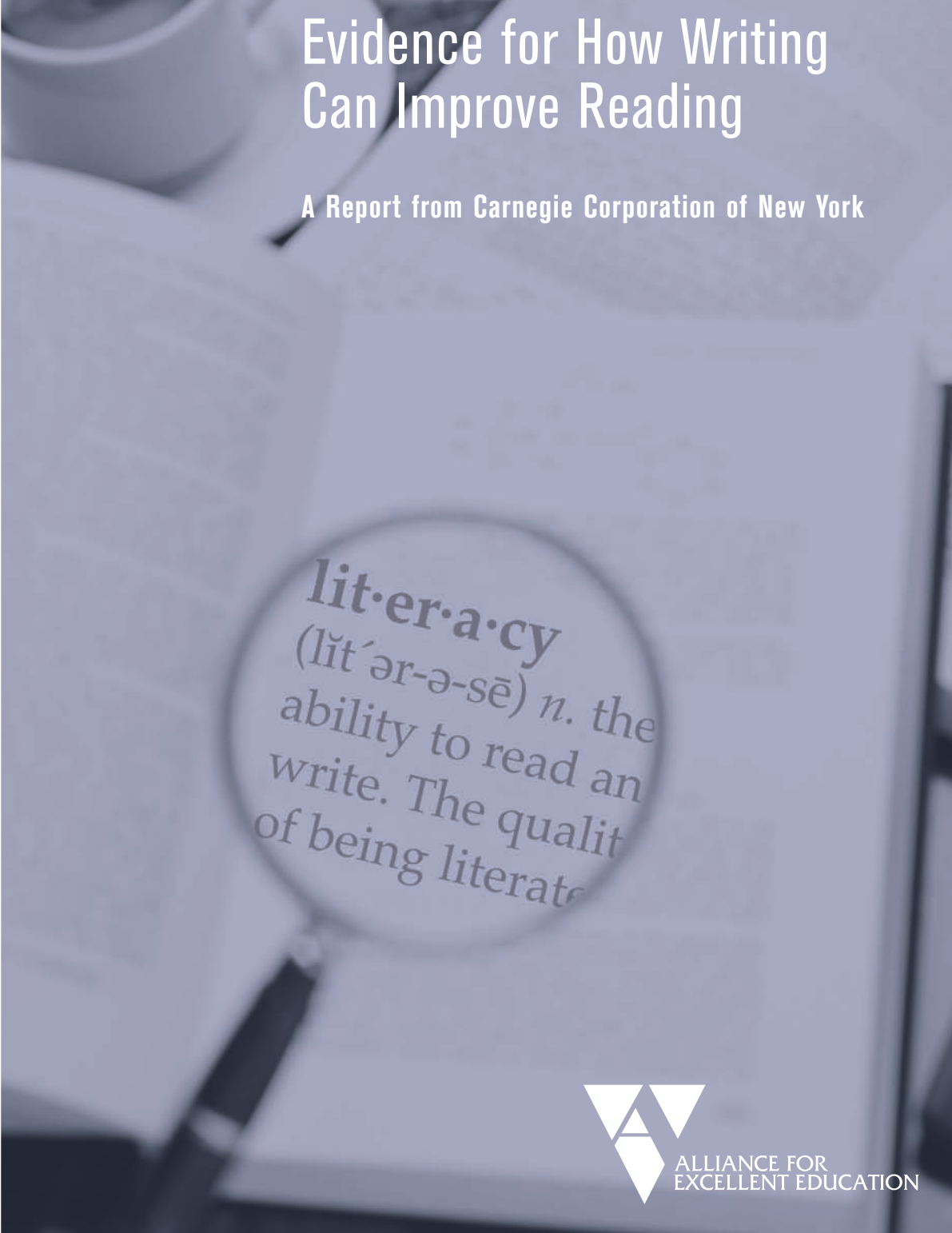


Writing to Read

Evidence for How Writing Can Improve Reading

A Report from Carnegie Corporation of New York

A magnifying glass is positioned over an open dictionary. The lens is focused on the entry for 'literacy'. The background shows a desk with a pen and a coffee cup, all in a soft, blue-tinted grayscale.

lit·er·a·cy
(lit'ər-ə-sē) *n.* the
ability to read and
write. The quality
of being literate

Steve Graham and
Michael Hebert
Vanderbilt University



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Carnegie Corporation's *Advancing Literacy* program is dedicated to the issues of adolescent literacy and the research, policy, and practice that focus on the reading and writing competencies of middle and high school students. *Advancing Literacy* reports and the *Time to Act* series of publications are designed to encourage local and national discussions, explore promising ideas, and incubate models of practice. For more information visit www.carnegie.org/literacy.

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Suggested citation: Graham, S., and Hebert, M. A. (2010). *Writing to read: Evidence for how writing can improve reading. A Carnegie Corporation Time to Act Report*. Washington, DC: Alliance for Excellent Education.

Writing to Read

Evidence for How Writing
Can Improve Reading

**Steve Graham and Michael Hebert
Vanderbilt University**

A Report from Carnegie Corporation of New York

About the Alliance for Excellent Education

The Alliance for Excellent Education is a Washington, DC-based national policy and advocacy organization that works to improve national and federal policy so that all students can achieve at high academic levels and graduate high school ready for success in college, work, and citizenship in the twenty-first century. The Alliance focuses on America's six million most-at-risk secondary school students—those in the lowest achievement quartile—who are most likely to leave school without a diploma or to graduate unprepared for a productive future.

The Alliance's audience includes parents, educators, the federal, state, and local policy communities, education organizations, business leaders, the media, and a concerned public. To inform the national debate about education policies and options, the Alliance produces reports and other materials, makes presentations at meetings and conferences, briefs policymakers and the press, and provides timely information to a wide audience via its biweekly newsletter and regularly updated website, www.all4ed.org.

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Acknowledgments

The authors would like to thank Andrés Henríquez, program officer at Carnegie Corporation of New York, who offered helpful suggestions in conceptualizing and reporting the research reviewed. We also wish to thank Paul Morphy, who provided technical assistance in calculating some effect sizes, as well as Rachel Mathias, Nicole Beitler, and Angeline Clark, who helped with various aspects of the project, including conducting electronic searches and locating studies. A special thanks goes to Andrew Wilson, Gina Biancarosa, and Bob Rothman, who took our original document and reworked it so that it was suitable for a broad audience. Finally, we especially appreciated feedback from the National Writing Project on how to make the initial draft of the document better.

Steve Graham

Michael Hebert

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FOREWORD

Around the world, from the cave paintings in Lascaux, France, which may be 25,000 years old, to the images left behind by the lost Pueblo cultures of the American Southwest, to the ancient aboriginal art of Australia, the most common pictograph found in rock paintings is the human hand. Coupled with pictures of animals, with human forms, with a starry night sky or other images that today, we can only identify as abstract, we look at these men's and women's hands, along with smaller prints that perhaps belong to children, and cannot help but be deeply moved by the urge of our ancestors to leave some permanent imprint of themselves behind.

Clearly, the instinct for human beings to express their feelings, their thoughts, and their experiences in some lasting form has been with us for a very long time. This urge eventually manifested itself in the creation of the first alphabet, which many attribute to the Phoenicians. When people also began to recognize the concept of time, their desire to express themselves became intertwined with the sense of wanting to leave behind a legacy, a message about who they were, what they had done and seen, and even what they believed in. Whether inscribed on rock, carved in cuneiform, painted in hieroglyphics, or written with the aid of the alphabet, the instinct to write down everything from mundane commercial transactions to routine daily occurrences to the most transcendent ideas—and then to have others read them, as well as to read what others have written—is not simply a way of transferring information from one person to another, one generation to the next. It is a process of learning and hence, of education.

Ariel and Will Durant were right when they said, “Education is the transmission of civilization.” Putting our current challenges into historical context, it is obvious that if today's youngsters cannot read with understanding, think about and analyze what they've read, and then write clearly and effectively about what they've learned and what they think, then they may never be able to do justice to their talents and their potential. (In that regard, the etymology of the word *education*, which is “to draw out and draw forth”—from oneself, for example—is certainly evocative.) Indeed, young people who do not have the ability to transform thoughts, experiences, and ideas into written words are in danger of losing touch with the joy of inquiry, the sense of intellectual curiosity, and the inestimable satisfaction of acquiring wisdom that are the touchstones of humanity. What that means for all of us is that the essential educative transmissions that have been passed along century after century, generation after generation, are in danger of fading away, or even falling silent.

In a recent report, the National Commission on Writing also addresses this concern. They say, “If students are to make knowledge their own, they must struggle with the details, wrestle with the facts, and rework raw information and dimly understood concepts into language they can communicate to someone else. In short, if students are to learn, they must write.”

It is in this connection that I am pleased to introduce *Writing to Read*, which builds on *Writing Next* by providing evidence for how writing can improve reading. As both reports warn, American students today are not meeting even basic literacy standards and their teachers are often at a loss for how to help them. In an age overwhelmed by information (we are told, for example, that all available information doubles every two to three years), we should view this as a crisis, because the ability to read, comprehend, and write—in other words, to organize information into *knowledge*—can be viewed as tantamount to a survival skill. Why? Because in the decades ahead, Americans face yet another challenge: how to keep our democracy and our society from being divided not only between rich and poor, but also between those who have access to information and knowledge, and thus, to power—the power of enlightenment, the power of self-improvement and self-assertion, the power to achieve upward mobility, and the power over their own lives and their families’ ability to thrive and succeed—and those who do not.

Such an uncrossable divide will have devastating consequences for the future of America. Those who enrich themselves by learning to read with understanding and write with skill and clarity do so not only for themselves and their families, but for our nation as well. They learn in order to preserve and enhance the record of humanity, to be productive members of a larger community, to be good citizens and good ancestors to those who will follow after them. In an age of globalization, where economies sink or swim on their ability to mine and manage knowledge, as do both individual and national security, we cannot afford to let this generation of ours and, indeed, any other, fall behind the learning curve. Let me bring us back to where we began: for all of us, the handprint must remain firmly and clearly on the wall.

Vartan Gregorian

President, Carnegie Corporation of New York

*Note: This text originally appeared as the forward to *Writing Next*, and is reprinted here with minor changes. Our deep thanks to Vartan Gregorian for permitting us to reprint it.

EXECUTIVE SUMMARY

The Challenge

Although some progress has been made in improving the literacy achievement of students in American schools during the last twenty years (Lee, Grigg, and Donahue, 2007; Salah-Din, Persky, and Miller, 2008), the majority of students still do not read or write well enough to meet grade-level demands. Poor literacy skills play a role in why many of these students do not complete high school. Among those who do graduate, many will not be ready for college or a career where reading and writing are required. These young people will find themselves at a serious disadvantage in successfully pursuing some form of higher education, securing a job that pays a living wage, or participating in social and civic activities.

The financial and social costs of poor literacy have been well documented (Greene, 2000). The consequences of poor reading and writing skills not only threaten the well-being of individual Americans, but the country as a whole. Globalization and technological advances have changed the nature of the workplace. Reading and writing are now essential skills in most white- and blue-collar jobs. Ensuring that adolescents become skilled readers and writers is not merely an option for America, it is an absolute necessity.

The Approach

During this decade there have been numerous efforts to identify instructional practices that improve adolescents' literacy skills, such as *Reading Next* (Biancarosa and Snow, 2004), which drew a set of fifteen instructional recommendations for an effective adolescent literacy program based on the professional knowledge and research of nationally known and respected literacy researchers. Such efforts also include systematic reviews of high-quality research to identify effective instructional practices for improving the comprehension of struggling adolescent readers (Scammacca et al., 2007), as well as similar analyses to identify effective practices for improving adolescent students' writing (Graham and Perin, 2007a; Rogers and Graham, 2008).

Despite these efforts, educators and policymakers need additional evidence-based practices for improving the literacy skills of students in American schools.

One often-overlooked tool for improving students' reading, as well as their learning from text, is writing. Writing has the theoretical potential for enhancing reading in three ways. First, reading and writing are both functional activities that can be combined to accomplish specific goals, such as learning new ideas presented in a text (Fitzgerald and Shanahan, 2000). For instance, writing about information in a science text should facilitate comprehension and learning, as it provides the reader with a means for recording, connecting, analyzing, personalizing, and manipulating key ideas from the text. Second, reading and writing are connected, as they draw upon common knowledge and cognitive processes (Shanahan, 2006). Consequently, improving students' writing skills should result in improved reading skills. Third, reading and writing are both communication activities, and writers should gain insight about reading by creating their own texts (Tierney and Shanahan, 1991), leading to better comprehension of texts produced by others.

This report provides evidence answering the following three questions:

1. Does writing about material students read enhance their reading comprehension?
2. Does teaching writing strengthen students' reading skills?
3. Does increasing how much students write improve how well they read?

Although writing is typically recommended as a part of a strong literacy program (e.g., Biancarosa and Snow, 2004), and several important reviews have selectively examined the impact of writing on reading (e.g., Applebee, 1984; Emig, 1977; Klein, 1999; Neville and Searls, 1991; Smith, 1988; Stotsky, 1982), the special strength of this report is that it comprehensively summarizes high-quality research using the powerful statistical method of meta-analysis. This technique allows researchers to determine the consistency and strength of the effects of an instructional practice, and to highlight practices holding the most promise.

Writing Next presented the results of a large-scale statistical review of research on the effects of specific types of writing interventions, and identified specific teaching techniques for improving the quality of adolescent students' writing. *Writing to Read* draws on the same type of statistical review of the research to highlight writing techniques shown to enhance students' reading.

To be successful, students today need strong literacy skills, and also need to be able to use these skills as tools for ongoing learning. This report builds on *Writing Next* by identifying writing practices found to be effective in helping students increase their reading skills and comprehension. We hope that besides providing classroom teachers with research-supported information about how writing can improve reading, our data will stimulate discussion and action at the policy and research levels, leading to the greater use of writing as a tool for enhancing reading and a greater emphasis on the teaching of writing in our nation's schools.

The Recommendations

Writing Practices That Enhance Students' Reading

This report identifies a cluster of closely related instructional practices shown to be effective in improving students' reading. We have grouped these practices within three core recommendations, here listed in order of the strength of their supporting evidence.

- I. **HAVE STUDENTS WRITE ABOUT THE TEXTS THEY READ.** Students' comprehension of science, social studies, and language arts texts is improved when they write about what they read, specifically when they
 - **Respond to a Text in Writing (Writing Personal Reactions, Analyzing and Interpreting the Text)**
 - **Write Summaries of a Text**
 - **Write Notes About a Text**
 - **Answer Questions About a Text in Writing, or Create and Answer Written Questions About a Text**

- II. **TEACH STUDENTS THE WRITING SKILLS AND PROCESSES THAT GO INTO CREATING TEXT.** Students' reading skills and comprehension are improved by learning the skills and processes that go into creating text, specifically when teachers
 - **Teach the Process of Writing, Text Structures for Writing, Paragraph or Sentence Construction Skills (Improves Reading Comprehension)**
 - **Teach Spelling and Sentence Construction Skills (Improves Reading Fluency)**
 - **Teach Spelling Skills (Improves Word Reading Skills)**

- III. **INCREASE HOW MUCH STUDENTS WRITE.** Students' reading comprehension is improved by having them increase how often they produce their own texts.

Writing to Read does not identify all the ways that writing can enhance reading, any more than *Writing Next* identified all of the possible ways to improve students' writing. However, all of the *Writing to Read* instructional recommendations have shown clear results for improving students' reading.

Nonetheless, even when used together these practices do not constitute a full curriculum. The writing practices described in this report should be used by educators in a flexible and thoughtful way to support students' learning.

The evidence is clear: writing can be a vehicle for improving reading. In particular, having students write about a text they are reading enhances how well they comprehend it. The same result occurs when students write about a text from different content areas, such as science and social studies.

This result is consistent with the finding from *Writing Next* that writing about science, math, and other types of information promotes students' learning of the material. In addition, teaching writing not only improves how well students write, as demonstrated in *Writing Next*; it also enhances students' ability to read a text accurately, fluently, and with comprehension. Finally, having students spend more time writing has a positive impact on reading, increasing how well students comprehend texts written by others. Taken together, these findings from *Writing to Read* and *Writing Next* highlight the power of writing as a tool for improving both reading and content learning.

INTRODUCTION

Literacy Is Critical to Success in the Twenty-first Century

Past generations of Americans with only a high school education were able to find jobs that paid a living wage without difficulty (Berman, 2009). Today, such jobs are becoming increasingly rare. Technological innovations, globalization, and changes in the workplace have increased the need for young people to obtain some form of higher education, whether it is in a two- or four-year college or involves technical or career coursework. Somewhere between one half to two thirds of new jobs in the future will require a college education and higher-level literacy skills (Carnevale and Derocers, 2004; Kirsch, Braun, Yamamoto, and Sum, 2007). The largest projected area for job growth is the service industry, with 20.5 million new jobs added to the economy during this decade (Berman, 2001). High-level literacy skills are almost a universal requirement for employees in this industry, as in professions such as finance, insurance, real estate, construction, and manufacturing. For example, almost 70 percent of salaried employees in these industries use writing as part of their jobs (National Commission on Writing, 2004). Over 90 percent of white-collar workers and 80 percent of blue-collar workers indicate that writing skill is important to job success (National Commission on Writing, 2006).

The growing demand for higher levels of education and literacy skills places new pressures on American schools. High schools must do more than graduate students: they must also prepare students for higher education and satisfying employment (Gewertz, 2009).

CAUSE FOR CONCERN

- Forty percent of high school graduates lack the literacy skills employers seek (National Governors Association, 2005).
- Lack of basic skills costs universities and businesses as much as \$16 billion annually (Greene, 2000).
- Poor writing skills cost businesses \$3.1 billion annually (National Commission on Writing, 2004).
- Only one out of three students is a proficient reader (Lee, Grigg, and Donahue, 2007).
- Only one out of four twelfth-grade students is a proficient writer (Salahu-Din, Persky, and Miller, 2008).
- One out of every five college freshman must take a remedial reading course (SREB, 2006).
- Nearly one third of high school graduates are not ready for college-level English composition courses (ACT, 2005).
- Three out of ten high school students do not graduate on time (Gewertz, 2009).
- Over half of adults scoring at the lowest literacy levels are dropouts (National Center for Educational Statistics, 2005).

Yet right now our high schools are not doing nearly enough to prepare young people for the future. Only seven in ten American students graduate from high school in four years (Gewertz, 2009). Many adolescents drop out of school because of poor literacy skills. It is unlikely that high school graduation rates will rise, or that college- and career-readiness efforts will prove successful, unless our schools help adolescents learn to read and write at a higher level.

Struggling Readers and Writers

According to findings from the 2007 National Assessment of Educational Progress (NAEP), only 33 percent of fourth-grade students and 31 percent of eighth-grade students perform at or above the “proficient” level (defined as solid academic performance) in reading (Lee, Grigg, and Donahue, 2007). In contrast, 34 percent of fourth-grade students and 43 percent of eighth-grade students score at the “basic” level, denoting only partial mastery of the literacy skills needed at their grade level. The rest of the students (33 percent of fourth graders and 26 percent of eighth graders) scored below this basic level.

As with reading, only a small percentage of students showed solid academic performance in writing on the 2007 NAEP (Salahu-Din, Persky, and Miller, 2008). Thirty-three percent of eighth-grade students and 24 percent of twelfth-grade students performed at or above the “proficient” level. This means that two thirds of eighth-grade students and three quarters of twelfth-grade students score at either the basic level or below in writing.

The knowledge and skills needed for higher education and for employment are now considered to be identical (ACT, 2005).

Problems acquiring needed literacy skills are heightened for students who do not speak English as their first language, students who have a disability, or who are black, Hispanic, or Native American. Reading and writing performance of these groups of students on the 2007 NAEP was significantly lower than the literacy performance of students who were native English speakers, who did not have a disability, or who were white, respectively. The results from the NAEP clearly demonstrate that large numbers of adolescents need interventions to help them become better readers and writers.

RECOMMENDATIONS FOR USING WRITING TO IMPROVE READING, AS IDENTIFIED BY META-ANALYSIS

Writing is often recommended as a tool for improving reading. In *Reading Next* (Biancarosa and Snow, 2004), intensive writing was identified as a critical element of an effective adolescent literacy program. *Reading Next* stated that writing instruction improves reading comprehension and that the teaching of writing skills such as grammar and spelling reinforces reading skills. It is also believed that writing about a text improves comprehension, as it helps students make connections between what they read, know, understand, and think (Carr, 2002).

This report provides long-needed guidance for teachers and policymakers by identifying specific writing practices that enhance students' reading abilities. The special contribution of this report is that it draws on empirical evidence in grades 1–12 in doing so. Its findings show that having students write about texts they read, explicitly teaching writing skills and processes, and having students write more *do* improve reading skills and comprehension.

We set out to collect, categorize, and analyze experimental and quasi-experimental data on the effectiveness of writing practices for improving students' reading skills and comprehension.

The empirical evidence from this analysis resulted in the identification of research-supported writing practices for improving students' reading.

The method used, meta-analysis, provides a measure of effectiveness using the effect size statistic.

A TECHNICAL NOTE ON EXPERIMENTAL AND QUASI-EXPERIMENTAL STUDIES

The benefit of using experimental and quasi-experimental types of studies for our review is that they allow for stronger inferences about cause-and-effect relationships than do other types of studies. In both, children in an experimental group receive a specific intervention (or treatment) and their performance is compared to a control group of children that receives a different treatment or no treatment. Experimental studies control for preexisting differences between students in the two groups through random assignment to a group, while quasi-experimental studies do so through other means. For the current analysis, we only included quasi-experimental studies that assessed students' reading performance at the start of the study, so that possible preexisting differences between students in each condition could be controlled.

The Meta-Analysis

Meta-analysis is a statistical technique for integrating, summarizing, and interpreting sets of empirical research that involve quantitative measures (Lipsey and Wilson, 2001). In this report, meta-analysis was used to investigate the effectiveness of writing about text, the effectiveness of the teaching of writing, and the effectiveness of having students write more.

This is the first meta-analysis examining the effects of different writing practices on students' reading performance. Previous meta-analyses focused only on single practices, such as the impact of sentence combining on reading comprehension (e.g., Neville and Searls, 1991), aggregated reading measures with other types of outcome measures (Bangert-Drowns, Hurley, and Wilkinson, 2004), or did not isolate the effect of the writing practice (Moore and Readence, 1984). The findings in this report are cumulative in that they build on earlier reviews examining the impact of writing on reading (e.g., Applebee, 1984; Emig, 1977; Graham and Perin, 2007a; Klein, 1999; Moore and Readence, 1984; Neville and Searls, 1991; NICHD, 2000; Smith, 1988; Stotsky, 1982). All pertinent studies from these prior reviews were included, and new studies were located through an extensive search of the literature (see Appendix A for details).

The recommendations from this review are in no way meant to detract from the significant contributions that other types of research make to the understanding of the effects of writing on reading. Likewise, many perspectives, including cognitive, sociocultural, rhetorical, cross-curricular, linguistic, and student centered (see Fitzgerald and Shanahan, 2000; Shanahan, 2006), contribute to knowledge of how writing influences reading.

A TECHNICAL NOTE ON META-ANALYSIS

What is a meta-analysis?

Meta-analysis is a particularly powerful way of summarizing large bodies of research, as it aggregates conceptually similar quantitative measures by calculating an effect size for each study. The strength of meta-analysis is that it allows consideration of both the strength and the consistency of a treatment's effects.

What is an effect size?

An effect size reports the average difference between one type of instruction and a control condition. It indicates the **strength** of the effect. The following guidelines provide a benchmark for interpreting the magnitude of an effect:

0.20 = **small** or mild effect

0.50 = **medium** or moderate effect

0.80 = **large** or strong effect

A **positive** effect size means the writing treatment had a positive effect on students' reading when compared to the control condition.

A **negative** effect size means that the control condition had a stronger effect on students' reading than the writing treatment.

Although these guidelines are commonly accepted, it is important to interpret an effect size within the context of a given field. Consequently, the findings from this meta-analysis are compared to findings from other meta-analyses examining different reading interventions (i.e., NICHD, 2000; Rosenshine and Meister, 1994; Slavin, Cheung, Groff, and Lake, 2008). Such comparison better contextualizes the power of writing as a means of improving reading achievement.

Also, it is important to remember that a large number of factors that influence youngsters' literacy outcomes and the difficulty of improving reading, especially for older students, render any significant effect meaningful.

Appendix A describes the methodology used in the meta-analysis.

Appendix B lists all the studies that were analyzed and provides descriptive information about each.

THE RECOMMENDATIONS

Effective Practices for Strengthening Reading Through Writing

- I. **HAVE STUDENTS WRITE ABOUT THE TEXTS THEY READ.** Students' comprehension of science, social studies, and language arts texts is improved when they write about what they read, specifically when they
 - **Respond to a Text in Writing (Writing Personal Reactions, Analyzing and Interpreting the Text)**
 - **Write Summaries of a Text**
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 - **Teach Spelling and Sentence Construction Skills (Improves Reading Fluency)**
 - **Teach Spelling Skills (Improves Word Reading Skills)**

- II. **INCREASE HOW MUCH STUDENTS WRITE.** Students' reading comprehension is improved by having them increase how often they produce their own texts.

In the following sections, we discuss each of these findings in turn by discussing the theory behind the practices and the results of the analysis. In several places, we also elaborate the activities involved in implementing the practices. Results are reported in effect size statistics, which allow us to understand the magnitude of impact an instructional practice can have on student outcomes.

When reading these sections, readers should keep in mind three important aspects of effect sizes. First, while it is tempting to regard practices that have large effect sizes as more effective than those with small effect sizes, effect sizes cannot be interpreted in this fashion. The effects we estimate for a particular practice always exist in relation to whatever practices were used in the “control” condition. In short, the effects for any two practices described in this report cannot be compared directly to or against each other.

Second, we report the effect sizes we found for two types of tests commonly used in research: norm-referenced tests and researcher-designed tests (see sidebar on page 12). Norm-referenced tests generally yield much smaller effect sizes than researcher-designed tests do. For example, two of the most robust reading instructional practices for improving children's reading comprehension, Reciprocal Teaching and generating questions, have effect sizes of 0.32 and 0.36 respectively when assessed using norm-referenced tests, and effect sizes of 0.88 and 0.86 respectively when assessed using researcher-designed

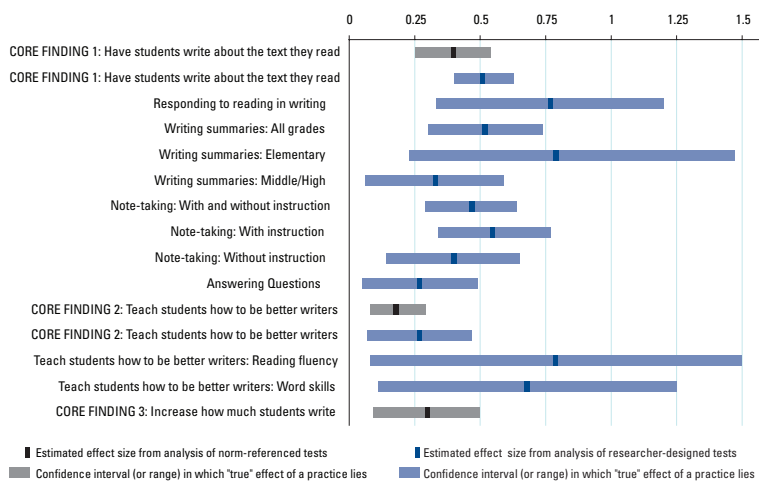
measures (Rosenshine and Meister, 1994; Rosenshine, Meister, and Chapman, 1996). Similar differences in effect sizes for different tests are found throughout our report (see graph below).

Third, because effect sizes are statistics, we can estimate more than the average effect size—we can also estimate a confidence interval. The confidence interval specifies the range in which we think the “true” effect of a practice lies. Thus, we present confidence intervals around the effect sizes we found in Figure 1. In general, confidence intervals tend to be smaller when the number of studies we have is bigger and also when tests are more precise. In fact, readers will likely note that we have a few very large confidence intervals for some of the effects. These large ranges suggest that we are less certain of a practice’s real effect, but critically we are still quite certain that there is an effect because none of these confidence intervals extends as low as zero. As a result, even when confidence intervals are large, we are reasonably certain that these practices do affect students in a positive way, we are just less certain of how large that effect is.

NORM-REFERENCED VS. RESEARCH-DESIGNED TESTS

Norm-referenced tests are designed to represent an individual’s ability relative to the range of abilities of a population on a measured skill. In contrast, researcher-designed tests generally do not have the time or the resources to sample the full range of abilities of a measured skill, and therefore cannot place an individual’s performance in that context. Even so, researchers generally take steps to ensure that their test results are as reliable as possible. Because of these differences, norm-referenced tests tend to have smaller margins of error when estimating student abilities. As a result, norm-referenced tests tend to yield smaller effect sizes and smaller confidence intervals. Nonetheless, both types of tests yield important information about the effectiveness of instruction. Whereas norm-referenced tests help us understand how well a targeted skill generalizes to other similar tasks, researcher-designed tests help us understand how well an intervention impacts a targeted skill.

WRITING TO READ EFFECT SIZES WITH CONFIDENCE INTERVALS



I. HAVE STUDENTS WRITE ABOUT THE TEXT THEY READ

Average Weighted Effect Size = 0.40 Published Standardized Norm-Referenced Tests (Based on 11 Studies)
Average Weighted Effect Size = 0.51 Researcher-Designed Tests (Based on 50 Studies)

Comprehending a text involves actively creating meaning by building relationships among ideas in text, and between the text and one's knowledge, beliefs, and experiences (Wittrock, 1990). Having students write about a text should enhance reading comprehension because it affords greater opportunities to think about ideas in a text, requires them to organize and integrate those ideas into a coherent whole, fosters explicitness, facilitates reflection, encourages personal involvement with texts, and involves students transforming ideas into their own words (Applebee, 1984; Emig, 1977; Klein, 1999; Smith, 1988; Stotsky, 1982). In short, writing about a text should enhance comprehension because it provides students with a tool for visibly and permanently recording, connecting, analyzing, personalizing, and manipulating key ideas in text.

The evidence shows that having students write about the material they read *does* enhance their reading abilities. In fact, fifty-seven out of sixty-one outcomes (93 percent) were positive, indicating a consistent and positive effect for writing about what is read. The impact of writing about reading applied broadly across different levels of schooling, as students participating in this research were in grades 2–12, with the majority in middle or high school. These positive effects were evident when students wrote about text in science and social studies as well as in English (60 percent of comparisons involved these disciplines; see Appendix B).

These effect sizes compared favorably with effects obtained by other researchers examining the impact of specific reading approaches, such as reading programs at the secondary level, reciprocal teaching (a popular method for teaching comprehension), and vocabulary instruction. The effect size for writing about text that was read (0.40) exceeded each of these effects, providing additional validation of its effectiveness as a tool for improving students' reading comprehension.

Writing about read texts was also an effective activity for lower-achieving students. In twelve studies involving such students, the average weighted effect size for writing about a text was 0.63. However, the average weighted effect size for writing about text activities was not greater than zero when lower-achieving students were not explicitly taught how to use them. This was not the case when such instruction was provided, as was true in the other nine studies. Although these findings must be viewed cautiously due to the small number of studies, they suggest that having lower-achieving students write about text without teaching them how to do so may not be effective. Our findings are consistent with findings from other reviews that explicit instruction is an important ingredient in the successful teaching of literacy practices (e.g., Graham and Perin, 2007a; NICHD, 2000).

Writing about a text proved to be better than just reading it, reading and rereading it, reading and studying it, reading and discussing it, and receiving reading instruction. These above-mentioned reading activities were undertaken 87 percent of the time by students in the control conditions.

The average weighted effect sizes for writing about text read versus these control conditions was positive and significant (0.35 for published standardized norm-referenced tests in nine studies and 0.49 for researcher-designed ones in forty-four studies).

We next consider how different types of writing about reading activities influence students' comprehension of text. These analyses are based on the findings from the sixty-one studies above.

Have Students Respond to a Text (Writing Personal Reactions, Analyzing and Interpreting the Text)

Average Weighted Effect Size = 0.77 Researcher-Designed Tests (Based on 9 Studies)

Writing an extended response to material involves either a personal reaction to the text or analysis and interpretation of it. The former includes writing a personal response to narrative material read or writing about a personal experience related to it. Analysis and interpretation activities, in contrast, focus on writing an analysis of the characters in a novel, writing a paper showing how to apply material that was read, composing a letter to another student explaining how to play a game described in a text, and analyzing a text in writing to develop a particular point of view. Newer and better understandings of textual material are likely to occur when students write about text in extended ways involving analysis, interpretation, or personalization (Langer and Applebee, 1987).

Our review of the data shows that extended writing has a strong and consistently positive impact on reading comprehension. All nine of the comparisons produced a positive outcome. Extended writing produced greater comprehension gains than simply reading the text, reading and rereading it, reading and studying it, reading and discussing it, and receiving reading instruction. These reading activities served as control conditions in all nine studies. (Note that in contrast to the other

EXTENDED WRITING: EXAMPLES

With **guided journal writing** students respond to text by answering open-ended questions about it in writing. For example, students might be asked to analyze why they think characters acted as they did and indicate what they would do in the same situation.

Source: Wong, Kuperis, Jamieson, Keller, and Cull-Hewitt (2002).

Students might also be asked to complete an **analytic essay** about the material they are reading. For instance, after reading about the history of the industrial revolution, students might be asked to write an essay in which they identify the three most important reasons for industrial growth during the nineteenth and twentieth centuries and explain the reasons for each of their choices.

Source: Langer and Applebee (1987).

writing about reading activities studied in this review, students were not expressly taught how to write extended responses. Finally, for writing a personal response to text, students applied this procedure over a three- to fourth-month period in several studies.)

Have Students Write Summaries of a Text

Average Weighted Effect Size = 0.52 Researcher-Designed Tests (Based on 19 Studies)

Transforming a mental summary of text into writing requires additional thought about the essence of the material, and the permanence of writing creates an external record of this synopsis that can be readily critiqued and reworked. As a result, summary writing seems likely to improve comprehension of the material being summarized.

Summary writing practices studied ranged from writing a synopsis with little to no guidance (e.g., writing a one-sentence summary) to the use of a variety of different guided summarizing strategies such as writing a summary of text using a set of rules or steps; developing a written outline of text and converting it to a summary; locating the main idea in each paragraph and summarizing it; and creating a written/graphic organizer of important information and converting it to a summary.

For students in grades 3–12, writing summaries about text showed a consistently positive impact on reading comprehension. Seventeen of the nineteen comparisons (89 percent) produced a positive outcome. While summary writing significantly improved middle and high school students' comprehension of text (average weighted effect size = 0.33 based on eleven studies), it had an even stronger effect on elementary students' comprehension (average weighted effect size = 0.79 based on four studies).

SUMMARY WRITING: EXAMPLES

Students are directly taught rules for how to **write a summary of material read**. This can involve teaching them how to write a summary of a paragraph using the following operations:

- 1) identify or select the main information;
- 2) delete trivial information;
- 3) delete redundant information; and
- 4) write a short synopsis of the main and supporting information for each paragraph.

In teaching this strategy, the teacher first explains each step and its purposes. Use of the strategy is then modeled, and students practice applying it, receiving teacher help and assistance as needed.

Source: Rinehart, Stahl, and Erickson (1986).

A different summary writing method focuses on the summarization of longer text. Students begin by creating a skeleton outline, starting with a thesis statement for the passage. Next, they generate main idea subheadings for each section of the text, and add two or three important details for each main idea. They then convert their outline into a written summary of the whole text.

Source: Taylor and Beach (1984).

Writing summaries about a text proved to be better than simply reading it, reading and rereading it, reading and studying it, and receiving reading instruction. The above reading activities served as control conditions in all but four studies (74 percent). The average weighted effect size decreased slightly, to 0.48, when summary writing was compared to control conditions only involving reading activities.

Have Students Write Notes About a Text

Average Weighted Effect Size = 0.47 Researcher-Designed Tests (Based on 23 Studies)

The act of taking written notes about text material should enhance comprehension (Kiewra, 1989; Peverly et al., 2007). This writing practice involves sifting through a text to determine what is most relevant and transforming and reducing the substance of these ideas into written phrases or key words. Intentionally or unintentionally, note takers organize the abstracted material in some way, connecting one idea to another, while blending new information with their own knowledge, resulting in new understandings of texts.

In the studies we reviewed, taking notes about text ranged from a prompt to take notes with little or no direction to the use of a wide variety of structured note-taking procedures such as developing a written outline of text; designing a written chart showing the relationship between key ideas, details, concepts, and vocabulary in text; and taking notes about text and separating these notes into different columns related to main ideas, details, and questions.

For students in grades 3–12, the various note-taking activities studied had a moderate and consistently positive impact on reading comprehension. Twenty-one of the twenty-three comparisons (91 percent) produced a positive outcome.

Taking notes about text proved to be better than just reading, reading and rereading, reading and studying, reading and underlining important information, and receiving explicit instruction in reading practices. The above reading activities served as the control conditions in all but two studies. The average weighted effect size increased slightly, to 0.48, when note taking was compared to control conditions only involving reading activities.

NOTE TAKING: EXAMPLES

Structured note taking involves creating a written organizational structure for material read. With one approach, students are taught how to create an organizer resembling a flow chart, depicting changes in the events of a story over time.

Source: Denner (1987).

Concept mapping is another approach for helping students organize their notes about material read. Students place each important concept from text in a circle and then show how the concepts link together using words and lines. One way of teaching this strategy is to first present a model of an *expert concept map* for a particular reading. After discussing this map, students then practice completing other *expert maps* that are incomplete, moving from more to less complete maps, until they can create their own map for material read.

Source: Chang, Chen, and Sung (2002).

Have Students Answer Questions About a Text in Writing, or Create and Answer Written Questions About a Text

Average Weighted Effect Size = 0.27 Researcher-Designed Tests (Based on 8 Studies)

Answering questions about a text can be done verbally, but there is greater benefit from performing such activities in writing. Writing answers to text questions makes them more memorable, as writing an answer provides a second form of rehearsal. This practice should further enhance the quality of students' responses, as written answers are available for review, reevaluation, and reconstruction (Emig, 1977).

For generating or responding to questions in writing, students either answered questions about a text in writing; received practice doing so; wrote their own questions about text read; or learned how to locate main ideas in a text, generated written questions for them, and then answered them in writing. These practices had a small but consistently positive impact on improving the reading comprehension of students in grade 6–12 when compared to reading or reading instruction. All eight of the studies resulted in a positive outcome for generating or answering questions in writing.

QUESTIONS: EXAMPLES

Answering questions in writing involves writing responses to questions inserted into text or presented at the end of a segment of text. For example, students may be asked to write short answers to four questions (one detail, two inferences, and one main idea) after reading a segment of text. They then check and correct their responses before reading the next segment of text.

Source: Peverly and Wood (2001).

Generating questions in writing is a strategy where students create written questions about text. For instance, students are taught the difference between a good question and a bad question, and then practice generating and answering their own questions about text. If they cannot answer a question, they generate a new one that can be answered.

Source: Cohen (1983).

II. TEACH STUDENTS THE WRITING SKILLS AND PROCESSES THAT GO INTO CREATING TEXT

While writing and reading are not identical skills, both rely on common processes and knowledge (Fitzgerald and Shanahan, 2000). Consequently, educators have long believed that the benefits of writing instruction carry over to improved reading. Our evidence shows that writing instruction does in fact strengthen a variety of reading skills.

Teach the Process of Writing, Text Structures for Writing, Paragraph or Sentence Construction Skills (Improves Reading Comprehension)

Average Weighted Effect Size = 0.18 Published Standardized Norm-Referenced Tests (Based on 12 Studies)
Average Weighted Effect Size = 0.27 Researcher-Designed Tests (Based on 5 Studies)

Teaching patterns for constructing sentences or larger units of text should improve reading skills. The practice of putting smaller units of writing together to create more complex ones should result in

greater skill in understanding such units in reading (Neville and Searls, 1991). This is the basic premise behind the writing instructional strategy known as sentence combining (Saddler and Graham, 2005). Better understanding of even larger units in text should be facilitated by teaching students basic structures for writing paragraphs, or common elements included in specific types of writing, such as persuasive essays.

Writing instruction did in fact show a small, but consistently positive, impact on reading comprehension when measured by both norm-referenced published standardized tests and researcher-designed tests. The outcomes in all studies were positive. The control condition in most of these studies (79 percent) was reading or reading instruction. When only these studies were considered, the average weighted effect size rose slightly, to 0.23 on published standardized norm-referenced tests (based on nine studies) and 0.30 on researcher-designed tests (based on four studies).

The effect of writing instruction on published standardized norm-referenced tests compares favorably with effects obtained in two other reviews examining the impact of a range of reading programs (Slavin et al., 2008) and vocabulary instruction (Elleman et al., 2009). (However, it was smaller than the effect of 0.32 obtained by Rosenshine and Meister [1994] for reciprocal teaching of comprehension strategies.)

It is important to note that there was variability in the types of writing instruction provided to students. These different types of writing instruction included the process approach, where students write frequently for real audiences; engage in cycles of planning, drafting, and revising text; take personal responsibility and ownership of writing projects; interact and help each other with their writing; participate in a supportive writing environment; and receive assistance and instruction as needed (Graham and Perin, 2007b). Note that studies examining process writing were limited to grades 1–4.

WRITING INSTRUCTION: EXAMPLES

One writing instructional procedure that facilitates reading growth is **sentence combining**. With this method, the teacher models how to combine simpler sentences into more complex ones. Students then practice combining similar sentences. An interesting twist on this approach is to have students combine sentences in material they are reading or disassemble such sentences.

Source: Hunt and O'Donnell (1970).

Students' reading skills can also be enhanced by teaching them how to use **text structure** as an aid for writing text. To illustrate, students are taught the basic elements of persuasion by identifying and discussing them in model essays. They then write their own persuasive texts using these elements, and revise the texts based on feedback from peers and the teacher.

Source: Crowhurst (1991).

We also included studies where other writing skills were systematically and explicitly taught to students. In several studies, this practice involved teaching a variety of skills, including how to write sentences, paragraphs, and longer units of text. In other instances, it involved teaching students how to write

more sophisticated sentences by learning how to combine less complex sentences into more complex ones. It further included several studies where students learned to use the structure of specific types of texts as a model or tool for writing their own papers. Finally, the spelling of content words was taught in one investigation. Studies examining the effectiveness of these approaches (instruction in spelling; instruction in writing sentences, paragraphs, and longer units of text) were limited to grades 4–12. In these twelve studies, the average weighted effect size on norm-referenced standardized measures of reading was 0.16. (Although small, the effect was statistically significant and compared favorably to the 0.17 effect size obtained by Slavin et al. [2008] in their meta-analysis of middle and high school reading programs.)

Teach Spelling and Sentence Construction Skills (Improves Reading Fluency)

Average Weighted Effect Size = 0.79 Published Standardized Norm-Referenced and Researcher-Designed Tests Combined (Based on 4 Studies)

Teaching students how words are spelled provides them with schemata about specific connections between letters and sounds, making it easier for them to identify and remember words in text containing these connections (Ehri, 1987; Moats, 2005/2006). The practice of putting smaller units of writing together in order to create more complex ones—from letters to words or words to sentences—should result in greater skill in understanding of these units in reading (Ehri, 2000; Neville and Searls, 1991).

In three of the four studies examining the impact of writing instruction on reading fluency, spelling skills were taught. In the other study, students were taught how to write more sophisticated sentences by combining simpler sentences into more complex ones. The overall effect size for these studies combined both standardized tests (two studies) and researcher-designed tests (two studies).

Writing instruction had a strong and consistent impact on improving students' reading fluency. *All* of the studies yielded a positive outcome. With one exception, the control condition was reading instruction. When the exception was eliminated, the average weighted effect size rose to 0.87. (Note that the studies reviewed all involved students in grades 1–7. Consequently, the impact of writing instruction on the reading fluency of older students is not known.)

Teach Spelling Skills (Improves Word Reading Skills)

Average Weighted Effect Size = 0.68 Published Standardized Norm-Referenced and Researcher-Designed Tests Combined (Based on 5 Studies)

As noted above, teaching students how to spell theoretically makes it easier for them to identify and remember words in text (Ehri, 1987; Moats, 2005/2006). More explicitly, spelling and word reading rely on the same underlying knowledge, and therefore instruction and practice in one should aid development of the other (Ehri, 2000; Snow, Griffin, and Burns, 2005).

Spelling instruction had a moderate and consistent impact on improving students' word reading skills. The five studies examining the impact of writing instruction on word reading skills all involved spelling instruction. The overall effect size for these studies combined both standardized tests (two studies) and researcher-designed tests (three studies). All of the studies yielded a positive outcome. These findings support the claim that learning to spell supports reading (Graham, 2000; Moats, 2005/2006).

With one exception, the control condition was reading or reading instruction. Notably, when the exception was eliminated, the average weighted effect size rose to 0.77. (Because all studies involved students in grades 1–5, we cannot generalize the findings to older students.)

III. INCREASE HOW MUCH STUDENTS WRITE

Average Weighted Effect Size = 0.30 Published Standardized Norm-Referenced Tests (Based on 6 Studies)

Reading and writing are communication activities, and writers can gain insights about reading by creating a text for an audience to read, even when the student is the intended audience (Nelson and Calfee, 1998). The process of creating a text prompts students to be more thoughtful and engaged when reading text produced by others. By writing, students learn to make their assumptions and premises explicit as well as observe the rules of logic when composing a text (Applebee, 1984), making them more aware of such issues in the material they read. Finally, writing involves generating meaning by using experience and knowledge to create a text and build relationships among words, sentences, and paragraphs (Wittrock, 1990).

According to the data we reviewed, increasing how much students write does in fact improve how well they read. The average weighted effect size on published standardized norm-referenced tests was small in all the studies we reviewed, but still consistently positive, as all studies yielded positive outcomes. The control condition in each of these experiments was either reading or reading instruction. Activities for increasing the amount of writing in the studies reviewed included writing about self-selected topics or topics chosen in collaboration with peers, setting aside fifteen extra minutes a day for sustained writing, using the Internet to write to pen pals, writing journal entries about daily experiences, interacting with others using a dialogue journal, and writing short passages using inference words. (Since all of the studies we reviewed involved students in grades 1–6, this finding cannot be generalized to older students.)

INCREASING STUDENTS' WRITING: EXAMPLES

Pen palling is a method in which two or more writers dialogue with each other about topics of interest. This can involve a younger student writing to an older student and vice versa.

Source: Dana, Scheffler, Richmond, Smith, and Draper (1991).

Daily writing about self-selected topics allows students to write about any topic of their choice. This can be done as a journal activity where the teacher reads and responds to something written by the student in a journal (without editing or correcting). Students sharing their writing with the teacher becomes optional over time.

Source: Peters (1991).

An average weighted effect size of 0.30 on published standardized norm-referenced tests compares favorably with effects obtained by other researchers examining the impact of specific approaches to teaching reading. It exceeded the overall effect of 0.17 for a range of reading programs studied by Slavin et al. (2008) as well as the effect of 0.10 for vocabulary instruction obtained by Elleman et al. (2009), and was equivalent to the effect of 0.32 obtained by Rosenshine and Meister (1994) for reciprocal teaching of comprehension strategies.

IMPLEMENTING THE RECOMMENDATIONS

From its humble beginnings 5,000 years ago as a method of keeping track of stored goods, writing's value has skyrocketed. Writing and the explicit teaching of writing has played a central role in education in many historical periods, from the ancient Greeks through much of the twentieth century. The Greeks valued writing for its rhetorical and persuasive powers; the Romans prized eloquence in writing; and the British of the eighteenth and nineteenth centuries saw it as a tool for instilling moral values. As scholars began to study writing systematically, it became clear that the written word is an indispensable tool for communication and achievement. In today's electronic world, writing provides an almost instantaneous means for communicating with family, friends, and colleagues (Graham, 2006). People use writing to explore who they are, to combat loneliness, and to chronicle their experiences. Writing is beneficial both psychologically and physiologically (Smyth, 1998). Writing is also a valuable tool for learning (Bangert-Drowns, Hurley, and Wilkenson, 2004; Graham and Perin, 2007a), enabling us to gather, preserve, and transmit information with great detail and accuracy. The permanence of the written word makes ideas readily available for review and evaluation. Writing's explicitness encourages the establishment of connections between ideas, and its active nature can foster the exploration of unexamined assumptions (Applebee, 1984).

This meta-analysis provides empirical support for another important role for writing: as an effective tool for improving students' reading. Writing about text enhances youngsters' comprehension of it. Teaching students how to write strengthens their comprehension, fluency, and word reading skills. Increasing how much students write improves how well they read.

The impact of writing and writing instruction in this review was especially notable as its effects on published norm-referenced standardized tests rivaled the impact of directly teaching reading skills to students. While we are not saying that writing practices should replace reading instruction, these practices provide teachers and schools with another effective tool for strengthening students' reading skills. (See Biancarosa and Snow [2004] and NICHD [2000] for other effective practices.) Given the importance of reading to young people's social, academic, and eventual occupational success, as well as the large number of students who struggle with reading, this is a noteworthy finding. Yet despite its importance for reading, learning, communicating, self-expression, self-exploration, and future employment, writing is not yet a priority in many of our schools. The National Commission on Writing (2003) indicates that efforts to improve writing are virtually nonexistent in current attempts to reform schools.

Note, however, that the effects of these writing practices on reading are likely to be minimal for students who write infrequently or receive little to no explicit instruction in how to write. For example, Weber and Henderson (1989) found that more writing instruction produced greater reading gains than less writing instruction.

In a national survey of writing practices at the high school level, Kiuahara, Graham, and Hawken (2009) found that students were rarely asked to complete writing assignments involving analysis and interpretation. Assignments that involved writing more than a single paragraph occurred less than once a month in 50 percent of classes. Applebee and Langer (2006) reported similar results, based on data from the National Assessment of Educational Progress. Kiuahara and colleagues further indicated that high school writing instruction was infrequent, even in language arts classes, and increasingly infrequent in social studies and science classes. Many teachers (60 percent of science teachers, for example) reported that they felt unprepared to teach writing. Although teachers in the elementary grades spend more time teaching writing and are better prepared to teach writing practices (Cutler and Graham, 2008; Graham, Harris, MacArthur, and Fink-Chorzempa, 2003), most elementary students only spend about twenty minutes a day writing.

Many evidence-based practices for teaching writing already exist. In *Writing Next* (Graham and Perin, 2007a), eleven effective instructional practices for students in grades 4–12 were identified through a comprehensive meta-analysis of the writing intervention research (see Graham, MacArthur, and Fitzgerald [2007] for a more detailed presentation of these practices). A number of these writing practices, such as teaching writing processes or how to construct more complex sentences, also had a positive impact on students' reading skills in this review. The challenge is helping schools and teachers make these and other effective practices an integral part of their literacy programs. This report proves that good writing instruction is vital to realizing the goal of literacy for all.

Putting the Recommendations into Practice

This report identifies writing practices that hold promise for improving students' reading. For one of the activities involving writing about text, **note taking**, the impact on reading was stronger when students were explicitly taught how to apply this skill. Other activities, such as **answering questions in writing** and **responding to text by writing a personal reaction or analyzing and interpreting it**, may also benefit from instruction, even though they had a strong positive impact on comprehension even when no instruction was given.

Writing about text activities had a positive impact on struggling students' understanding of a text. An important key to success in using these activities with lower-achieving students was to provide them with ongoing practice and explicit instruction.

THE OPTIMAL MIX

Researchers do not know what combination or how much of the different writing about text practices should be emphasized. The four practices validated here—questions, note taking, summary writing, and extended response—serve different purposes. Consequently, how they are applied will depend on goals established by the learner and the teacher.

It is also likely that students will need more or less support in applying these practices, depending upon their familiarity with the practices and their own capabilities.

The **writing about text activities** validated in this review were applied with a variety of reading material, including narrative and expository texts. They were also effective in a variety of different disciplines, including science, social studies, and the language arts. Many content-area teachers do not use writing to promote students' learning (Kiuahara, Graham, and Hawken, 2009), but the findings from this report and *Writing Next* suggest that such techniques should be used more often. When students read texts in science, social studies, and the language arts, their comprehension of this material is improved by writing about it. Likewise, writing about information presented in math, science, and other content classes enhances their learning of this material, as was shown in *Writing Next*.

While most of the research (81 percent) examining the effectiveness of writing about text activities was conducted with students in grade six or above, such activities had a strong and positive impact on reading comprehension as early as second grade (Adams-Boating, 2001). Perhaps not surprisingly, writing about text activities was used almost exclusively in the language arts in the earliest grades (2–4), but by fifth grade such activities enhanced students' comprehension of science and social studies texts (see Appendix B).

Writing instruction that strengthened students' reading skills included both process writing and skills instruction. Both types of approaches to writing instruction were found to promote better student writing in *Writing Next*. Some literacy experts (Freedman, 1993; Smith, 1994) have argued that instructional approaches like

COMBINING WRITING AND READING INSTRUCTION

One purpose of this meta-analysis was to look specifically at the effects of writing instruction on reading. It did not look at the effects of integrated reading and writing instruction on either reading or writing. But this does not mean that writing and reading instruction should be treated as separate entities. We believe that reading and writing instruction will be even more effective when they are designed to work together to achieve common goals and reinforce the reciprocal acquisition of central literacy knowledge, skills, and strategies.

process writing, which rely on informal and incidental learning methods, should not be combined with approaches that emphasize the explicit and systematic instruction of skills and processes. While there is very little evidence on this issue, studies have found that combining process writing with more explicit instructional approaches enhances students' writing (see Graham and Perin, 2007b). Further, teachers overwhelmingly view combining process writing and skills instruction as a positive practice (Cutler and Graham, 2008; Graham, Harris, Fink-Chorzempa, and MacArthur, 2002).

The National Commission on Writing (2003) recommended that schools double the amount of time students spend writing. Our finding that **increasing how much students write improves their comprehension of texts produced by others** is consistent with this recommendation (at least for grades 1–6). Writing time can be extended by having students use writing across the curriculum and write more at home.

Note that the fact that a writing intervention was effective in the studies we reviewed does not guarantee that it will be effective in all other situations. No intervention is effective with all students in all situations. These writing practices should be used and combined flexibly and thoughtfully.

A RESEARCH AGENDA FOR THE FUTURE

This report is the only comprehensive review applying meta-analytic procedures to determine the effects of multiple writing practices on students' reading performance. Included studies date from the 1930s to the present. A considerable body of studies has accumulated over the years, resulting in ninety-three comparisons examining the effects of writing on reading. The available studies involve a variety of disciplines, including the language arts, science, social studies, and second-language learning, conducted with students in urban, suburban, and rural schools. The existing body of experimental and quasi-experimental research is large enough to draw conclusions and recommendations that will help policymakers and educators reengineer our schools to meet the goal of literacy for all.

Unfortunately, there are a number of gaps in the research base, and areas where more evidence is needed. Thus, we need to create a research agenda that will strengthen the knowledge base for policy and practice. It appears that interest in this area of research is declining, as only ten experimental or quasi-experimental studies were published during the last decade. We hope this report will spur new research efforts into the effectiveness of writing practices in strengthening literacy, especially in the areas listed below.

- There is a special need for studies conducted with low-achieving students. Across the three questions posed by our study, we were able to locate only eighteen studies where an effect size could be computed for such students. There were just an additional three comparisons involving English language learners (each focused on writing-to-learn activities). So even though a solid body of research into the literacy-strengthening effect of writing practices now exists, fewer than 25 percent of the comparisons focused on the most vulnerable students. This serious gap in the literature was especially evident for studies examining the effect of writing instruction, as well as the effect of extra writing on reading. (Also, it was not possible to determine if there was a relationship between student achievement level and the effectiveness of different writing practices.)
- Cross-comparisons of the effect of different writing practices on different aspects of performance are also needed. Such cross-comparisons were beyond the scope of this report, but different writing practices most likely influence different aspects of performance (Langer and Applebee, 1987).
- So far, almost no research has been conducted on how to bring the writing practices reviewed here to scale. More research is also needed to determine the mechanisms leading to the effectiveness of a specific writing practice for improving reading. The impact of writing on a broader array of reading outcomes should be considered also, as very few studies consider any reading component beyond comprehension.

- The rich nature of the practice of writing and its relative neglect in instructional research make it inevitable that many potentially effective practices have not yet been studied. Research is needed not only to verify the effectiveness of unstudied existing practices, but to develop and test new ones. Such research could determine whether different writing practices can be combined together in productive ways. For instance, a recent study by Lee and Collins (2008) employed a variety of writing activities to foster students' thinking about text. It is possible that more complex and multi-component practices will yield stronger reading gains.
- Digital writing is a rapidly growing field of interest for many educators, and digital devices are becoming more popular in the classroom. The 2011 NAEP Framework will include a digital platform for writing assessments in grades 8–11. Therefore, more research is needed on the effects of digital technologies for writing activities in our nation's schools.
- An especially promising area for future research involves studying a greater range of “writing about text” practices, especially those that involve conducting written analyses/interpretation of text or developing a written response based on personal reactions to the text. These practices yielded a relatively large average weighted effect size, but only a few different such activities were tested.
- There are also many gaps in our knowledge about the impact of writing instruction on reading. Does the “process writing” approach to writing instruction strengthen the reading skills of adolescent readers? Do youngsters become better readers as a result of explicit instruction in planning and revising? Both of these approaches improve students' writing (Graham and Perin, 2007b), but it is unclear if their effects extend to reading. It is likely that the impact of writing instruction on reading can be strengthened if educators design instruction to intentionally promote such a result. Clearly, research is needed to determine how best to make these connections.
- More research is needed on the *long-term* effects of writing and writing instruction on reading.
- This review did not include studies that were conducted in special schools for students with disabilities (such as deafness, autism, or emotional disturbance), since our purpose was to draw instructional recommendations for regular public and private school settings. But this omission should not be interpreted to mean that writing, reading, or writing to enhance reading is unimportant for these students.
- A high level of literacy cannot be acquired during a few school years or rest solely on the efforts of individual students or teachers. Helping our nation's students become good readers and writers is a collaborative effort involving all stakeholders in the educational process.

Our shared goal is to achieve a high level of literacy for all students, thereby helping our nation's young people to lead more fulfilled, productive lives. This report shows that writing practices can be used to make a significant contribution to the goal of literacy for all.

CONCLUSION

Writing practices cannot take the place of effective reading practices (see Biancarosa and Snow [2004] and NICHD [2000] for a review of such practices). Instead, writing practices complement reading practices and should always be used in conjunction, with each type of practice supporting and strengthening the other.

This study shows that students' reading abilities are improved by writing about texts they have read; by receiving explicit instruction in spelling, in writing sentences, in writing paragraphs, in text structure, and in the basic processes of composition; and by increasing how much and how frequently they write. Our evidence shows that these writing activities improved students' comprehension of text over and above the improvements gained from traditional reading activities such as reading text, reading and rereading text, reading and discussing text, and receiving explicit reading instruction.

The empirical evidence that the writing practices described in this report strengthen reading skills provides additional support for the notion that writing should be taught and emphasized as an integral part of the school curriculum. Previous research has found that teaching the same writing process and skills improved the quality of students' writing (Graham and Perin, 2007a; see also Graham, in press; Rogers and Graham, 2008) and learning of content (as demonstrated in Graham and Perin [2007a] and Bangert-Drowns, Hurley, and Wilkinson [2004]). Students who do not develop strong writing skills may not be able to take full advantage of the power of writing as a tool to strengthen reading.

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APPENDIX A: META-ANALYSIS METHODOLOGY

This appendix reviews in greater detail the methodology used to conduct the meta-analysis that yielded the *Writing to Read* recommendations. A more in-depth description of the methodology can be found in a forthcoming publication (Graham and Hebert, under review).

Location and Selection of Studies

This meta-analysis was performed to answer three questions about the impact of writing on reading:

1. Does writing about material read enhance students' comprehension of text?
2. Does teaching writing strengthen students' reading skills?
3. Does increasing how much students write improve how well they read?

The answers to these questions provided the basis for a series of instructional recommendations regarding how writing can facilitate reading.

The strategies used for locating and selecting studies for inclusion were influenced by eleven factors:

First, the search concentrated on studies that provided empirical evidence relevant to answering one or more of the questions above.

Second, only studies employing an experimental or quasi-experimental design were included. Consequently, each study in this review compared at least two groups of students who received different instructional conditions. The following examples illustrate appropriate comparisons for each question posed above: one group writes a summary of text read and the other group reads and studies the same material (Question 1); one group is taught how to write increasingly complex sentences and the other group is taught reading skills (Question 2); one group is asked to write in a journal each day and the other group spends this time reading (Question 3). Even though correlational, qualitative, and single subject design studies and studies where students serve as their own controls add important information to the dialogue about effective instructional practices (see Pressley, Graham, and Harris, 2006), they were not included in this review.

Third, studies were only included if the treatment group wrote or received writing instruction. Writing had to involve students' creation of meaningful written text. Consequently, we did not include studies where the treatment involved copying written text or writing single words. We excluded studies involving typing practice or the completion of written cloze activities where students added a missing word to a sentence. Studies were further eliminated if ambiguity about students' creation of written text existed. To illustrate, if students were asked to answer questions about text read but it was not possible to determine if this resulted in the production of written answers, the study was eliminated. The only

exception to the rule that treatment groups must create connected written text was spelling instruction. It is commonly assumed that spelling instruction has a positive impact on word reading skills (Adams, 1990; Ehri, 1987), and such instruction typically involves copying in writing words to be learned (Graham et al., 2008).

Fourth, studies were excluded if it was not possible to isolate the effect of the writing activity or writing instruction. This eliminated most studies that investigated integrated reading and writing instruction.

Fifth, studies were excluded if students in the control condition wrote or received writing instruction. There were exceptions to this rule. For example, a study was included if both the treatment and control conditions received the same amount of writing or writing instruction as part of their typical language arts program, but the experimental manipulation for the treatment group involved writing or additional writing instruction. Furthermore, a control condition was not classified as involving writing if students copied text (which never occurred) or completed written cloze activities involving single words (which occurred once). This was consistent with the rules for identifying a writing treatment. The preferred control condition was some form of student reading (e.g., reading and rereading, reading and discussion, and reading and studying) or reading instruction. This occurred 85 percent of the time. In 4 percent of the studies, students in the control condition continued to receive their usual classroom instruction. In these business-as-usual situations, there was no evidence that students were writing or receiving writing instruction as defined above. Another 12 percent of studies involved a control that received oral practice, math instruction, mental study, or no instruction.

Sixth, only studies that assessed reading performance were included. Examples of reading comprehension measures were oral and written retells, oral and written answers to questions, answers to multiple-choice questions, completion of cloze activities, and written summaries. Word reading was measured by reading real or nonsense words, whereas reading fluency was assessed by the number of words read correctly within a specified time frame. Reading measures included both researcher-constructed and norm-referenced standardized tests. If a reading comprehension score for a norm-referenced standardized measure could not be isolated, then the more global score for that test was used as a proxy for reading comprehension.

Seventh, studies were excluded if the writing treatment was identical to the reading outcome measure, as the treatment and assessment of the effectiveness of the treatment could not be separated one from the other. For example, a study was eliminated if the treatment involved instruction in how to write summaries of text and the only reading outcome was based on students' summary writing performance. Likewise, a study was eliminated if the only reading measure involved answering text questions in writing and the treatment involved practice in doing just that. If either of these types of studies included other reading measures, they were retained, but findings from measures taught or practiced were not used in any analysis.

Eighth, this meta-analysis was limited to studies of students in grades 1–12. Most of the studies involved students in grades four and higher.

Ninth, studies of writing treatments in special schools for youngsters with deafness, autism, emotional disturbance, or other disabilities were not included. While writing to improve reading should be an important part of the curriculum for these students, the purpose of this review was to draw recommendations for regular public and private school settings.

Tenth, only studies that provided the data needed to calculate appropriate statistics, including an effect size and a weighted average effect size, were included. For instance, if a study did not provide information on the number of participants involved in the experiment, it was excluded, as it could not be used in the calculation of an average weighted effect size. Quasi-experimental studies were excluded if they did not provide a reading pretest measure for both the writing treatment and control group. Without such a pretest, it is possible that the calculated effect is a function of initial differences favoring the treatment or control condition. This same stipulation was not required for experimental studies, as it is assumed that the process of randomization eliminates pretreatment differences between groups.

Eleventh, a search that was as broad as possible was undertaken to identify relevant studies for this review (i.e., studies that provided evidence on the three questions addressed by this review). In June 2008, 260 electronic searches were run in multiple databases, including ERIC, PsychINFO, ProQuest, and Education Abstracts, and Dissertation Abstracts, to identify relevant studies. For the 14,000 items identified through the electronic searches, each entry was read separately by both authors of this review. If the item looked promising, based on its abstract or title, it was obtained (there was 99.2 percent agreement between the two authors, with all disagreements resolved by the first author). In addition, hand searches were conducted for the following peer-reviewed journals: *Assessing Writing*, *Journal of Literacy, Reading and Writing: An International Journal*, *Reading Research and Instruction*, *Reading Research Quarterly*, *Research in the Teaching of Writing*, *Scientific Studies of Reading*, and *Written Communication*. Other sources for possible studies included the Report from the National Reading Panel, *Teaching Children to Read* (NICHD, 2000), as well as chapters examining the relationship between writing and reading in influential books on reading, such as *The Handbook of Reading Research* (Kamil, Mosenthal, Pearson, and Barr, 2000). Once a document was obtained, the reference list was searched to identify additional promising studies. Of 746 documents collected, we found ninety-three experiments that met the inclusion criteria. Reliability for selected documents was established by both authors independently reading all studies. There were only three disagreements between the two authors (reliability = 99.6 percent). Disagreements were resolved by consensus.

Categorizing Studies According to Questions and Methods

Each study was read and then placed into a category based on the question it answered. Studies assigned to Questions 1 and 2 (i.e., writing about text and impact of writing instruction) were further examined and placed into pre-identified instructional subcategories. For Question 1, these categories were answering questions in writing, taking notes, summarizing, and extended writing. For Question 2, they were process writing and skills instruction. Studies that did not fit neatly into the pre-identified instructional methods categories were held apart until all studies had been read once.

A subsequent examination of studies addressing Question 1 resulted in the creation of an additional category, writing short responses about text read (brief analogy, metaphor, and compare/contrast statement), and splitting note taking into two categories: unstructured notes and structured notes. All of the studies addressing Question 1 measured the effects of writing on reading comprehension.

Reexamination of studies addressing Question 2 resulted in the development of a new set of categories. There were only three studies examining the effects of process writing instruction on reading, with all of the remaining studies involving some form of skills instruction, including the teaching of spelling (six studies), sentence skills (seven studies), text structure (two studies), or some combination of these skills (two studies). Within these studies, there were fifteen comparisons assessing the impact of writing instruction on reading comprehension, five comparisons assessing word effects, and four comparisons assessing reading fluency effects. Since there were too few process writing studies to retain the original process writing versus skills distinction, studies were parsed according to the impact of writing instruction on specific outcome measures: specifically, reading comprehension, reading fluency, and word recognition skills.

For all three questions, studies were subsequently reexamined to verify that they were under the appropriate question and subcategory. It should be noted that reading comprehension was the outcome measure in all nine of the studies pertinent to Question 3 (impact of extra writing on reading). Descriptive information and summary effect sizes for all studies are presented for each question and subcategory in Appendix B. Those subcategories that were analyzed separately and included in Appendix B are described below.

Generating or Responding to Questions in Writing. This included writing short answers to questions about a text before, during, or after reading it as well as generating in writing questions to ask about a text.

Taking Unstructured and Structured Notes About a Text. This involved taking written notes about a text during or after reading it. Notes could be unstructured or organized via an outline, graphic organizer, column method, and so forth.

Writing a Summary of a Text. This included self-generated synthesis of a text as well as summaries written with a specific example in mind or by using specific rules. In some instances, students were first taught how to locate or organize important information in a text before paraphrasing it.

Extended Writing About a Text. This involved a more extended writing response, going beyond single statements in response to a question or precise summaries about a text. Extended written responses focused on students' personal reaction to material read; analysis, interpretation, or application of the material presented in the text; or explaining the text material to others.

Coding of Study Features

Each study was coded for twelve variables: grade, type of student, number of participants, locale, treatment length, training of participants, control condition, subject, genre, outcome measures, publication type, and research design. These variables provided information on the treatment (treatment length and training of participants), who received it (grade and type of student), how broadly it was applied (number of participants and locale), what discipline it was designed to impact (subject and genre), how it was assessed (outcome measures and research design), and what intervention served as the control condition. Most of these variables were also selected because it was assumed that they might account for variability in effect sizes beyond subject-level sampling error (assessed by the test of homogeneity). For instance, variability in effects may be related to systematic differences in treatment (e.g., training versus no training), participants (e.g., older versus younger students or more capable versus less capable students), or control conditions. Coding features that are included in Appendix B and those that play a key role in contextualizing the findings from this review are described below. See Graham and Hebert (under review) for a fuller description of other study features coded. For all study features coded, there was 94.8 percent agreement between the first and second author, with all disagreements resolved through discussion.

Grade. The specific grade(s) that participants attended were identified. In a few instances, it was known only that students were in middle or high school, as the researchers did not identify specific grade levels of participants.

Type of student. Participants were labeled as full range (representing the full range of writers found in typical classrooms); average (average readers/writers; this category did not include the weakest and strongest writers in a classroom); above average (above-average readers/writers), ELL (English language learners: students with English as a second language); poor reader, writer, or speller (students with identified weaknesses in reading, writing, or spelling based on test data provided by the researcher); and as having or not having a particular type of disability (e.g., learning disability). Students with identified weaknesses in reading, writing, or spelling were further classified as lower-achieving students.

Training. Students received training if they participated in at least one session where they practiced or were taught how to use the target writing procedure.

Subject. The specific discipline(s) where participants applied the writing treatment. These included language arts, science, social studies, math, foreign language, and psychology.

Genre. The type of reading or writing task completed by participants (i.e., narrative, expository, persuasive, and other).

Locale. Geographic location where the study took place: urban, suburban, or rural.

Outcome measure. Measures used to assess the impact of writing treatments were coded according to type and skills assessed. Type included published standardized norm-referenced tests and researcher-developed measures. Skills assessed include reading comprehension, word recognition, and reading fluency.

Calculation of Effect Sizes

Ideally, effect sizes are calculated from designs where students are randomly assigned to treatment and control conditions. The studies in this meta-analysis included designs where randomization did (experimental) and did not occur (quasi-experimental). Since an important function of randomization is to ensure a lack of bias in assignment, failure to randomly assign participants increases the likelihood of inequalities between the treatment group and the control group. Consequently, for quasi-experimental design studies, effect sizes (d) were computed as the difference between the treatment and control condition (i.e., $\bar{Y}_{tx} - \bar{Y}_{ctrl}$) after adjusting for pretest reading differences by subtracting the mean difference at pretest from posttest, or estimating the posttest mean-difference statistic from covariate-adjusted posttest means. This difference was then divided by the pooled standard deviation for the posttest. In a few instances, it was necessary to compute an effect size for the posttest and pretest separately, and obtain an adjusted effect size by subtracting the effect size for the pretest from the effect size for the posttest (Slavin, Cheung, Groff, and Lake, 2008). In each of these cases, the pretest and posttest were measures of the same construct, but different scales were used to measure the construct.

For experimental studies, a pretest was not a requirement for inclusion in this review, as there was no bias in assignment, and insistence on a pretest would eliminate some of the methodologically strongest studies. For these comparisons, effect sizes were calculated by subtracting the mean posttest performance of the control group from the mean posttest performance of the writing treatment group and dividing by the pooled standard deviation of the two groups.

For both experimental and quasi-experimental designs, missing standard deviations were estimated from summary statistics reported by researchers or by estimating residual sums of squares to compute a root mean squared error (RMSE) (e.g., Shadish, Robinson, and Congxiao, 1999; Smith, Glass, and Miller, 1980). For covariate or complex factorial designs, pooled standard deviations were estimated by calculating and restoring the variance explained by covariates and other “off-factors” to the study’s error term and recalculating the root-mean-squared error (RMSE), or pooled standard deviation, from the composite variance. All computed effects were adjusted for small-sample-size bias ($d_{adj} = d * \gamma$; $\gamma = 1 - 3/4(n_{tx} + n_{ctrl}) - 9$; Hedges [1982]).

As a prelude to calculating the effect size for some comparisons, it was necessary to average the performance of two or more groups in each condition. For example, some studies provided separate statistics by grade or type of writer for the treatment and control conditions. To aggregate data in each condition, the procedure recommended by Nouri and Greenberg (Cortina and Nouri, 2000) was applied. This procedure estimates an aggregate group or grand mean. We first calculated the aggregate treatment or control mean as an n -weighted average of subgroup means:

$$\bar{Y}_{..} = \frac{1}{n_{..}} \left[\sum_{j=1}^k (n_{.j}) (\bar{Y}_{.j}) \right]$$

Then, the aggregate variance was calculated by adding the n -weighted sum of squared deviations of group means from the grand mean to the sum of squared deviations within each subgroup:

$$s_{..}^2 = \frac{1}{n_{..} - 1} \left[\sum_{j=1}^k n_{.j} (\bar{Y}_{.} - \bar{Y}_{.j})^2 + \sum_{j=1}^k (n_{.j} - 1) s_{.j}^2 \right]$$

Aggregated treatment or control means and standard deviations were used to compute an independent effect size (d).

Across studies, there was no single reading measure used by a majority of investigators. For example, researcher-devised measures of reading comprehension included answering questions about a text (multiple choice and short answers), retelling what was read (orally or in writing), summarizing a text in one sentence, and identifying words systematically omitted from a text (cloze procedure). As a result, there was no single assessment that could be used as a measure of reading comprehension, word reading skills, or reading fluency. Moreover, many researchers administered multiple tests assessing the same construct (i.e., reading comprehension) and, in some instances, measures assessing other reading constructs (e.g., reading fluency). Consequently, effect sizes for multiple measures of the same construct within a study were aggregated. Aggregation of effects of different measures for the same construct is preferable when intercorrelations among these measures are unknown, as standard error estimation is complicated when this information is missing (Gleser and Olkin, 1994).

Researcher-devised measures are typically more sensitive to treatment effects than published standardized norm-referenced measures, as they are often designed to test what is taught. Consequently, these two types of assessments were not aggregated, even when they measured the same construct. There were two exceptions to this rule. First, there were five comparisons examining the effects of writing instruction (i.e., spelling instruction) on word reading skills. Two of these studies assessed the effects of writing instruction using a norm-referenced standardized test. The other three comparisons relied on researcher-designed measures. Because of the small number of studies and similarities in the research-devised and published standardized norm-referenced measures (each type of test assessed reading real or nonsense words), all five studies were used to obtain an overall effect size for this treatment.

Second, there were four comparisons that examined the effects of writing instruction on reading fluency, with an equal number applying the two types of assessments. We decided to combine these assessments for the same reasons as for the first exception.

Statistical Analysis of Effect Sizes

For each question posed at the start of Appendix A, analyses were only conducted for a writing treatment that contained four or more independent comparisons assessing the same reading construct. Although both Hillocks (1986) and Graham and Perin (2007a) applied the same criteria, it must be recognized that small sample sizes are not very reliable, and a summary statistic is not reported with small samples and considerable variation in effect sizes.

Our meta-analysis employed a weighted random-effects model. For each treatment involving four or more comparisons, we calculated the mean, standard deviation, and median for the unweighted effect sizes. We also calculated the mean and confidence interval for weighted effect sizes. While it is best to interpret the magnitude of an effect size in relation to the distribution of other mean effect sizes in the same general area (i.e., other treatments designed to influence reading performance), a widely used rule of thumb is that an effect size of 0.20 is small, 0.50 is medium, and 0.80 is large.

We further conducted tests of homogeneity to determine if the various effect sizes weighted and averaged together in a treatment estimated the same population effect size. When variability in effect sizes was larger than expected based on sampling error alone (i.e., the homogeneity test was statistically significant), and there were at least twelve effect sizes computed for the treatment, we examined if this excess variability could be accounted for by identifiable differences between studies (e.g., training versus no training). Using a random-effects model (Lipsey and Wilson, 2001), effect sizes were partitioned to determine if a specific study feature accounted for a significant proportion of the excess variability in effect sizes.

To avoid inflating sample size and violating the assumption of independence of data (Wolf, 1986), only one effect size for each study was used when conducting the analysis for each question posed at the start of Appendix A. For example, in answering Question 1 (impact of writing on comprehension of text read), there were six studies that involved multiple writing treatments. To illustrate, Langer and Applebee (1987) compared three different writing treatments to a reading control group. Using the Nouri-Greenberg procedure (Cortina and Nouri, 2000), the effect sizes for reading comprehension for these three writing treatments were aggregated to form a single effect size for the first level of analysis examining if writing about text produced significant and homogeneous effects. For any follow-up analyses that involved a specific writing treatment included in Langer and Applebee (1987), such as summary writing, the aggregated effect size was disaggregated in order to obtain the relevant effect. Appendix B reports the disaggregated effect size for these six studies. In addition, the effect sizes for studies reported by Callahan (1977) and Sullivan (1977) were aggregated, as it was clear that

they involved a single study that was split into two manuscripts, with each document focusing on different grades.

There were some exceptions to the rule of one effect size per study. For example, when answering Question 1 (impact of writing on comprehension of text read) several investigators reported multiple studies in the same paper (Barton, 1930; Doctorow, Wittrock, and Marks, 1978; Vidal-Abarca and Gilabert, 1995). There were also several studies (Denner, 1987; Slater, 1982) where one version of the treatment was compared to a control condition and another version of the treatment was compared to a separate control condition. In all of these cases, the assumption of independence of data was maintained. Furthermore, while a single effect size was calculated for the two different extended writing treatments tested in Licata (1993), a separate effect size was computed for each treatment when follow-up analyses were conducted to determine the effectiveness of different writing about text activities.

Exceptions to the rule of one effect size per study for Question 2 (impact of writing instruction on reading) involved Kelley (1984), where two different treatments (process writing and skills instruction) were compared to a single control condition, and Weber and Henderson (1989), where two different doses of the same treatment were compared to a single control condition. An effect size was calculated for each version of the treatment in these two studies. Another exception to one effect size per study for Question 2 involved studies that assessed multiple aspects of reading performance (e.g., reading comprehension and reading fluency or reading fluency and word reading). Uhry and Shepherd (1993) assessed reading comprehension, word reading skills, and reading fluency, whereas Weber and Henderson (1989) assessed reading fluency and word reading skills. Since there was an adequate number of effects (four or greater) to run separate analyses for each of these constructs (maintaining the assumption of data independence), none of the effect sizes from these investigations were aggregated or discarded.

In addition, several studies (e.g., Placke, 1987) had both researcher-developed and published standardized norm-referenced measures of reading comprehension, and neither of these effects were discarded or aggregated, as analysis for the two types of assessment were run separately. As noted earlier, this was not the case for the effects of writing instruction on reading fluency or word reading skills.

Note that not all of the analyses are included in this document. These can be obtained from Carnegie Corporation of New York or from a forthcoming article (Graham and Hebert, under review).

Limitations

Readers should keep in mind several limitations and caveats of this review's findings.

First, only studies in which the performance of an experimental group was compared with that of a control group were included in this report. As a result, conclusions from this meta-analysis do not reflect the findings from (a) studies where students acted as their own controls; (b) the many investigations that measured associations between writing and reading performance; or (c) observational studies that examined the literacy practices of teachers, including how they apply writing to support reading.

Second, the purpose of this report was to determine if writing and writing instruction improves reading. Consequently, we reviewed studies where the impact of writing or a writing activity on reading could be reasonably isolated. This meant that studies examining the impact of integrated reading and writing instruction were excluded, and the effects of different writing interventions were not compared one to another. Therefore, no conclusions can be drawn from this report about the value of combining writing and reading instruction or the relative effectiveness of different writing activities.

Third, some writing procedures have been the focus of more research than others. For example, although developing short written analogies and metaphors for text read (see Linden and Wittrock [1981] in Appendix B) may be an effective practice for fostering comprehension, not enough research is available to draw even a tentative conclusion about the impact of these practices. In addition, only three treatments (note taking, summary writing, and writing instruction) yielded more than twelve effect sizes. Less confidence can be placed in the reliability of an average weighted effect size when it is based on a small number of studies.

Fourth, for the writing treatments that involved twelve or fewer effect sizes, not all grade levels were covered. Even for the three areas (note taking, summary writing, and writing instruction) that received the most empirical attention, some grades received little, and in some instances no, attention. Interpretations of the findings from this meta-analysis must be tempered by this fact.

Fifth, it was not possible to examine whether student type moderated outcome effects for any specific treatment. We did find that writing about text activities was effective for lower-achieving students, but this was based on a total of only twelve studies.

Sixth, no conclusions can be drawn from this report about the long-term impact of the writing treatments included in our review. Fewer than ten studies assessed maintenance of the effects of writing about texts, for example, and these studies were not representative, as two thirds of them involved note taking.

Seventh, as with prior meta-analysis of the writing intervention literature (e.g., Bangert-Drowns, Hurley, and Wilkinson, 2004; Graham and Perin, 2007a, 2007b; Hillocks, 1986), a host of decisions

had to be made about which studies to include and exclude, what question a study answered, and which instructional methods category it best fit. In light of reactions to earlier reviews (e.g., Stotsky, 1988), other researchers will undoubtedly question one or more of the decisions made in this review. Consequently, we tried to make our reasoning and decisionmaking processes as transparent as possible.

Eighth, one concern with meta-analysis involves comparability of outcome measures on which the effect sizes are based. We addressed this problem in two ways. Effect sizes were not aggregated across constructs (e.g., effect sizes for reading comprehension and word reading skills were not aggregated), but they were aggregated for a specific construct, such as reading comprehension. Although the aggregated effect sizes were assumed to measure the same construct, these conceptually similar measures were not exactly the same. This introduces unwanted noise into the machinery of meta-analysis, and may mask important distinctions about which elements of a construct such as reading comprehension are impacted (Langer and Applebee, 1987).

Finally, another concern with meta-analysis involves how coherent the interventions are for the treatment as well as the control condition, which is also a concern in the current review. For most of the instructional methods categories (see Appendix B), we believe that the interventions are reasonably coherent. The least coherent grouping involves the studies that tested the impact of writing instruction on reading (Question 2). This included process writing, sentence combining, spelling, text structure, and general writing skills instruction. Although all of these studies shared the common characteristic that students were taught how to write, what was taught and how it was taught differed across investigations. In terms of comparability of control conditions, 85 percent of the studies involved some form of reading or reading instruction. However, the remaining 15 percent involved a variety of control conditions, including oral instruction, math instruction, undefined business-as-usual, and no instruction.

APPENDIX B: DETAILS OF EXPERIMENTAL AND QUASI-EXPERIMENTAL STUDIES SUPPORTING KEY ELEMENTS OF THE IMPACT OF WRITING ON READING

1A. Impact of Writing on Reading Comprehension

(Generating or Responding to Questions in Writing)

Study	Grade	Students	Treatment	Training	Content Area	Effect Size
Cohen, R. (1983). Self-generated questions as an aid to reading comprehension. <i>Reading Teacher, 36</i> , 770–775.	3	Ave and BA	Students received training in generation of written questions about text versus BAU reading instruction	T	LA	*0.75
MacGregor, S. K. (1988). Use of self-questioning with a computer-mediated text system and measures of reading performance. <i>Journal of Reading Behavior, 20</i> , 131–148.	3	Ave and AA	Students generated and answered self-generated questions in writing versus reading the text	NT	LA	*0.34
Berkowitz, S. J. (1986). Effects of instruction in text organization on sixth-grade students' memory for expository reading. <i>Reading Research Quarterly, 21</i> , 161–178.	6	GR and PR	Students practiced answering questions in writing and discussed their answers with teachers versus reading the text	NT	SS	0.35
Coffman, G. A. (1992). <i>The effects of basal reader questions, causal chain questions, and unaided reading on sixth graders' understanding of complex stories</i> . Unpublished dissertation, University of Kansas.	6	FR	Students answered questions about text in writing versus reading the text	NT	NR	0.32
Taylor, B., and Berkowitz, S. (1980). Facilitating children's comprehension of content material. In M. L. Kamil and A. J. Moe (Eds.), <i>Perspectives in reading research and instruction. Twenty-ninth yearbook of the National Reading Conference</i> (pp. 64–68). Clemson, SC: National Reading Conference.	6	Ave and AA	Students practiced answering questions about text in writing versus reading the text and performing a distracter task	NT	SS	0.26
Taylor, B. M., and Beach, R. W. (1984). The effects of text structure instruction on middle-grade students' comprehension and production of expository text. <i>Reading Research Quarterly, 19</i> , 134–146.	7	FR	Students practiced answering questions in writing and received feedback from teachers about accuracy of answers versus BAU reading instruction	T	SS	0.26
Langer, J. A., and Applebee, A. N. (1987). <i>How writing shapes thinking: A study of teaching and learning</i> . NCTE Research Report No. 22.	9 and 11	FR	Students read and answered questions about text in writing versus reading and studying the text	NT	SS	0.06

Peverly, S. T., and Wood, R. (2001). The effects of adjunct questions and feedback on improving the reading comprehension skills of learning-disabled adolescents. <i>Contemporary Educational Psychology</i> , 26, 25–43.	9–11	RD	Students practiced writing responses to questions inserted in text or after the text versus reading the text	NT	LA	*0.44
Bean, T. W., Singer, H., Sorter, J., and Frazee, C. (1983). Acquisition of summarization rules as a basis for question generation in learning from expository text at the high school level. In J. A. Niles (Ed.), <i>Searches for meaning in reading/language processing and instruction. Thirty-second yearbook of the National Reading Conference</i> (pp. 43–48). Rochester, NY: National Reading Conference.	10	AA	Students were taught to generate main idea statements, write three questions for the statement, and draw conclusions versus reading and discussing the text	T	SS	0.27
Hayes, D. A. (1987). The potential for directing study in combined reading and writing activity. <i>Journal of Reading Behavior</i> , 19, 333–352.	10	Ave and AA	Students wrote questions about material read versus students who completed matching exercises	NT	SC	0.14
Andre, M., and Anderson, T. H. (1979). The development and evaluation of a self-questioning study technique. <i>Reading Research Quarterly</i> , 14, 605–623.	11–12	Ave and AA	Students were taught to locate the main idea and generate questions in writing or practiced generating questions with no main idea training versus reading the text	T/NT	PSY	0.51

1B. Impact of Writing on Reading Comprehension

(Taking Unstructured Notes About Material Read)

Study	Grade	Students	Treatment	Training	Content Area	Effect Size
Leshin, C. B. (1989). <i>Spatial representation and reading comprehension in 5th and 6th grade students</i> . Unpublished dissertation, Arizona State University.	5 and 6	FR	Students were told to take written notes about a passage versus underlining important information in the passage	NT	SC	0.43
Denner, P. R. (1987). <i>Comparison of the effects of episodic organizers and traditional note taking on story recall</i> . ERIC Document Reproduction Service No. ED270731.	7	FR	Students were taught to list important written notes about text versus reading and rereading text	T	LA	0.50
Denner, P. R. (1992). Comparison of the effects of episodic mapping and traditional note taking on the recall of historical text. Paper presented at the Northern Rocky Mountain Educational Research Association, Rapid City, SD.	8	GR and PR	Students were taught to take written notes about text versus reading and rereading text	T	SS	0.45
Ryan, M. T. (1981). <i>Effects of paraphrase note taking on prose learning</i> . Unpublished dissertation, University of Connecticut.	MS	FR	Students were told to take written notes after each paragraph versus reading text carefully	NT	LA	0.53

Matthews, C. O. (1938). Comparison of methods of study for immediate and delayed recall. <i>Journal of Educational Psychology</i> , 29, 101–106.	9–12	FR	Students were told to take written notes while they read versus reading text	NT	SS	-0.15
Kulhavy, R. W., Dyer, J. W., and Silver, L. (1975). The effects of note taking and test expectancy on the learning of text material. <i>Journal of Educational Research</i> , 68, 363–365.	11 and 12	FR	Students were told to read and take up to three lines of written notes for each page of text versus reading and studying text	NT	LA	0.37
Schultz, C. B., and Di Vesta, F. J. (1972). Effects of passage organization and note taking on the selection of clustering strategies and on recall of textual materials. <i>Journal of Educational Psychology</i> , 63, 244–252.	11 and 12	AA	Students were told to take written notes while reading versus reading text	NT	SS	0.15
Walko, J. K. (1989). <i>The effect of varied note-taking strategies on students' ability to profit from visualized instruction as measured by tests assessing different educational objectives</i> . Unpublished dissertation, Pennsylvania State University.	12	FR	Students were told to read the passage, take notes in writing, and study their notes versus reading and studying without note taking	NT	SC	-0.11

1C. Impact of Writing on Reading Comprehension (Taking Structured Notes About Material Read)

Study	Grade	Students	Treatment	Training	Content Area	Effect Size
Bayne, M. (1984). A study of the use of the semantic webbing technique to improve reading comprehension of third and fourth graders. Paper presented at the Annual Meeting of the Northern Rocky Mountain Educational Research Association, Laramie, WY.	3 and 4	FR	Students were taught how to create a written semantic web for text read versus reading instruction	T	LA	*0.14
Chang, K. E., and Sung, Y. T. (2002). The effect of concept mapping to enhance text comprehension and summarization. <i>Journal of Experimental Education</i> , 71, 5–23.	5	FR	Students were taught to construct written maps of text read or constructed maps of texts without instruction versus reading text	T/NT	SC	0.52
Berkowitz, S. J. (1986). Effects of instruction in text organization on sixth-grade students' memory for expository reading. <i>Reading Research Quarterly</i> , 21, 161–178.	6	GR and PR	Students were taught to construct written maps of text versus reading and rereading text	T	SS	0.87
Barton, W. A. (1930). <i>Contributions to education no. 411: Outlining as a study procedure</i> . New York, NY: Columbia University Bureau of Publications.	7	FR	Students were taught to outline text in writing versus reading text	T	SS	0.69

Bigelow, M. L. (1992). <i>The effects of information processing strategies and cognitive style on achievement of selected educational outcomes</i> . Unpublished dissertation, Pennsylvania State University.	7 and 8	FR	Students read a text and were told to take written notes in an outline form or in a matrix form versus reading text	NT	SC	0.78
Denner, P. R. (1987). Comparison of the effects of episodic organizers and traditional note taking on story recall. ERIC Document Reproduction Service No. ED270731.	7	FR	Students were taught how to identify and organize important written notes of text versus reading and rereading text	T	LA	0.77
Armbruster, B. B., and Anderson, T. H. (1980). <i>Technical report no. 160: The effect of mapping on the free recall of expository text</i> . Urbana-Champaign: University of Illinois, Center for the Study of Reading.	8	FR	Students were taught to map passages in writing with the aid of cues and then without the aid of cues versus BAU	T	SC	0.43
Chang, S.-J. (1987). <i>An application of schema theory to school learning: Learning geography with the help of a note taking schema</i> . Unpublished dissertation, University of Texas at Austin.	8	FR	Students were taught to take notes in writing using a two-column method or using a graphic organizer versus reading text	T	SC	0.69
Denner, P. R. (1992). Comparison of the effects of episodic mapping and traditional note taking on the recall of historical text. Paper presented at the Northern Rocky Mountain Educational Research Association, Rapid City, SD.	8	GR and PR	Students were taught to map text in writing versus reading and rereading text	T	SS	0.54
Slater, W. (1982). <i>The effects of structural organizers and rhetorical predicates on the recall of expository text</i> . Unpublished thesis, University of Minnesota.	9	FR	Students wrote notes about text on a structural organizer versus students who were provided with a structural organizer of material read	NT	SS	0.76
Slater, W. (1982). <i>The effects of structural organizers and rhetorical predicates on the recall of expository text</i> . Unpublished thesis, University of Minnesota.	9	FR	Students read text and took notes versus students who read the passage	NT	SS	0.87
Faber, J. E., Morris, J. D., and Lieberman, M. G. (2000). The effect of note taking on ninth grade students' comprehension. <i>Reading Psychology</i> , 21, 257–270.	9	GR and PR	Students were taught to take written notes using the Cornell method versus reading text	T	SS	0.03
Barton, W. A. (1930). <i>Contributions to education no. 411: Outlining as a study procedure</i> . New York, NY: Columbia University Bureau of Publications.	9–12	FR	Students were taught to identify the main points in a paragraph and turn them into a written outline versus the same instruction with no outlining	T	SS	0.44
Barton, W. A. (1930). <i>Contributions to education no. 411: Outlining as a study procedure</i> . New York, NY: Columbia University Bureau of Publications.	HS	FR	Students received instruction and practice in outlining text in writing versus reading text	T	SS	0.92

Vidal-Abarca, E., and Gilabert, R. (1995). Teaching strategies to create visual representations of key ideas in content area text materials: A long-term intervention inserted in school curriculum. <i>European Journal of Psychology of Education, 10</i> , 433–447.	6	FR	Students were taught to turn text into a written key-idea map versus BAU reading instruction	T	SC	0.22
Vidal-Abarca, E., and Gilabert, R. (1995). Teaching strategies to create visual representations of key ideas in content area text materials: A long-term intervention inserted in school curriculum. <i>European Journal of Psychology of Education, 10</i> , 433–447.	8	FR	Students were taught schemas for organizing text into written maps versus BAU reading instruction	T	SC	0.24

1D. Impact of Writing on Reading Comprehension (Writing a Summary About Material Read)

Study	Grade	Students	Treatment	Training	Content Area	Effect Size
Jenkins, J. R., Heliotis, J. D., and Stein, M. L. (1987). Improving reading comprehension by using paragraph restatements. <i>Exceptional Children, 54</i> , 54–63.	3–6	LD	Students were taught to write paragraph restatements versus BAU reading instruction	T	LA	0.68
Jennings, J. H. (1990). A comparison of summary and journal writing as components of an interactive comprehension model. In J. Zuttell and S. McCormick (Eds.), <i>Learner factors/teacher factors: Issues in literacy research and instruction. Fortieth yearbook of the National Reading Conference</i> (pp. 67–82). Chicago: National Reading Conference.	5	FR	Students were taught to organize information from text and then write a summary from it versus BAU reading instruction	T	SS	0.34
Newlun, C. (1930). <i>Teaching children to summarize in fifth grade history: Teachers College contributions to education, no. 404</i> . New York, NY: Teachers College, Columbia University.	5	FR	Students were taught to write summaries of text versus reading and studying text	T	SS	*0.36
Amuchie, P. M. (1983). <i>Teaching summarization skills to bilingual elementary school children</i> . Unpublished dissertation, University of California, Los Angeles.	5 and 6	ELL	Students were taught rules for writing paragraph summaries of text versus BAU reading instruction	T	LA	1.36
Doctorow, M., Wittrock, M. C., and Marks, C. (1978). Generative recall and reading comprehension. <i>Journal of Educational Psychology, 70</i> , 109–118.	6	GW	Students were told to write one-sentence summaries after each paragraph versus reading text	NT	NR	1.56
Doctorow, M., Wittrock, M. C., and Marks, C. (1978). Generative recall and reading comprehension. <i>Journal of Educational Psychology, 70</i> , 109–118.	6	PW	Students were told to write one-sentence summaries after each paragraph versus reading text	NT	NR	0.98
Rinehart, S. D., Stahl, S. A., and Erickson, L. G. (1986). Some effects of summarization training on reading and studying. <i>Reading Research Quarterly, 21</i> , 422–438.	6	FR	Students were taught rules for summarizing text in writing versus reading and completing worksheets	T	SS	0.50

Taylor, B., and Berkowitz, S. (1980). Facilitating children's comprehension of content material. In M. L. Kamil and A. J. Moe (Eds.), <i>Perspectives in reading research and instruction. Twenty-ninth yearbook of the National Reading Conference</i> (pp. 64–68). Clemson, SC: National Reading Conference.	6	Ave and AA	Students were taught how to generate a one-sentence summary in writing for each paragraph versus reading and an unrelated task	T	SS	0.43
Ryan, M. T. (1981). <i>Effects of paraphrase note taking on prose learning</i> . Unpublished dissertation, University of Connecticut.	6–8	FR	Students were told to paraphrase each paragraph versus reading text	NT	LA	0.43
Taylor, B. M., and Beach, R. W. (1984). The effects of text structure instruction on middle-grade students' comprehension and production of expository text. <i>Reading Research Quarterly, 19</i> , 134–146.	7	FR	Students were taught how to generate a summary in writing after outlining text material versus BAU reading instruction	T	SS	0.75
Bates, G. W. (1981). <i>The comparative effects of two mathemaginic activities on ninth-grade good and poor readers' comprehension, retention, and attitudes</i> . Unpublished dissertation, University of Wisconsin, Madison.	9	GR and PR	Students were given model summaries and asked to emulate them in writing as they read text versus reading and rereading of text	NT	LA	-0.17
Langer, J. A., and Applebee, A. N. (1987). <i>How writing shapes thinking: A study of teaching and learning</i> . NCTE Research Report No. 22.	9 and 11	FR	Students were told to write a summary versus reading and studying text	NT	SS	0.51
Trasborg, C. F. (2005). <i>Comparing the effectiveness of direct explanation and note-taking training on the reading comprehension of secondary students</i> . Unpublished dissertation, City University of New York.	9 and 10	PR	Students were taught to write one-sentence summaries of paragraphs versus BAU reading instruction	T	SS	*0.38
Graner, P. G. (2007). <i>The effects of strategic summarization instruction in the performance of students with and without disabilities in secondary inclusive classes</i> . Unpublished dissertation, University of Kansas.	10	NLD and LD	Students were taught to summarize passages in writing versus instruction in test-taking and vocabulary skills	T	LA	0.20
Hayes, D. A. (1987). The potential for directing study in combined reading and writing activity. <i>Journal of Reading Behavior, 19</i> , 333–352.	10	Ave and AA	Students were told to summarize passages in writing versus reading and completing matching exercises	NT	SC	-0.01
Hare, V. C., and Borchardt, J. (1984). Summarization skills. <i>Reading Research Quarterly, 20</i> , 62–78.	11	AA	Students were taught rules for summarizing text in writing versus no treatment	T	SC	0.46
Tsai, B. R. (1995). <i>Effects of student-generated summaries, instructor-provided summaries, and frequency of summarization during computer-based instruction</i> . Unpublished dissertation, University of Minnesota.	9–12	FR	Students were taught steps for summarizing text in writing versus reading and studying text	T	SC	0.28
Placke, E. (1987). <i>The effects of cognitive strategy instruction on learning disabled adolescents' reading comprehension and summary writing</i> . Unpublished dissertation, State University of New York.	9–12	LD	Students were taught to summarize the main idea of a paragraph in writing versus preparing for tests using the cloze procedure	T	SS	*-0.64 0.57

Salisbury, R. (1934). A study of the effects of training in logical organization as a method of improving skill in study. <i>Journal of Educational Research</i> , 28, 241–254.	7, 9, and 12	FR	Students were taught to create written summaries after they outlined text versus BAU reading instruction	T	LA	*0.57
Weisberg, R., and Balajthy, E. (1989). Transfer effects of instructing poor readers to recognize expository text structure. In S. McCormick and J. Zutell (Eds.), <i>Cognitive and social perspectives for literacy research and instruction. Thirty-eighth yearbook of the National Reading Conference</i> (pp. 279–286). Chicago: National Reading Conference.	10–12	PR	Students were taught to construct written summaries of text from graphic organizers they created versus reading and discussing text	T	SS	0.44
Bretzing, B., and Kulhavy, R. (1979). Note taking and depth of processing. <i>Contemporary Educational Psychology</i> , 4, 145–153.	11–12	FR	Students wrote three-line summary of each paragraph read or summarized main idea and ideas most important to text versus reading and rereading	NT	SS	0.56
Weisberg, R., and Balajthy, E. (1990). Development of disabled readers' metacomprehension ability through summarization training using expository text: Results of three studies. <i>Journal of Reading, Writing, and Learning Disabilities International</i> , 6, 117–136.	NR	PR	Students were taught rules for summarizing text in writing versus reading instruction	T	SS	0.81

1E. Impact of Writing on Reading Comprehension (Extended Writing Activities)

Study	Grade	Students	Treatment	Training	Content Area	Effect Size
Adams-Boating, A. (2001). <i>Second graders' use of journal writing and the effects on reading comprehension</i> . Unpublished master's thesis, Keen University, Sydney, Australia.	2	FR	Students wrote a personal response to stories versus additional reading instruction	NT	LA	1.07
** Jaekyung, L., Collins, J., and Fox, J. (2008). <i>When writing serves reading: Randomized trials on writing intensive reading comprehension (WIRC) in low-performing urban elementary schools</i> . Paper submitted for publication.	4 and 5	FR	Students used think sheets to find and organize ideas in writing and do extended writing to summarize, make inferences, and connect ideas versus reading without think sheets	T	LA	*0.36
Saunders, W. M., and Goldenberg, C. (1999). The effects of instructional conversations and literature logs on the story comprehension and thematic understanding of English proficient and limited English proficient students. <i>Elementary School Journal</i> , 99, 277–301.	4 and 5	FR and ELL	Students wrote about personal experiences related to the story they were reading versus reading and studying text	NT	LA	0.08

Jennings, J. H. (1990). A comparison of summary and journal writing as components of an interactive comprehension model. In J. Zuttell and S. McCormick (Ed.), <i>Learner factors/teacher factors: Issues in literacy research and instruction. Fortieth yearbook of the National Reading Conference</i> (pp. 67–82). Chicago: National Reading Conference.	5	FR	Students wrote personally reflective journal entries in response to text versus BAU	NT	SS	1.83
Copeland, K. A. (1987). <i>The effects of writing upon good and poor writers' learning from prose</i> . Unpublished dissertation, University of Texas at Austin.	6	GW and PW	Students read passages about a game and explained the game to a friend in writing versus reading and rereading passages	NT	LA	1.27
Olsen, M. O. (1991). <i>The effects of the reader response journal technique on reading comprehension, attitude toward reading, and writing ability of sixth and eighth graders</i> . Unpublished dissertation, University of Connecticut.	6 and 8	FR	Students wrote personal responses to material read versus BAU reading instruction	NT	LA	*0.53
Langer, J. A., and Applebee, A. N. (1987). <i>How writing shapes thinking: A study of teaching and learning</i> . NCTE Research Report No. 22.	9 and 11	FR	Students read a passage and analyzed it in writing by developing a particular point of view versus reading and studying the passage	NT	SS	0.62
Wetzel, G. H. (1990). <i>The effects of writing-to-learn on literature comprehension on English literature</i> . Unpublished dissertation, Temple University.	11	FR	Students participated in a variety of writing activities after reading (e.g., critical analysis, summary, journal writing, and free writing) versus reading text	NT	LA	*0.23
Bowman, C. (1989). <i>The effect of learning logs on high school literature achievement</i> . Unpublished master's thesis, Virginia Polytechnic Institute and State University.	12	FR	Students wrote personal responses to material read versus reading text	NT	LA	0.47
Wong, B. Y. L., Kuperis, S., Jamieson, D., Keller, L., and Cull-Hewitt, R. (2002). Effects of guided journal writing on students' story understanding. <i>Journal of Educational Research</i> , 95(3), 179–193.	12	FR	Students wrote responses to characters and their actions or identified and discussed important information from the text in writing versus reading text and discussion on same theme	NT	LA	0.87
Licata, K. P. (1993). <i>Writing about mathematical relations in science: Effects on achievement</i> . Buffalo, NY: State University of New York at Buffalo.	HS	FR	Students wrote an analytic compare/contrast essay of material read versus reading and studying text	NT	SC	0.56
Licata, K. P. (1993). <i>Writing about mathematical relations in science: Effects on achievement</i> . Buffalo, NY: State University of New York at Buffalo.	HS	FR	Students wrote an application essay showing concrete application of material versus reading and studying text	NT	SC	0.33

1F. Impact of Writing on Reading Comprehension

(Writing Short Statements About Material Read)

Study	Grade	Students	Treatment	Training	Content Area	Effect Size
Linden, M., and Wittrock, M. C. (1981). The teaching of reading comprehension according to the model of generative learning. <i>Reading Research Quarterly</i> , 17, 44–57.	5	FR and ELL	Students read text, labeled illustrations they made, wrote summaries, analogies, and metaphors (on different days and in different orders) versus reading with discussion and reading skills instruction	NT	LA	0.92
Hayes, D. A. (1987). The potential for directing study in combined reading and writing activity. <i>Journal of Reading Behavior</i> , 19, 333–352.	10	Ave and AA	Students wrote compare-and-contrast statements about material read versus students who completed matching exercises about material read	NT	SC	0.11

2A. Impact of Writing Instruction on Reading Comprehension

Study	Grade	Students	Treatment	Training	Content Area	Effect Size
Frey, J. L. (1993). <i>The process writing approach and its effects on the reading comprehension of first-grade students in the Mississippi delta</i> . Unpublished dissertation, Delta State University.	1	FR	Students taught process writing versus reading instruction	T	LA	*0.12
Uhry, J. K., and Shepherd, M. J. (1993). Segmentation/spelling instruction as part of a first-grade reading program: Effects on several measures of reading. <i>Reading Research Quarterly</i> , 28, 218–233.	1	FR	Extra spelling instruction versus reading instruction	T	LA	*0.43
Hunt, K. W., and O'Donnell, R. (1970). <i>An elementary school curriculum to develop better writing skills</i> . ERIC Document Reproduction Service No. ED050108.	4	FR	Students received instruction in written sentence combining versus reading instruction	T	LA	*0.26
Licari, R. (1990). <i>The effects of directed writing activities on reading comprehension performance</i> . Paper presented at the Annual Meeting of the Northeastern Educational Research Association, Ellenville, NY.	4	FR	Students provided with process writing instruction versus reading instruction	T	LA	*0.41
Crowhurst, M. (1991). Interrelationships between reading and writing persuasive discourse. <i>Research in the Teaching of English</i> , 25, 314–338.	6	FR	Students practiced writing persuasive essays after receiving instruction on their basic structure and viewing a model of one versus reading and discussing persuasive essays	T	SS	0.36
Hamby, J. (2004). <i>Explicit writing instruction: Effects on sixth grade students' writing and reading achievement</i> . Unpublished dissertation, University of San Diego.	6	PR	Students taught to write sentences, paragraphs, and longer units of text versus reading instruction	T	LA	*0.25

Kelley, K. (1984). <i>The effects of writing instruction on reading comprehension and story writing ability</i> . Unpublished dissertation, University of Pittsburgh.	6	FR (excludes SWD)	Students taught process writing versus silent reading	T	LA	*0.40
Kelley, K. (1984). <i>The effects of writing instruction on reading comprehension and story writing ability</i> . Unpublished dissertation, University of Pittsburgh.	6	FR (excludes SWD)	Students taught sentence, paragraph, and story writing skills versus silent reading	T	LA	*0.31
Neville, D. D., and Searles, E. F. (1985). The effects of sentence-combining and kernel-identification training on the syntactic component of reading comprehension. <i>Research in the Teaching of English</i> , 19, 37–61.	6	FR	Students received instruction in written sentence combining versus reading text and cloze activities	T	SS	*0.06 0.32
Shockley, S. J. (1975). <i>An investigation into the effects of training in syntax on reading comprehension</i> . Unpublished dissertation, University of Georgia.	7	PR	Students did sentence writing exercises related to fables they read versus reading and reading instruction	T	LA	*0.30
Jones, J. L. (1966). <i>Effects of spelling instruction in eighth-grade biological science upon scientific spelling, vocabulary, and reading comprehension; general spelling, vocabulary, and reading comprehension; science progress; and science achievement</i> . Unpublished dissertation, University of Maryland.	8	Ave and AA	Students practiced spelling science words in writing versus no instruction	T	SC	*0.22 0.22
Phelps, S. F. (1978). <i>The effects of integrating sentence-combining activities and guided reading procedures on the reading and writing performance of eighth-grade students</i> . Unpublished dissertation, Syracuse University.	8	Ave	Students received instruction on combining sentences in writing for reading material versus students reading material and viewing examples of combined sentences	T	LA	0.32
***Callahan, T. F. (1977). <i>The effects of sentence-combining exercises on the syntactic maturity, quality of writing, reading, and attitudes of ninth grade students</i> . Unpublished dissertation, University of New York at Buffalo; Sullivan, M. A. (1977). <i>The effects of sentence-combining exercises on syntactic maturity, quality of writing, reading ability, and attitudes of students in grade eleven</i> . Unpublished dissertation, University of New York at Buffalo.	9 and 11	FR	Students received written sentence combining instruction versus BAU	T	LA	*0.02
Baker, C. A. (1984). <i>Effects of comparison/contrast writing instruction on the reading comprehension of tenth-grade students</i> . Unpublished dissertation, Indiana State University.	10	FR	Using a model of a compare-and-contrast essay, students practiced writing such papers versus reading and discussing these essays	T	LA	0.23

Gonsoulin, K. W. (1993). <i>The effects of sentence combining curricula on descriptive writing performance, reading achievement, and writing apprehension: A study with high-risk secondary students</i> . Unpublished dissertation, University of Florida.	10–12	PR	Students received written sentence combining instruction versus reading instruction	T	LA	*0.17
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2B. Impact of Writing Instruction on Reading Fluency Skills

Study	Grade	Students	Treatment	Training	Content Area	Effect Size
Uhry, J. K., and Shepherd, M. J. (1993). Segmentation/spelling instruction as part of a first-grade reading program: Effects on several measures of reading. <i>Reading Research Quarterly</i> , 28, 218–233.	1	FR	Students received extra spelling instruction in writing versus reading instruction	T	LA	*0.70
Weber, W. R., and Henderson, E. H. (1989). A computer-based program of word study: Effects on reading and spelling. <i>Reading Psychology</i> , 10, 157–171.	3–5	FR	Students received two months of extra spelling instruction in writing versus BAU reading instruction	T	LA	1.17
Weber, W. R., and Henderson, E. H. (1989). A computer-based program of word study: Effects on reading and spelling. <i>Reading Psychology</i> , 10, 157–171.	3–5	FR	Students received one month of extra spelling instruction versus BAU reading instruction	T	LA	0.79
Hughes, T. O. (1975). <i>Sentence combining: A means of increasing reading comprehension</i> . ERIC Document Reproduction Service No. ED112421.	7	FR	Students received sentence combining instruction in writing versus students who worked on oral language arts newspaper activities	T	LA	*0.57

2C. Impact of Writing Instruction on Word Reading Skills

Study	Grade	Students	Treatment	Training	Content Area	Effect Size
Uhry, J. K., and Shepherd, M. J. (1993). Segmentation/spelling instruction as part of a first-grade reading program: Effects on several measures of reading. <i>Reading Research Quarterly</i> , 28, 218–233.	1	FR	Students received extra spelling instruction in writing versus reading instruction	T	LA	*1.78
Conrad, N. (2008). From reading to spelling and spelling to reading: Transfer goes both ways. <i>Journal of Educational Psychology</i> , 100, 869–878.	2	Ave	Students practiced spelling words in writing versus reading the same words	T	LA	0.62
Graham, S., Harris, K., and Chorzempa, B. (2002). Contribution of spelling instruction to the spelling, writing, and reading of poor spellers. <i>Journal of Educational Psychology</i> , 94, 669–686.	2	WS	Students received written spelling instruction versus math instruction	T	LA	*0.51

Weber, W. R., and Henderson, E. H. (1989). A computer-based program of word study: Effects on reading and spelling. <i>Reading Psychology, 10</i> , 157–171.	3–5	FR	Students received two months of extra written spelling instruction versus reading instruction	T	LA	0.54
Weber, W. R., and Henderson, E. H. (1989). A computer-based program of word study: Effects on reading and spelling. <i>Reading Psychology, 10</i> , 157–171.	3–5	FR	Students received one month of extra written spelling instruction versus reading instruction	T	LA	0.34

3. Impact of Writing More on Reading Comprehension

Study	Grade	Students	Treatment	Training	Content Area	Effect Size
Bode, B. A. (1988). <i>The effect of using dialogue journal writing with first graders and their parents or teachers as an approach to beginning literacy instruction</i> . Unpublished dissertation, University of South Florida.	1	FR	Students completed dialogue journal writing with invented spelling versus reading instruction	NA	LA	*0.36
Healy, N. A. (1991). <i>First-graders writing with invented or traditional spelling: Effects on the development of decoding ability and writing skill</i> . Unpublished dissertation, University of Minnesota.	1	FR	Students wrote with invented spelling throughout the entire school year versus students who did not begin writing until midyear and received reading instruction instead	NA	LA	*0.56
Ramey, E. K. (1989). <i>The effect of shared journal writing on the development of reading comprehension of first-grade students</i> . Unpublished dissertation, Auburn University.	1	FR	Students wrote about self-selected topics (Experiment 1) or topics they chose with peer help (Experiment 2) versus reading or being read to	NA	LA	*0.16
Sussman, G. L. (1998). <i>The effects of phonologically constructed spelling on first graders' literacy development</i> . Unpublished dissertation, Fordham University, New York.	1	WS	Students spent extra time writing and were encouraged to use invented spelling versus students who read previous journal entries	NA	LA	0.22
Peters, P. A. (1991). <i>A self-generated writing program and its effects on the writing and reading growth in second-grade children</i> . Unpublished dissertation, Boston University.	2	FR	Students wrote about self-selected topics versus reading text	NA	LA	*0.31
Reutzel, D. R. (1985). Story maps improve comprehension. <i>Reading Teacher, 38</i> , 400–404.	3	FR	Students wrote short passages using inference words as a prompt for writing versus reading instruction	T	LA	0.87
Soundy, C. S. (1978). <i>Effects of writing experiences in the expressive mode on children's reading comprehension and writing ability</i> . Unpublished dissertation, Rutgers University.	3–6	FR	Students did fifteen minutes of daily expressive writing versus daily sustained silent reading	NA	LA	*0.42

Roy, C. P. (1991). <i>The effects of a related reading-writing activity upon intermediate students' reading comprehension, vocabulary, and essay writing development</i> . Unpublished dissertation, Rutgers University.	4 and 5	FR	Students kept a writing journal about daily experiences and a writing journal about what they read versus daily reading	NA	LA	*0.01
Dana, M. E., Scheffler, A. J., Richmond, M. G., Smith, S., and Draper, H. S. (1991). Writing to read: Pen palling for a purpose. <i>Reading Improvement, 28</i> , 113–118.	6	FR	Students wrote, edited, and rewrote papers plus wrote to college pen pals versus students who received reading instruction	NA	LA	0.24

- * Effect sizes calculated for published standardized norm-referenced test
 ** Raw data means and standard deviation at student level obtained from the author
 *** Callahan (1977) and Sullivan (1977) combined as same study, but different grade levels

LA = language arts
 SS = social studies
 SC = science
 FL = foreign language
 NS = not specified
 PSY = psychology
 T = training
 NT = no training
 GR = good readers
 BA = below-average students
 RD = students with reading disabilities
 NA = not applicable

FR = full range of students found in typical classrooms
 PW = poor writers
 Ave = average students only, no high or low students
 AA = above-average students
 WS = weak spellers
 SW = strong writers
 GW = good writers
 ELL = English language learners
 LD = students with learning disabilities
 NLD = not learning disabled
 SWD = students with disabilities



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