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A Meta-Analysis of Writing Instruction for Students in the Elementary Grades

Steve Graham
Arizona State University

Debra McKeown
Georgia State University

Sharlene Kiuhara
Westminister College

Karen R. Harris
Arizona State University

In an effort to identify effective instructional practices for teaching writing to elementary grade students, we conducted a meta-analysis of the writing intervention literature, focusing our efforts on true and quasi-experiments. We located 115 documents that included the statistics for computing an effect size (ES). We calculated an average weighted ES for 13 writing interventions. To be included in the analysis, a writing intervention had to be tested in 4 studies. Six writing interventions involved explicitly teaching writing processes, skills, or knowledge. All but 1 of these interventions (grammar instruction) produced a statistically significant effect: strategy instruction (ES = 1.02), adding self-regulation to strategy instruction (ES = 0.50), text structure instruction (ES = 0.59), creativity/imagery instruction (ES = 0.70), and teaching transcription skills (ES = 0.55). Four writing interventions involved procedures for scaffolding or supporting students' writing. Each of these interventions produced statistically significant effects: prewriting activities (ES = 0.54), peer assistance when writing (ES = 0.89), product goals (ES = 0.76), and assessing writing (0.42). We also found that word processing (ES = 0.47), extra writing (ES = 0.30), and comprehensive writing programs (ES = 0.42) resulted in a statistically significant improvement in the quality of students' writing. Moderator analyses revealed that the self-regulated strategy development model (ES = 1.17) and process approach to writing instruction (ES = 0.40) improved how well students wrote.

Keywords: writing, composition, meta-analysis, instruction, elementary grades

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The development of the Common Core State Standards (CCSS; National Governors Association & Council of Chief School Officers, 2010) has made writing and the teaching of writing an integral part of the school reform movement in the United States (Graham, in press). Learning how to write and using writing as a tool for learning received considerable emphasis in CCSS. This document provided benchmarks for a variety of writing skills and applications students are expected to master at each grade and across grades. In the elementary grades, this includes spelling, handwriting, typing, sentence construction (including grammar skills), and strategies for planning and revising. It also includes writing different types of text (persuasive, narrative, and informative), writing for different purposes (facilitate text comprehension and content learning), and using technology to support writing. If elementary grade teachers are to meet CCSS for writing, they need effective instructional tools.

Purpose of the Current Review

A useful approach for identifying instructional practices that have the power to transform students' writing is to conduct systematic reviews of writing intervention research. The systematic approach we applied in this review is meta-analysis. This method of review is used to summarize the magnitude and directions of the effects obtained in a set of empirical research studies (Lipsey & Wilson, 2001). In this article, we present a comprehensive meta-analysis of experimental and quasi-experimental writing studies conducted with elementary grade students. The purpose of this review was to identify effective practices for teaching writing to these children. Meta-analysis is well suited to this purpose, as it provides an estimate of a "treatment's effect under conditions that typify studies in the literature" (Bangert-Drowns, Hurley, & Wilkinson, 2004, p. 34).

A review identifying effective writing practices at the elementary level is needed for three reasons. First, studies of teachers'

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Steve Graham, Mary Lou Fulton Teachers College, Arizona State University; Debra McKeown, School of Education, Georgia State University; Sharlene Kiuhara, School of Education, Westminster College; Karen R. Harris, Mary Lou Fulton Teachers College, Arizona State University.

Steve Graham and Karen R. Harris are authors of some of the studies reviewed in this meta-analysis. Harris developed the self-regulated strategy development (SRSD) model tested in 14 studies included in the review, and Harris and Graham developed a number of the strategies used in the SRSD studies. The lesson plans and instructional procedures used in SRSD studies are published in two books for teachers. Graham and Harris are authors of these two books.

Correspondence concerning this article should be addressed to Steve Graham. E-mail: steve.graham@asu.edu

practices have raised serious concerns about the quality of writing instruction received by students in the elementary grades (e.g., Fisher & Hebert, 1990; Gilbert & Graham, 2010). Thus, it is important to identify writing treatments with evidence of effectiveness, as this provides elementary teachers with instructional practices that can potentially improve the quality of their instruction and their students' writing. Second, there is a growing consensus that waiting until later grades to address literacy problems that have their origin in earlier grades is not successful (Slavin, Madden, & Karweit, 1989). Applying evidence-based writing practices with elementary grade students should reduce the number of youths who reach middle school and do not write well enough to meet grade-level demands (Harris, Graham, & Mason, 2006). Third, there is no comprehensive meta-analysis of writing treatments conducted just with elementary grade students.

Previous Meta-Analyses in Writing

During the last 30 years, researchers have undertaken a number of meta-analyses of true and quasi-experiments to identify effective practices for writing instruction. Some of these reviews focused on a single writing treatment, finding that teaching strategies for planning or revising (Graham, 2006a; Graham & Harris, 2003), word processing (Bangert-Drowns, 1993; Goldberg, Russell, & Cook, 2003; Morphy & Graham, 2012), and the process approach to writing (Graham & Sandmel, 2011) improved the overall quality of text produced by typical and, in most cases, struggling writers. Other reviews focused more broadly, examining the effectiveness of multiple writing treatments at specific grades. Hillocks (1986) conducted a review of writing interventions with students in Grade 3 through college, whereas Graham and Perin (2007a, 2007c) limited their review to writing treatments applied in Grades 4–12.

Although the meta-analyses conducted by Hillocks (1986) and Graham and Perin (2007a, 2007c) were conducted almost 20 years apart and differed somewhat in terms of grade level, there was some overlap in their findings. In both reviews grammar instruction was ineffective in improving writing, but sentence-combining instruction, study and emulation of good models of writing, and inquiry activities improved the quality of students' writing. Hillocks also found that students' writing improved when they evaluated writing using a writing guide or scale, whereas Graham and Perin reported that the process approach to writing instruction, strategy instruction, summarization, prewriting activities, peer assistance, setting product goals, and word processing positively enhanced the quality of students' writing.

The current meta-analysis has the greatest overlap with Graham and Perin's (2007a, 2007c) review. They conducted a meta-analysis of writing treatments tested with true and quasi-experiments with students in Grades 4–12. Their outcome measure was writing quality, and studies were only included in the analysis if quality was reliably measured. They excluded studies conducted in special schools for students with disabilities (e.g., schools for the deaf). Finally, they only calculated an average weighted effect size (ES) for a writing treatment if it had been tested in four investigations. This meta-analysis applied these same principles, except it did not include studies conducted with middle and high school students. Despite these similarities, there was only modest overlap in the studies included in this review and the one by Graham and Perin (35 of 115 articles, or 30%).

A second difference between this and the Graham and Perin (2007a, 2007c) review was that quasi-experiments had to assess writing quality at pretest to be included in this meta-analysis, since students were not randomly assigned to conditions (allowing us to adjust for any pretest differences). A third difference was that effects from all quasi-experiments in this review were adjusted for possible data clustering due to hierarchical nesting of data (i.e., researchers assigned classes to treatment or control conditions but then examined student-level effects).

In summary, the primary research question guiding this review was, What writing treatments improve the quality of writing produced by students in the elementary grades? The findings from this meta-analysis have important theoretical implications for writing development. Drawing on a general model of development proposed by Alexander (1997), Graham (2006b) argued that writing strategies, knowledge, skills, and motivation play an important role in students' growth as writers. This meta-analysis provides evidence on the veracity of this claim, at least in part, as some of the treatments evaluated are specifically designed to improve writing strategies, knowledge, or skills. If a treatment designed to enhance knowledge of text structure, for example, improves writing quality, then the theoretical role of knowledge in writing development is supported.

Method

Study Inclusion and Exclusion Criteria

A study had to meet the following criteria to be included in this meta-analysis: (a) was a true experiment (random assignment to conditions) or a quasi-experiment, (b) involved students who were attending an elementary school (in some studies elementary schools included students in Grades 1–5, whereas in other studies elementary schools included Grade 6), (c) contained a treatment group that received a writing intervention, (d) included a measure of writing quality at posttest (quasi-experiments had to include a comparable pretest quality measure, and studies were excluded if interrater reliability of quality was not established or was less than .60), (e) was presented in English, and (f) contained the statistics necessary to compute a weighted ES (or statistics were obtained from the authors). Studies were excluded if the writing treatment took place in a special school for students with disabilities (e.g., school for the deaf), as the purpose of the review was to draw conclusions for more typical school settings.

Search Strategies Used to Locate Studies

Four search strategies were applied. First, 95 electronic searches (ending in October 2010) were conducted (ERIC, PsycINFO, Education Abstracts, ProQuest, and Dissertation Abstracts). These involved the following keywords combined with writing and composition: *peer collaboration*, *peer revising*, *peer planning*, *peers*, *summary*, *summary instruction*, *summary strategies*, *motivation*, *motivation and instruction*, *technology*, *speech synthesis*, *spell checkers*, *strategy instruction*, *sentence combining*, *dictation*, *goal setting*, *genre*, *free writing*, *writer's workshop*, *process writing*, *process approach*, *self-monitoring*, *self-evaluation*, *national writing project*, *assessment*, *evaluative scales*, *usage*, *imagery*, *creativity*, *mechanics*, *grammar*, *inquiry*, *models*, *collaborative learn-*

ing, *spelling instruction*, *handwriting instruction*, *word processing*, *word processor*. Over 12,000 abstract and titles were identified. Each was read by the first author, and if the item looked promising, it was obtained.

Second, the following 18 journals were hand searched: *American Educational Research Journal*, *Assessing Writing*, *Contemporary Educational Psychology*, *Elementary School Journal*, *Exceptional Children*, *Journal of Educational Psychology*, *Journal of Educational Research*, *Journal of Experimental Education*, *Journal of Learning Disabilities*, *Journal of Literacy*, *Journal of Special Education*, *Learning Disability Quarterly*, *Learning Disabilities Research and Practice*, *Reading and Writing*, *Reading and Writing Quarterly*, *Reading Research Quarterly*, *Research in the Teaching of Writing*, and *Written Communication*. Third, pertinent references from previous writing meta-analyses (i.e., Bangert-Drowns, 1993; Goldberg et al., 2003; Graham, 2006a; Graham & Harris, 2003; Graham & Hebert, 2010; Graham & Perin, 2007c; Graham & Sandmel, 2011; Hillocks, 1986; Morphy & Graham, 2012) were examined. Fourth, reference lists of obtained articles were searched.

Of 424 documents collected, 115 articles were found that met inclusion and exclusion criteria. The interrater reliabilities of the quality writing measures in the studies included in this meta-analysis were generally strong. Correlations between two or more raters' scores were used to calculate reliability in 68% of studies, with a median reliability of .86 and a range of .62–.97 (reliability was .80 or greater in 88% of studies, and reliability was in the .60s in only two studies). Percent of exact agreement was applied in 22% of studies, with a median of 90% agreement and a range of 70%–97% (reliability was 80% or greater in 89% of studies). Seven percent of studies used percent of agreement within a single point to calculate reliability, with a median of 96.5% and a range of 80%–100% (all but one study was above 90%). Finally, three studies calculated coefficient alphas, with a median coefficient of .92 and a range of .76–.93.

Categorizing Studies Into Treatment Conditions

Step 1. First, each study was read by the first author and placed (if possible) into one of the 14 writing treatment categories identified by Graham and Perin (2007a). This included the process approach to writing instruction defined as involving extended opportunities for writing; writing for real audiences; engaging in cycles of planning, translating, and reviewing; personal responsibility and ownership of writing projects; high levels of student interactions; creation of a supportive writing environment; self-reflection and evaluation; personalized individual assistance and instruction; and in some instances more systematic instruction. Categorization also included four treatments where explicit teaching of skills, process, or knowledge occurred. These were grammar instruction (e.g., students systematically studied parts of speech, diagrammed sentences, and so forth), sentence combining (students were taught to construct more complex sentences through exercises where two or more basic sentences are combined into a single sentence), strategy instruction (the teacher modeled how to use specific strategies for planning, revising, and/or editing text; students practiced applying the target strategies in at least three sessions, with the goal of using these strategies independently), and text structure instruction (students taught knowledge about the structure of specific types of text, such as stories or persuasive essays).

There were seven categories that studies were placed in that involved procedures for scaffolding students' writing: prewriting activities (students engaged in activities, like using a semantic web, to generate or organize ideas for their papers), inquiry (students engaged in activities to develop ideas for a particular writing task by analyzing immediate and concrete data), procedural facilitation (students were provided with external supports, such as prompts or hints, to facilitate one or more processes such as planning or revising), peer assistance (students worked together to plan, draft, and/or revise their papers), study of models (students examined examples of specific types of text and attempted to emulate the forms in these examples in their own writing), product goals (students were assigned specific goals for writing), and feedback (students received input from others about their written product).

The final two placement categories were word processing (students used word processing programs to compose their compositions) and extra writing time (students spent additional time writing). Studies that did not fit neatly within one of these 14 categories were held apart. These studies were group together in what we referred to as an unspecified category.

Step 2. The studies placed in the 14 treatments were reread by the first author to determine whether the intervention in each investigation represented the same general writing treatment. For any study in which this was not the case, it was placed in the unspecified category.

Step 3. Studies placed in the unspecified category were reexamined by the first author, and five new treatment categories were created. They were teaching transcription skills (students were taught handwriting, spelling, or keyboarding), adding self-regulation instruction to strategy instruction (students were taught to apply goal setting and self-assessment as part of strategy instruction), imagery/creativity instruction (students taught how to form images or how to be more creative), assessing writing (students received feedback from peers, the teacher, or other adults about their writing, and students were taught to assess their own writing), and comprehensive writing programs (writing treatments designed to serve as a complete writing program). Studies in the feedback category and the process approach to writing instruction category (see Step 1) were included in assessing writing and comprehensive writing programs, respectively. At this point, there were 17 writing treatments.

Step 4. The final step involved eliminating any treatment category where we were unable to calculate at least four or more effects testing its effectiveness (this was identical to the procedures applied by Graham & Perin, 2007c). This resulted in the elimination of four treatments: sentence combining, inquiry, procedural facilitation, and study of models. This left us with 13 writing treatments with four or more effects testing their effectiveness.

Reliability of this categorization process was established by having the second and third authors read and categorize all studies. There were only two disagreements with the first author. It should be noted that we decided to use a monothetic (mutually exclusive) rather than a polythetic classification scheme for two reasons: (a) most of the studies involved specific, well-defined interventions, and (b) previous attempts to use a polythetic approach to classifying writing interventions (e.g., Hillocks, 1986) have been criti-

cized for trying to force broader schemes, such as natural or environmental teaching approaches, on a literature that is difficult to classify in this way (Stotsky, 1988).

Coding of Study Features

Each study was coded for grade, participant type (e.g., struggling writers, English Language learners, etc.), genre of the posttest measure, description of treatment and control conditions, and publication type. Nine quality indicators were also coded: (a) design (random assignment with the appropriate unit of analysis; i.e., true experiment); (b) treatment fidelity was established through direct observation; (c) teacher effects controlled (e.g., random assignment of teachers); (d) more than a single teacher carried out each condition; (e) total attrition was less than 10% of total sample; (f) total attrition was less than 10%, and equal attrition across conditions was evident (i.e., conditions did not differ by more than 5%); (g) pretest equivalence of writing quality was evident in quasi-experiments (i.e., conditions did not differ by more than 1 standard deviation for the condition with the least variance); (h) pretest ceiling or floor effects were not evident for writing quality in quasi-experiments (more than 1 standard deviation from floor and ceiling); and (i) posttest ceiling or floor effects for writing quality were not evident (more than 1 standard deviation from floor and ceiling). Each quality indicator was scored as 1 (met) or 0 (not met). A total score was calculated for each study (7 possible points for true experiments and 9 possible points for quasi-experiments). This was converted to a percentage by dividing obtained score by total possible points and multiplying by 100%. Coding for study descriptors and quality indicators were independently completed by the second and third authors (96.2% agreement). Disagreements were resolved by reexamining the study.

Calculation of ESs and Statistical Analysis

Basic procedures. ESs were calculated just for writing quality. If a holistic quality measure (a single score that measures general overall quality) was available, then the ES was calculated with this score. If only an analytic quality measure (separate scores for specific aspects of writing, such as content, organization, vocabulary, mechanics, and so forth) was available, a separate ES was computed for each aspect of writing assessed and averaged to produce a single ES. We converted analytic quality measures to a single score because halo effects (the separate scores are moderately to highly related and are best captured through a single, general factor) are evident in studies examining the reliability and validity of analytic measures (see Graham, Hebert, & Harris, 2011). We computed an ES for norm-referenced outcome measures only if they assessed quality or structure of a sample of students' writing.

An ES was calculated for true experiments by subtracting the mean score of the treatment group at posttest from the mean score of the control group at posttest and dividing by the pooled standard deviation of the two groups. The same procedure was used with quasi-experiments, except the mean pretest score for each group was subtracted from the mean posttest score.

In some cases, ESs had to be calculated by estimating missing means and standard deviations. For a few quasi-experiments, ESs had to be calculated separately for both pretest and posttest (the quality measures were not identical). An adjusted ES was then obtained by subtracting pretest ES from posttest ES. Moreover, before calculating some ESs, it was necessary to average the performance of two or more groups in each condition (e.g., statistics were reported separately by grade) using the Nouri and Greenberg procedure (Cortina & Nouri, 2000).

All quasi-experiments where classes were assigned to treatment conditions, but student-level effects were examined, were adjusted for clustering effects with imputed intraclass correlation (ICC) estimates for reading comprehension from national studies (Hedges & Hedberg, 2007) that were adjusted to writing quality ICCs, with data from a large study of writing that involved a single grade level (Rock, 2007). In addition, it was necessary to adjust the effects for three true experiments (Glaser, Buddle, & Brunstein, 2011; Jones, 2004; Norris, Reichard, & Mokhtari, 1997) that involved cluster randomized assignment (classes were randomly assigned to treatments, and summary statistics were based on class-level data) with the imputed ICCs described above. All computed effects were adjusted for small sample size bias.

Statistical analysis. This meta-analysis employed a weighted random-effects model. For each writing treatment, we calculated an average weighted ES (weighted by multiplying each ES by its inverse variance) as well as the confidence interval and statistical significance of the obtained ES. Two measures of homogeneity (Q and I^2) were also calculated, allowing us to determine whether variability in the ESs for a specific writing treatment was larger than expected based on sampling error alone. When homogeneity in ESs for a specific writing treatment exceeded sampling error alone, there were at least eight ESs, and each treatment subcategory tested involved at least four effects, we conducted moderator analysis to determine whether this excess variability could be accounted for by identifiable differences between studies (e.g., participant type).

Finally, the ESs for each writing treatment were examined to see whether any specific ES was exerting undue influence in terms of sample size or magnitude of ES. Outliers were defined with Tukey's (1977) definition of an extreme observation as falling 3 times the interquartile range above the 75th percentile or below the 25th percentile of the distribution of all related scores. Three effects (Kozlow & Bellamy, 2004; Pritchard & Marshall, 1994; A. L. Thibodeau, 1964) exerted undue influence due to sample size and were Winsorized so that they did not exceed Tukey's definition.

Results

Table 1 contains information on the studies testing each writing treatment. A more detailed version of Table 1 that includes additional information on the treatment and control condition in each study, genre tested at posttest, sample size of the study, publication type, and study quality score is contained in the supplemental materials. Table 2 includes the number of studies, average weighted ES, confidence interval, standard error, and statistical significance for each writing treatment as well the two heterogeneity measures (Q and I^2).

Table 1
Information on Individual Studies for Writing Treatments That Included Four or More Effect Sizes

Study	Grade	Participant type	Effect size
Strategy instruction			
Harris et al. (2006)[a] SRSD	2	FR	1.89
Harris et al. (2011) SRSD	2–3	SW	1.11
Harris & Graham (2004)[a] SRSD	2–3	SW	0.67
Lane et al. (in press)[a] SRSD	2–3	SW	0.68
Graham et al. (2005)[a] SRSD	3	SW	1.78
Tracy et al. (2009) SRSD	3	FR	0.25
Curry (1997) SRSD	4	SW	0.57
Glaser et al. (2011)[a] SRSD	4	FR	1.31
Glaser & Brunstein (2007) SRSD	4	FR	1.19
Walser (2000)[a]	4	FR	0.67
Warrington (1999)	4	FR	0.52
Englert et al. (1991)	4–5	FR, SW	0.51
Troia & Graham (2002)[a]	4–5	SW	0.83
MacArthur et al. (1991) SRSD	4–6	SW	1.26
Anderson (1997)[a] SRSD	5	FR, SW	1.49
Sawyer et al. (1992) SRSD	5–6	SW	0.63
Torrance et al. (2007) SRSD	6	FR	3.19
Fitzgerald & Markham (1987)[a]	6	FR	0.31
Welch (1992)	6	SW	1.72
Wong et al. (2008) SRSD	6	AVG	0.64
Adding self-regulation to strategy instruction			
Harris et al. (2006)[a]	2	SW	0.32
Graham et al. (2005)[a]	3	SW	0.13
Kurtz (1987)	3–6	SW	1.09
Brunstein & Glaser (2011)[a]	4	FR	0.86
Glaser & Brunstein (2007)	4	FR	0.87
Sawyer et al. (1992)	5–6	SW	0.02
Text structure instruction			
Carr et al. (1991)	2	FR	0.94
Sinclair (2005)	3	FR	0.33
Riley (1997)	3–5	FR	0.32
Fitzgerald & Teasley (1986)[a]	4	SW	0.17
Kaminski (1994)	4	FR	0.13
Gambrell & Chasen (1991)[a]	4–5	SW	0.90
Gordon & Braun (1986)[a]	5	FR	0.71
Raphael et al. (1986)	5–6	FR	0.34
Crowhurst (1991)[a]	6	FR	0.74
Creativity/imagery instruction			
Jampole et al. (1991)[a]	3–4	HA	0.82
Fortner (1986)	3–6	SW	0.83
Jampole et al. (1994)[a]	4–5	HA	0.84
Stoddard (1982)	5–6	HA	0.23
Teaching transcription skills			
Graham et al. (2000)[a]	1	SW	0.54
Graham & Harris (2005)[a]	1	SW	0.21
Jones (2004)	1	FR	1.00
Jones & Christensen (1999)	1	SW	2.40
Rutberg (1998)	1	SW	−0.12
Graham et al. (2002)[a]	2	SW	−0.12
Berninger et al. (2002)[a]	3	SW	0.35
Shorter (2001)	3	FR	0.38
Grammar instruction			
Green (1991)	3	BLL	0.47
Anderson (1997)[a]	5	FR, SW	−1.49
Pantier (1999)	5	FR	0.21
A. E. Thibodeau (1964)	6	FR	−0.38

(*table continues*)

Table 1 (*continued*)

Study	Grade	Participant type	Effect size
Prewriting activities			
B. H. Moore & Cadwell (1993)[a]	2–3	FR	0.88
Norris et al. (1997)[a]	3	FR	0.56
Kurtz (1987)	3–6	SWD	0.87
Loader (1989)	4	FR	0.44
McNulty (1980)	4	FR	0.43
Doan (2008)[a]	4–5	FR	0.37
Reece & Cumming (1996)[a]	5–6	FR	0.86
A. L. Thibodeau (1964)	6	FR	0.38
Peer assistance			
Paquette (2009)	2	FR	0.70
MacArthur et al. (1995)	4–6	SWD	1.33
Yarrow & Topping (2001)	5–6	FR	0.76
Olson (1990)	6	FR	0.67
Product goals			
Graham & Harris (2006)[a]	4	SW	0.28
Ferretti et al. (2009)[a]	4–6	FR, SW	1.11
Ferretti et al. (2000)[a]	4–6	FR, SW	0.35
Schunk & Swartz (1993a, Experiment 2)[a]	4	FR	1.08
Midgette et al. (2008)[a]	5	FR	0.58
Schunk & Swartz (1993a, Experiment 1)[a]	5	FR	1.49
Graham et al. (1995)[a]	5–6	SW	0.75
Assessing writing			
Paquette (2009)	2	FR	−0.02
Rosenthal (2006)	3	FR	0.23
Collopy (2008)	4	FR	−0.01
Guastello (2001)	4	FR	1.12
Schunk & Swartz (1993b)[a]	4	HA	0.92
Schunk & Swartz (1993a, Experiment 1)[a]	5	FR	0.67
Schunk & Swartz (1993a, Experiment 2)[a]	4	FR	0.83
Young (2000)	4	FR	0.82
Meyer et al. (2010)	4–6	FR	0.29
Ross et al. (1999)	4–6	FR	0.17
Holliway (2004)[a]	5	FR	0.58
Olson (1990)	6	FR	0.24
Wolter (1975)[a]	6	FR	0.70
Kozlow & Bellamy (2004)[a]	3–6	FR	0.10
Word processing			
Lanter et al. (1987)	1, 3, 6	FR	0.65
Pearce-Burrows (1991)	3–4	FR	−0.44
Owston & Wideman (1997)	3–5	FR	0.71
Zhang et al. (1995)[a]	3–5	SW	1.05
Stewart (1999)	4	AVG	−0.30
Cheever (1987)	4	FR	0.36
M. A. Moore & Turner (1988)	4–5	FR	0.43
Dybdahl et al. (1997)	5	FR	−0.32
Grejda & Hannafin (1992)[a]	6	FR	0.45
Englert et al. (2007)	NS	SW	1.46
Extra writing			
Peters (1991)	2	FR	0.33
Soundy (1987)[a]	3–6	FR	0.34
Gomez et al. (1996)	5	ELL	−0.23
Raphael et al. (1986)	5–6	FR	0.69
Wienke (1981)	6	FR	0.35
Comprehensive writing programs			
Klesius et al. (1991)	1	FR	0.15
Croes (1990)[b]	1–5	SW	0.34
Eads (1989)[b]	1–6	FR	0.27

Table 1 (*continued*)

Study	Grade	Participant type	Effect size
Hamilton (1992)[b]	2	FR	0.75
Minns (1989)[b]	2	AVG	0.26
Weiss (1992)[b]	2–3	SW	0.80
Green (1991)[b]	3	BLL	−0.47
Fleury (1988)[b]	3–5	FR	0.33
Roberts (2002)[b]	3–5	FR	0.42
Swain et al. (2007)[b]	3–5	FR	0.53
Wetzel (1985)	3–5	FR	−0.18
Pritchard & Marshall (1994)[b]	3–6	FR	0.39
Berninger et al. (2006, Experiment 4)	4	FR	0.38
Curry (1997)[b]	4	SW	0.45
Umbach (1990)[a,b]	4	FR	−0.06
Clippard & Nicaise (1998)[b]	4–5	SW	0.37
Kirby (1987)	4–5	ELL	0.51
Kerchner & Kistinger (1984)	4–6	SW	0.24
MacArthur et al. (1995)	4–6	SW	0.44
Bui et al. (2006)	5	FR, SW	0.28
Dougans (1993)[b]	5	FR	0.26
Ginn et al. (2002)	5	HA	2.20
Pantier (1999)[b]	5	FR	−0.22
Kelley (1984)[b]	6	AVG	1.64
Kelley (1984)	6	AVG	1.61

Note. SRSD = self-regulated strategy development; FR = full range (regular full class); SW = struggling writers; AVG = average students; NS = not specified; SWD = students with disabilities; BLL = bilingual language learners; ELL = English language learners; HA = high-achieving students.
[a] True experimental design. [b] Process approach.

Quality of Research

Information for each writing treatment for study quality by each quality indicator is available in the supplemental materials. Across all studies, the quality of research was weak, as only 36% of studies were a true experiment, just 29% of studies established treatment fidelity, and only 37% of the investigations controlled for teacher effects. On the positive side, 63% of studies involved multiple teachers in the treatment and control conditions, 71% evidenced attrition less than 10%, and 76% and 73% did not evidence floor or ceiling effects at pretest (quasi-experiments) or posttest (true and quasi-experiments),

Table 2
Average Weighted Effect Sizes and Confidence Intervals for Writing Treatments

				Test of null hypothesis		Heterogeneity	
Writing intervention	No. of studies	Effect size	Confidence interval	*SE*	*p*	*Q*	I^2
Strategy instruction	20	1.02	[0.74, 1.30]	.142	<.001	55.73[a]	65.91
SRSD	14	1.17	[0.81, 1.53]	.184	<.001	40.61[a]	67.87
Non-SRSD	6	0.59	[0.74, 1.30]	.134	<.001	4.32	0.00
Adding self-regulation to strategy instruction	6	0.50	[0.16, 0.83]	.170	.003	7.27	31.18
Text structure instruction	9	0.59	[0.35, 0.83]	.121	<.001	4.73	0.00
Creativity/imagery instruction	4	0.70	[0.41, 1.00]	.151	<.001	2.69	0.00
Teaching transcription skills	8	0.55	[0.08, 1.02]	.240	.022	31.67[a]	78.79
Grammar instruction	4	−0.41	[−1.2, 0.38]	.404	.312	13.31[a]	77.46
Prewriting activities	8	0.54	[0.31, 0.76]	.114	<.001	3.37	0.00
Peer assistance	4	0.89	[0.35, 1.42]	.271	.001	1.08	0.00
Product goals	7	0.76	[0.44, 1.08]	.163	<.001	13.14[b]	54.34
Assessing writing	14	0.42	[0.22, 0.62]	.102	<.001	24.35[b]	46.61
Adult feedback	5	0.80	[0.48, 1.13]	.167	<.001	1.55	0.00
Peer/self-feedback	10	0.37	[0.14, 0.60]	.116	.001	20.31[b]	55.67
Word processing	10	0.47	[0.19, 0.75]	.143	.001	15.87	43.29
Extra writing time	5	0.30					
Comprehensive writing programs	25	0.42	[0.28, 0.56]	.073	<.001	36.80[b]	34.78
Process approach	16	0.40	[0.31, 0.49]	.047	<.001	12.37	0.00
Other comprehensive programs	9	0.55	[0.29, 0.95]	.205	.007	24.34[a]	67.13

Note. SRSD = self-regulated strategy development.
[a] Process approach. [b] True experimental design.

respectively. Also, writing quality scores for treatment and controls were equivalent at pretest in 78% of quasi-experiments. It should be noted, however, that we adopted a liberal criteria for determining whether pretest differences were evident (i.e., the pretest difference between conditions was more than the standard deviation for the condition with the least variance). A more stringent criterion of .5 standard deviation would have identified 12 additional quasi-experiments as being nonequivalent at pretest. However, these studies had little impact on the analyses, as removing them did not change the statistical significance of any treatment and the impact on point estimates were never larger than .05 standard deviations, except for transcription where the point estimate moved from 0.55 to 0.42.

Across writing treatments there was considerable variation in study quality. Adding self-regulation to strategy instruction, teaching transcriptions skills, and strategy instruction ranked as having the most high-quality studies as 83%, 75%, and 70%, respectively, of the studies in these treatments met two thirds or more of the quality indicators. This was followed by prewriting activities (50%), product goals (43%), extra writing (40%), assessing writing (36%), peer assistance (25%), comprehensive writing programs (22%), word processing (20%), process approach to writing instruction (13%), text structure instruction (11%), creativity/imagery instruction (0%), and grammar instruction (0%).

Explicit Teaching

Strategy instruction. Twenty studies examined the effectiveness of strategy instruction (students in Grades 2–6; see Table 1). Most of these studies focused on just teaching planning or drafting strategies ($N = 14$), followed by planning, drafting, or revising strategies ($N = 4$) and just revising ($N = 2$). Most of the studies ($N = 16$) involved teaching genre-specific strategies (e.g., how to plan and write a persuasive text), whereas the rest focused on teaching strategies that could be applied across genres (e.g., semantic webbing). Almost one half of the studies were conducted with the full range of students in regular classrooms ($N = 10$), whereas all but one of the rest of the studies involved struggling writers (the exception involved average writers). Control conditions were varied, ranging from skills instruction ($N = 6$) to a poorly specified or partial process writing approach ($N = 8$) to unspecified control ($N = 2$).

Strategy instruction enhanced the quality of students' writing. All of the studies produced a positive effect, yielding a statistically significant average weighted ES of 1.02. The Q test for heterogeneity was statistically significant, however, and I^2 indicated that 60% of the variance was due to between-study factors (see Table 2). Consequently, we examined whether type of strategy instruction moderated average ES and accounted for excess variability.

Fourteen of the studies involved strategy instruction using the self-regulated strategy development (SRSD) model (Harris & Graham, 1996). With this model, students are taught general and task-specific writing strategies, the background knowledge needed to use the strategies, and procedures (goal setting, self-monitoring, self-instructions, and self-reinforcement) for regulating the strategies, the writing process, and writing behaviors. Instruction is typically criterion based, teachers are encouraged to individualize teaching to address students' needs, students' attitudes toward writing and their self-efficacy are supported, and students are viewed as collaborators in the learning process.

The average weighted ES for SRSD (1.17) was statistically larger than the average weighted ES for non-SRSD interventions (0.59; $Q_{between} = 10.08$, $p = .001$). The average weighted ES was statistically greater than no effect for both SRSD and non-SRSD, and type of instruction accounted for some of the excess variance, as all the variance in ESs for non-SRSD studies was accounted for by sampling error alone (see I^2 statistic in Table 2).

To account for excess variance in ESs for SRSD, we ran additional moderator analyses. Neither type of student (full range vs. struggling writers) nor grade (primary vs. intermediate grades) statistically moderated ESs for SRSD.

Adding self-regulation instruction to strategy instruction. In six studies (see Table 1), the benefit of adding self-regulation instruction (e.g., goal setting and self-assessment) to strategy instruction was tested (five of these investigations involved SRSD). Students were in Grades 2–6, and all but two of these studies involved struggling writers.

Adding self-regulation instruction to strategy instruction improved writing quality. All of the studies produced a positive effect, yielding an average weighted ES of 0.50. This effect was statistically greater than no effect, and the variability in ESs was not statistically greater than sampling error alone (see Q in Table 2).

Text structure instruction. We calculated an ES for nine studies that examined the impact of teaching text structure (see Table 1). Students were in Grades 2–6, with all but one study conducted with the full range of students in regular classrooms. Control conditions were varied (vocabulary or summary writing instruction, free writing, reading text, reading instruction). The majority of the studies involved teaching the structure of stories ($N = 5$), with the remaining studies teaching a variety of text structures (e.g., persuasive, expository, academic).

Teaching students the structure of text improved writing quality. Each study produced a positive ES, yielding an average weighted ES of 0.59. This effect was statistically significant, and all variance in ESs was accounted for by sampling error alone (see I^2 statistic in Table 2).

Creativity/imagery instruction. We located four studies (see Table 1) that examined the impact of teaching students either how to be more creative or how to form visual images (two studies tested each procedure). It should be noted that instruction in these studies did not appear to tie creativity or imagery instruction directly to the process of creating written text. Students in these studies were in Grades 3–6, with three of the studies focusing on high-achieving students and one study on struggling writers. Control conditions were varied (e.g., listening and responding to stories, completing reading and writing activities, no treatment control).

Teaching students how to be more creative or how to produce visual images improved writing quality. All studies produced a positive ES, resulting in an average weighted ES of 0.70. This effect was statistically significant, and all the variance in ESs was accounted for by sampling error alone (see I^2 statistic in Table 2).

Teaching transcription skills. The impact of teaching transcription skills (handwriting, spelling, and/or keyboarding) was tested in eight studies (see Table 1). Students were in Grades 1–3, with all but two of the studies involving struggling writers. Handwriting was taught in five studies, spelling in three studies, and keyboarding in one study. Control conditions varied considerably

(e.g., mathematics instruction, phonological awareness instruction, unspecified).

Teaching transcription skills enhanced writing quality. The average weighted ES was 0.55, and this effect was statistically greater than no effect. Seventy-five percent of studies produced a positive effect. Variability in ESs, however, was statistically greater than sampling error alone (see *Q* in Table 2).

Grammar instruction. We calculated four effects for the teaching of grammar (see Table 1). Students in these studies were in typical classrooms in Grades 3, 5, and 6. Both treatment and comparison conditions were varied (e.g., comparisons were made to process writing, strategy instruction, and typical language arts instruction).

Teaching grammar did not statistically influence writing quality (see Table 2). One half of the effects were negative, and the resulting average weighted ES was −0.41.

Scaffolding Students' Writing

Prewriting activities. Eight studies tested the effectiveness of prewriting activities (see Table 1). Students in these studies were in Grades 2–6. All of the investigations except one involved the full range of students in regular classrooms. Preplanning in these studies mostly focused on making notes or drawing pictures prior to writing, with one study concentrating on gathering information via the Internet. The control conditions typically involved just writing ($N = 4$) or skills instruction ($N = 2$).

Involving students in prewriting activities improved writing quality. All studies yielded a positive ES, resulting in an average weighted ES of 0.54. This effect was statistically significant, and all variance in ESs was accounted for by sampling error alone (see I^2 statistic in Table 2).

Peer assistance when writing. We calculated four effects examining the effectiveness of peers working together when writing (see Table 1). The four investigations were conducted with students in Grades 2–6. With the exception of one study involving struggling writers, students represented the full range of students in regular classrooms. Three of the studies involved students helping one another with revising, whereas one of the studies focused more broadly as students helped one another throughout the writing process. In the control conditions, all students carried out writing processes independently.

Having students work together enhanced writing quality. Each study produced a positive ES, yielding an average weighted ES of 0.89. This effect was statistically significant, and all variance in ESs was accounted for by sampling error alone (see I^2 statistic in Table 2).

Product goals. Seven studies conducted with students in Grades 4–6 examined the effects of product goals (see Table 1). Five of the studies included students who represented the full range of children in the regular classroom, whereas four investigations included struggling writers (two studies had both types of students). Goals ranged from objectives to include specific types of information in a paper (e.g., reasons to support a thesis) to making specific types of revisions (e.g., add three new things to the paper). Control conditions involved various types of general goals (e.g., write a persuasive text, make paper better).

Providing students with specific goals had a positive impact on writing quality. All studies yielded a positive ES, resulting in a statistically significant average weighted ES of 0.76. The *Q* test for heterogeneity was statistically significant, and I^2 indicated that 54% of the variance was due to between-study factors (see Table 2). We conducted a moderator analysis involving participant type (there were eight ESs for this variable): full range ($N = 4$) versus struggling writer ($N = 4$). Although the average weighted ES of these two groups (full range = 0.71; struggling writers = 0.43) did not differ statistically ($p = .34$), all the variance in ESs was accounted for by sampling error alone for struggling writers.

Assessing writing. We calculated 14 effects for assessing writing with children in Grades 2–6 (see Table 1). Students in all but one of these studies involved the full range of children in regular classes (gifted children was the exception). The assessment of writing was quite varied in the 14 studies and included teacher feedback (on students' papers or their progress learning a specific writing skill; peer feedback [giving and/or receiving feedback on a paper]) and student self-assessment (teaching students to use rubrics or 6-trait methods to assess their writing).

Assessment had a positive impact on writing quality. The average weighted ES was 0.42, and this effect was statistically significant (86% of studies yielded a positive effect). The *Q* test for heterogeneity was statistically significant, however, and I^2 indicated that 47% of the variance was due to between-study factors (see Table 2). As a result, we examined whether type of assessment moderated average ES and accounted for excess variability. This involved comparing studies where adults provided feedback (teachers or parents; $N = 5$) to studies where feedback mostly came from peers or students' themselves ($N = 10$). One study (Guastello, 2001) had a parent feedback treatment and a treatment where students were taught to self-assess their writing.

The average weighted ES for adult feedback (0.80) was statistically larger than the average weighted ES for peer or self-feedback (0.37; $Q_{\text{between}} = 10.40$, $p = .001$). The average weighted ES for both types of feedback were statistically greater than no effect, and variability of ESs in studies involving adult feedback was not greater than sampling error alone (see I^2 statistic in Table 2).

Alternative Modes of Composing

Word processing. Ten studies conducted with students in Grades 1–6 tested the effectiveness of word processing (see Table 1). Most of these investigations ($N = 7$) involved the full range of students in typical classes (two studies involved struggling writers and one study average writers). All of the studies involved comparing word processing to writing by hand, with two of the studies testing the effectiveness of word processing programs with additional software for facilitating planning or drafting of text (Englert, Zhao, Dunsmore, Collings, & Wolbers, 2007) or vocabulary and speech synthesis capabilities (Zhang, Brooks, Frields, & Redelfs, 1995).

Using word processing to write had a positive effect on writing quality. The average weighted ES was 0.47 (70% of the studies yielded a positive effect). This effect was statistically greater than no effect, and the *Q* statistic was not statistically significant (see Table 2).

Other Writing Activities

Extra writing time. We calculated five effects for studies examining the effects of increasing how much students wrote (see Table 1). These studies involved students in Grades 2–6, with all but one of them conducted with full-range students in a typical class. Extra writing ranged from writing about self-selected topics to daily expressive writing time. Comparison conditions ranged from writing skills instruction to silent reading time to unspecified treatment. Increasing how much students wrote improved writing quality. The average weighted ES was 0.30, with all but one study (conducted with English language learners) resulting in a positive effect. This effect was statistically greater than no effect, and all the variance in ESs was accounted for by sampling error alone (see I^2 statistic in Table 2).

Comprehensive writing programs. Twenty-five studies examined comprehensive writing programs (16 studies tested the process writing approach). These studies involved students in Grades 1–6. One half of the studies were conducted with full-range students in typical classes ($N = 13$), with the remaining studies involving struggling writers ($N = 7$) or average ($N = 2$), high-achieving ($N = 1$), or English language learning students ($N = 2$). The writing treatment in studies that did not test just the process approach to writing were varied and included a process approach combined with word processing and strategy instruction; whole language approach, language experience; direct instruction writing program; and writing skill and text structure instruction.

Comprehensive writing programs improved writing quality. The average weighted ES was 0.42 (81% of studies produced a positive effect). This effect was statistically greater than no effect. The Q test for heterogeneity was statistically significant, however, and I^2 indicated that 35% of the variance was due to between-study factors (see Table 2). As a result, we examined whether type of program (process writing approach vs. other comprehensive programs) accounted for excess variability. Although the average weighted ES of these two groups (process approach to writing = 0.40; other comprehensive programs = 0.55) did not differ statistically ($p = .69$), the Q statistic for the process approach was not statistically significant, and all the variance in ESs was accounted for by sampling error alone (see I^2 statistic in Table 2).

Discussion

The implementation of CCSS in American schools requires that many teachers and schools change how writing is taught to children in the elementary grades. We believe that these changes are more likely to be successful if teachers apply effective tools for teaching writing. The findings from this meta-analysis demonstrate that there are a variety of evidence-based instructional procedures for improving the writing of students in the elementary grades.

Caveats

Before summarizing the findings from this review, it is important to consider six factors that can influence interpretation. First, this review involved aggregating the findings from individual studies to draw conclusions about specific writing treatments. The value and scope of any conclusion drawn depends on a variety of factors, such as the quality of the investigations and who participated in the studies. For example, it is not appropriate to draw a broad conclusion aimed at all elementary students if the research reviewed only involved students in the primary grades. Thus, the conclusions drawn in this review were restricted to the grades and types of students tested. Our conclusions were further constrained by study quality. This information was used to indicate how much confidence can be placed in the findings for a treatment.

It must be noted that 10% of studies included in this review were quasi-experiments where treatment and control each involved a single class taught by different teachers (possibly confounding treatment with teacher effects). We reran our analyses and found that eliminating these single-class studies had virtually no impact, as ESs changed by .04 standard deviations or less and statistical significance remained the same in all analyses except one. We were unable to test this with grammar instruction, because two of the four studies involved a single class.

Second, one concern with meta-analysis involves the comparability of outcome measures on which the ESs are based. We addressed this problem by limiting our analyses to measures of writing quality. However, measures of writing quality were not the same across all studies, as they included holistic, analytic, and norm-referenced measures. This introduced some unwanted noise into the machinery of our meta-analysis.

Third, another concern with meta-analysis involves the similarity of the control conditions in studies testing a specific treatment. If there is considerable variability in control conditions, the conclusions must be interpreted in light of this situation. For example, if the effects for all studies are positive and there is variability in the control conditions, it can be argued that the treatment is effective when tested against multiple comparisons (although interpretation is cleaner when there is a single common point of comparison). In contrast, if studies testing a specific treatment produced a mix of positive and negative effects and there were differences in the control or comparison conditions, this complicates interpretation, as variability in effects may be related to this difference. For some treatments (e.g., product goals) in this meta-analysis, the control conditions were relatively similar. For other treatments (e.g., comprehensive writing programs), there was more variability in control conditions.

Fourth, some writing treatments have been the focus of more research than others. For example, the impact of strategy instruction was tested in 20 experiments, whereas we located only four studies that examined grammar instruction. There is clearly a need for additional study of treatments that have been tested infrequently. Moreover, new treatments need to be developed and tested, as the number of writing treatments assessed in one or more studies was limited.

Fifth, despite our comprehensive search, it is likely that we did not find all possible studies. We do not think this is a serious problem, as a fail-safe N analysis showed that to nullify the overall ES of studies in this review (average weighted ES for all studies = 0.42, CI [0.28, 0.56]), there would have to be 84 missing studies for every located study.

Sixth, we adjusted ESs for quasi-experiments to take into account clustering variance. These adjustments were made by imputing ICCs derived mostly from the study of reading. Although we would have preferred using ICCs based on writing data, such statistics were not available for each grade level. ICCs based on reading provide a relatively good match to writing, as students'

performance on these two skills is strongly related (Fitzgerald & Shanahan, 2000).

What Instructional Practices Improve the Quality of Elementary Students' Writing?

We calculated an average weighted ES for 13 writing treatments (each treatment was assessed by four or more studies). For all but one treatment, the average weighted ES was positive and statistically greater than 0. The only exception was teaching grammar, where a statistically nonsignificant average weighted ES of −0.41 was obtained (Graham & Perin, 2007a, obtained an ES of −0.32 with Grade 4–12 students in 11 studies). There are several reasons, however, to be cautious in interpreting this finding. First, grammar instruction was the control condition (not the experimental condition) in all four studies that tested this treatment. Second, the comparison condition to which grammar instruction was compared varied considerably, as did the obtained effects. Third, the overall quality of studies assessing grammar instruction was low. Additional and better research is needed to test the effectiveness of such instruction.

In summarizing the findings for the other 12 writing treatments next, we include a recommendation, average weighted ES, grade range, and description of types of students tested. The confidence that can be placed in a recommendation based on the quality of the studies assessing it was specified, as were findings that must be interpreted more cautiously due to variability in the comparison conditions. When possible, we compared the findings for a specific writing treatment in this review with findings for the same or similar writing treatments in previous meta-analyses. If there was no suitable comparison, the obtained ES was compared to the average weighted ES of 0.55 for all studies included in this meta-analysis.

Our 12 recommendations are ordered as follows. Our findings for writing treatments involving explicit instruction are presented first, followed by findings for approaches to scaffolding students' writing. Then, findings for alternative modes of composing (i.e., word processing), extra writing, and comprehensive writing programs are summarized. In each category (e.g., explicit instruction) with two or more treatments, interventions with larger weighted average ESs are presented before ones with smaller effects. The only exception involves strategy instruction and adding self-regulation to strategy instruction, as these treatments are directly tied to each other.

Explicit Instruction

1. Teach students strategies for planning, drafting, or revising different types of text (average weighted ES = 1.02). All 20 studies where writing strategies were taught to both typically developing and struggling writers in Grades 2–6 resulted in a positive effect. This occurred even though strategy instruction was compared to a variety of different control conditions and the strategies tested varied from procedures that could be applied only with a specific type of writing (e.g., persuasive) or more broadly. The SRSD model (Harris & Graham, 1996) of strategy instruction was particularly effective, yielding an overall ES 1.17, but so were other forms of strategy instruction (collectively they resulted in an overall ES of 0.59). Considerable confidence can be placed in these findings, as the quality of the research was high. These findings are comparable to those of Graham and Perin (2007c), who reported an overall ES of 0.82 with Grade 4–12 students (SRSD, ES = 1.14; other strategy instruction approaches, ES = 0.62), and Graham (2006a), who found an average ES of 1.15 (not weighted by sample size) for students in Grades 2–10 (SRSD, ES = 1.57; other strategy instruction approaches, ES = 0.89).

2. Teach students procedures for regulating the writing strategies they are taught (average weighted ES = 0.50). Both typically developing students (Grade 4) and struggling writers (Grades 2–6) benefited when they were taught how to apply self-regulation procedures, such as goal setting and self-assessment, to help them manage the writing strategies they were taught. Five of the six studies involved SRSD instruction, and all studies produced positive effects. These findings help to explain why SRSD obtained such large effects (see above), as the teaching of goal setting, self-assessment, and other self-regulation procedures as part of strategy instruction is one way in which SRSD differs from other strategy instructional approaches (Harris & Graham, 1996). Considerable confidence can be placed in these findings, as the quality of the research was high and the study comparisons were similar (strategy instruction plus self-regulation vs. strategy instruction). The overall finding for this recommendation was comparable to the overall average weighted ES of 0.55 for all studies in the current meta-analysis.

3. Teach students how to form images and be more creative (average weighted ES = 0.70). Teaching the process of visual imagery or how to be more creative consistently enhanced the writing quality of mostly high-achieving students in Grades 3–6 (positive effects were obtained for creativity instruction in one study with struggling writers in Grades 3–6). It should be noted that the control conditions in the four studies testing this treatment were varied. It also appeared (but it cannot be determined conclusively from the obtained reports) that students were not taught how to apply mental imagery or creativity directly to their writing. Considerable care must be exercised in interpreting the findings for this recommendation, as all four studies were of poor quality. The overall finding for this treatment exceeded the overall average weighted ES of 0.55 for all studies in this review.

4. Teach students how different types of text are structured and formed (average weighted ES = 0.59). Teaching students in Grades 2–6 the structure and form of narrative and expository text resulted in a positive effect. This occurred in all studies testing this treatment, even though control conditions varied considerably. This overall positive effect was mostly limited to typically developing students, although two studies involved struggling writers in Grades 4 and 5. Interpretation of these findings must be tempered by the poor quality of research in this area. The overall effect for text structure instruction was comparable to the overall average weighted ES of 0.55 for all studies in this review.

5. Teach students spelling, handwriting, and keyboarding (average weighted ES = 0.55). Teaching text transcription skills improved the quality of writing produced by students in Grades 1–3 in six out of eight studies. Four of the studies where positive effects were obtained were conducted with struggling writers, whereas positive effects were evident in two other studies involving typically developing writers. Although considerable confidence can be placed in this recommendation, as study quality was high, there was considerable variability in control conditions. The

overall effect for this treatment was equivalent with the overall average weighted ES of 0.55 for all studies in the current meta-analysis.

Scaffold Students' Writing

6. Develop instructional arrangements where children work together to plan, draft, revise, and edit their papers (average weighted ES = 0.89). Such collaborative activities had a positive effect in all studies conducted with students in Grades 2–6 (control conditions were relatively similar). These effects were obtained mostly with typically developing children, but one study involved struggling writers in Grades 4–6. The confidence that can be placed in this recommendation, however, must be tempered by the generally poor quality of research. Peer assistance produced a slightly larger overall effect in this review than it did (0.75) in the Graham and Perin (2007a) review with students in Grades 4–12.

7. Set clear and specific goals (e.g., add three new ideas when revising) for what students are to accomplish when writing (average weighted ES = 0.76). All studies involving product goals with students in Grades 4–6 resulted in a positive effect (control conditions were relatively similar in each study). This was true for typically developing writers and struggling writers. The confidence that can be placed in these findings must be tempered somewhat by study quality. However, all studies were true experiments. Product goal effects in this meta-analysis were comparable to the overall effect (0.70) obtained in the Graham and Perin (2007a) review with students in Grades 4–12.

8. Engage students in activities that help them gather and organize ideas for their papers before they write a first draft (average weighted ES = 0.54). All studies testing prewriting activities resulted in positive effects with students in Grades 2–6 (the control conditions varied modestly). These studies mostly involved typically developing students (one was conducted with struggling writers in Grades 3–6). The confidence that can be placed in the findings, however, must be tempered somewhat by study quality. The overall effect for prewriting in this review was greater than the effect for prewriting (0.32) obtained by Graham and Perin (2007a) with students in Grades 4–12.

9. Assess students' writing and progress learning to write (average weighted ES = 0.42). Twelve of 14 studies where teachers, peers, or students' assessed one or more aspects of writing or learning to write yielded positive effects for typically developing students in Grades 1–6 (control conditions were characterized by the lack of the target assessment procedure). The two studies that yielded negative effect involved the 6+1 Trait model (Collopy, 2008; Paquette, 2009). In addition, assessment procedures where adults (teachers and in one instance parents) gave feedback produced larger effects (0.80) than studies where feedback came mostly from peers or the writer themselves (0.37). Some caution must be exercised in interpreting the findings for this recommendation due to poor study quality. The overall effect for assessing writing was slightly smaller than the overall average weighted ES of 0.55 for all studies in the current meta-analysis.

Alternative Modes of Composing

10. Make it possible for students to use word processing as a primary tool for writing (average weighted ES = 0.47). Seven of the 10 studies that examined the effectiveness of word processing with students in Grades 1–6 produced positive effects (the control conditions were relatively similar across investigations). Two of the studies that produced positive results involved struggling writers, and word processing programs in these studies included additional software designed to help the writer. Caution must be used in interpreting the effects of word processing, however, due to poor study quality. The finding for this recommendation was compatible with the overall effect of 0.50 obtained by Graham and Perin (2007a) with students in Grades 4–12, and overall effect of 0.52 by Morphy and Graham (2012) with struggling writers in Grades 1–12.

Other Writing Activities

11. Increase how much students write (average weighted ES = 0.30). Four of the five studies that examined the effects of increasing how much students in Grades 2–6 wrote (at least 15 extra minutes a day) produced positive effects. Each study that yielded a positive effect was conducted with typically developing students, whereas the one study that produced a negative effect involved English language learners (Gomez et al., 1996). Control conditions varied considerably across the five studies, and some caution needs to be exercised in interpreting the findings for this recommendation due to poor study quality. The overall effect for extra writing was smaller than the overall average weighted ES of 0.55 for all studies in the current meta-analysis.

Complete Writing Programs

12. Implement a comprehensive writing program (average weighted ES = 0.42). Four out of every five studies testing a comprehensive writing program with Grade 1–6 students produced a positive effect. More specifically, implementing a process approach to writing had a positive impact on writing quality in typical elementary grade classrooms (average weighted ES = 0.40). Such findings for the process approach are similar to those of Graham and Perin (2007a), who reported an overall ES of 0.32 with students in Grades 4–12 (they did not correct for quasi-experiment pretest differences), and Graham and Sandmel (2011), who reported an average ES of 0.31 with students in Grades 1–12 (they included studies where the reliability of quality scores was not established). It should be noted that Graham and Sandmel did not find a statistically significant effect for process writing when just studies involving students at risk (struggling writers and English language learners) were analyzed. We did not conduct such an analysis, as variability in ESs did not exceed sampling error for studies testing the process approach. The confidence that can be placed in the process approach and other comprehensive writing programs must be tempered by the poor quality of the studies testing these treatments.

How the Findings From This Meta-Analysis Support and Extend Prior Findings

As was the case in earlier meta-analysis of true and quasi-experiments (conducted with students in Grades 1–12 or Grades 4–12), the findings from the this review provided support for the effectiveness of six writing practices: strategy instruction (cf.

Graham, 2006a; Graham & Harris, 2003; Graham & Perin, 2007a); peers working together as they plan, draft, and revise papers (cf. Graham & Perin, 2007a); product goals (cf. Graham & Perin, 2007a); prewriting activities (cf. Graham & Perin, 2007a); word processing (cf. Bangert-Drowns, 1993; Goldberg et al., 2003; Graham & Perin, 2007c; Morphy & Graham, 2012); and the process approach to writing instruction (cf. Graham & Perin, 2007a; Graham & Sandmel, 2011).

The effectiveness of strategy instruction, product goals, prewriting activities, and word processing was also supported in an earlier meta-analysis of single-subject-design research with students in Grades 1–12 (Rogers & Graham, 2008). Moreover, an analysis of qualitative research studying the practices of highly effective teachers in Grades 4–12 (Graham & Perin, 2007b) found that such teachers engaged in two of the practices found effective here: treating writing as a process and teaching students strategies for carrying out these processes. Collectively, the findings from these multiple reviews provide evidence that these six practices are effective with younger as well as older students and that each practice (with the exception of peers working together) is supported by multiple forms of data.

The findings from this meta-analysis extended previous reviews by identifying six additional practices that were effective. This included including self-regulation instruction as part of strategy instruction; teaching text structure, creativity/imagery, and text transcription skills (spelling, handwriting, and keyboarding); assessing students' writing; and increasing how much students write. Although Graham and Perin (2007a) collected enough studies to compute an average weighted ES for text structure instruction and extra writing with students in Grades 4–12, they chose not to do so because of the small number of ESs (five and six, respectively), disparate findings for each treatment, and variability in control conditions. Hillocks (1986) reported an average ES of 0.36 for student evaluation of writing using scales (this finding with older students overlaps somewhat with our finding for assessing writing). Additional research is needed to determine whether the six newly identified practices are effective with older students (this even includes some aspects of teaching transcription skills, such as spelling instruction).

Implications for Theory, Policy, Classroom Practices, and Future Research

Theory. The findings from this review provide support for the theoretical contention (see Graham, 2006b) that writing strategies and knowledge play an important role in elementary students' growth as writers. When students receive instruction designed to enhance their strategic prowess as writers (i.e., strategy instruction, adding self-regulation to strategy instruction, creativity/imagery instruction), they become better overall writers. Likewise, when students are taught specific knowledge about how to write (i.e., test structure instruction), the overall quality of their writing improves.

Support for the contention that writing skill development fuels elementary students' growth as writers received only partial support. Teaching text transcription skills such as handwriting, spelling, or typing improved the writing of students in Grades 1–3 (although most of the studies reviewed were conducted with weaker writers). In contrast, grammar instruction had no appreciable effect on writing. Additional research is needed to determine which skills contribute to which students' writing development and when.

Policy. Despite the importance of writing, too many students do not develop the writing skills they need to be successful (Salahu-Din, Persky, & Miller, 2008). If this is to change, improving writing instruction must become a national priority (even beyond CCSS).

One possible reason for why writing has played a minor role in past reform efforts is that policy makers may believe that the tools for improving how well students' write do not exist. This meta-analysis and previous ones (e.g., Bangert-Drowns, 1993; Goldberg et al., 2003; Graham & Perin, 2007a, 2007c; Hillocks, 1986) indicate otherwise, as a variety of effective tools for improving the overall quality of students' writing were identified. In addition, previous meta-analysis of true and quasi-experiments demonstrated that writing instruction improves students' reading skills (Graham & Hebert, 2010) and writing about material read or presented in class enhances the learning of such information (Bangert-Drowns et al., 2004; Graham & Hebert, 2010; Graham & Perin, 2007c). Using writing to support student learning likely depends on how well students write. For all of these reasons, it is time for federal, state, and school leaders to step up to the plate and place a greater emphasis on improving students' writing.

Classroom practices. Implementing evidence-based writing instruction is a challenging task (Rogers & Graham, 2008). Just because a writing practice was effective in multiple research studies does not guarantee that it will be effective in all other situations. Rarely, if ever, is there a perfect match between the conditions under which the writing practice was implemented in the research studies and the conditions in which it was subsequently put to use in classrooms. Even if there was a good match, the safest course of action is for teachers implementing the writing practice to monitor its effects to be sure it works in their classrooms with their students.

It must also be recognized that we do not know what combination or how much of each of the recommended writing practices in this review or other reviews (e.g., Graham & Perin, 2007c) is needed to maximize writing instruction. There is some preliminary evidence, however, that using different writing practices together can be beneficial (Sadoski, Wilson, & Norton, 1997). Even so, the recommendations for teaching writing from this and other recent reviews (e.g., Graham & Perin, 2007c) are incomplete, as they do not address all aspects of writing (e.g., sentence construction, teaching vocabulary for writing). In any event, if the recommendations in this review are to be implemented, professional development at both the preservice and in-service levels will be critical to ensure teachers learn how to apply them effectively.

Another issue in implementing the writing practices identified in this and other reviews revolves around the different organizational structures or formats for teaching writing that exist in schools. In elementary schools, for example, regular classroom teachers, special education teachers, other specialists (e.g., reading specialists), and aides may all be involved in one or more aspects of writing instruction. In addition, writing might be taught or applied in separate subject areas such as social studies or science. The interaction between these various formats and the writing practices identified here has not been tested. In other words, it is not certain how well the writing practices recommended here would fare in

each of these different formats. Consequently, before implementing one or more of these practices, teachers should conduct a careful analysis of the organizational structure or format within which it will be placed, with the aim of identifying factors that may facilitate or impede effectiveness.

Future research. This review provides important insights into the strengths and weaknesses of true and quasi-experiments testing the effectiveness of specific writing practices with students in the elementary grades. Bluntly put, the quality of much of the intervention research in this area was not what it should be. There were only three writing treatments (i.e., strategy instruction, adding self-regulation to strategy instruction, and teaching transcription skills) where 70% or more of the studies met at least two thirds of the target quality indicators. Across all studies, random assignment of students to conditions was rare (36% of studies), as was controlling for teacher effects (37% of studies). Attrition problems were too common (40% of studies), as were pretest ceiling and floor effects at posttest (27% of studies). Likewise, treatment fidelity was rarely established. There is clearly a need to improve the quality of this research.

Another area of concern involves the actual number of studies that have been conducted. We located 115 true and quasi-experiments conducted with elementary grade students. This compares well with the 123 documents located by Graham and Perin (2007a) applying the same type of research with students in Grades 4–12. However, it is dwarfed by the number of studies conducted by researchers in areas such as reading. Writing has not been a priority for many research funding agencies. This needs to change if we are to develop a better understanding of how to teach writing effectively.

It is also important to note that there are a number of gaps in research and areas where more evidence is needed. For example, most of the research in this meta-analysis focused on typically developing students. We located only 30 studies where an ES could be computed for struggling writers, five studies where this was the case with high-achieving students, and just three studies that were conducted with English language learners or bilingual students. Likewise, some writing treatments have hardly been tested at all (e.g., interactive writing or sentence combining instruction), and there are many writing practices have never been tested. Such gaps must be filled if we are to provide effective writing instruction to all elementary grade students.

Finally, we identified only four writing treatments (process writing, strategy instruction, assessing writing, and word processing) that had been tested in 10 or more studies. Less confidence can be placed in the reliability of an average ES when it is based on a small number of studies. Thus, additional replication is needed for most of the writing treatments examined in this meta-analysis. Beyond replication, all of the writing treatments identified in this review would benefit from additional experimentation. As an example, the effects of strategy instruction were not tested in all grades, with all types of writing genres, or with gifted and English language learners.

Concluding Comments

Meta-analysis provides a useful tool for drawing "important insight from what might otherwise be a confused and disparate literature" (Bangert-Drowns et al., 2004, p. 52). In the elementary grades, the writing intervention literature certainly fits this description. Like Hillocks (1986) and Graham and Perin (2007c), we capitalized on the strengths of meta-analysis to identify effective writing treatments for young children. This was a productive strategy, as we identified 13 practices that improved the quality of these students' writing.

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Correction to Graham et al. (2012)

In the article "A Meta-Analysis of Writing Instruction for Students in the Elementary Grades," by Steve Graham, Debra McKeown, Sharlene Kiuhara, and Karen R. Harris (*Journal of Educational Psychology*, Advance online publication. July 9, 2012. doi: 10.1037/a0029185), the names of authors Sharlene Kiuhara and Debra McKeown were misspelled as Sharlene Kiuhare and Deborah McKeown. All versions of this article have been corrected.

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