysis requires a qualitative and completely human-centered, subjective interpretation of a text's meanings and the meanings of its parts. For pure qualitative analysis, there is no way around text on text, meaning that the interpretation is preserved by writing and no aggregation of the result is possible (for a good account of different paradigms, see Hennink, Hutter, & Bailey, 2011). However, in many cases, research that started out qualitatively may find converging aspects that create context within and between texts. As soon as they are aggregated in terms of hierarchy, taxonomy, co-occurrence, differences, and many other possible referencing techniques, the aggregation itself leads to quantitative methods—even if only that categories and subcategories are counted in some way, for example, by way of qualitative content analysis (Schreier, 2012). Hence, it may still make sense to quantify some of the subjective views from pure qualitative research. Linguistic tools that basically allow multiple-source handling, annotation, and different quantitative coding referring to the meaning of text parts are not very different from concording at the first sight. However, the metalevel of interpretation makes the difference. The tools (like QDA, Atlas, NVivo) are not strictly linguistic tools, but as strong annotators and data management software, they help with a key linguistic problem: aggregating things that are alike or different in text. Key functions of modern software include planning and project management, help with memos, reading, highlighting, commenting, and basic concording, guidance through coding to find similarities and differences (for aggregation), and assistance with organizing the data and with general output (for an overview, see Lewins & Silver, 2014).

Qualitative data analysis tools are interesting to look at, but aggregation is required to handle more complex content analysis of larger qualitative datasets. Most modern tools possess many features also inherited by concordance tools. The main difference is in the rich possibilities to annotate the findings right where they are discovered by using the functions that are built for creating categories, and also to account for multiple perspectives by different reviewers. Technically, this is the same procedure as the one used with classical qualitative categorical content analysis. The focus of the coding, however, lies more on the use of language. So, what is the difference? The traditional categories of a postqualitative analysis refer to what is meant. A linguistic analysis using the same tools

would focus on how it is written, how the language is built, and how things relate within the text, thus allowing a different scope, that is, to search for general ways that writers encode their thought to text.

MINING THE SYNTAX: TAGGING AND PARSING

Analyzing the syntax can help in many ways. It is possible but very labor intensive to analyze syntax by hand. Syntax can be reconstructed by computer-linguistic means. First, word forms are identified, usually by a mix of rule- and lexicon-based approaches (Brill, 1995) to keep the necessary digital lexicon small. The lexicon and rules are both language-dependent, while the underlying principles of tagging are universal. Tagging places tags for the word forms at the words so that a machine would have access to information on whether a word is a verb, a noun, or something else. Here is a small example:

1. The chickens are in the barn.

Its tagged counterpart would look like this (using the Brill Tagger by Brill, 1995):

2. The/DT chickens/NNS are/VBP in/IN the/DT barn/NN.

The parser first detects the determiner (DT), then it detects a plural noun (NNS), a specific verb (VBP: be, present, not in third person), a preposition (IN), another determiner, and another noun. “Be,” “Do,” and “Have” have specific tags, whereas all other verbs are only tagged according to their function (tense, gerunds, participles).

The word forms themselves can afford insight into someone’s writing. Are there many adjectives (which may be an indicator for connotations or meanings that show how subjects contextualize or feel about the objects described)? Are there many conjunctions (perhaps a hint concerning a text’s coherence)? Usually, the word forms will not directly point at higher functions, but their combination may be interesting for predicting higher text functions, especially if the context of a word repeatedly binds specific forms. For instance, a particular noun might “attract” many adjectives or a specific one very often: If the barn in the example presented above were instead often called a “cold” or “cruel” barn, then this would not only say something about the barn but also about the text, maybe even its pragmatics, given the context. With a parser, the tagged words are bound together to form sentence trees. The kind of sentence structure tree produced depends on the parser. Coming directly from a parser, it looks like the following syntax tree produced by the Stanford Parser (see Socher, Bauer, Manning, & Ng, 2013).

```
(ROOT
(S
    (NP (DT The) (NNS chickens))
    (VP (VBP are)
      (PP (IN in)
        (NP (DT the) (NN barn))))
    (. .)))
```

This simple example illustrates how a parser not only creates the hierarchy of the sentence but also adds more syntactic functions that are not represented by words directly: The preposition has its own structural phrase position (because it could also hold a phrase), which is not visible as a word but only as an important part of the sentence structure and is then instantiated by IN (used for the actual preposition or in other cases also for a subordinating conjunction).

If it is going to be used directly for analysis, it may be better to transform the sentence tree into a graph. Figure 28.2 shows a sentence tree for the example. How the sentence structure is used further depends on the methodology one is using. It can, for instance, be interesting to see which concepts the verb binds. Determining whether similar or identical concepts are bound repeatedly throughout one or more texts can shed light into their representation.

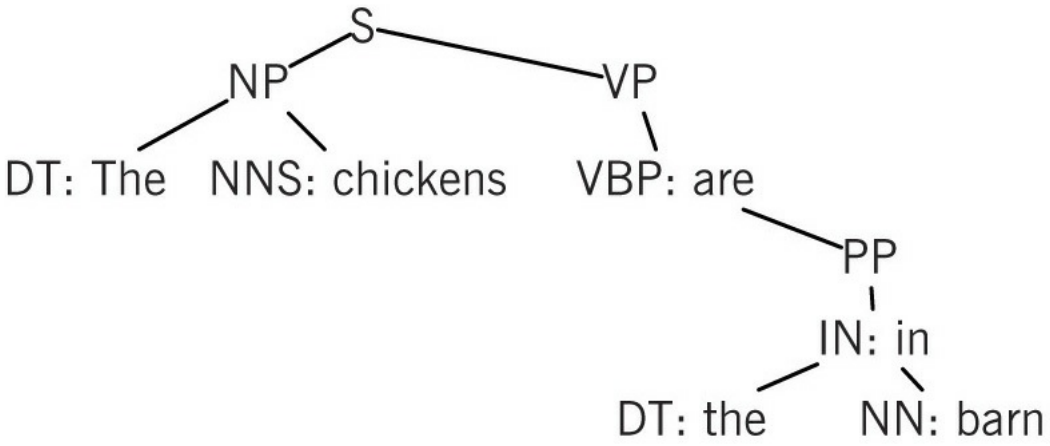


FIGURE 28.2. Graphical representation of a sentence tree.

In research on writing it may in rare cases be of interest to look at parser results directly. Mining the syntax is a complex process to conduct, and not so many research projects will go through the trouble. However, if writing experts know what to look for in texts to categorize the writing into higher functions by observing lower syntactic features, it may help to shorten the analysis, which would otherwise need labor-intensive manual analysis because it may neither be possible due to a common lack of resources nor necessary due to the dependence of some of the common research questions on syntax and semantics.

Of course, looking at the syntax is mandatory if the use of syntax is the key aspect of the writing research in question. In this case, an automated reconstruction of the syntax could make the individual rating and multiple coding of the proper use of syntax or the type or style of the writing unnecessary (Rauh, Pirnay-Dummer, & Roeder, 2009). Also, the following, more elaborate automated tools all have to start with looking at the syntax somehow—at least to see what is in the neighborhood of something.

AUTOMATED SEMANTIC ANALYSIS

Semantic analysis focuses on what a text *is about* as opposed to how it is built. It looks at ways to analyze the meaning of the text, and some of the tools provide the means to separate the meaning from everything else, thus trying to aggregate the sense only. A badly written text may have the same meaning as a well-written text, although the relation between meaning and other aspects of text quality will correlate in most real examples. In a way, semantic analysis is the researcher's quest to access what could be poetically described as "frozen thought" because it is "frozen" by the writer into the text. That initial mental model of the writer is externalized within the writing

process and encoded into text. There is, however, no way to just represent thought. In fact, during writing the thoughts must be carefully sequenced. And readers must decode the same material but only by using their own thought and experiences. To conduct semantic analysis with linguistic tools means to translate the meaning of a text from natural language into other, more formal representations that are easier to measure and aggregate: semantic structures. What these structures look like and how they are built up depends on the tool and methodology that is used. Note that these structures are essentially different from sentence trees. They capture semantic relations rather than syntactic ones.

Automated tools exploit the fact that syntax and semantics are not independent and the specific ways in which they are not independent (Anderson, 2006; Fanselow & Felix, 1990). Thus, most languages commonly make use of specific sequentialization patterns to bind different kinds of things (Bach, 1989) together in a meaningful way (Chomsky, 1981; Haegeman, 2009). The first step for all fully automated tools is to translate a given text into a graph or graph-like structure that most of the time represents some kind of a network (see graph theory, e.g., Tittmann, 2010).

A graph is a set of nodes and links. The nodes represent anything that can be connected in a meaningful way. What can be connected meaningfully depends on the domain and purpose of the content. For most methods, these are nouns (see Figure 28.3). The links represent relations between the nodes. The relations can be simple (just existing), named ("part of," "leads to," "consists of," "is a." "causes") or quantified—for example, how strongly connected two concepts are. The latter is called the level of association, but this does not represent how similar two concepts are. If we build up a model by firefighters or, say, for alchemists in a fantasy novel, "fire" and "water" could be very closely associated—although of course for different reasons. A graph that fully represents levels of associations between its nodes is also often called a pathfinder network because paths of the strongest relations can be traced within such a graph by following the strongest links. Most of the output of the semantic tools available is compatible with pathfinder networks if it fulfills the requirement to create a level of association—that is, some kind of a meaningful weight between words (Schvaneveldt, 1990; Schvaneveldt & Cohen, 2010).

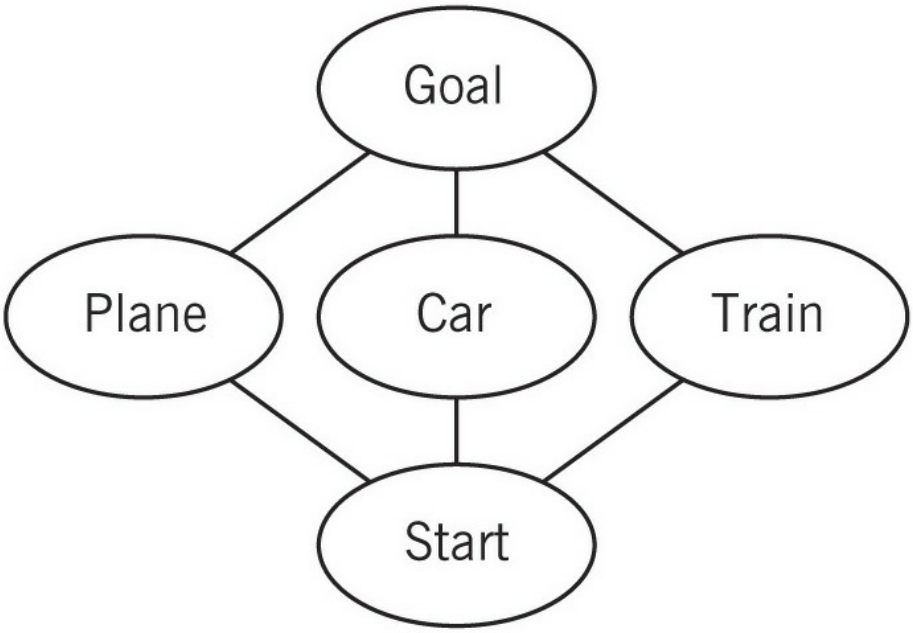


FIGURE 28.3. Example of a simple graph structure.

How the level of association is calculated differs tremendously between the available methodologies. Researchers have to take great care to pick the right tool for their research question.

Such a structure generically connects things to other things in a given functional way (e.g., through propositions, word associations, causal relations, or any other kind of relation). Graphs can be represented graphically as in Figure 28.3, but their essential point is not so much their picture derivate but their data structure, which also makes the comparison of two or more of such structures very easy.

Latent Semantic Analysis

Latent semantic analysis (LSA) uses corpus-linguistic methods to compute semantic relations between words (Deerwester, Dumais, Landauer, Furnas, & Harshman, 1990). It comes with algorithms to detect synonymy (words that mean the same in the context) and polysemy (words that have multiple related meanings), for instance, "bed" can be something to sleep in or what a stream lies on. LSA needs a large corpus that represents roughly the same area of expertise in which the individual writing should be categorized and analyzed. If such a corpus is available (and it usually is for most of the K–12 topics), LSA is a very easy way to find even complex semantic similarities on the basis of words that co-occur in texts. LSA can find semantically similar documents to the one it analyzed from its corpus, compare relations between terms, and analyze if they fit the relations within its corpus or find semantically matching documents by search terms. Within writing research, LSA can help to answer questions such as, "How well does that text semantically match with common K–12 knowledge?", "How related are the most frequent terms used by a specific writer in common K–12 knowledge?" In general, LSA can provide similarities of a specific document to its corpus.

As a downside, the more specialized an expertise gets, the less likely it will be that a fitting reference-corpus is available, making the tool less accurate (Pirnay-Dummer & Walter, 2009). This does not at all reduce the validity of the tool but requires substantial resources to create a fitting corpus first.

Text-Model Inspection Trace of Concepts and Relations

Text-Model Inspection Trace of Concepts and Relations (T-MITOCAR) is a heuristic that uses the syntax trees of a whole text to exploit the fact that the main verb of a sentence *usually* binds things that are also more closely related conceptually within the syntax, at least in commonly used language.

Text is analyzed on a graph, similar to a concept map or a pathfinder network (Pirnay-Dummer & Spector, 2008; Pirnay-Dummer & Ifenthaler, 2010). The T-MITOCAR software can graphically represent and visualize any text of a certain length.

Figure 28.4 shows a graphical representation of the T-MITOCAR analysis. It was constructed by analyzing the concording section of this chapter automatically by T-MITOCAR. The software uses GraphViz (Ellson, Gansner, Koutsofios, North, & Woodhull, 2003) to visualize the graphs. The graphs from T-MITOCAR have also been successfully used to facilitate and inform ongoing writing processes, where the writers received an immediate viszualization of their incomplete work during coaching sessions on writing (Pirnay-Dummer & Rohde, 2009).

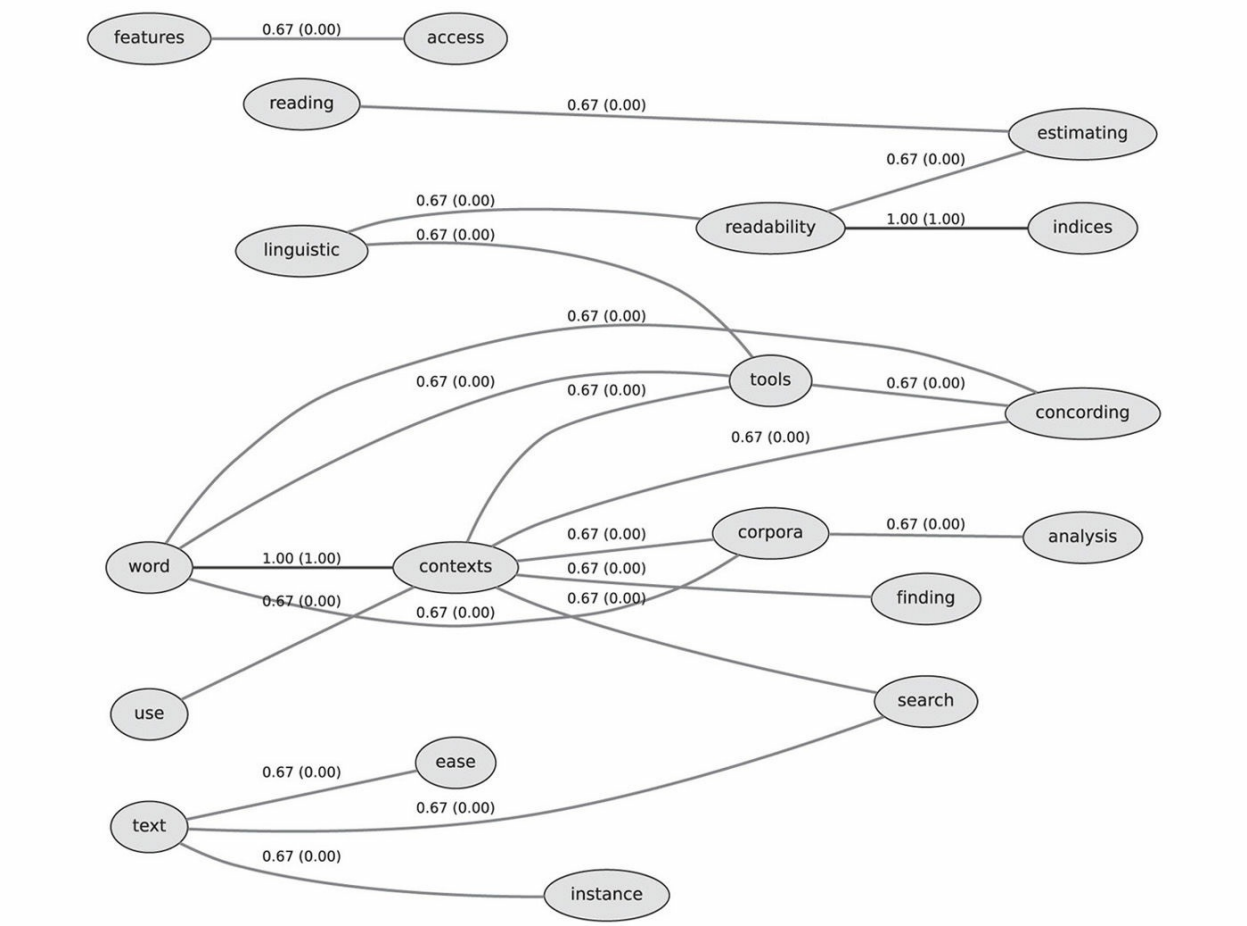


FIGURE 28.4. Graphical representation of a T-MITOCAR association network.

T-MITOCAR tracks the level of association between concepts from a text. At the links are measures of association as weights between 0 and 1. One stands for the strongest association within the text, and zero stands for no association. Within the parentheses is a linear transformation of the same value, so that the weakest links that still made it to the graph show a zero and the strongest show a one. In Figure 28.4 there are only two layers of association (1, the strongest layer and .67 the second strongest). At least one layer is always omitted (the weakest), so that no "random associations" are represented. Of course, nonassociations do not get represented, so there will be no value outside of the parentheses that shows zero. The underlying principle does not necessarily work within single sentences, since syntax is more expressive and complex. But texts that contain 350 or more words can be used to generate associative networks as graphs from text, and the heuristic becomes stable at this point because of redundancies in commonly used language. The representation process is carried out automatically in multiple computer-linguistic stages, which do not require any manual interaction or coding by the researchers using the tool. Nor do they require the researcher to have any of the expertise under investigation. In contrast to the LSA methods, no fitting corpus is needed; the algorithms work with the text alone.

T-MITOCAR can be used to extract the semantic model from a text. The graphic itself can help with analysis of what the text means or any kind of clustering (including building categories from the represented networks). Within the section "Formats of Comparison and Scoring," I also give an overview on how to compare the resulting graphs quantitatively—to search for semantic and structural similarity between texts. Comparison measures are also built

into the original T-MITOCAR software. With both the computer linguistic analysis and the comparison option, the software can help to address questions such as the following. For instance, within a class of journalist apprentices, we could investigate how much content of the original message finds its way into a report. To do this investigation, I would compare each text written by the apprentices during a given time to the original message given to them. Additionally, I would compare their results to some examples written by job veterans. The result could inform the instructors how well the class is doing compared to the beginning, help to give specific content-related feedback to the writers, for example, by using the graphical representation of their writing, and compare it to one of the veterans' models. Textbooks can be used as reference models if students write several essay assignments over time. Depending on the goal of the class, a convergence toward the textbook model or a divergence may be intended. Also, within-group homogeneity of the meanings within their texts can be interesting to look at: Do they all write about the same thing, or do they write about very different aspects? Both convergence and divergence can be tracked by similarity measures (see "Formats of Comparison and Scoring" for details). In general, T-MITOCAR can help with every application where the semantic model of a text can be helpful and where texts should be compared for their semantic and structural similarity.

The tool is also embedded in the AKOVIA (Automated Knowledge Visualization and Assessment) framework (Pirnay-Dummer & Ifenthaler, 2010) or in HIMATT (Highly Integrated Model Assessment Tools and Technology (Pirnay-Dummer, Ifenthaler, & Spector, 2010) after being cross-validated with the other tools of the framework (Johnson, O'Connor, Spector, Ifenthaler, & Pirnay-Dummer, 2006). A standalone version of the tool itself and the integrated frameworks are kept free of charge for noncommercial research projects and are accessible by request on online-platforms to run independently on all conceivable platforms that can run a browser.

Analysis of Lexical Aggregates Reader

The Analysis of Lexical Aggregates (ALA) Reader (Clariana, 2005) is a linguistic tool for Microsoft Windows with a similar purpose to T-MITOCAR but a different approach. It uses a list of up to 30 search terms provided by the researcher to create a proximity file from any text of up to 30 sentences written in English. Although never cross-validated with T-MITOCAR, it seems that the preset list helps make the output model more precise, leading to more focused and more precise results. But the researchers will have to work with content experts to obtain a precise list, which is manageable compared to the efforts of creating a fitting corpus for LSA.

The sentences must be split into one sentence a line, and meta-information on the document must be provided within each file. The resulting proximity files can be visualized by another program called Pathfinder KNOT, which is distributed free of charge by Interlink. The representations look similar to the one shown in Figure 28.4, just without the ellipses. Additionally, the ALA Reader provides a file interface that allows the results to be imported into CMAP, a commonly used concept-mapping tool (see Cañas et al., 2004). This permits a variety of applications for the technology, for instance, to give writers something to conceptually "play with." The proximity files can be analyzed and scored for their similarities to measures that have been developed to score concept maps (Taricani & Clariana, 2006)—for example, the use of words and the centrality of concepts (Clariana, Engelmann, & Yu, 2013).

Applications for the ALA reader are very similar to the ones for T-MITOCAR. Only the focus shifts a bit. With the ALA reader, researchers need a preconcept of what to search for. This makes the analysis a bit more precise, but aspects that are not specifically searched for will not be found. A combination is also thinkable where I would first perform a T-MITOCAR analysis, and once I have the terms and once I know they are used homogeneously, I could run the ALA reader to add more precision to the clustering or similarity.

Local Semantic Trace

The Local Semantic Trace (LoST; Pirnay-Dummer, 2015) is a quasi-propositional structure that can be reconstructed from written content that is incomplete or does not follow a proper grammar. It can also retrace bits of knowledge from text that contains only very few words, making the microstructure of such artifacts of knowledge externalization available for automated analysis and comparison. LoST was built to track knowledge and understanding in contexts that contain small pieces of speech, such as discussion boards, chats, forums, or other discourse, with very small amounts of text.

LoST heuristically searches for things that are bound closely without having to reconstruct sentence structures and maps them on a sequence (chains of words), similar to what we do while listening. The sequence does not resemble any sentence structure but just the simple chain of events within the speech. The looser the grammar and the shorter the sentences, the closer the associations needed to become in order to have a chance of being understood by someone. Instead of an entire network graph (association network), it just constructs a sequence that can be further analyzed and compared. Within these boundaries, LoST can use the sequences to compare them to predefined expert structures or other model solutions, for instance, a selection of the best student texts. The tool is currently still in its beta phase but will be available under conditions similar to those of T-MITOCAR after more testing and cross-validation. In its initial validation study, it has been successfully tested for algorithmic stability on 310 different topics from five different domains and different sources (Pirnay-Dummer, 2015).

Using the LoST tool is quite simple. It first needs at least one reference model for comparison with the individual texts. The reference model consists of a list of word-pair associations (association table), which need to be provided by an expert. It is a search pattern that looks for similar associations within all the individual texts. The second part of the model is the synonym register, which also needs to be constructed by the expert. Every word in the word-pair list can have a number of synonyms that will be treated equally when LoST searches the texts. Both tables are provided within a single Excel® file. The first tab contains the association table, and the second tab contains the synonym register. English and German are implemented in the current version. The data can be provided as a single plain-text file per text unit or within a single Excel® File: Either way, LoST will output an Excel® file with each case in a separate line containing similarity measures on how well the written text matches the provided expert model.

With larger sample sizes that contain less text per individual or per writing situation and in which the text features cannot be aggregated through analysis of the group rather than the individual, the before-mentioned methodologies cannot find traces of knowledge.

Methods of the Semantic Web

The semantic web is a class of tools, technologies, and algorithmic methods to associate meaning with a vast amount of partial standardized data—that is, to base some of machine performance on meaning. The web ontology is a metaphor that comes from the classic ontology from the Greek word ντοϙο (on'-toce), which stands for "of being," for *all that is* (the *onte*) is the product (as data) from the semantic web technologies and serves at the same time as a reasoning basis to support knowledge and decision making within humans and machines (Pirnay-Dummer, 2012). The reference to the *onte* comes from the vision that eventually such databases become so rich and multidimensional that they contain almost everything there is to know (the better term would be "everything there is to refer to"). It usually contains a vast amount of aggregated relational content.

Methods of the semantic web (Davies, Studer, & Warren, 2006; Maedche, Pekar, & Staab, 2002), particularly

those that help to automatically create web ontologies, can be suited to supporting large-scale research on writing. The methods require large amounts of text, and they are not fully automated. Essentially, they do something similar to the ALA Reader or T-MITOCAR: They create machine-readable content from text and meta-information. If some effort is spent on creation, machine-learning algorithms can take over some of the work of further constructing the ontology. Before an ontology is created, it may make sense to use the semantic web search engine "Swoogle" (Ebiquity Group at UMBC, 2007). Even if there is no fitting ontology, browsing through them may also help with planning to build one.

There are tools for searching within the large mass of resulting hierarchical data, tools that help to edit and maintain large ontologies, extractors for metadata, databases, authoring tools, and machine-learning tools (Allemang & Hendler, 2012). Because the database for the ontology is usually very large, it opens access to tools that can make deductions from the data while the results are not strictly *in* the data. These tools are called reasoners. This is something that smaller datasets and tools cannot hope to achieve and may open a very interesting gate to research on writing. In larger research projects, ontologies could be used to cluster texts for their content, writing style, kind of opinion, rationale, world-view, and belief. In short: ontologies may help to identify how texts semantically connect to large amounts of already existing text and thus help to find out how a text is like in comparison to what is already written.

As yet, however, neither tools nor methods are available to automatically carry out such a data analysis. Using a web ontology as a means of comparison for writing would currently require manual search. The methods of the Semantic Web could also help to aggregate large datasets (that contain text) where tools that aim at small to medium sample sizes (n < 100,000) are not feasible or would take up too much computing time (e.g., T-MITOCAR or the ALA reader).

FORMATS OF COMPARISON AND SCORING

So far, I have introduced various tools that can re-create semantics and structure from text in aggregated or a more formal (and therefore machine-readable) way (e.g., ALA reader, T-MITOCAR, web ontologies). One way or another, whether research questions address learning, expertise, convergence, or divergence, measures of comparison are needed to find out how similar two writings are; how essays and expressed thought change over time; and how much content is conveyed from one source (e.g., message) to another (e.g., reporting). For comparison, either a reference model or a set of observable criteria can be manually applied to a text.

On the less automated side, rubrics of criteria could help with the comparison. They can postulate a single dimension (e.g., for grading) or several. In more complex settings for analysis, a single criterion can be fulfilled in more than one way. For instance, the formation of a proper rationale within an essay can be fulfilled in different ways. It can be presented hierarchically, sequentially, or dialectically with embedded arguments and counterarguments, or in many other ways. Hence, scoring by using such a criterion is different from a test scale, where a sum or a mean would suffice. In such cases, we score the best hit: Whichever subcriterion scores higher would then constitute the value criteria. Obviously, subscoring every criterion is very labor intensive and requires a lot of both interpretation and expertise. But even with highly experienced raters and with criteria that are clearly observable, such approaches have always come with objectivity issues. Some research goals may require less objectivity, but for grading or scoring any kind of outcome, a lack of objectivity would prevent the results from being transferable to any other situation—or worse, to any other observer.

On the more automated side, similarities between co-occurrences of words or linguistic functions and/or

structures are usually compared between two texts. The co-occurrences form a model structure, and most of the time this is a graph or a graph-like structure. Features of such structures can then be assessed by looking at sets of identical versus differing features of two graphs (like the resulting models of the ALA reader or T-MITOCAR) and by calculating similarity by set theory (Tversky, 1977). Alternatively, they can be assessed by comparing frequencies of occurrences, for example, the number of links and co-occurrences, such as the number of matching neighbors (Pirnay-Dummer & Ifenthaler, 2010).

For more complex research questions that aim at the structure of expertise, emerging algorithms can analyze substructure—for instance, to find out whether the microstructures of two texts represent similar knowledge structures (Pirnay-Dummer, 2010; Schvaneveldt et al., 1985). All the tools produce some kind of a similarity index, which measures how alike two texts are with regard to a certain aspect, such as readability, the use of nouns or adjectives, the features of knowledge structure (centrality of certain concepts), or semantics (similarity of propositions within a knowledge structure). For instance, between writing samples on the same topic over time by the same individual (e.g., a graded assignment) that are analyzed by T-MITOCAR for their semantic model (see Figure 28.4), there could be a change in terms (over time) while the structure stays about the same. This could be an indicator for an individual who adopts the jargon of a domain but stays on the same level of understanding. Another individual could have reverse results: The terms stay the same, but the structure changes strongly. This could represent a restructuring of thought by the individual. The first one would yield a change of used terms over time, while the second one would both change structure and propositions (the way things are associated) but stay about the same as regards the terms he or she uses.

Obviously, there is not a single similarity measure nor a single score that determines whether a text is good. Scoring text for its quality or for reaching certain goals is always a multidimensional task. Throughout this chapter, I have sometimes referred to comparison. It is not uncommon in research to use outside criteria to determine whether somebody writes more like an expert or produces a more similar semantic structure. But in writing, goals can also be on the other end: Fostering diversity in writing would lead to a focus on increasing variance over time. For both goals, similarity measures can reveal what happens over time.

Combinations of these measures can predict variables within and outside of the text. Outside variables may include aspects of learning, transfer in writing or in reasoning, or many more. Inside variables, on the other hand, may predict more abstract features of the text to a certain level, which would otherwise only be interpretable by human raters. Autoscoring is only a very small part. Preclustering many texts, for instance, into more and less problematic ones, and providing feedback to writers or instructors on the basis of this clustering could also help direct attention to the right sources. The compositionality of language—that is, building more complex things out of very simple blocks over and over again even up to the semantics (Partee, 2004)—supports this assumption. But this is also a field in which more research has to be conducted and new emerging technologies are needed.

Still, it is important to stress that in all of these approaches it is not the texts themselves that are compared but rather features of the text—either easily accessible features of the text (such as word counts, word forms, word and paragraph lengths) or more complex features of aggregates of the text (such as pathfinder networks, association networks, ontologies). On the other hand, they provide a fast means of (pre-) analyzing data in multiple ways. Most of the above-mentioned methods for automated semantic analysis come with some comparison algorithms that fit their methodology. In the selection of the linguistic analysis tools, the type and availability of comparison should play a role in the decision-making process.

OPEN ENDINGS

The objectivity of human interpretation is an open ending that cannot be solved. Objectivity may be increased by connecting criteria to aspects of text that are more observable. But particularly for qualitative research, this comes with the danger of narrowing the expectations of written content too much. Only an ongoing and vivid methodological discussion allows the researchers (not only the methodologists) to critically review their approaches in light of their theories.

Ambiguity is one of the most powerful and admirable features of natural language. It allows for imperfect communication, which in turn means that it allows communication itself. Otherwise, a true meaning of something would have to be established between two speakers in order for a conversation to ensue. This raises a methodological question in which precision is necessary: How can a methodology precisely analyze something that is ex ante not precise? I cannot give a finite answer to this question. Nor do I believe that there is one. I do not think that burying one's head in the sand will be the answer. When we find ourselves thrown back to a position where things are not analyzable per se, everything stays strictly subjective, and even the attempt to structure language systematically is considered to be futile. I would rather take this as encouragement to further evolve the methodologies to meet current needs with all the new technology to which we have access. But this attempt also involves another consideration: There will not be one single technology or one single tool that will answer all the questions. Technologies can be converged and integrated to a certain point. But the reason for these attempts is mainly to make things easier for researchers.

I have not considered anything beyond semantics in this chapter—for good reason. Even the most elaborate semantic web methods have problems contextualizing pragmatics. The reason is that pragmatics are not encoded into the text but into the writer's context. Consider this simple conversation:

FATHER: The children are giving me a real headache today. They've been wild all day.
MOTHER: Okay, you know what? Let's not shoot them right away.

We would certainly know the following things in everyday life.

1. There is no situation possible in which these parents shoot their children.
   (very important observation in this context)
2. She (either)
   1. opposes his anger by exaggerating his position, which could mean attacking him.
   2. tries to calm him down with a joke.
   3. is bothered by him because she thinks he should be able to handle the situation.
   4. believes and says that he is incapable of handling children and by her statement refers to the particularly annoying dimension of his incompetency.

This is obviously an open-ended list. But nothing inherent in the conversation can help to resolve these interpretations. Detecting a lie is even worse. In other words: There are parts of language that exploit the gap between what is said and the range of what can possibly be meant. Particularly in fictional texts, this can be very tricky. Thus, all the tools may very well help to aggregate aspects of the texts up to their semantics, and they may even provide strong predictors for more elaborate meanings or aspects outside the text (like learning or knowing), but they will not take over the interpretation of contexts that are outside of a text. This last step is still left for qualitative analysis. But the clustering can help to direct attention to the important things more quickly, which remains one of the main reasons for using any kind of tool at all.

Large-scale assessment in writing will reveal the need for automated handling and multidimensional score

estimation of short answers—for instance, from such open questions that usually produce short answers. Other demanding tasks include reconstructing conversation in MOOCs, discussion boards, and microblogs. Tools such as LoST are under development, but there are still many open questions about the right measures and reconstruction from texts that do not follow a common grammar. To solve this problem, we need new descriptive grammars (if there are any) for these kinds of written speech, or we need to build more tools for analysis that work without resolving grammar.

CONCLUSION

In this chapter, I have selected tools from almost the entire spectrum of linguistic analysis, starting with simple word counts and searches and ending with more complex approaches to semantic structures. All these tools are ready to be implemented in research on writing. The selection certainly depends on the research question—as always. Except for the semantic web tools, I have selected the tools with regard to their feasibility for the researcher. Naturally, the methodologies for the more complex questions are also a bit more complex regarding the interpretation of their output. But the ease of use should be about the same. Maybe some of the tools can help a bit to conduct great research on writing or just inspire a web search for more useful methods: A vast number of tools are available out there, and it is just not possible to fit them all into one chapter. In the end, the tools should help and facilitate new research on writing or even inspire more areas of interest beyond what has been done before.

REFERENCES

Allemang, D., & Hendler, J. A. (2012). *Semantic Web for the working ontologist modeling in RDF, RDFS and OWL* (2nd ed.). Amsterdam: Elsevier.

Anderson, J. M. (2006). The non-autonomy of syntax. *Folia Linguistica, 39*(3–4), 223–250.

Bach, E. (1989). *Informal lectures on formal semantics*. New York: State University of New York Press.

Barlow, M. (2000). *MonoConc Pro 2.0*. Houston, Texas: Athelstan Software.

Brill, E. (1995). Transformation-based error-driven learning and natural language processing: A case study in part of speech tagging. *Computational Linguistics, 21*(4), 543–565.

Cañas, A. J., Hill, G., Carff, N., Suri N., Lott, J., Eskridge, T., et al. (2004). CmapTools: A Knowledge Modeling and Sharing Environment. In A. J. Cañas, J. D. Novak, & F. M. González (Eds.), *Concept maps: Theory, methodology, technology. Proceedings of the First International Conference on Concept Mapping* (pp. 125–133). Pamplona, Spain: Universidad Pública de Navarra.

Chomsky, N. (1981). *Lectures on government and binding*. Dordrecht, The Netherlands: Foris.

Clariana, R. B. (2005). ALA-Reader 1.01. Retrieved from *www.personal.psu.edu/rbc4/score.htm.*

Clariana, R. B., Engelmann, T., & Yu, W. (2013). Using centrality of concept maps as a measure of problem space states in computer-supported collaborative problem solving. *Educational Technology Research and Development, 61*(3), 423–442.

Crossley, S. A., Greenfield, J., & McNamara, D. (2008). Assessing Text Readability Using Cognitively Based Indices. *TESOL Quarterly, 42*, 475–493.

Davies, J., Studer, R., & Warren, P. (Eds.). (2006). *Semantic Web technologies: Trends and research in ontology-based systems*. Chichester, UK: Wiley.

Deerwester, S. C., Dumais, S. T., Landauer, T. K., Furnas, G. W., & Harshman, R. A. (1990). Indexing by latent

semantic analysis. *Journal of the American Society of Information Science, 41*(6), 391–407.

Ebiquity Group at UMBC. (2007). Swoogle. Available from *http://swoogle.umbc.edu*.

Ellson, J., Gansner, E. R., Koutsofios, E., North, S. C., & Woodhull, G. (2003). *GraphViz and Dynagraph. Static and dynamic graph drawing tools.* Florham Park, NJ: AT&T Labs Research.

Fanselow, G., & Felix, S. W. (1990). *Sprachtheorie* (2nd ed.). Tübingen, Germany: Franke.

Flesch, R. (1948). A new readability yardstick. *Journal of Applied Psychology, 32*, 221–233.

Haegeman, L. (2009). *Introduction to government and binding theory* (2nd ed.). Malden, MA: Blackwell.

Hennink, M., Hutter, I., & Bailey, A. (2011). *Qualitative research methods*. London: Sage.

Ifenthaler, D., & Pirnay-Dummer, P. (2009). Assessment of knowledge: Do graphical notes and texts represent different things? In M. R. Simonson (Ed.), *Annual proceedings of selected research and development papers presentat at the national convention of the Association for Educational Communications and Technology (32nd, Louisville, KY, 2009)* (Vol. 2, pp. 86–93). Bloomington, IN: AECT.

Johnson, T. E., O'Connor, D. L., Spector, J. M., Ifenthaler, D., & Pirnay-Dummer, P. (2006). Comparative study of mental model research methods: Relationships among ACSMM, SMD, MITOCAR & DEEP methodologies. In A. J. Canas & J. D. Novak (Eds.), *Concept maps: Theory, methodology, technology*. San Jose, Costa Rica: Proceedings of the Second International Conference on Concept Mapping.

Klare, G. R. (1975). Assessing readability. *Reading Research Quarterly, 10*(1), 62–102.

Lewins, A., & Silver, C. (2014). *Using software in qualitative research a step-by-step guide* (2nd ed.). Los Angeles: SAGE.

Maedche, A., Pekar, V., & Staab, S. (2002). Ontology learning part one—on discovering taxonomic relations from the web, *Proceedings of the Web Intelligence Conference* (pp. 301–322). Berlin: Springer.

Michalke, M. (2014). Package koRpus. Retrieved from *http://r.reaktanz.de/pckg/koRpus/koRpus.pdf.*

Partee, B. H. (2004). *Compositionality in formal semantics. Selected papers of Barbara Partee*. Malden, MA: Blackwell.

Pirnay-Dummer, P. (2010). Complete structure comparison. In D. Ifenthaler, P. Pirnay-Dummer, & N. M. Seel (Eds.), *Computer-based diagnostics and systematic analysis of knowledge* (pp. 235–258). New York: Springer.

Pirnay-Dummer, P. (2012). Ontology and semantic web. In N. M. Seel (Ed.), *Encyclopedia of the sciences of learning* (pp. 2507–2510). New York: Springer.

Pirnay-Dummer, P. (2015). Local semantic trace. A method to analyze very small and unstructured texts for propositional knowledge. *Technology, Knowledge and Learning, 20*(1), 93–114.

Pirnay-Dummer, P., & Ifenthaler, D. (2010). Automated knowledge visualization and assessment. In D. Ifenthaler, P. Pirnay-Dummer, & N. M. Seel (Eds.), *Computer-based diagnostics and systematic analysis of knowledge* (pp. 77–115). New York: Springer.

Pirnay-Dummer, P., Ifenthaler, D., & Spector, J. M. (2010). Highly integrated model assessment technology and tools. *Educational Technology Research and Development, 58*(1), 3–18.

Pirnay-Dummer, P., & Rohde, J. (2009). *How knowledge assessment methods may be utilized to help learners with their assignments. Using automated assessment tools to provide coaching support during writing tasks.* Paper presented at the AERA, 60.021, Devision C, Section 7: Technology Research, San Diego, CA.

Pirnay-Dummer, P., & Spector, J. M. (2008). *Language, association, and model re-representation. How features of language and human association can be utilized for automated knowledge assessment.* Paper presented at the AERA 2008, TICL SIG, New York.

Pirnay-Dummer, P., & Walter, S. (2009). Bridging the world's knowledge to individual knowledge using latent semantic analysis and web ontologies to complement classical and new knowledge assessment technologies.

Technology, Instruction, Cognition and Learning, 7(1), 21–45.

R Core Team. (2014). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing.

Rauh, K., Pirnay-Dummer, P., & Roeder, A. (2009). The effect of writing style on text-based knowledge externalizations made using T-MITOCAR. In Kinshuk, D. G. Sampson, J. M. Spector, P. Isaías, & D. Ifenthaler (Eds.), *Proceedings of the Celda 2009, Cognition and Exploratory Learning in the Digital Age, November 22–22* (pp. 93–100). Rome, Italy: Iadis.

Schreier, M. (2012). *Qualitative content analysis in practice*. Los Angeles: Sage.

Schvaneveldt, R. W. (1990). *Pathfinder associative networks: Studies in knowledge organization.* Norwood, NJ: Ablex.

Schvaneveldt, R. W., & Cohen, T. A. (2010). Abductive reasoning and similarity: Some computational tools. In D. Ifenthaler, P. Pirnay-Dummer, & N. M. Seel (Eds.), *Computer-based diagnostics and systematic analysis of knowledge* (pp. 189–211). New York: Springer.

Schvaneveldt, R. W., Durso, F. T., Goldsmith, T. E., Breen, T. J., Cooke, N. M., Tucker, R. G., et al. (1985). Measuring the structure of expertise. *International Journal of Man-Maschine Studies, 23*, 699–728.

Scott, M. (2012). *WordSmith Tools version 6*. Liverpool, UK: Lexical Analysis Software.

Socher, R., Bauer, J., Manning, C. D., & Ng, A. Y. (2013). *Parsing with compositional vector grammars.* Paper presented at the Annual meeting of the Association for Compuatational Linguistics (ACL) 2013, Sofia, Bulgaria.

Taricani, E. M., & Clariana, R. B. (2006). A technique for automatically scoring open-ended concept maps. *Educational Technology Research and Development, 54*, 61–78.

Tittmann, P. (2010). Graphs and networks. In D. Ifenthaler, P. Pirnay-Dummer, & N. M. Seel (Eds.), *Computer-based diagnostics and systematic analysis of knowledge* (pp. 177–188). New York: Springer.

Tversky, A. (1977). Features of similarity. *Psychological Review, 84*, 327–352.

Wiechmann, D., & Fuhs, S. (2006). Concordancing software. *Corpus Linguistics and Linguistic Theory, 2*(1), 107–127.

Author Index

The pagination of this electronic edition does not match the edition from which it was created. To locate a specific passage, please use the search feature of your e-book reader or select a page number link below.

Abbott, R. D., 31, 32, 34, 116, 122, 125, 136, 137, 138, 145, 147, 155, 191, 194, 196, 197, 202, 352, 353, 357

Abbott, S. P., 32, 136, 147, 194, 197, 357

Abelson, R., 133

Abrami, P., 94

Acevedo, A., 82

Acevedo, C., 231, 240

Ackerman, J., 243

Adams, M. J., 148

Adamson, F., 330

Addisson, J., 92

Adler-Kassner, L., 396

Adriaens, J., 353

Aglinskas, C., 202

Ahissar, M., 353
Ahlers, R., 324
Ahlsén, E., 417, 419
Ahmed, Y., 138, 197, 198, 199, 203
Ainley, M., 161
Ajay, H. B., 399
Akkus, R., 250
Al Otaiba, S., 145, 146, 355
Alamargot, D., 26, 59, 68, 69, 73, 130, 132, 133, 144, 414, 420
Albrechtsen, D., 366, 369
Alegria, J., 147
Alexander, J., 42, 43, 44
Alexander, P. A., 25, 28, 29, 34
Allemang, D., 437
Allen, L. K., 5, 316, 318, 321, 323, 324, 325
Allison, T., 119
Alonso Cortes, M. D., 154
Alstad, Z., 125
Altemeier, L., 31, 197, 202
Altmann, L. J., 146, 353
Alvermann, D. E., 45
Alves, R. A., 74, 135, 138, 191, 356, 414
Amanti, C., 368
Ambridge, B., 139
Amrein, A. L., 257
Amso, D., 117
Anderson, J. A., 68
Anderson, J. M., 433
Anderson, J. R., 68
Anderson, K. T., 385
Anderson, L. M., 282
Anderson, R. C., 309
Anderson, S., 116
Andrada, G. N., 278
Andrade, H. G., 279
Andrade, H. L., 279
Andrade, M., 370
Andrews, R., 92, 216, 294, 295, 296
Andrews-Weckerly, S., 301
Andreyev, S., 400
Andriessen, J., 154
Angelone, E., 417
Anthony, H. M., 282

Anthony, J. L., 151
Antolini, E., 168
Anton, J. L., 119
Apel, K., 359
Appadurai, A., 111
Applebee, A. N., 17, 89, 133, 134, 166, 195, 201, 243, 246, 257, 263, 289, 370
Aram, D., 151
Arcon, N., 5, 243, 301, 312
Arfé, B., 125
Ariasi, N., 252
Aristotle, 305
Arnaut, K., 111
Aro, M., 153
Arroyo, I., 322
Artemeva, N., 11
Asaro-Saddler, K., 282, 351
Ascorti, K., 201, 276, 279, 280, 283
Ashbaugh, H., 320
Ashley, K. D., 17
Atkins, M., 223
Atkinson, D., 200, 364
Attali, Y., 318, 319, 400, 401, 405
Atwell, N., 166
Atwood, T., 123, 125
Au, R. K. C., 354
Augsburger, A., 125
August, D., 359, 387
Aukerman, M., 98
Aull, L. L., 95
Austin, G., 24
Autio, E., 339
Avishag, R., 200
Awati, N., 122
Ayres, A., 1
Azano, A., 335

Baaijen, V. M., 412
Babayiğit, S., 153, 197
Bach, E., 433
Baddeley, A. D., 29, 31
Bahr, R. H., 353, 355
Bailey, A., 369, 431
Bailey, T., 138, 296

Baker, S., 5, 216, 243, 301, 312
Baker, W., 277, 283
Bakhtin, M., 380
Baldeweg, T., 118
Ball, A. F., 365, 379, 380, 383
Ball, S. E., 199
Ballarin, C., 252
Ballinger, S., 367
Baltar, M., 17
Baltodano, M., 380
Bandura, A., 34, 35, 160, 161, 162, 163, 166, 168, 169
Bangert-Drowns, R. L., 201, 216, 243, 245, 247, 251, 252
Baquedano-López, P., 47
Barab, S. A., 49
Barham, I., 295
Barletta Manjarres, N., 17
Barlow, M., 430
Barnes, J., 353
Barnett, A. L., 351, 353, 357, 418
Barnhart, J., 151
Barrera, F. D., 317
Bartlett, L., 104
Barton, D., 11, 104, 106, 380
Baskervill, W., 289
Basso, A., 116
Basso, K., 104
Bateman, D. R., 295
Bauer, J., 432
Bawarshi, A., 15
Baym, N. K., 106
Bazerman, C., 2, 11, 12, 13, 14, 15, 16, 18, 25, 89, 90, 93, 196, 259, 312
Beach, C., 93
Beach, K., 45
Beach, R., 3, 88, 92, 93, 95, 162, 196, 259, 275, 309, 340
Beal, C. R., 279, 322
Bean, R. M., 338
Beaufort, A., 18, 42, 44, 49, 245
Beauvais, C., 63
Beauvais, L., 63
Beck, S. W., 89, 263
Beers, S. F., 135, 352
Begay, K., 137
Béguin, A., 61

Behizadeh, N., 89, 96
Behrns, I., 417, 419
Beigman-Klebanov, B., 400, 406
Belcher, D., 367
Bellair, L. W., 353
Bennett, R. E., 405
Bentolila, A., 288
Benton, S., 161, 168
Berchoud, M., 369
Bereiter, C., 2, 25, 27, 29, 30, 31, 33, 75, 79, 82, 104, 131, 134, 138, 160, 175, 176, 211, 243, 250, 273, 274, 277, 278, 279, 283, 303, 307, 317
Berkenkotter, C., 14, 16
Berlin, J., 17
Berliner, D. C., 257
Berman, R. A., 145, 147, 149, 153, 154, 155
Bernard, T. J., 385
Berndorff, D., 161
Berninger, V. W., 3, 31, 32, 34, 73, 116, 118, 122, 124, 125, 126, 130, 131, 135, 136, 137, 138, 145, 147, 149, 155, 191, 194, 196, 197, 198, 199, 202, 349, 350, 351, 352, 353, 355, 356, 357, 358, 359
Bernstein, B., 227, 228, 229
Bertelson, P., 147
Berthold, K., 244
Benier, N., 16
Biancarosa, G., 301, 339, 396
Bianco, M., 138
Biber, D., 396
Bickerton, D., 81
Bielaczyc, K., 261
Biesta, G., 92
Bigelow, M., 365, 368
Bigozzi, L., 196
Billington, L., 359
Bindman, M., 296
Birbili, M., 43
Bishop, D. V. M., 354, 355
Bitan, T., 123
Bitchener, J., 370
Black, J., 288
Black, R. W., 43, 45, 46, 106, 107
Blackburn, M. V., 105
Blaggan, S., 355
Blakeslee, A. M., 12
Blamey, K. L., 338

Blanchard, D., 400
Blanche-Benveniste, C., 145, 147
Blau, S., 333
Blei, D. M., 399
Bliss, L., 405
Blomert, L., 197
Blommaert, J., 93, 111, 260, 379, 380
Bloodgood, J., 150
Bloome, D., 89, 90, 96
Blot, R. K., 106
Blount, N., 211
Boatright, M. D., 263, 266, 267
Boch, F., 12
Bock, K., 132, 138
Boers, F., 366
Bol, L., 277
Bolam, R., 334
Bolinger, A., 216
Boman, J. S., 244
Bong, M., 168
Bonin, P., 74, 75, 132
Bonini, A., 93
Bonitatibus, G. J., 279
Bonnotte, I., 134
Booth, J. R., 120, 122, 123, 124
Booth, W. C., 195
Borkovec, T., 162
Bornstein, M., 178
Borzone de Manrique, A. M., 151
Boscolo, P., 34, 35, 160, 167, 168, 201, 246, 249, 252, 276, 279, 280, 283
Bosman, A. M. T., 356
Botting, N., 354
Bouayad-Agha, N., 78
Boulay, B. A., 279, 338
Bourdin, B., 32
Bouthillier, J., 367
Bouwer, R., 61
Bowman, P., 385
Boyd, D., 93
Boyd, F., 16
Braaksma, M. A. H., 61, 67, 281, 322, 417
Bradley, B. A., 49
Bradley, L., 147

Bradock, R., 211
Bragg, R., 32
Brain, L., 116
Branco, M., 74, 356
Brand-Gruwel, S., 416
Brandon, R. D., 324
Brandt, D., 16, 42, 105, 257, 410, 415
Bransford, J., 260
Branum-Martin, L., 196
Brass, J. J., 107
Bräuer, G., 18
Bredekamp, S., 147
Breetvelt, I., 26, 57, 58, 59, 60, 67, 68
Brem, S., 118
Brennan, R. L., 64
Brent, D., 42
Breyer, F. J., 395
Bridgeman, B., 317, 401
Brill, E., 431
Brindle, M., 174, 223
Brinton, D., 289
Brinton, L., 289
Britner, S. L., 35, 163
Britt, A., 319
Britt, M. A., 202, 280, 283
Britton, B. K., 81
Britton, J., 17, 107, 244
Broc, L., 355
Brock, C., 16
Brodney, B., 82
Bromme, R., 201
Bronfenbrenner, U., 49
Brooke, R., 336
Brookes, G., 358
Brown, K., 371
Brown, M. S., 319
Bruce, B., 68
Bruce, D. L., 46
Bruffee, K., 17
Bruner, J. S., 24
Bruning, R. H., 4, 25, 34, 160, 161, 162, 164, 166, 169
Brunk-Chavez, B., 93
Brunstein, J. C., 83

Bruss, K. S., 13
Bryant, P. E., 146, 147, 295, 296
Bryk, A. S., 339
Brysbaert, M., 353
Buchanan, J., 92
Buchanan, P., 335
Bucholtz, M., 385
Buckwalter, J. K., 368
Buehl, J., 12
Bui, D. C., 124
Bull, R., 139
Bunch, G. C., 367
Bures, E. M., 94
Burgess, A., 17
Burgess, S. R., 151
Burke, Q., 107, 110
Burkhard, T., 6, 377
Burkle, L., 382
Burman, D., 123
Burnham, B., 338
Burnham, S., 212
Burns, M. S., 147
Bursky, S. A., 395
Burstein, J. C., 6, 278, 316, 317, 319, 371, 395, 400, 401, 404, 405, 406
Bushey, B., 301
Butler, J. A., 105, 280, 283
Byrne, B., 147, 148
Byrne, M., 357

Cabe, R., 333
Caccamise, D., 278, 403
Cagan, J., 79
Cai, Z., 318, 323
Cain, C., 104
Cain, K., 134
Cajkler, W., 295
Calfee, R. C., 194
Calkins, L. M., 166, 168, 333
Callahan, R., 365, 366
Callens, M., 353
Camp, H., 91
Campbell, S., 353
Canagarajah, S., 105, 369

Cañas, A. J., 436
Cantrell, R. J., 244, 252
Carbone, P. M., 93, 260
Cardoso-Martins, C., 151
Carey, L., 272
Carl, M., 422
Carless, D., 370
Carlino, P., 18
Carlisle, J., 197
Carlo, M. S., 359
Carotti, L., 249, 252
Carr, B. J., 14, 107
Carroll, L., 13
Carson, J. G., 368, 417
Carter, R., 289, 291, 292
Cartwright, A. C., 194
Cary, L., 147
Casbergue, R., 147, 152
Case, R., 29, 30
Casey, B. J., 117, 118
Caso-Fuertes, A., 211
Castedo, M., 11, 14
Castek, J., 41
Castelló, M., 11, 13
Castells, N., 419
Castillo-Rosenthal, Z., 367
Castro, S. L., 74, 356, 414
Cataldo, S., 147
Catts, H. W., 355
Cavagnetto, A. R., 248
Cavalier, A., 32
Cazden, C. B., 102, 104
Cellier, J. M., 420
Chalk, J. C., 353
Chambers, A. B., 4, 211
Chan, A. H., 353
Chandler-Olcott, K., 46
Chang, F., 138
Chang, P., 263
Chang, S., 357
Chanquoy, L., 26, 130, 132, 144
Chapelle, C., 371
Charman, T., 354

Charney, D., 277
Chen, C. F. E., 321
Chen, C. H., 245, 248, 250, 251
Chen, J., 231
Chen, Y. C., 250
Cheng, L., 369
Cheng, W. Y. E., 321
Cheng-Lai, A., 353
Chenoweth, N. A., 74, 413
Chenu, F., 132, 414
Cheong, Y. F., 35, 164
Chesnet, D., 59
Cheville, J., 319
Childs, M., 231
Chin, C., 260, 263
Chinen, M., 369
Chipere, N., 289, 297
Chisholm, J. S., 265, 267
Chitez, M., 18
Cho, J., 110
Cho, K., 275, 276, 277, 279, 280, 283
Cho, S., 123
Chodorow, M., 319, 400, 401, 406
Chomsky, N., 433
Chorzempa, B. F., 136
Christensen, C. M., 41, 358
Christensen, L. B., 45
Christian, D., 367
Christie, F., 14, 17, 227, 231
Christie, J. F., 147, 152
Church, M. A., 35
Chuy, M., 243, 250, 252
Cielocha, K. M., 48
Cignatta, T., 369
Cinciala, M., 289
Clariana, R. B., 436
Clark, C., 89
Clark, R. A., 274
Clarkson, B., 354, 355
Clauser, B. E., 319
Clinton, K., 42, 105
Close, L., 200
Cobb, P., 261

Coffin, C., 240, 263
Coffman, W. E., 61
Cohen, L., 119
Cohen, P., 322
Cohen, S., 338
Cohen, T. A., 433
Cohn, A. C., 353
Coirier, P., 154
Coiro, J., 41
Coker, B. L. S., 420
Cole, M., 90, 103, 104, 258, 259, 260, 261, 262
Coleman, C., 353
Coleman, K. B., 137
Collins, A. M., 68, 261
Collins, J., 106, 111
Collins, S., 250
Collins Block, C., 166, 167
Collum, E., 365
Coltheart, M., 359
Colvin, C., 162
Comber, B., 50
Condon, W., 319
Confrey, J., 261
Coniam, D., 370
Connelly, V., 6, 74, 349, 351, 353, 354, 355, 356, 357, 417, 419
Connor, C. M., 203
Connor, J., 365
Conti-Ramsden, G., 354
Converse, C. W., 14
Cook, G., 369
Cook, L. S., 263
Cook, V., 417
Cook, W., 211
Cooks, J., 381, 388
Cooper, H., 178
Cope, B., 368
Copple, C., 147
Coppola, N. W., 396
Cordewener, K. A. H., 356
Córdova, R. A., 335
Corkill, A., 161
Correa, J., 359
Correnti, R., 249, 337

Corrigan, J. A., 2, 41, 46, 405
Cortez Roman, N. A., 17
Cortina, J. M., 178
Coskie, T., 338, 339
Costa, L.-J., 196, 199
Costermans J., 131
Cousins, M., 356
Couzijn, M., 281
Cowey, W., 231
Cox, B. E., 197
Cox, M., 263
Cox, R. D., 35
Coyle, D., 336
Cragg, L., 138, 355
Crawford, S., 95
Crinon, J., 17, 277, 283
Critten, S., 74, 356, 419
Cronbach, L. J., 64
Cronin, B., 245
Cronnell, B. A., 198
Cross, G. A., 12
Crossley, S. A., 96, 316, 317, 318, 319, 320, 321, 323, 324, 429
Crowell, A., 309, 310
Crowther, J. E., 75
Crozier, W. R., 352
Crusan, D., 369
Culican, S., 234, 240
Cull-Hewitt, R., 244
Cumming, A., 6, 364, 366, 367, 368, 369
Cumming, G., 32, 82
Cummins, J., 364, 365, 368, 369, 370, 371
Cummins, S., 367
Cunningham, L., 339
Curry, M., 336
Curry, T., 96
Curtis, M., 14
Curwen, M. S., 259
Cutler, L., 49, 166, 289
Cziko, C., 260

Daems, F., 167
Dai, J., 318, 323
Dale, R., 76

Daly, J., 162
Damasio, A., 116
Damasio, H., 116
Dam-Jensen, H., 420–421
Daneman, J., 194
Danoff, B., 224
Dansac, C., 59, 69
Darder, A., 380, 381
Darling-Hammond, L., 330, 341
Dash, S., 341
Dauterman, J., 12
Davey, T., 317, 401
Davies, C., 43
Davies, J., 107, 437
Davies, S. P., 82
Davies Samway, K., 367
Davis, M., 353
Davis, N. E., 321
Davison, C., 364, 365
de Beaugrande, R., 175
De Bernardi, B., 168
de Glopper, K., 366, 412
De Jong, P. F., 146, 151
de Kramer, R., 341
De La Paz, S., 32, 94, 202, 246, 248, 250, 251, 252, 273, 279, 282, 283, 302, 303, 306, 308, 312
De Maeyer, S., 60
de Milliano, I., 92
de Oliveira, L. C., 263, 366, 367
De Smet, M. J., 416
De Weck, G., 138
Deacon, S. H., 353
Dean, T. R., 48
Deane, P., 317, 319, 320, 401, 405
DeBoer, T., 118
DeCosta-Smith, M., 14
Deerwester, S. C., 434
Deess, P., 404
Del Favero, L., 161, 252
Delcambre, I., 18
Delia, J. G., 274
Dell, G. S., 138
Dell, S., 240
Delp, V., 95

Demers, J., 367
Dempsey, M., 34, 161, 169
Denham, K., 292
Dennis, S., 318
Deno, S., 32
Derewianka, B., 17, 290
Desimone, L. M., 330, 338, 342
Desroches, A., 122
Deussen, T., 339
Devine, M., 296
Devitt, A., 12, 15
Dexter, E., 339
Diab, N. M., 94
Diamond, K. E., 198, 200
Dias, P., 16, 18
Dich, N., 353
Dick, F., 135
Dicks, J., 367
Dierking, R. C., 332
Dignath, C., 177
Dijkstra, T., 84
Dikli, S., 316, 317, 319
DiPardo, A., 96
diSessa, A., 261
Dobrin, D., 15
Dochy, F., 276
Dockrell, J. E., 6, 74, 125, 349, 351, 354, 355, 356, 358, 417, 419
Doerr-Stevens, C., 92, 95
Dogan, N., 81
Doheny-Farina, S., 14
Dole, J. A., 200, 338
Dombek, J., 203
Domingo, M., 108
Donahue, C., 11, 18
Donnelly, A., 340
Donovan, C., 15
Dooley, S., 278, 396, 403
Dougherty, E. A., 244
Douglas, D., 371
Dow, M., 353
Dowdall, C., 108
Dowdy, N. S., 30, 301
Downey, R., 161

Dragsted, B., 422
Draper, J. A., 338
Dredger, K., 93
Dressman, M., 365
Driscoll, D. L., 45
Driskell, J. E., 324
Du, Y., 279
Duff, P., 366
Duffy, J., 14
Duffy, T. M., 43
Duffy, W., 94
Dufresne, R. J., 42
Dumais, S. T., 434
Duncan, L. E., 384
Duncum, P., 43
Dunlop, M., 369
Dunn, J., 301
Dunsmore, K., 258
Durgunoglu, A. Y., 16
Dworin, J. E., 387, 388
Dyer, M., 331
Dyson, A. H., 13, 16, 93, 147, 148, 152, 154
Dysthe, O., 18

Early, J. S., 14
Early, M., 367, 368
Eccles, J. S., 34
Echevarria, J., 366
Eckhoff, A., 403
Ede, L., 15, 94
Edelsky, C., 368, 370
Eden, G. F., 121
Edlund, J., 411
Edwards, O. V., 311
Edwards, R., 92
Edwards-Groves, C. J., 46, 48, 49
Egawa, K., 338
Ehrensberger-Dow, M., 420, 421
Ehrhardt, J. S., 246
Ehri, L. C., 151, 197, 198
Ehrlich, M.-F., 138
Eissa, M. A., 179
Elbow, P., 14

Elish-Piper, L., 339
Elley, W., 295
Elliot, A. J., 35
Elliot, N., 6, 42, 395, 396, 404, 406
Ellis, A., 194
Ellis, N., 147, 289, 292
Ellis, P., 379
Ellis, R., 82, 297
Ellson, J., 434
Elman, J. L., 135
Emig, J., 107
Emilia, E., 231, 240
Encinas, F., 18
Enderle, P., 248
Engelhard, G., 89, 96
Engelhardt, L., 119, 120
Engelmann, T., 436
Engeström, Y., 45, 90, 91
Englert, C. S., 258, 262, 282, 283
Enright, K. A., 263, 366
Enright, M. K., 317
Epting, L., 167
Erickson, F., 261
Ericsson, K. A., 30, 320
Ericsson, P. F., 319
Erskine, J. M., 153
Erstad, O., 92
Espino, S., 419
Evans, N., 370

Faber, B., 14
Fabos, B., 45, 46, 107, 263
Fair, D. A., 123
Faltis, C., 366
Fan, Y., 5, 301
Fanselow, G., 433
Faraday, M., 301
Faragher, B., 354
Farr, R., 32
Farrington, D. P., 416
Farrington, S., 240
Faulkner, A., 400
Favart, M., 63

Fayol, M., 3, 31, 32, 59, 68, 73, 74, 130, 131, 132, 133, 134, 136, 137, 138, 145, 196, 353, 357, 411, 414
Fecho, B., 88, 90
Feenberg, A., 94
Felix, S. W., 433
Felton, M. K., 94, 202, 246, 248, 250, 251, 252, 309
Feng, Y., 34
Fernandez, E., 107
Fernández-Villanueva, M., 369
Fernheimer, J. W., 12
Ferreiro, E., 11, 14, 147, 148, 150, 152
Ferrer, E., 139
Ferretti, R. P., 5, 30, 94, 249, 251, 252, 280, 283, 301, 302, 303, 304, 305, 307, 308, 311, 312
Ferris, D., 370
Fidalgo, R., 83, 191, 322
Fielding-Barnsley, R., 147, 148
Figueiredo, D., 93
Finders, M., 18
Fink, B., 136
Fink, L., 341
Finnegan, R., 105
Fisher, D., 262, 321
Fisher, M. T., 262
Fishman, J., 13
Fitzgerald, J., 1, 33, 138, 174, 194, 195, 197, 272, 274, 282, 365, 367, 370, 396
Fleischer, C., 396
Flesch, R., 429
Flor, M., 400
Florey, K. B., 289
Flower, L. S., 2, 24, 25, 26, 27, 29, 57, 58, 68, 72, 78, 79, 81, 83, 94, 95, 104, 130, 131, 132, 160, 175, 176, 195, 243, 272, 274, 303, 316
Foltz, P. W., 6, 318, 395, 397, 403
Fontich, X., 288
Foorman, B. R., 196
Forsman-Schneider, A., 110
Forster, M., 234
Fougerouse, M.-C., 288
Foulin, J. N., 131, 132, 146, 148
Fowles, M. E., 319
Fox, R. F., 332
Francis, D., 369
Franzak, J., 365
Franzke, M., 278, 403
Frausin, T., 280

Freadman, A., 92
Freedman, A., 16
Freedman, S. W., 95, 273, 283
Freeman, D., 365
Freeman, Y., 365
Freire, P., 381, 386
French, L. A., 138
Frey, N., 321
Friedlander, B., 219, 338
Friedman, D., 118
Friedrich, L., 92, 332
Friedrich, T., 162, 275
Friston, K. J., 121
Fuchs, D., 358
Fuchs, L. S., 358
Fuhs, S., 430
Fuller, D. F., 153
Furnas, G. W., 434
Fusaro, J. A., 244
Futagi, Y., 401

Gaddes, A., 262, 386
Gagne, P., 318
Galbraith, D., 79, 80, 84, 146, 148, 244, 249, 273, 284, 303, 412
Gallena, E., 167
Galvan, N., 246
Gamannossi, B., 196
Gamboa, M., 108
Ganding, III, E., 5, 257
Ganobcsik-Williams, L., 18
Gansner, E. R., 434
Ganson, K., 168
Garcia, A., 262, 386
Garcia, G., 367
García, J. N., 83, 322
Garcia, N. P., 125, 196, 197
García, O., 368
Garcia, V., 317
Garcia-Mila, M., 93, 246
Garcia-Sanchez, J., 211
Garris, R., 324
Garrod, A. C., 279
Garrod, S., 80

Gathercole, S. E., 139
Gauthier, I., 119, 123
Gay, G., 381
Gebhard, M., 366, 367
Gee, J. P., 41, 45, 102, 104, 107, 108, 110, 380, 385
Geertz, C., 109
Geiser, S., 316
Geisler, C., 416
Gelati, C., 246
Genter, D., 68
Gentil, G., 368
Geoghegan, C. M., 5, 330
George, D., 43
Gerde, H. K., 198
Gernsbacher, M. A., 132, 280
Gersten, R., 216
Geva, E., 370
Gibbons, P., 367
Gibson, E., 149
Gibson, S., 358
Giedd, J., 118
Gielen, S., 276
Gikandi, J. W., 321
Gilabert, S., 93, 246
Gilbert, J., 289
Gilhooly, D., 108, 109
Gillen, J., 110
Gillespie, A., 28, 69, 216, 243
Gilliam, S., 397
Gilliland, B., 263
Giltrow, J., 17
Giroux, H. A., 381
Glaser, C., 83
Glass, G., 94
Glenn, C. G., 133
Gleser, G. C., 64
Glogger, I., 244, 245, 246, 247, 251, 252
Glucksberg, S., 80
Glynn, S. M., 81
Godley, A. J., 265, 267
Goffman, I., 92
Goldberg, A., 216
Goldenberg, C., 387

Goldin, I. M., 17
Goldstein, H., 67
Goldstein, L., 370
Gombert, J. E., 134
Gomez, K., 94
Gomez, L. M., 94
Gonzalez, N., 368
Gonzalez, V., 369
Goodnow, J., 24
Goodwin, M., 335
Goody, J., 11, 104
Gordon, A. M., 414
Gordon, W., 212
Gosine, K., 367
Gough, P. B., 145, 146
Gouveia, C., 240
Grabe, W., 367
Grabill, J. T., 12, 93
Grabowski, J., 131, 411, 414
Graesser, A. C., 316, 317, 322
Gragg, G., 288
Graham, S., 1, 2, 4, 24, 27, 28, 29, 31, 32, 33, 34, 35, 49, 57, 69, 83, 125, 132, 136, 138, 147, 149, 155, 160, 161, 166, 167, 168, 174, 177, 178, 189, 191, 194, 196, 197, 201, 203, 211, 212, 213, 214, 215, 216, 217, 219, 223, 224, 243, 245, 246, 248, 249, 257, 265, 273, 274, 276, 279, 281, 282, 283, 289, 290, 295, 296, 301, 303, 304, 305, 306, 307, 308, 316, 321, 322, 323, 332, 338, 349, 357, 358, 396
Graves, D. H., 166, 168, 212, 213
Gray, B., 231
Gray, J., 211
Green, S., 201
Greenberg, D., 197
Greene, B., 32
Greenfield, J., 429
Greenhow, C., 41, 108
Greenidge, W., 47, 48
Greenleaf, C., 260, 261, 263
Gregg, N. G., 353
Griffin, P., 147
Griffin, W., 125
Griffin, Z. M., 76
Griffith, P. L., 145
Grimes, D., 320
Grisham, D. L., 262
Grogan, P. R., 339

Grooms, J., 248
Grootendorst, R., 301, 302, 305, 309
Grosjacques, G., 357
Gross, A., 12
Guasch, O., 288
Guastello, E. F., 279
Gue, V., 262, 385
Guerra, J. C., 387
Guitiérrez, K., 364
Gunderson, L., 365, 368
Gunduz, S., 47, 247
Gunel, M., 47, 245, 247, 250, 252
Gunnarsson, B.-L., 15
Guo, Y., 367
Gutiérrez, K. D., 47, 261
Guzzetti, B. J., 108
Gwosdek, H., 288, 290

Haas, C., 14, 107, 245, 261
Haastrup, K., 366
Hacker, D. J., 44, 179, 200
Haddix, M., 379, 386
Haegeman, L., 433
Hale, S., 124
Haley, A., 73
Hall, A. M., 396
Hall, H., 382
Hall, K., 385
Hall, L. A., 262
Hall, N., 137
Hall, V., 338
Halliday, M. A. K., 4, 134, 228
Hall-Mills, S., 359
Hamers, J., 366
Hamilton, D. P., 13
Hamilton, L. S., 249
Hamilton, M., 104, 106, 380
Hamner, B., 401, 402
Hana, J., 288
Hancock, C., 289
Hand, B., 47, 245, 247, 250, 251, 252, 261
Handsfield, L. J., 48
Haneda, M., 365, 366, 369

Harackiewicz, J. M., 35
Harbaugh, G., 352
Hardman, F., 295
Hargreaves, A., 334
Haria, P., 14, 201, 279, 303
Harklau, L., 260, 263, 364, 368
Harman, R., 366
Harris, K. R., 4, 28, 31, 33, 83, 132, 136, 160, 161, 166, 174, 175, 177, 178, 179, 189, 191, 211, 212, 215, 216, 219, 223, 224, 248, 249, 279, 281, 290, 303, 305, 306, 321, 322, 337, 338, 349
Harris, R. J., 294, 295
Harris, S., 365, 366
Harshman, R. A., 434
Hart-Davidson, W., 12
Hartelius, L., 417, 419
Hartley, J., 163
Hasan, R., 134
Haswell, R., 319
Hattie, J. A. C., 17, 234, 239, 240
Hawisher, G. E., 97
Hawken, L. S., 168, 289, 307
Hawkins, E., 292
Hawkins, L. K., 49
Hawkins, M., 364, 368
Hayes, D. A., 195
Hayes, D. P., 135
Hayes, E. R., 107
Hayes, J. R., 2, 24, 25, 26, 27, 28, 29, 33, 34, 57, 58, 59, 68, 72, 74, 75, 76, 78, 79, 80, 81, 83, 104, 122, 124, 130, 131, 132, 145, 153, 160, 175, 176, 195, 197, 243, 272, 273, 274, 277, 278, 279, 280, 283, 284, 303, 316, 349, 350, 351, 352, 355, 356, 359, 411, 413, 419, 420
Hayes-Roth, B., 79
Hayes-Roth, F., 79
Hayes-Skelton, S., 162
Haynes, R., 211
Heaps, A., 92
Heath, S. B., 16, 104, 259, 260, 380
Hebert, M., 31, 201, 203, 215, 216, 223, 243, 245, 246, 248, 249, 251, 279, 290, 321, 358, 396
Hecht, S., 200
Hedberg, E. C., 178
Hedges, L. V., 178
Heeger, D. J., 117
Heffernan, L., 43
Hefty, M., 289
Heine, C., 421

Heldner, M., 411
Helstad, K., 262, 336
Hendler, J. A., 12, 437
Henkemans, F. S., 301, 305
Hennink, M., 431
Henriksen, B., 366
Henry, L. A., 41
Herault, L., 357
Herman, P., 94
Hermann, T., 131
Herrera, A., 382
Herrera, S. G., 387
Herrington, A., 14
Herrlitz, W., 69
Heurley, L., 137
Hibbert, M., 107
Hickmann, M., 134
Hicks, D., 260
Hicks, S., 167
Hidi, S., 34, 35, 134, 160, 161, 167, 168
Hieshima, J., 151
Higgins, D., 317, 401
Higgins, J. P., 178
Higgins, L., 95
Higgs, J., 3, 102
Hildreth, G., 150
Hildyard, A., 134
Hillerman, T., 212
Hillocks, G., 17, 97, 195, 211, 215, 217, 265, 275, 279, 283, 290, 295, 296
Hine, C., 106
Hinton, G. E., 68
Hirabayashi, J., 332
Hirvela, A., 367
Hislam, J., 295
Hjørland, B., 214
Hladka, B., 288
Ho, R. M. H., 139
Hoadley, C. M., 262
Hogaboam-Gray, A., 279
Hogan, T. P., 355
Hohenshell, L. M., 250, 261
Holland, D., 104, 105, 260, 266
Holliway, D. R., 280, 283

Holzäpfel, L., 244, 247
Holzberger, D., 168
Honan, E., 46
Honeycutt, R. L., 332
Horn, B., 396
Horn, C., 162
Horn, E., 211
Hornberger, N. H., 104, 365, 367, 368
Horne, M., 11
Horst, M., 338
Hoste, V., 414
Houtlosser, P., 302
Hovy, E., 79
Howard, E., 367
Howe, C., 94
Howell, E., 340
Hoy, W. K., 168
Huang, D., 110
Huber, P., 288
Hübner, S., 244, 247, 252
Huddleston, R., 290
Hudson, J., 133
Hudson, K., 107
Hudson, R., 5, 288, 289, 294, 295
Huettman, E., 12
Hughes, C., 32
Hughes, J., 41
Hull, G. A., 3, 5, 45, 92, 102, 103, 104, 106, 107, 108, 109, 110, 111, 257, 260, 263, 265, 266, 267, 380
Hulleman, C. S., 35
Hulstijn, J., 366
Hunt-Barron, S., 333, 340, 341
Hunter, C., 382
Hunter, J. E., 13, 178
Huot, D., 366
Hurley, M. M., 201, 216, 243
Hurry, J., 296
Hutchins, E., 245
Hutter, I., 431
Hyland, F., 370
Hyland, K., 12, 15, 90, 263, 366, 370
Hymes, D., 102, 380
Hyon, S., 227

Ianetta, M., 282, 308
Ifenthaler, D., 434, 436, 438
Inesta, A., 13
Ingebrand, S., 203
Inhoff, A. W., 414
Itō, M., 103, 111, 257

Jackson, G. T., 323, 325
Jackson, J. L., Jr., 109, 110
Jackson, N. E., 359
Jackson, S., 302
Jacob, R., 338
Jacobs, G. E., 105, 107
Jacobs, S., 302
Jacovina, M. E., 5, 316
Jaffré, J.-P., 136
Jakobs, E. M., 419
Jakobsen, A. L., 421
James, K. H., 3, 116, 119, 120, 121, 123, 125, 126
James, T., 119
Jamieson, D., 244
Jang, E. E., 369
Jansen, C., 244
Janssen, D., 413
Janssen, T., 281
Jao, R. J., 3, 116
Jeffery, J. V., 263
Jewitt, C., 41, 42, 105
Jiménez, R., 387
Jisa, H., 132, 414
Jobard, G., 119
Jocson, K. M., 107, 259, 262, 381, 388
Johansson, R., 418
Johansson, V., 411, 416, 418
John, V. P., 102
Johns, A. M., 227
Johnson, D. W., 251, 252
Johnson, M. D., 35, 82, 160, 163, 278
Johnson, M. L., 167
Johnson, N., 403
Johnson, R. T., 251, 252
Johnson, S. C., 121
Johnson, T. E., 436

Johnson-Laird, P. N., 132
John-Steiner, V., 262
Johnston, J., 138
Johnstone, K. M., 320
Jones, J., 202
Jones, P., 290
Jones, R. H., 97
Jones, S. M., 92, 138, 296, 339, 349
Jordan, C., 263
Jordan, M. I., 399
Joseph, D., 261
Joshi, K., 404
Jucks, R., 201
Juel, C., 32, 136, 145, 146, 197
Jun, S. W., 367
Jung, H., 369
Just, M., 194

Kafai, Y. B., 107, 110
Kail, R. V., 139
Kalantzis, M., 368
Kaldenberg, E., 250
Kalman, J., 15
Kaminski, R., 333, 340
Kamler, B., 50
Kandel, S., 357
Kane, M. T., 319, 395, 405
Kang, G., 330, 336
Kapp, F., 168, 202
Kardash, C. M., 303, 304
Karlsson, A-M., 16
Karmiloff-Smith, A., 134, 150, 154
Katz, L., 90
Katz, M. L., 45, 107, 108, 257, 263
Kaufer, D. S., 132
Kauffman, D. F., 4, 25, 34, 35, 160, 161
Kazelskis, R., 82
Keener, M. C., 44
Keith, G., 292
Kell, C., 105
Keller, L., 244
Kellogg, R. T., 26, 26–27, 29, 30, 60, 69, 79, 81, 82, 132, 137, 160, 168, 278, 316, 320, 324, 412, 416, 420
Kells, M. H., 384, 387

Kemp, N., 93
Kendall, S., 397
Kennedy, E., 384, 385
Kenney, N., 110
Keranen, N., 18
Kerr, K. R., 107
Kersey, A. J., 119, 121
Kessler, B., 151
Ketter, J., 13
Keys, C. W., 250
Khramtsova, I., 161
Kibler, A., 262, 366, 367, 368
Kieffer, M. J., 369
Kieft, M., 244, 249, 250, 281
Kim, J. S., 337
Kim, Y. S., 359
Kincheloe, J. L., 381
King, J. R., 202
King, K., 367, 368
Kinloch, V., 6, 377, 378, 379, 380, 388
Kinney, A., 107
Kinnucan-Welsch, K., 339
Kintsch, E., 278, 403
Kintsch, W., 30, 318, 397, 403
Kinzer, C. K., 41
Kirby, J. R., 353
Kircher, J. C., 44
Kireyev, K., 397
Kirkpatrick, L. C., 248
Kirschner, P. A., 416
Kist, W., 41
Kitsantas, A., 161, 164, 165, 169
Kiuhara, S. A., 31, 83, 132, 160, 168, 177, 216, 289, 307
Klare, G. R., 429
Klassen, R., 162
Klein, P. D., 5, 243, 244, 245, 246, 248, 251, 301, 312
Klein Gunnewiek, L., 69
Klinger, D., 369
Klobucar, A., 404, 406
Knight, M., 75
Knobel, M., 42, 44, 45, 47, 263
Knoch, U., 369
Knorr-Cetina, K., 11

Knox, E., 354
Kobayashi, H., 417
Kohnen, A., 18
Kolln, M., 289, 294
Kong, A., 366, 367
Koop, C., 237
Kopp, W., 330
Korner, H., 231
Koschmann, T., 250
Kostouli, T., 91
Kotovsky, K., 79
Koutsofios, E., 434
Kozarian, L., 107
Krampe, R. Th., 320
Krathwohl, D. R., 246
Kress, G. R., 41, 42, 104, 105, 135, 261
Kristmanson, P., 367
Krüger, S., 244
Kruse, O., 18
Kuhn, D., 309, 310
Kuiken, F., 65
Kukich, K., 319
Kunst, H., 69
Kunter, M., 168
Kuo, L. J., 309
Kuperis, S., 244
Kwok, M. N., 5, 257
Kyle, K., 321

Lachicotte, W., Jr., 104
Lacina, J., 166, 167
Ladson-Billings, G., 381, 382, 384, 387
Laham, D., 318, 397
Laham, R. D., 318
Lai, M., 94
L'Allier, S. K., 339
Lam, S. S. T., 354
Lam, W. S. E., 106, 107, 108, 265, 367, 371
Lamb, H., 295
Lambert, E., 357, 414
Lammertyn, J., 353
Lamon, M., 251
Lancaster, Z., 95

Land, L., 338
Land, R., 337, 366
Landauer, T. K., 318, 319, 396, 397, 434
Landerl, K., 153
Landon-Hays, M., 257
Langer, J. A., 17, 166, 289, 195, 198, 201, 246, 257, 263, 370
Lankshear, C., 42, 44, 45, 47, 263
Lantolf, J., 369
Lapp, D., 262
Larkin, R. F., 355
Larson, A., 319
Lashley, K., 72
Lassonde, C. A., 367
Latour, B., 105, 106
Lauer, C., 419, 423
Laung, H. W. H., 354
Laurinen, L. I., 15, 60, 94
Lave, J., 259, 260
Lavelle, E., 168
Lavoie, M. J., 398
Law, N., 94
Leacock, C., 401
Leacock, T. L., 245
Leander, K. M., 105, 106, 260, 266
Ledward, A., 296
Lee, C. D., 260, 382
Lee, E., 108, 109
Lee, I., 369, 370
Lee, J. S., 385
Lee, K., 139
Lee, M.-J., 168
Lee, W., 168
Lefebvre, H., 105
Lehrer, R., 261
Leijten, M., 6, 57, 59, 90, 201, 352, 410, 411, 412, 413, 414, 415, 416, 417, 419, 420, 421, 422, 423
Leinster, S. J., 358
Leki, I., 364, 365, 367, 368, 369, 370
Lembo, L., 282, 308
Lemonnier, F., 366
Leonard, L. B., 354
Leopold, C., 244, 246, 247
Leppänen, P., 118
Lesaux, N. K., 369

Lété, B., 132, 133, 411, 414
Leu, D. J., 2, 41, 42
Leung, C., 366, 369
Leutner, D., 244, 247
Levelt, W. J. M., 80, 131, 132
Levin, H., 149
Levin, I., 145, 147, 150, 151, 154
Levin, T., 251
Levy, C. M., 60, 131
Lewins, A., 431
Lewis, C., 45, 46, 107, 263
Lewis, W. E., 249, 251, 252, 301, 303, 312
Lewison, M., 43
Li, J., 366, 367
Li, L., 48
Li, M., 246
Liberman, G., 154
Lieberman, A., 330, 331, 332, 334, 342
Likens, A., 325
Lillis, T., 97
Limbrick, L., 335
Limpo, T., 135, 138, 191
Lin, C. S., 338
Lindgren, E., 6, 90, 201, 369, 410, 413, 416, 417
Lindholm-Leary, K., 367
Lindsay, G., 354, 355
Lindstromberg, S., 366–367
Lines, H., 295, 296, 349
Lingard. L., 16
Link, H., 368
Linquanti, R., 369
Lipnevich, A. A., 405
Lipsey, M. W., 178, 214, 217
Lipstein, R., 160, 161, 168
Li-Tsang, C. W. P., 353, 354
Litt, R. A., 352, 353
Litterio, L., 12
Liu, Y., 231
Livneh-Zirinski, M., 357
Lloyd-Jones, R., 211
Lo, A. G., 353
Lo, Y. G., 368
Lo Bianco, J., 368

Lobeck, A., 292
Lochbaum, K. E., 396, 403
Locke, T., 289, 297
Lofty, J. S., 260
Lomax, R. G., 197, 198
Lombardino, L. J., 146, 353
Long, E., 95
Longcamp, M., 119, 120, 125
Lonigan, C. J., 148, 150, 151
Lopez, D., 197
Lopez-Campelo, B., 83
Lopez-Gutierrez, P., 83
Lotherington, H., 47, 48
Lövstedt, A.-C., 240
Lowther, D. L., 46
Lu, R., 277
Luke, A., 104, 260
Lumbelli, L., 280
Luna, M., 89, 243
Lund, A., 262, 336
Lundstrom, K., 277, 283
Lunsford, A., 13, 15, 94
Luzón, M. J., 16
Lyster, R., 367

Macagno, F., 302
MacArthur, C. A., 1, 2, 5, 14, 24, 30, 32, 33, 34, 35, 57, 90, 94, 125, 161, 196, 201, 249, 250, 272, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 301, 303, 306, 307, 308, 310, 396
Macauley, W. J., 295
MacCuish, D., 318
MacGillivray, L., 259
Macken, L., 414
Mackie, C. J., 355, 356
MacLean, M., 353
Macnab, J., 356
Macqueen, S., 367
Madill, L., 45
Madnani, N., 400, 401
Maedche, A., 437
Maggio, S., 132, 133, 414
Magnifico, A., 167
Mahar, D., 46
Mahboob, A., 227, 240

Mahiri, J., 262
Mahn, H., 335
Maier, J., 247
Main, K., 46
Mäki, H. S., 153
Malardier, N., 74
Malave, G., 388
Malloy-Miller, T., 356
Maloney, J. H., 110
Manchón, R., 364, 365
Mann, W., 76
Manning, C. D., 432
Maouene, J., 126
Marcu, D., 80
Mariage, T. V., 258
Marin, B., 277, 283
Markham, A. N., 106
Markham, L. R., 282
Marple, S., 110
Marsh, J., 47, 48
Marshall, J. D., 201, 246
Marston, D., 32
Martello, J., 14
Martín, E., 89, 243, 249
Martin, J. R., 227, 228, 229, 231, 232, 233, 236, 240
Martin, N., 17
Martin, R. C., 75, 76
Martinez, R. A., 93, 249, 368
Martinez-Roldan, C. M., 388
Martlew, M., 349
Marttunen, M. J., 15, 60, 94
Mason, L., 160, 161, 166, 219, 303, 322
Massey, G., 421
Masters, G., 234
Masters, J., 341
Mastropieri, M., 219
Mateos, M., 89, 243, 249
Maton, K., 227, 231, 240
Matsuhashi, A., 411
Matsumura, L. C., 249
Matsushima, K., 201, 280
Matthiesen, A. L., 335
Matuchniak, T., 107

Maugham, S., 212
Maughan, B., 352
Mavrognes, N., 290, 295, 296
May, M., 358
Mayfield, E., 396*f*
Mazur, E., 107
McAlpine, L., 18
McBride-Chang, C., 151
McCabe, A., 134
McCarthey, S. J., 5, 17, 330, 336, 340, 367, 369
McCarthy, G., 119
McCarthy, J. E., 12, 14
McCarthy, J. H., 355, 356
McCarthy, L. P., 12, 17
McCarthy, P. M., 162, 165, 318, 319
McClay, J., 46
McClelland, J. L., 68
McCutchen, D., 29, 31, 32, 33, 34, 131, 134, 136, 137, 145, 151, 160, 168, 194, 280, 283, 303
McDermott, M. A., 247, 250
McDowell, L., 250
McGee, S. J., 92
McGinley, W., 197
McGregor, B., 13
McGroarty, M. E., 276, 283
McInnes, D., 231
McKay, P., 369
McKendree, J., 352, 358
McKeough, A., 368
McKeown, D., 31, 33, 83, 132, 160, 177, 216, 281, 303
McKeown, K., 78
McKim, C., 34, 161
McKim, K. K., 105, 106
McKinney, M., 332
McLain, L., 353
McLaren, D. G., 121
McLaren, P., 381
McLaughlin, M. W., 334
McLean, C. A., 108
McLeod, A., 17
McLeod, M., 12
McMahon, A., 334
McMann, D., 335
McNamara, D. S., 5, 17, 96, 169, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 429

McNorgan, C., 122
McRae, D., 234
McVerry, J. G., 45
Meadows, M., 359
Meckel, H., 211
Medway, P., 14, 16
Medwell, J., 136
Medzerian, S., 17
Mehta, P. D., 196
Meier, S., 162
Mendelovits, J., 234
Mendenhall, R., 382
Mentz, O., 369
Méot, A., 74
Mercado, L., 82
Mercer, N., 94
Merchant, G., 48
Messer, D., 355
Messick, S., 46, 405
Messina, R., 251
Mestre, J. P., 42
Mesulam, M., 125
Meth, J. M., 335
Meyer, T., 332
Michaels, S., 97
Michalke, M., 430
Midgette, E., 14, 201, 279, 280, 283, 303, 304
Miel, S., 6, 395
Mikulecky, L., 1
Miller, B., 211
Miller, C., 12, 15
Miller, G. A., 24, 29
Miller, J., 1
Miller, L., 334, 356
Miller, M., 162, 163
Miller, R., 15
Miller, T. P., 17
Millin, T., 240
Mills, K. A., 103
Minguela, M., 419
Miras, M., 419
Mirkin, P., 32
Mishler, E. G., 260

Misischia, C., 90, 200
Missiuna, C., 356
Mizokawa, D., 32
Mkhize, D., 17
Mo, E., 359
Mohan, B., 366, 367
Moje, E. B., 5, 104, 107, 257, 258, 259, 260, 264
Molfese, V., 145
Moll, L. C., 261, 368, 370
Monroe, B. W., 338
Montavon, M., 382
Monte-Sano, C., 263
Montgomery, D., 354
Moore, J. L., 93
Moore, N. S., 90, 201, 281, 283, 310
Mora, P., 377
Morais, J., 147
Morlock, L., 96
Morphy, P., 215, 217, 358
Morris, P. A., 49
Morrison, G. M., 46
Morrow, D., 321
Morrow, L., 148, 149, 154
Mortimore, T., 352
Moses, A., 367
Moss, J., 79
Moss, M., 338
Mostafavi, S., 110
Muchamore, R., 236
Mueller, F. L., 260
Mueller, P., 124, 125
Murphy, C. C., 34, 162
Murphy, E., 369
Murphy, J. J., 13
Murphy, P. K., 34
Murray, A., 332
Musanti, S., 335
Muth, K. D., 81
Myers, G., 13, 14
Myers, M., 317
Myerson, J., 124
Myhill, D. A., 92, 135, 138, 295, 296, 349

Nagy, W., 135, 197
Nam, H., 110
Nanda, H., 64
Napoliello, E. M., 121
Naqvi, R., 368
Nardi, B. A., 245
Nash, H. M., 134
Nash, J., 33, 34, 72, 79
Nassaji, H., 366
Nation, K., 138, 352, 353, 355
Nekrasova, T., 396
Nelson, C. A., 118
Nelson, K., 138
Nelson, M. E., 111, 263, 267
Nelson, M. M., 277
Nelson, N. W., 12, 13, 167, 194, 384
Nelson, S., 289
Nemet, F., 248
Neufeld, B., 339
Neufeld, P., 47
Neuman, S. B., 147, 339, 340
Neuwirth, C., 322
Newell, A., 25, 74, 81
Newell, G. E., 3, 17, 88, 91, 93, 97, 196, 201, 245, 246, 259, 275, 309
Ney, J., 211
Ng, A. Y., 399, 432
Nickoson, L., 383
Niedo, J., 116, 122, 125
Nielsen, K. H., 352, 353
Nir-Sagiv, B., 147, 153, 154, 155
Nobre, A., 119
Nokes, J. D., 200
Nolan, S., 160
Nolen, S. B., 200
Nordstokke, D., 368
Norris, J., 289, 365
North, S. C., 97, 434
Norton, D., 223
Nottbusch, G., 75, 76
Nouri, H., 178
Nückles, M., 244, 247
Nunes, T., 146, 295, 296
Nussbaum, E. M., 303, 304, 311

Nuthall, G. A., 233
Nystrand, M., 175, 273, 274, 277, 280

O'Brien, D. G., 258
O'Byrne, W. I., 45
Ochs, E., 131
O'Connor, D. L., 436
Odom, S. L., 177
O'Donnell-Allen, C., 335
O'Dwyer, L., 341
O'Flahavan, J. F., 197
Ofstad Oxborough, G. H., 74
O'Hallaron, C., 366
O'Hare, F., 196
Okolo, C. M., 249
Olinghouse, N. G., 28, 32, 69, 96, 168, 278
Olivares, F., 83
Olive, T., 30, 31, 63, 69, 74, 132, 356, 411, 412, 414
Olson, C. B., 337, 366
Olson, J. M., 146
Olson, R. K., 354
Olson, V. B., 276, 283
Olsson, J., 296
O'Neill, P., 396
O'Neill, R. E., 307
Ong, J., 65, 244
Onghena, P., 276
Onishi, K. H., 138
Oostdam, R., 366
Oppenheimer, D., 124, 125
Orellana, M. F., 93, 260, 364, 383, 385
Orlikowski, W., 12
Orsillo, S., 162
Ortega, L., 289, 365, 368, 417
Ortiz, S., 289
Ortmeier-Hooper, C., 263, 366
Osborne, J., 260, 263
O'Shea, M., 294
Otuteye, M., 13

Pacheco, M., 93
Page, E. B., 317, 398, 399
Page, S., 240

Page-Voth, V., 303, 304, 306
Pahl, K., 45
Paine, T., 1
Painter, C., 229
Pajares, F., 34, 35, 45, 160, 161, 162, 163, 164, 166
Palikara, O., 354, 355
Palmer, E., 167
Pamula, M., 369
Panaccione, C., 397
Paoletti, G., 280
Paradis, J., 15
Paré, A., 11, 16, 18
Paris, D., 378, 382
Park, A., 107
Parks, S., 366
Parrila, R., 353
Partee, B. H., 439
Passig, D., 17
Patalano, A. L., 79
Patel, V. L., 245
Pavlenko, A., 369
Pearson, P. D., 334, 366, 367
Peckham, I., 42
Peeters, E., 276
Pekar, V., 437
Pekrun, R., 324
Pelias, R., 382
Pella, S., 336
Penington, B., 354
Pennebaker, J. W., 319
Pennell, M., 42
Pennycook, A., 90
Penuel, W. R., 261
Peppler, K., 110
Perera, K., 294
Perez, B., 367, 368
Perez, R. P. Y., 76, 80
Perfetti, C. A., 319
Perin, D., 34, 83, 160, 166, 167, 177, 178, 197, 202, 211, 214, 215, 217, 219, 245, 249, 250, 251, 257, 265, 276, 295, 296, 301, 305, 316, 321, 322, 323, 332, 358, 396, 420, 421
Perkins, D. N., 301
Perkins, K., 94
Perrin, D., 420, 421

Perry, K., 367
Persky, H., 1
Peters, M., 355
Peterson, C., 134
Peterson, D. S., 334, 338
Peterson, R. L., 354
Peverly, S. T., 124, 125
Pfitscher, C., 368
Philipp, A., 168
Philippakos, Z. A., 35, 278, 279, 280, 282, 283, 308
Piazza, S. V., 384
Piccardo, E., 369
Pickering, M. J., 80
Pickering, S. J., 139
Pifarré, M., 48
Pigg, S., 93
Pinto, G., 196, 200
Pintrich, P. R., 29, 35
Piolat, A., 30, 132
Pirnay-Dummer, P., 6, 427, 432, 434, 436, 437, 438
Plester, B., 93
Plumb, M., 357
Poehner, M., 369
Polatajko, H., 356
Polleck, J. N., 367
Pollock, R., 107
Pontart, V., 358
Pontecorvo, C., 147, 148, 152
Porsche, M., 365, 366
Poskiparta, E. H., 153
Potts, D., 367
Poulos, J., 338
Powell, D. R., 198
Powell, K. T., 14
Powell, P., 316
Powers, D. E., 319
Prain, V., 250, 251
Pressley, M.,, 178
Price, D., 12, 13
Prince, M. P., 244
Prior, P., 15, 90, 91
Pritchard, R. J., 332
Propen, A., 14

Proske, A., 168, 202
Prunty, M., 357
Psotka, J., 318
Pullum, G., 290
Puranik, C. S., 145, 146, 148, 150, 151, 353, 355
Purcell, J. J., 121
Purcell, K., 92
Purcell-Gates, V., 365
Pytash, K. E., 263
PytlikZillig, L., 169

Quinlan, T., 278, 317, 352, 411
Quiroga, J., 367

Raedts, M., 167
Raine, R. B., 323
Rainville, K. N., 339
Rajaratnam, N., 64
Ramineni, C., 317
Ramirez, G., 367
Rampton, B., 111
Ramus, F., 352
Ranker, J., 48, 49
Ransdell, S. E., 60, 131
Rapanta, C., 93
Rapaport, S., 145
Raphael, T. E., 282
Rapp, B., 121, 123
Raskind, W., 352
Rasmussen, J., 45
Rau, P. S., 82
Rauh, K., 432
Raulerson, B., 316, 320, 324
Ravid, D., 145, 147
Razali, A. B., 49
Read, S., 257
Redford, M. A., 134
Reece, J. E., 32, 82
Reed, C., 198, 302
Reed, P. M., 263
Reeve, R., 251
Reeves, C., 82
Rehder, B., 318

Reid, R., 161, 303
Reiff, M. J., 15
Reinking, D., 49
Remond, M., 138
Renkl, A., 244, 247
Renninger, K. A., 35, 35–36, 160, 161, 168
Resnick, M., 110
Ress, D., 117
Reynolds, D., 367
Reynolds, G. A., 202, 249, 250, 251
Reznitskaya, A., 309, 310
Ribas, T., 288
Rice, J. E., 43
Rice, R., 97
Richards, J. C., 367
Richards, T., 122, 124, 125, 194
Richardson, J. T. E., 352
Richardson, L., 382
Richardson, W., 211
Richards-Tutor, C., 366
Ricketts, J., 354
Riddle-Buly, M., 338
Ridout, R., 290
Ries, M. L., 121
Rijlaarsdam, G., 2, 17, 26, 27, 33, 57, 58, 59, 60, 65, 67, 131, 167, 244, 280, 281, 283, 291, 322, 416, 417
Rinck, F., 12
Rinderer, R., 162
Rinnert, C., 417
Risemberg, R., 4, 25, 28, 33, 73, 175, 176, 177, 179, 188, 190, 191, 274, 303
Ritchey, K. D., 200
Riujlaarsdam, G., 249
Rivard, L. P., 250
Rivera, C., 365
Rivera, M., 369
Rivers, A., 382
Robbins, B., 32
Robbins, S., 331
Robelia, B., 41, 108
Robert, I. S., 421
Robinson, E. J., 78
Robinson, L., 338, 339
Robledo, P., 83
Roca de Larios, J., 369

Rock, J. L., 178, 405
Rodriguez, M. C., 334
Roeder, A., 432
Roelle, J., 244, 249, 251, 252
Roemer, L., 162
Roen, D. H., 280
Roeske, D., 122
Rogers, D., 367
Rogers, L., 34, 212, 215, 217, 219
Rogers, P., 14, 15
Rogers, R., 335
Rogoff, B., 259
Rohde, J., 434
Rohman, G., 175
Roland, D., 135
Rolheiser, C., 279
Roozen, K., 15, 45, 90, 91, 97
Roper, D., 339
Ros, C., 59
Rosario-Ramos, E., 265
Roscoe, R. D., 17, 96, 169, 316, 317, 318, 320, 321, 322, 323, 324
Rose, B., 387
Rosé, C., 396*f*
Rose, D., 4, 227, 228, 231, 232, 233, 234, 236, 237, 240
Rose, J., 353
Rose, M. A., 240, 248, 251
Rosemary, C. A., 339
Rosen, R., 17
Rosenberg, W., 211
Rosenblum, S., 357
Rosenfeld, E., 382
Rosenstein, M., 403
Rosinski, P., 93
Ross, J. A., 279
Ross, S. M., 46
Roth, M., 119
Rothery, J., 227, 229, 230, 231, 236, 237, 289
Rothlein, D., 123
Rothstein, H. R., 178
Rouiller, Y., 276
Rouse, R., 386
Roux, F. E., 120
Rowe, D., 14

Rowen, N., 367
Rowsell, J., 45, 110
Royer, J. M., 42
Royster, J., 14
Rubin, A. D., 68
Rubin, D., 195
Rudner, L. M., 317, 318, 319
Rudniy, O., 404
Rueda, S., 387
Ruiz-Primo, M. A., 246
Rumelhart, D. E., 68
Rusk, N., 110
Russell, D. R., 11, 15, 91
Russell, M., 341

Sabbaghan, S., 417
Sackett, D., 211
Sacredoti, E., 78
Saddler, B., 282, 351
Sadoski, M., 223
Sagstetter, V., 93
Sahel, S., 75
Sahl, K., 46
Sahni, U., 106
Salahu-Din, D., 1
Salas, N., 146, 152, 153
Sampson, V., 248, 250
Samuels, B., 246
San Francisco, A. R., 359
San Pedro, T., 380
Sanchez, C. A., 419, 423
Sandbank, A., 147, 152
Sanders, T., 61, 65, 67, 76, 416
Sandmel, K., 174, 217
Sanford, K., 45
Santangelo, T., 4, 28, 32, 33, 34, 174, 212, 217, 223, 295, 358
Sato, K., 201, 280
Savery, J. R., 43
Sawyer, R. J., 83
Sayers, D., 371
Scardamalia, M., 2, 25, 27, 29, 30, 31, 33, 75, 79, 82, 104, 131, 134, 138, 160, 175, 176, 211, 243, 250, 251, 273, 274, 277, 278, 279, 283, 303, 307
Schaenen, I., 48, 49

Schafer, W., 32
Schank, R. C., 133
Schauble, L., 261
Scheffler, P., 289
Schickedanz, J., 147, 152
Schilperoord, J., 68, 74, 76, 131
Schleppegrell, M. J., 231, 240, 263, 366, 367
Schmid, M., 367
Schmidt, F. L., 178
Schmidt, K., 247
Schneider, J., 246
Schock, R., 338
Schoenbach, R., 260
Schoer, L., 211
Schoonen, R., 61, 66, 366, 369
Schradie, J., 107
Schreier, M., 431
Schreiner, M. E., 318
Schriefers, H., 84
Schrijver, I., 417, 420, 421
Schriver, K. A., 59, 200, 272, 419
Schryer, C., 16
Schulte-Löbbert, P., 201
Schultz, K., 3, 88, 90, 102, 103, 104, 107, 109, 380
Schunk, D. H., 164, 165, 166, 167, 169, 275
Schunn, C. D., 277
Schuster, M. L., 14
Schvaneveldt, R. W., 433, 438
Schwarcz, H., 335
Schwartz, C., 125
Schwartz, G. G., 17, 263
Schwartz, S. S., 274, 276, 279, 282, 283, 306, 307
Schwonke, R., 244, 247
Scollon, R., 97
Scollon, S. B. K., 97
Scott, C. M., 355
Scott, L. S., 118
Scott, M., 430
Scott, T. D., 179
Scribner, S., 103, 104, 258, 259, 260, 261, 262
Scruggs, T., 219
Seah, L. H., 251
Sebrechts, M. M., 82

Sebring, P. B., 110
Secco, T., 133
Sefton-Green, J., 44, 103, 110
Seger, W., 366
Seidelhofer, B., 365
Seifert, C. M., 79
Selland, M., 96
Selzer, J., 11, 12
Senauke, L., 332
Senko, C., 35
Sewell, J., 289
Sexton, M., 306
Seymour, P. H., 153
Shamo, W., 162
Shanahan, C., 90, 98, 200, 202, 302
Shanahan, T., 4, 89, 90, 148, 194, 195, 196, 197, 198, 199, 200, 201, 202, 302, 355
Shankland, R., 160
Shanton, K. D., 332
Shapiro, L. R., 133
Shapiro, S., 364, 368
Share, D. L., 148
Sharp, D. B., 316
Sharp, J., 161
Sharples, M., 76, 80
Shaw, V., 309
She, H. C., 245, 248, 250, 251
Sheehy, M., 92
Shell, D. F., 34, 162
Sheridan, M. P., 383
Sherman, C. K., 282
Shermis, M. D., 6, 278, 316, 317, 319, 371, 395, 401, 402, 405
Shipka, J., 15, 90, 91
Short, D., 366
Shukla, S., 288
Shute, V. J., 321
Siegel, M., 261
Signorini, A., 151
Silliman, E. R., 122, 353, 355, 356
Silva, T., 364, 366, 367
Silver, C., 431
Simkin, Z., 354
Simon, H. A., 25
Simon, J., 134

Sinatra, G. M., 167
Sinha, A., 18
Sitko, B. M., 175
Skaar, H., 18
Skinner, D., 104
Slattery, S., 419
Sleegers, P., 92
Slembrouck, S., 111
Slomp, D. H., 2, 41, 45, 46, 50, 89, 405
Smagorinsky, P., 14, 213, 263, 264, 266, 267
Smart, G., 13
Smit, D., 42
Smith, A., 92, 110
Smith, E. E., 30
Smith, J. K., 93, 309, 405
Smith, S., 275
Smolkin, L., 15
Smyth, M., 356
Smythe, S., 47
Snellings, P., 66
Snow, C. E., 147, 301, 359, 365, 366, 396
Snow, E. L., 323, 324, 325
Snowling, M. J., 352, 358
So, H. J., 251
Socher, R., 432
Soep, E., 107
Solé, I., 419
Solórzano, R., 369
Song, Y., 280, 283, 301, 307, 308, 311
Soter, A., 197
Souberman, E., 262
Spector, J. M., 434, 436
Spelman Miller, K., 416
Spiegel, D. L., 138
Spinuzzi, C., 15, 91
Spivey, N. N., 195, 202
Sporns, O., 123
Spotti, M., 111
Spratley, A., 260
Sprenger, S., 84
Sprenger-Charolles, L., 136
Squire, K. D., 49
Staab, S., 437

Stagg Peterson, S., 46
Stahl, G., 250
Stainthorp, R., 153, 197
Stang, K. K., 332
Stanovich, K. E., 147
Starke-Meyerring, D., 11, 12, 18
Steffe, L. P., 262
Stein, N. L., 133
Steinbach, R., 82
Steinberg, S. R., 381
Steinkuehler, C. A., 107, 110
Stephens, D., 339
Stephens, Y., 18
Stevens, D. D., 282
Stevenson, M., 66, 369, 417
Stewart, M. A., 387, 388
Stewart, R. A., 258
Stille, S., 369
Stoddard, B., 276, 279, 282, 283
Stoel, R., 366
Stokes, L., 332
Stoll, L., 334
Storch, N., 366
Storms, B. A., 96
Stormzand, M., 294
Stornaiuolo, A., 92, 106, 107, 108, 263, 265, 266
Stotsky, S., 194
Stratman, J. F., 272
Street, B. V., 41, 102, 104, 259, 260, 266, 380
Street, C., 332
Streeter, L., 318
Strickland, D., 148, 149, 154
Stroupe, C., 42
Struyven, K., 276
Studer, R., 437
Studley, R., 316
Sugarman, J., 367
Sugimoto, T., 46, 405
Sullivan, K. P. H., 413, 416, 417
Sulzby, E., 148, 150, 151, 152, 197
Sumfleth, E., 244
Sumner, E., 353, 354, 418
Sun, Y., 251

Suthers, D., 250
Sutton, P., 201
Swain, M., 366, 369, 417
Swanson, D. B., 319
Swanson, H. L., 29, 30, 31, 125, 130, 138, 145, 194, 273
Swanson, L., 34
Swartz, C. W., 164, 166, 167, 169, 275
Swedlow, J., 174
Swerts, M., 411
Sylvester, R., 47, 48
Szwed, J. F., 104

Taborelli, A., 116
Tabors, P., 365, 366
Takayoshi, P., 14, 107
Talbert, J. E., 334
Tamborello, F. P., 75
Tardy, C., 366
Taricani, E. M., 436
Tatum, A. W., 262, 383, 384, 385
Tausczik, Y. R., 319
Taylor, B. M., 334, 338
Taylor, J. C., 250
Taylor, M. J., 118
Taylor, S., 368
Taylor, W. P., 196
Teberosky, A., 147, 148, 150
Tejeda, C., 47
Tellier, P., 420
Tesch-Römer, C., 320
Tetreault, J., 400, 401, 406
Thaiss, C., 15, 18
Therrien, W. J., 250
Thibodeau, A. L., 179
Thomas, G. V., 78
Thomas, K. M., 117, 118
Thomas, S., 334
Thompson, I., 94
Thompson, P. W., 262
Thompson, S., 76
Thorndike, E. L., 42
Thorne, K., 368
Thorpe, M., 92

Thralls, C., 14
Tierney, R. J., 194, 196, 197, 200, 201
Tillema, M., 58, 65, 66, 67, 416
Tillett, P. I., 399
Timmermans, M., 84
Timperley, H., 17
Tinzman, M., 197
Tittmann, P., 433
Toh-Heng, H. L., 251
Tolchinsky, L., 3, 144, 147, 148, 149, 150, 151, 154
Topping, K. J., 275, 276
Tops, W., 353
Tordoir, A., 295
Torrance, M., 3, 72, 74, 75, 76, 78, 83, 273, 284, 303, 322
Torres, R. D., 380
Trabasso, T., 133
Tracy, K., 333, 340
Trapani, C. S., 317, 401
Traweek, D., 149
Traxler, M., 280
Treiman, R., 151
Troia, G. A., 34, 160, 168, 338
Truman, D. L., 398
Tsai, S. P., 246
Tseng, A., 117
Tufte, B., 45
Tullock, B., 369
Tunmer, W. E., 146
Tuomi-Gröhn, T., 45
Turkeltaub, P., 121
Turner, J., 260
Tversky, A., 438
Twain, M., 212
Tynes, B., 382

Uccelli, P., 366
Ulu, C., 245
Usher, E. L., 35, 160, 161

Vaessen, A., 197
Valdés, G., 366, 368
Valentine, J. C., 178
Valiante, G., 34, 35, 162, 163, 164

van Cauwenberghe, E., 353
van den Bergh, H., 2, 26, 27, 33, 57, 58, 59, 60, 61, 65, 67, 69, 244, 249, 322, 416, 417
van den Branden, K., 60
van den Broek, P., 133
van der Hoeven, J., 58, 66
van der Leij, A., 146, 151
van der Spek, E. D., 324
van Dijk, T. A., 131
van Eemeren, F. H., 301, 302, 304, 305, 309
van Galen, G. P., 357
van Gelderen, A., 66, 92, 366
Van Hees, V., 353
van Horenbeeck, E., 414, 415
van Hout-Wolters, B. H. A. M., 61, 322
van Leeuwen, T., 93, 104
van Nimwegen, C., 324
van Oostendorp, H., 324
van Schooten, E., 366
van Steendam, E., 2, 27, 33, 57
van Vaerenbergh, L., 417, 421
Van Waes, L. V., 6, 57, 59, 90, 167, 201, 352, 410, 411, 412, 413, 414, 415, 417, 419, 421, 423
van Weijen, D., 58, 61, 62, 63, 64, 65, 69, 416
van Wijk, C., 76, 79
Vanderberg, R., 31
Vanderburg. M., 339
VanDerHeide, J., 3, 17, 88, 91, 93, 97, 196, 259, 309
Vandermolen, J., 338
VanLehn, K., 322, 324
Varner, L. K., 17, 320, 321
Vasudevan, L., 107, 108, 263, 267, 386
Vaughan, K., 137, 197
Vauras, M. M., 153
Vedder, I., 65
Veel, R., 231
Velay, J. L., 119
Verheyden, L., 60, 61
Verhoeven, L., 16, 356
Vernon, S. A., 147
Verspoor, M., 367
Vertovec, S., 111
Vetter, A., 265, 267
Vezzani, C., 196
Vieira, K., 16

Vignolo, L., 116
Villalón, R. Y., 89, 243
Villalva, K., 367
Vincent, J., 48, 49
Vinci-Booher, S., 121
Voeten, M. J., 153
von Kleist, H., 84
Voss, J. F., 246
Vukelich, C., 146, 152
Vygotsky, L. S., 262, 380, 417

Wade-Stein, D., 278, 403
Wager, T. D., 30
Wagner, M., 369
Wagner, R. K., 146, 197, 355
Wagner, T., 251
Walden, A., 336
Wallace, C. W., 250
Wallace, D. L., 273, 279, 283
Wallace, M., 334
Wallot, S., 414
Walmsley, J., 289, 295
Walpole, S., 338
Walter, K., 74, 356, 419
Walter, S., 434
Walton, D. N., 301, 302, 303, 305, 307, 311
Wang, E., 249
Wang, J., 319, 414
Wang, X., 279
Ward, J., 89
Wardle, E., 42, 90, 97
Ware, P., 318
Warfield, T. D., 320
Warren, J. E., 94
Warren, P., 437
Warriner, D. S., 111
Warschauer, M., 107, 318, 320
Watson, A., 295, 296, 349
Watt, I., 104
Way, D., 136
Wearing, H., 139
Weaver, C., 289
Wei, R. C., 330, 331, 334, 338, 342

Weigle, S. C., 316
Weingarten, R., 75
Weintraub, N., 32, 149
Weisberg, T., 167
Welch, C., 317
Wells, G., 365, 366, 369
Wells, J., 45
Wengelin, Å., 6, 74, 352, 353, 410, 411, 412, 417, 418, 419, 421
Wenger, E., 259, 260
Wesdorp, H., 295
Wessels, S., 387
West, K. C., 47
Weston, J. L., 316
Whitaker, D., 32, 34, 136, 138, 147, 357
White, E. M., 42
Whiteford, A. P., 168, 278
Whitney, A. E., 331, 332, 333
Whittaker, D., 197
Whittaker, R., 240
Wiechmann, D., 430
Wiemer-Hastings, P., 319
Wiener, J., 370
Wigfield, A., 34
Wijsman, E., 352
Wilder, P., 365
Wiley, J., 246
Wilkinson, B., 201, 216, 243
Willey, R. J., 280
Williams, A., 94
Williams, G. J., 290, 355
Williams, J. M., 13, 369
Williamson, D. M. W., 317, 395, 405
Williamson, J., 295
Willingham, D., 31
Willis, A. I., 382
Wills, K. V., 97
Willson, V., 223
Wilmut, K., 357
Wilson, A. A., 263, 266, 267
Wilson, D. B., 178, 214, 217
Wilson, J. S., 278, 367
Wimmer, H., 153
Windschitl, M., 46

Windsor, J., 355
Wineburg, S. S., 200
Wingate, U., 323
Winn, W. D., 126, 145, 352
Winograd, P., 246
Winokur, J., 212
Winsor, D., 14
Wissinger, D., 94
Wissman, K., 386
Witte, S. P., 245, 248, 261
Wohlwend, K. E., 45
Wolbers, K., 160
Wolff, S., 317
Wollman-Bonilla, J. E., 17, 47
Wolsey, T. D., 262
Womack, E., 381
Wong, A., 119
Wong, B. Y., 244
Wood, C., 93
Wood, D. R., 331
Woodard, R., 330, 336
Woodhull, G., 434
Woods, D., 93
Woodworth, R. S., 42
Woolf, B., 322
Woolfolk, A., 168
Wouters, P., 324
Wright, T., 340
Wydell, T. N., 352
Wyllie, M., 295
Wyman, L. T., 111
Wynhoff Olsen, A., 91, 93

Xi, X., 316, 395
Xin, M. C., 94
Xu, G., 121
Xu, X., 367

Yancey, K., 42
Yang, C. L., 75
Yang, E. M., 250
Yarrow, F., 276
Yates, C. M., 194

Yates, J., 12
Yee, L., 94
Yeh, K. H., 251
Yerry, F., 212
Yi, Y., 107, 108, 257, 262, 367, 368, 371
Yoon, C., 367
Yore, L., 250
Young, R., 110
Yousoubova, L., 11
Yu, N., 357
Yu, W., 436
Yuan, F. Y., 82

Zachry, M., 14
Zawacki, T. M., 15
Zawilinski, L., 2, 41, 48
Zhang, C., 367
Zhang, J., 245, 251
Zhang, L. J., 65
Zheng, J., 96
Zheng, X., 29
Zheng, Y., 369
Zhu, W., 276, 283
Zidonis, F. J., 295
Zigmond, N., 338
Zimmerman, B. J., 4, 25, 28, 33, 73, 161, 163, 164, 165, 169, 175, 176, 177, 179, 188, 190, 191, 274, 303
Zohar, A., 248
Zucchermaglio, C., 147, 148, 152
Zuercher, N., 168
Zuidema, L. A., 341
Zumbrunn, S., 34, 161

Subject Index

The pagination of this electronic edition does not match the edition from which it was created. To locate a specific passage, please use the search feature of your e-book reader or select a page number link below.

Note: f or *t* following a page number indicates a figure or a table.

Abstract planning, 79–81. *See also* Planning processes in writing
Abstractness, 153–154
Academic language, 260, 366–367
Achievement, 35, 232–233
Action-perception loops, 126

Activities, 17, 91–95, 221*t*, 229
Activity theory of learning, 90–91, 244–245
Actor-network theory (ANT), 104–106
Additive–cumulative views, 145–147
Adolescents. *See also* High school writing instruction

culturally and linguistically diverse classrooms (CLD) and, 385

keystroke logging and, 417

new literacies and, 45–47

overview, 257

writing development and, 90, 123–124

Adults, 132–133
Affective factors, 27, 381
Affinity identities, 385. *See also* Identity
Age factors, 367–368
AIMs (Attract the reader's attention, Identify the problem, Map the context, State the thesis) strategy, 307
Alternative to Incarceration Program (ATIP), 108
Analysis of Lexical Aggregates (ALA) Reader, 436
Argumentation Schemes (AS) condition, 307
Argumentative writing

dialogue and, 309–311

evaluation and revision and, 280

goal setting and, 303–305

overview, 5, 301–303, 311–312

problem solving and, 303–308

strategy instruction and, 305–308

writing to learn (WTL) and, 246, 248–249

Artificial intelligence (AI), 317
Ask and Answer Critical Questions (ASCQ) condition, 307
Assessment. *See also* Automated essay scoring (AES) system; Standardized testing

automated writing evaluation (AWE) systems and, 396, 399, 403, 405

English language learners and, 369–370

genre pedagogy and, 229, 234–237, 235*t*, 236*t*

self-efficacy and, 164

writing development and, 96, 97

Association for Supervision and Curriculum Development (ASCD), 340
At-risk students, 384–386. *See also* English language learners; Learning disabilities
Audience

argumentative writing and, 305–306

evaluation and revision and, 274, 280–281, 283–284

learning to write and, 17

reading–writing relationships and, 201

writing processes and, 14–15

Author–reader relationships, 196, 200–201. *See also* Reading–writing relationships
Automated essay scoring (AES) system, 278, 317–320. *See also* Automated writing evaluation (AWE) systems; Computer-based writing instruction; Feedback
Automated writing evaluation (AWE) systems. *See also* Computer-based writing instruction

computer-based writing instruction and, 322

E-rater system, 317, 400–401

evaluation and, 401–402

extrapolation, 404–405

generalization and, 402–404

Intelligent Essay Assessor (IEA), 397–398

intelligent tutoring systems (ITS) for writing and, 323

overview, 6, 320–321, 395–398, 406

Project Essay Grade (PEG), 398–400

utilization, 405–406

Bayesian text classification, 317
Behavioral processes, 176*t*
Bereiter and Scardamalia (1987) models, 27–28, 175–178
Biliteracy, 368–369, 387–388

Blood oxygen level dependent (BOLD) signal, 117, 120, 122, 123–124
Books, 179, 179*t*, 188
Brain development, 117–126, 119*f*. *See also* Neuroscience research

Capitalization, 146
CDO (compare, diagnose, and operate) model, 273–274, 279–280
Central executive, 29–30
Children, 133–136. *See also* Developmental processes; Early childhood; Middle childhood
Coaching, 169
Coaching, professional, 330, 338, 338–340. *See also* Professional development
Cognitive Band, 74–75
Cognitive models

- evaluation and revision and, 283, 284
- overview, 2–3, 4, 24–29
- reading–writing relationships and, 195, 196, 202–203
- writing to learn (WTL) and, 243–245, 251

Cognitive processes

- motivation, 34–36
- overview, 26, 27, 36–37
- pauses in keystroke logging and, 411–415, 412*f*, 413*f*, 415*t*
- planning and, 73–81, 77*f*
- reading–writing relationships and, 202–203
- self-regulation and, 33–34
- transcription skills, 31–32
- working memory and, 29–31
- writing development and, 89–90, 145

Cognitive self-regulation instruction (CSRI), 322
Cognitive strategies, 179, 179*t*, 184*t*–188*t*, 189–190
Collaboration

- argumentative writing and, 309–311
- English language learners and, 366

evaluation and revision and, 276

grammar instruction and, 291

learning to write and, 17

new literacies and, 48

self-efficacy and, 166, 167

writing development and, 94, 97

writing processes and, 59–60

writing to learn (WTL) and, 250

Combined use of reading and writing, 201–202. *See also* Reading–writing relationships
Common Core State Standards (CCSS)

argumentative writing and, 302, 312

automated writing evaluation (AWE) systems and, 396, 397–398, 404, 406

culturally and linguistically diverse classrooms (CLD) and, 383–384

high school writing instruction and, 257

overview, 1–2

professional development and, 338

self-regulation and, 191

writing development and, 89

Communicative functions of writing, 12–14, 48–49, 135–136, 301
Composition, 43, 133–136, 151–154
Computer feedback, 278. *See also* Feedback
Computer-assisted tomography (CT), 117–118. *See also* Neuroscience research
Computer-based writing instruction, 6, 316–317, 321–325, 367. *See also* Automated essay scoring (AES) system; Automated writing evaluation (AWE) systems; Instruction in writing; Linguistic analysis tools
Computer-supported collaborative learning (CSCL), 250, 250–251
Conceptions of writing, 251–252
Conceptual model of expertise, 43–44
Concordance tools, 6, 430–431
Conditions of writing, 167–168
Connection with others via writing, 107–108
Connectors, 138, 146

Construction, 263–264
Content, 76–81, 77*f*, 397
Content learning, 195, 201–202, 248–252, 302, 366
Contexts, 92–93, 379, 383–385
Criterion Online Writing Evaluation service, 404
Critical pedagogy, 380–381
Critical standards, 302
Culturally and linguistically diverse classrooms (CLD). *See also* English language learners

contexts and, 383–385

identity and, 385–387

overview, 377–380, 388–389

research and, 382–388

theoretical perspectives, 380–382

Culturally relevant pedagogy (CRP), 381–382
Culturally sustaining pedagogy (CSP), 381–382
Curriculum, 228, 233–234

DARE (Develop a topic sentence, Add supporting ideas, Reject possible arguments for the other side, and End with a conclusion) strategy, 248–249, 306–307
Decoding skills, 146, 196, 355
Deconstruction, 229–230, 230*f*, 231
Deliberative planning, 78–79. *See also* Planning processes in writing
Design-based research, 267–268
Detailed Reading, 232–233
Developmental Assessment Resource for Teachers (DART), 234
Developmental coordination disorder (DCD), 6, 351, 356–360. *See also* Learning disabilities
Developmental processes. *See also* Children; Writing development

brain development and, 118–124, 119*f*

evaluation and revision and, 273–274

grammar instruction and, 289–290

reading–writing relationships and, 203

self-efficacy and, 162–165

social practices and, 91–95

sociocultural perspectives on, 88–90

translation and, 132–136

working memory and, 30

writing tasks and, 349–351, 350*f*

Diagnostic labels, 357–358, 369–370. *See also* Learning disabilities
Dialogue, 33–34, 309–311
Diffusion tensor imaging (DTI), 117–118. *See also* Neuroscience research
Digital storytelling, 45–46
Digital writing. *See also* New literacies

collaboration and, 94

contextualizing activity, 92–93

out-of-school writing and, 108–111

overview, 46–47

sociocultural perspectives and, 259–260

writing development and, 97

Disciplinary literacy, 201–202, 262–263
Discourse analysis, 96–97
Discourse features, 78, 197, 228, 249, 366, 401
Discursive perspective of identity, 385. *See also* Identity
DISKS (*Disciplinarity, Knowledge and Schooling*) project, 227
Distributed cognition, 244–245
Domain knowledge

new literacies and, 43–44

overview, 16, 28–29

reading–writing relationships and, 195

self-efficacy and, 161–162

translation and, 137

writing development and, 149

writing quality and, 161

Drafting strategy, 221, 221*t*
DSM-5, 351, 354
Dual-language programs, 367. *See also* English language learners

Dynamic Indicators of Basic Early Literacy Skills (DIBELS), 339
Dysgraphia, 117, 122
Dyslexia. *See also* Learning disabilities

brain development and, 122

diagnosis and, 357–358

handwriting and, 353–354

interventions and, 358–359

keystroke logging and, 417–419

overview, 6, 351, 352–353, 359–360

phonological aspects of language and, 356

Dysphagia. *See* Language learning disorder (LLD)

Early childhood, 118, 119–121, 119*f*, 149–154. *See also* Children; Developmental processes
Early Language and Literacy Classroom Observation (ELLCO), 340
Ecological model of development, 45
Editing text, 221, 221*t*
Educational Testing Services (ETS), 400–401
Electroencephalograms (EEGs), 117–118, 410. *See also* Neuroscience research
Emergent writing, 3–4, 149–154. *See also* Writing development
Emotional states, 35, 163
Engagement, 221, 221*t*, 229
English language learners. *See also* Culturally and linguistically diverse classrooms (CLD)

assessment and, 369–370

intervention studies, 337–338

keystroke logging and, 416

modeling and scaffolding writing strategies, 366–368

new literacies and, 46

out-of-school writing and, 106, 108

overview, 6, 364–366, 370–371

professional development and, 341

reading–writing relationships and, 199–200

sociocultural perspectives and, 263

writers' characteristics and, 66–67, 69

writing competencies in multiple languages, 368–369

writing development and, 366

writing processes and, 63–66, 64*f*, 65*t*

Environmental factors, 33–34, 36, 176*t*, 220–221, 221*t*
E-rater system, 317, 400–401. *See also* Automated essay scoring (AES) system; Automated writing evaluation (AWE) systems
Essay feedback systems. *See* Automated essay scoring (AES) system; Automated writing evaluation (AWE) systems
Ethnic diversity. *See* Culturally and linguistically diverse classrooms (CLD)
Ethnography, 109–110
Evaluation

argumentative writing and, 311–312

automated writing evaluation (AWE) systems and, 401–402

genre pedagogy and, 229, 234

overview, 36

writing development and, 350*f*

writing processes and, 58, 58*t*

Evaluation instruction. *See also* Instruction in writing

developmental and individual differences and, 273–274

feedback and, 274–278

overview, 272, 282–284

research and, 274–282

strategy instruction and, 281–282

teaching goals and criteria for, 278–280

Event-related potentials (ERPs), 117–118. *See also* Neuroscience research
Evidence-based practice for instruction. *See also* Instruction in writing

affordances and caveats, 222–224

establishing, 215–219, 216*t*–217*t*, 218*t*

guidelines for teaching writing and, 220–224, 221*t*

identification of, 214–215

overview, 4, 211–214, 224

in writing, 219–220, 220*t*

Expectations, 221, 221*t*
Expertise, 43–44, 137
Extrapolation, 404–405

Feedback

automated essay scoring (AES) system and, 317–320

automated writing evaluation (AWE) systems and, 320–321, 396, 398, 403, 405–406

computer-based writing instruction and, 278, 316–317

evaluation and revision and, 275

giving, 277–278

guidelines for teaching writing and, 222

learning to write and, 17

from peers, 275–278

self-efficacy and, 164

from teachers, 275

writing processes and, 14–15

Fluency, 422–423
Formative feedback, 321, 403. *See also* Feedback
Functional dynamic approach, 57–60, 58*t*, 60*f*. *See also* Writing processes
Functional magnetic resonance imaging (fMRI), 117–118, 120, 121–122, 123–124, 410. *See also* Neuroscience research

Galvanic skin response (GSR), 410
Gender, 163–164, 384, 386
Generalization, 42, 402–404
Generalized psychophysiological interactions (gPPI) functional connectivity analysis, 121
Generating ideas, 58–59, 58*t*, 60*f*
Genre pedagogy

assessment and, 234–237, 235*t*, 236*t*

development of, 229–234, 230*f*, 232*t*

evaluation and, 234

overview, 4, 227, 239–240

phases of, 229–234, 230*f*, 232*t*

research and, 237–240, 238*f*, 239*f*

theoretical perspectives, 227–228, 228*f*

Genres

argumentative writing and, 304–305

knowledge of, 44, 69, 229–230, 230*f*

new literacies and, 48–49

writing development and, 151–152

writing processes and, 14–15, 63

Gifted students, 385–386
Goal orientation, 35
Goal setting

argumentative writing and, 303–305, 308

guidelines for teaching writing and, 221

overview, 33–34, 36

self-regulation and, 175–176, 179, 179*t*, 180*t*–181*t*, 188–189, 190

writing processes and, 58, 58*t*

Goals, 27, 78, 164, 220–221, 221*t*
Grading, 278–280
Grammar

automated writing evaluation (AWE) systems and, 397, 399, 401

grammatical cohesion, 429–430

learning disabilities and, 355, 359

systemic functional linguistic (SFL) theory and, 228

writing development and, 154

Grammar instruction. *See also* Instruction in writing

guidelines for teaching writing and, 221

history of, 288–289

issues with, 289–291

overview, 5, 297

research and, 294–297

theoretical perspectives, 291–294, 292*f*, 293*f*, 294*f*

Graph structure, 433–434, 433*f*
Graphic characteristics, 149–150
Graphomotor planning, 119, 119*f*
Great Divide theories, 104, 145–149
Guided practice, 221, 276

Handwriting. *See also* Transcription skills

brain development and, 121–122, 123, 124

guidelines for teaching writing and, 221

instruction and, 124

interventions and, 358

learning disabilities and, 353–354, 358

overview, 31–32

reading–writing relationships and, 197

translation and, 136

writing development and, 145, 147

Hayes (1996) model, 27
Hayes and Flower (1980) model, 26–27, 29, 175
Hearing impairments, 417–418
High school writing instruction, 257–262, 266–268. *See also* Adolescents; Instruction in writing
Historical reasoning strategy, 306–307

History content area, 248–249, 252

Idea generation, 122–123
Identity

communicative functions of writing and, 13–14

culturally and linguistically diverse classrooms (CLD) and, 379, 385–387

English language learners, 367

new literacies and, 47, 48, 104–105

sociocultural perspectives and, 260–261, 263–264, 265–266

Ideology, 380–381
Independent Construction, 229–230, 230*f*, 231–232
Individual differences, 273–274
Individual interest, 35–36. *See also* Interest
Infancy, 118. *See also* Developmental processes
Information processing models, 243–244
Inquiry activities, 221, 383
Instant messaging, 45–46, 106
Institutional perspective of identity, 385. *See also* Identity
Instruction in writing. *See also* Computer-based writing instruction; Evaluation instruction; Evidence-based practice for instruction; Grammar instruction; High school writing instruction; *Reading to Learn* (R2L) program; Revision instruction; Strategy instruction; Teachers; Writing instruction; Writing to learn (WTL)

automated writing evaluation (AWE) systems and, 396, 399, 405–406

brain development and, 124–125

cognitive models and, 25, 36–37

culturally and linguistically diverse classrooms (CLD) and, 379, 382–388

English language learners and, 366–371

genre pedagogy and, 229–234, 230*f*, 232*t*

guidelines for teaching writing and, 220–224, 221*t*

identifying EBPs for, 215–220, 216*t*–217*t*, 218*t*, 220*t*

new literacies and, 46–47, 48

overview, 4–5, 36

planning and, 82–83

reading–writing relationships and, 198–199, 203

self-efficacy and, 166

self-regulation and, 179, 179*t*, 184*t*–188*t*, 189–190

sociocultural perspectives and, 268

writing development and, 93–94, 97–98, 146–147, 148–149

writing to learn (WTL) and, 248–252

Intelligent Essay Assessor (IEA), 318, 397–398. *See also* Automated essay scoring (AES) system; Automated writing evaluation (AWE) systems
Intelligent tutoring systems (ITSs), 5, 321–325. *See also* Computer-based writing instruction
IntelliMetric system, 317. *See also* Automated essay scoring (AES) system
Interest, 35–36, 161, 168
International Literacy Association, 340–341
Internet, 41–42, 92–93. *See also* New literacies
Interventions, 330, 336–338, 358–359

Joint Construction, 229–230, 230*f*, 231–232
Journal writing strategies, 249, 252
Justification, 276–277

Keystroke latencies, 73–76
Keystroke logging

overview, 6, 410–411, 422–423

pauses and cognitive writing processes, 411–415, 412*f*, 413*f*, 415*t*

struggling writers and, 417–422

writing development and, 415–417

Knowledge

grammar instruction and, 291–292

guidelines for teaching writing and, 221, 221*t*

overview, 14

self-efficacy and, 168

sociocultural perspectives and, 260

translation and, 137

writing development and, 94–95

Knowledge Forum (KF), 250–251
Knowledge-constituting model, 244, 249
Knowledge-telling model, 27–28, 133–134, 175–176
Knowledge-transforming model, 27–28, 175–176

Labels, 385–386. *See also* English language learners; Gifted students; Learning disabilities; Underachievers
Language effect, 63–67, 64*f*, 65*t*, 69
Language learning disorder (LLD). *See also* Learning disabilities

diagnosis and, 357–358

interventions and, 358–359

keystroke logging and, 417–419

overview, 6, 354–355, 359–360

phonological aspects of language and, 356

transcription and translation and, 356

writing development and, 351

Latent Dirichlet allocation (LDA) model, 399
Latent semantic analysis (LSA)

automated essay scoring (AES) system and, 317, 318, 319–320

automated writing evaluation (AWE) systems and, 397

overview, 434

Text-Model Inspection Trace of Concepts and Relations (T-MITOCAR), 434–436, 435*f*

Learning

combined use of reading and writing and, 201–202

genre pedagogy and, 229

guidelines for teaching writing and, 222

National Writing Project and, 232–233

overview, 15–18

reading for, 231–234, 232*t*

social action perspective of, 89

sociocultural perspectives on, 259

writing and, 222, 246–248

Learning communities. *See* Professional learning communities (PLCs)
Learning disabilities. *See also* Developmental coordination disorder (DCD); Dyslexia; Language learning disorder (LLD)

argumentative writing and, 303

brain development and, 122

culturally and linguistically diverse classrooms (CLD) and, 384

diagnosis and, 357–358

evaluation and revision and, 273, 276, 279

handwriting and, 353–354

interventions and, 358–359

keystroke logging and, 417–422

overview, 6, 349, 351–352, 359–360

phonological aspects of language and, 355–356

reading–writing relationships and, 199

transcription and translation and, 356

writing tasks and, 349–351, 350*f*

Learning problems, 199. *See also* Learning disabilities
Letter representations, 120–121, 123, 136, 151
Letter-sounds relations, 147–148, 197
Lexical knowledge

automated writing evaluation (AWE) systems and, 397

dyslexia and, 353

grammar instruction and, 290

translation and, 138, 139

writing development and, 153–154

Linguistic analysis tools. *See also* Computer-based writing instruction

Analysis of Lexical Aggregates (ALA) Reader, 436

comparison and scoring, 438–439

concordance tools, 6, 430–431

indices for readability, 429–430

latent semantic analysis (LSA) and, 434

Local Semantic Trace (LoST), 436–437

overview, 427–428, 427*f*, 439–440

qualitative data analysis tools, 431

Semantic Web, 437–438

syntax analysis and, 431–438, 432*f*, 433*f*, 435*f*

writing tasks and, 428–429

Linguistically diverse classrooms. *See* Culturally and linguistically diverse classrooms (CLD); English language learners

Literacy, 104, 105, 105–106, 302

Literacy coaching, 338–340. *See also* Coaching, professional

Literacy Collaborative (LC), 339

Literacy Specialist Project (LSP), 339

Literature, 249, 252

Local Semantic Trace (LoST), 436–437

Long-term memory

dyslexia and, 352–353

learning disabilities and, 359

overview, 26, 27, 29–30

planning and, 80

writing development and, 350*f*

Magnetic resonance imaging (MRI). *See* Structural magnetic resonance imaging (MRI)

Mastery experiences, 35, 161

Materials, 350*f*

Meaning, 14, 264–265, 290

Measurement Incorporated (MI), 399

Memory processes, 24. *See also* Working memory
Mental imagery, 179, 179*t*, 183*t*–184*t*, 190
Mental representations, 25, 130–131, 133, 175–176
Metacognition

evaluation and revision and, 274

new literacies and, 44–45

reading–writing relationships and, 197

translation and, 139

writing development and, 89, 97

writing to learn (WTL) and, 247

Meta-comments, 58, 58*t*
Metaknowledge, 195
MEXICA program, 80
Middle childhood, 121–123. *See also* Children; Developmental processes
Modeling

English language learners and, 366–368

guidelines for teaching writing and, 221, 221*t*

self-efficacy and, 35, 162, 169

self-regulation and, 179, 179*t*, 188

Monitoring, 36, 58
MonoConc Pro software, 430
Morphology

dyslexia and, 353

English language learners and, 367

grammar instruction and, 290

instruction and, 124

writing development and, 145, 146–147

Motivation. *See also* Self-efficacy

argumentative writing and, 303

English language learners and, 367

guidelines for teaching writing and, 221, 221*t*

overview, 27, 34–36, 160–161

sociocultural perspectives and, 260

Motor experience, 120–121
Multileveled writing systems of the brain, 116–117. *See also* Neuroscience research
Multimodal writing, 108–111, 247. *See also* Digital writing

Name writing, 150–151
Narrative quality, 355
Narrative schema, 133–134
National Assessment of Educational Progress (NAEP), 166, 301
National Council of Teachers of English (NCTE), 340–341
National Writing Project, 5, 213, 331–333, 335–336, 342
Natural Language Generation (NLG), 76, 78, 79
Natural language processing (NLP), 317, 324, 397, 400–401, 415
Nature perspective of identity, 385. *See also* Identity
Neural processing of letters, 120–121
Neuroimaging technology, 117–118
Neuroscience research

instruction and, 124–125

methods used to study the brain, 117–118

overview, 3, 116–117, 125–126

New literacies. *See also* New Literacy Studies; Technological advances

adolescents and, 45–47

collaboration and, 94

contextualizing activity, 92–93

instruction and, 125

integrating in the classroom, 46–47

out-of-school writing and, 106, 108–111

overview, 41–45

patterns in, 50

sociocultural perspectives and, 259–260

young children and, 47–49

New Literacy Studies, 3, 41–42, 102–103, 104–106, 380. *See also* New literacies
New London Group, 43–44, 105
No Child Left Behind, 406
Nonverbal IQ, 145
Note-taking, 33–34, 81–82. *See also* Record keeping

Observational learning, 416–417
Opinion essays, 302–303
Oral and written language learning disability (OWL LD), 122. *See also* Learning disabilities
Oral language, 199–200, 355
Organization, 33–34
Orthography, 124, 137, 197, 353
Outcome expectancies, 168–169
Outlining, 81–82
Out-of-school writing

connection with others via, 107–108

contexts and practices of, 107

English language learners, 367

learning to write and, 18

methodological framework, 103

new directions in researching, 109–111

new literacies and, 45–46, 47–48

overview, 102–103

research and, 106–109

self-authorship and, 108–109

sociocultural perspectives and, 266

theoretical perspectives, 103–106

Partnership for Assessment of Readiness for College and Careers (PARCC), 401–402
PAULINE system, 79
Pausing in keystroke logging. *See also* Keystroke logging

overview, 422–423

pauses and cognitive writing processes, 411–415, 412*f*, 413*f*, 415*t*

writing processes and, 58, 58*t*

Peer response

argumentative writing and, 309–311

learning to write and, 17

review and feedback from peers, 275–278, 279, 282–284

writing development and, 97

Peer-learning settings, 259. *See also* Instruction in writing
Performance theories, 104–106
Personal/covert processes, 176*t*
Phonemic awareness, 124, 146–147, 198
Phonology

adolescents and, 124

dyslexia and, 352

instruction and, 124

learning disabilities and, 355–356

phonological loop, 29–30

reading–writing relationships and, 197

translation and, 137

writing development and, 145, 147–148

Physiological states, 163
Planning processes in writing. *See also* Self-regulation processes

cognitive processes and, 73–81, 77*f*

guidelines for teaching writing and, 221, 221*t*, 222

learning to write and, 17

overview, 3, 33–34, 72–73, 83–84

scaffolding and self-regulation and, 81–83

style and, 67

translation and, 132

working memory and, 29–30

writing development and, 145, 350*f*

writing processes and, 58, 62–63, 62*f*

PLANS (Pick goals, List ways to meet goals, And make Notes, Sequence notes) strategy, 306–307, 308
Power, 380–381
Pragma-dialectical theory, 302
Premotor activations, 120–121
Preschoolers, 149–154. *See also* Developmental processes; Early childhood; Emergent writing
Prewriting activities. *See also* Planning processes in writing

guidelines for teaching writing and, 221

overview, 81–82, 132

self-regulation and, 179, 179*t*, 182*t*–183*t*, 189, 190

Principle component analysis (PCA), 399
Problem analysis, 175–176
Problem solving

argumentative writing and, 303–308

learning to write and, 17

overview, 24–25, 27

revision and, 273

self-regulation and, 175–176

Problem translation, 175–176
Process approach to writing, 164, 283. *See also* Writing processes
Production of texts, 12, 58*t*, 355
Professional development. *See also* National Writing Project; Teachers

culturally and linguistically diverse classrooms (CLD) and, 384

evidence-based practice for instruction and, 224

intervention studies, 336–338

literacy coaching, 338–340

networks of, 330–334

online options, 340–341

overview, 5, 330, 341–342

professional learning communities, 330, 334–336, 342

Reading and Writing Project, 333–334

Professional learning communities (PLCs), 330, 334–336, 342. *See also* Professional development
Professional writing, 419–422
Project Essay Grade (PEG), 398–400
Pronunciation, 290
Propositions, 302, 350*f*
Punctuation, 137, 146, 355

Qualitative data analysis tools, 431

Race-to-the-Top consortia, 401–402, 405
Racial diversity. *See* Culturally and linguistically diverse classrooms (CLD)
Rapid automatized naming (RAN), 146
Rational Band, 74–75
Reactive planning, 78–79. *See also* Planning processes in writing
Readability tools, 6, 429–430. *See also* Linguistic analysis tools
Reader experiences, 280–281, 283–284. *See also* Audience
Reading, 32, 197, 231–234, 232*t*, 350*f*
Reading and Writing Project, 333–334. *See also* Professional development
Reading comprehension

automated writing evaluation (AWE) systems and, 404

evaluation and revision and, 279–280

language learning disorder (LLD) and, 355

overview, 36, 202

prior knowledge and, 195

revision and, 273

summary writing and, 246–247

writing to learn (WTL) and, 249

Reading to Learn (R2L) program. *See also* Genre pedagogy

assessment and, 234–237, 235*t*, 236*t*

evaluation and, 234

overview, 231–234, 232*t*

research and, 237–240, 238*f*, 239*f*

Reading–writing relationships, 4, 194–203. *See also* Author–reader relationships
ReadWriteThink, 340–341
RECAP (Restate thesis, Explain how thesis is supported, Close the essay, Avoid new arguments, Present ideas)
strategy, 323
Recontextualization, 93–94
Record keeping, 33–34. *See also* Note-taking
Reflection, 273
Rehearsing, 33–34
Relationships, 12–14
Representations, 14, 263–264
Reprocessing, 58
Rereading, 58, 58*t*, 59, 60*f*
Retrieving, 133
Reviewing records, 33–34
Revision

argumentative writing and, 310–311

feedback and, 274–278

guidelines for teaching writing and, 221, 221*t*

learning to write and, 17

overview, 5, 33–34

research and, 274–282

style and, 67

teaching goals and criteria for, 278–280

theoretical perspectives, 272–273

writers' characteristics and, 66–67

writing processes and, 58, 58*t*

Revision instruction, 272, 273–274, 281–284. *See also* Instruction in writing
Rhetorical factors, 43–44, 93–94, 302

Rhetorical Theory (RST), 76, 77*f*, 78–79

Scaffolding, 34, 81–83, 221*t*, 283–284, 366–368
SCAN (Does it make Sense? Is it Connected to my belief? Can I Add more? Note errors) strategy, 307
Schemas, writing. *See* Writing schemas
Science content area, 248, 250, 252
Science Writing Heuristic (SWH), 250
Second-language learners. *See also* English language learners

grammar instruction and, 289

keystroke logging and, 416

overview, 364–366

reading–writing relationships and, 199–200

writing competencies in multiple languages, 368–369

Self-authorship, 108–109
Self-consequating, 33–34
Self-efficacy

argumentative writing and, 303

overview, 4, 28, 34–35, 160–161, 169–170

research and, 162–169

sources of, 161–162

Self-evaluation, 33–34, 97, 179, 179*t*, 181*t*–182*t*, 189, 190. *See also* Assessment
Self-instructions, 58, 58*t*
Self-monitoring, 33–34
Self-regulated strategy development (SRSD). *See also* Self-regulation processes

argumentative writing and, 305–306, 307–308

intervention studies, 338

learning disabilities and, 358

overview, 189, 190

planning and, 83

professional development and, 338, 342

self-efficacy and, 162, 166

writing to learn (WTL) and, 248–249

Self-regulation processes. *See also* Planning processes in writing; Self-regulated strategy development (SRSD)

argumentative writing and, 303, 305–306, 307–308, 312

evaluation and revision and, 274

executive functions, 125

forms of, 176–177, 176*t*

intelligent tutoring systems (ITS) for writing, 322

models of writing and, 175–177, 176*t*

overview, 4, 28, 33–34, 36, 174–175, 190

planning and, 81–83

research and, 177–191, 179*t*, 180*t*–188*t*, 190–191

self-efficacy and, 163

Self-selecting models, 33–34
Semantic analysis, 433–434
Semantic Web, 437–438
Sentence Making, 233
Sentence planning, 75–76, 401. *See also* Planning processes in writing
Sentence tree, 432, 432*f*
Sentence writing skills, 3, 221
Situated cognition and metacognition, 44–45, 244–245. *See also* Metacognition
Skills, 137–138, 260. *See also* Strategy instruction
SLATE (*Scaffolding Literacy in Tertiary and Academic Environments*) project, 227
Smarter Balanced, 401–402
Social constructs, 25, 33–34, 380
Social persuasion, 35, 162–163
Social practices

overview, 3

systemic functional linguistic (SFL) theory and, 227–229, 228*f*

writing development and, 90, 91–95, 96, 98

Sociocognitive perspective

culturally and linguistically diverse classrooms (CLD) and, 380

reading–writing relationships and, 195, 196, 200–201, 203

writing development and, 89–90

Sociocultural perspective

culturally and linguistically diverse classrooms (CLD) and, 382

instruction and, 97–98, 268

keystroke logging and, 416–417

overview, 3, 5, 6, 88–90, 98, 257–262

research and, 95–97, 261–264, 266–268

social practices and, 91–95

theoretical perspectives, 266–267

South Carolina Reading Initiative (SCRI), 340
Spatial theories, 104–106
Special populations, 6. *See also* Culturally and linguistically diverse classrooms (CLD); English language learners; Learning disabilities
Specific language impairment (SLI). *See* Language learning disorder (LLD)
Speech Writer system, 324
Spelling skills. *See also* Transcription skills

automated writing evaluation (AWE) systems and, 399, 401

brain development and, 122, 123–124

dyslexia and, 352–353

grammar instruction and, 290

instruction and, 124, 221

interventions and, 358

language learning disorder (LLD) and, 355

learning disabilities and, 358

overview, 32

phonological aspects of language and, 356

reading–writing relationships and, 196, 197

systemic functional linguistic (SFL) theory and, 228

translation and, 136, 137

writing development and, 145, 146, 147, 152–154

Standardized testing, 46, 96, 339, 369–370. *See also* Assessment
Standards. *See* Common Core State Standards (CCSS)
Statistical modeling, 317, 397
STOP (Suspend judgment, Take a side, Organize their ideas, and Plan) strategy, 248–249, 306–307
Strategy instruction. *See also* Instruction in writing

argumentative writing and, 305–308

computer-based writing instruction and, 316, 322–323

evaluation and revision and, 281–282

guidelines for teaching writing and, 221, 221*t*

overview, 36

planning and, 83

self-efficacy and, 164

translation and, 138–139

Structural magnetic resonance imaging (MRI), 117–118. *See also* Neuroscience research
Structuring, 58–59, 58*t*, 76–81, 77*f*
Struggling learners, 384–386, 417–422. *See also* English language learners; Learning disabilities
Subject matter knowledge, 44
Summarization, 403–404
Summary Street program, 278
Summary writing, 246–247, 249
Summer Institute, 331–332. *See also* National Writing Project
Syntax

complexity and, 146, 153–154

features, 399

grammar instruction and, 290

knowledge of, 139

linguistic analysis tools and, 431–438, 432*f*, 433*f*, 435*f*

planning and, 75

syntactic tools, 6

translation and, 138

Systemic functional linguistic (SFL) theory, 227–229, 228*f*

Task complexity, 65–66
Task environment

overview, 26, 27

self-regulation and, 175

writing development and, 350*f*

writing processes and, 61–66, 62*f*, 64*f*, 65*t*

Task schema, 272–273
Teacher education, 367. *See also* Professional development
Teacher Learning Instrument (TLI), 339
Teachers. *See also* Instruction in writing; Professional development

evidence-based practice for instruction and, 212, 223–224

feedback from, 275

goals and evaluation criteria of, 278–280

grammar instruction and, 291

guidelines for teaching writing and, 220–224, 221*t*

learning to write and, 17–18

National Writing Project and, 331–332

new literacies and, 46–47

self-efficacy and, 162, 168–169

writing development and, 93–94, 148–149

writing to learn (WTL) and, 252

Teaching to learning cycle (TLC), 229–230, 230*f*
Teaching/Learning Centers (TLCs), 335. *See also* Professional learning communities (PLCs)
Technological advances. *See also* New literacies

automated essay scoring (AES) system, 278

computer-supported collaborative learning (CSCL) and, 250–251

guidelines for teaching writing and, 222

overview, 6, 42–45

self-efficacy and, 169

sociocultural perspectives and, 259–260

Terra Nova, 339
Test of English as a Foreign Language iBT (TOEFL iBT), 400
Test of Reading Comprehension (TORC), 404
Text generation, 79–80
Text organization, 138, 153
Text production, 58, 145, 273
Text quality, 60–61, 60*f*, 62*f*
Text-Model Inspection Trace of Concepts and Relations (T-MITOCAR), 434–436, 435*f*, 438
Textual perspective, 89–90
Think-aloud methods, 24–25, 68, 196, 281
Time for planning and writing, 33–34, 220, 221*t*
Tool use, 263–264
Topic effect, 61–63, 62*f*
Transcription skills. *See also* Handwriting; Spelling skills; Typing skills

composing and, 151–154

guidelines for teaching writing and, 221

language learning disorder (LLD) and, 355

learning disabilities and, 356–357

overview, 31–32

sentence planning and, 75–76

translation and, 136

working memory and, 30

writing development and, 145–146, 350*f*

Transfer, 42, 93–94, 97
Transforming, 33–34, 42, 94–95
Translation

adult writers and, 132–133

child writers and, 133–136

keystroke logging and, 417, 420–422

knowledge and expertise to prepare for, 137

learning disabilities and, 356

methodological framework, 131–132

overview, 3, 73, 130–131, 139

planning and, 79–80

research and, 136–139

sentence planning and, 75–76

writing development and, 148, 350*f*

writing processes and, 58

TREE (Topic sentence, Reasons, Examination, Ending) strategy, 305–306
Tutoring, 179, 179*t*, 188, 367
Typing skills, 32, 124, 221. *See also* Transcription skills

Underachievers, 384–386. *See also* English language learners; Learning disabilities
Upstate Writing Project, 341
Utilization, 405–406

Vicarious experience, 35, 162
Virtual worlds, 110–111
Visuo–spatial sketchpad, 29–30
Vocabulary choices, 146
Vocabulary knowledge

automated writing evaluation (AWE) systems and, 397, 401

grammar instruction and, 290

guidelines for teaching writing and, 221

language learning disorder (LLD) and, 355

learning disabilities and, 359

reading–writing relationships and, 197

writers' characteristics and, 66–67

writing development and, 145, 146

Word choice, 222, 306–307, 401
Word recognition, 197, 198
WordSmith software, 430
Working memory

instruction and, 124–125

overview, 27, 29–31

reading–writing relationships and, 197

translation and, 139

writing development and, 121, 145, 350*f*

World-Class Instructional Design and Assessment consortium (WIDA), 369
WRITE (Work form your plan, Remember your goals, Include transition words, Try to use different kinds of sentences, add Exciting interesting words) strategy, 308
Write It Right project, 230–231. *See also* Genre pedagogy
Writer characteristics, 66–67
Writers' workshop, 212, 265
WriteToLearn system, 397–398, 403–404
Writing, conditions of, 167–168
Writing Circles, 336
Writing development. *See also* Developmental processes; Emergent writing

brain development and, 118–124, 119*f*

Great Divide theories, 145–149

instruction and, 97–98

interventions and, 358–359

keystroke logging and, 415–417

learning disabilities and, 349–351, 350*f*, 355, 358–359

learning to write and, 15–18

overview, 2–4, 98, 144–145, 149–154

research and, 95–97, 154–155

social practices and, 91–95

writing competencies in multiple languages, 368–369

writing development and, 93–94

Writing fluency, 197, 422–423
Writing instruction. *See* Instruction in writing
Writing Pal (W-Pal) system, 317–318, 323. *See also* Automated essay scoring (AES) system
Writing processes

components and functions, 57–60, 58*t*, 60*f*

guidelines for teaching writing and, 221, 221*t*

overview, 14–15, 44

pauses and cognitive writing processes, 411–415, 412*f*, 413*f*, 415*t*

style and, 67

task environment and, 61–66, 62*f*, 64*f*, 65*t*

text quality and, 60–61

writers' characteristics and, 66–67

writing development and, 350*f*

writing processes and, 58*t*

Writing quality, 161
Writing schemas, 350*f*, 351
Writing Self-Efficacy Scale (WSES), 164
Writing tasks, 246–248, 349–351, 350*f*, 428–429
Writing to learn (WTL)

instruction and, 252

overview, 5, 243

research and, 248–252

theoretical perspectives, 243–245

writing tasks and, 246–248

Zimmerman and Risemberg (1997) model, 28, 176–177, 176*t*

into vital, needed resources for practitioners, academics, and general readers. Our dedicated editorial professionals work closely on each title to produce high-quality content that readers can rely on. The firm is owned by its founding partners, President Bob Matloff and Editor-in-Chief Seymour Weingarten, and many staff members have been at Guilford for more than 20 years.

Discover Related Guilford Books

Sign up to receive e-Alerts with new book news and special offers in your fields of interest: *http://www.guilford.com/ealerts.*