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A Meta-Analysis of Writing Interventions for Students With Learning Disabilities

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ABSTRACT: *In this meta-analysis, the impact of writing interventions on the quality of writing produced by students with learning disabilities (LD) was assessed. Ancestral and electronic searches were used to locate experimental, quasi-experimental, and within-subjects design studies with participants in Grades 1–12 with documented LD. The effects of writing interventions on participants' writing quality were averaged across 43 eligible studies to calculate an average weighted mean effect size (*ES*). Average weighted mean* ES *were also calculated for six writing treatment subgroups that contained four or more studies each (i.e., strategy instruction, dictation, procedural facilitation, prewriting, goal setting, and process writing). Overall, writing interventions had a statistically significant positive impact on the writing quality of students with LD (*ES *= 0.74). All writing treatment subgroups also had positive average weighted* ES*, but only four were statistically different from zero (i.e., strategy instruction* ES *= 1.09, dictation* ES *= 0.55, goal setting* ES *= 0.57, and process writing* ES *= 0.43). In addition, treatments designed specifically to enhance writing processes (e.g., planning, revising) were only effective when instruction was provided. Implications for the types of writing treatments and the types of instruction that may be most beneficial to students with LD are discussed and directions for future research are provided.*

Students with learning disabilities (LD) have considerable difficulty learning to write (Graham & Harris, 2003). Their difficulties with writing are complex and manifested in multiple ways. Compared to their typically achieving peers, they spend less time planning, less time generating coherent ideas, and less time revising for meaning and content (Gersten & Baker, 2001; Graham, Harris, & McKeown, in press). Further, students with LD typically approach writing as if it involves a single process: content generation. When given a topic to write about, they search long-term memory for relevant information, generate text based on what they know about the topic and the genre of writing, and compose each subsequent phrase or sentence in response to the one before it. This process continues until they have exhausted their knowledge of the topic or met the length requirement for the assignment (e.g., write one page); the resulting text often lacks coherence, clarity, and purpose (Graham, 1990).

In addition, students with LD often approach revising as if it were proofreading. Most of their revisions involve making changes in spelling, grammar, and mechanics (Graham, MacArthur, & Schwartz, 1995). They experience difficulty coordinating the processes involved in skilled revision, including evaluating text, making decisions about what to change, and executing a plan for the proposed changes (Graham, 1997).

Another challenge for students with LD involves difficulties with handwriting, typing, and spelling (Graham et al., in press). These transcription problems impede their writing in several ways. When students must focus on forming letters properly and spelling words correctly, they have little room left in working memory to devote to content, meaning, and written coherence (Baker, Gersten, & Graham, 2003). Difficulties with transcription skills make it more likely students with LD will forget ideas or writing plans being held in working memory. Also, they may terminate the writing process prematurely due to fatigue.

Because writing can be cognitively overwhelming, physically exhausting, and time consuming for students with LD, they often develop negative attitudes about writing (Graham et al., in press). As a result, many students with LD put forth minimal effort when writing and avoid writing when possible (Baker et al., 2003; Garcia-Sanchez & Fidalgo-Redondo, 2006).

To address the writing difficulties experienced by students with LD, it is important to identify instructional practices that enhance the quality of their writing. There are many practices that are potentially effective. For instance, students' transcription difficulties might be addressed through dictation or by teaching them handwriting and typing skills (Portilla-Revollar, 1994). Unsophisticated approaches to planning and revising might be ameliorated by explicitly teaching students with LD to use strategies for these tasks (e.g., Garcia-Sanchez & Fidalgo-Redondo, 2006) or by providing procedural supports (e.g., prompts) that help them carry out these processes (e.g., Graham, 1990, 1997).

The identification of effective writing practices provides more than just practical information. It also provides important theoretical insights into the writing challenges faced by students with LD. For example, if procedures designed to enhance students' planning or revising processes result in improvement in writing quality, this provides evidence of the role of such processes in the writing difficulties experienced by students with LD. Likewise, the presumed impact of weak transcription skills on writing is further verified if writing improves with the removal of these skills via dictation.

One approach for identifying effective writing practices for students with LD is to conduct a systematic review of writing interventions with these students. To do this, we chose meta-analysis. In contrast to a narrative review of the literature, meta-analysis permits analysis of the magnitude, direction, and consistency of writing intervention effects obtained across all relevant empirical studies (Borenstein, Hedges, Higgins, & Rothstein, 2009).

Researchers have reported positive effects of specific writing treatments for struggling writers and students with LD in several meta-analyses (Graham, 2006: Graham & Harris, 2003; Graham, McKeown, Kiuhara, & Harris, 2012; Graham & Perin, 2007; Rogers & Graham, 2008). However, none of these reviews focused specifically on students with LD; only one provided results disaggregated for students with LD (Graham & Harris, 2003), but this was only for strategy instruction.

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To date, only Gersten and Baker (2001) have conducted a meta-analysis synthesizing the research on writing interventions for students with LD. They examined the impact of 13 true- and quasi-experiments on the writing of students with LD in Grades 1 to 9. Overall, writing interventions had a positive impact (*ES* = 0.81) on students' writing. After a post hoc analysis of specific features of the writing interventions, Gersten and Baker indicated three instructional components were essential for effective writing instruction for students with LD: (a) explicit instruction in the steps of the writing process, (b) explicit instruction in text structures of various writing genres, and (c) guided feedback from the instructor or peers during the writing process.

The present meta-analysis extends Gersten and Baker's (2001) review in four ways. First, only studies that included a measure of writing quality were reviewed, as this measure provides a broad index of writing performance. Gersten and Baker computed an *ES* for each study using all writing measures assessed. This is problematic, as studies varied considerably in the writing measures used to compute the aggregate *ES*. Although measures of writing quality vary, they provide a more consistent index than aggregating all possible outcomes. Second, our search for studies was more extensive than Gersten and Baker's search, as we searched more databases; hand searched more journals; included grey literatures, dissertations, and theses; and conducted ancestral searches of all obtained documents. Third, the current review incorporated 12 additional years of research beyond the Gersten and Baker paper. As a result, we found more than four times as many writing comparisons as were located by Gersten and Baker. Fourth, we tested if explicit instruction in writing processes was related to variability in effects.

The present review was guided by two research questions: (a) Are writing interventions, in general, effective for students with LD? and (b) Which specific writing interventions are effective with students with LD? Moderator analyses were also applied to determine if specific study-level characteristics (e.g., study quality, explicit instruction) accounted for excess variability in effects.

METHOD

Study Eligibility Criteria

To be eligible for this review, each study had to meet these criteria: (a) included students in Grades 1 to 12 identified as LD with appropriate supporting information (e.g., test scores, Individualized Education Plans, special education placement); (b) tested a writing intervention (this ranged from teaching writing to activities where students carried out a procedure designed to improve writing performance); (c) assessed the quality of students' writing (quality measures included holistic scales, analytic scales, and norm-referenced assessments); (d) involved a true-experiment with randomization, a quasi-experiment with pretest data, or a within-subjects group design (i.e., students participated in both the treatment and comparison conditions); (e) provided data for calculating an *ES* and an average weighted *ES* (authors were contacted to obtain missing information for studies published in the last 10 years); and (f) was published in English. We did not include studies examining the effectiveness of word processing with students with LD, as this was examined in a recent meta-analysis by Morphy and Graham (2012).

Search Strategies

We conducted electronic searches, ending in December 2011, of Education Abstracts, ERIC, PsycInfo, ProQuest, and Dissertation Abstracts International. Search terms describing writing (*writing skills* or *writing instruction* or *written language*), the population (*special education* or *struggling writers* or *learning disabilit** or *learning disabled* or *writing problems*), and writing outcomes (*writing quality* or *composition* or *assessment*) were combined with these keywords: *revising, editing, prewriting, peer writing, summary writing, writer's workshop, process writing, strategy instruction, dictation, sentence combining, genre, imagery, rubrics, goal setting, inquiry, self-assessment, self-monitor, self-evaluation, grammar, spelling, mechanics, motivation, planning, peer collaboration, free writing, models, 6 traits, evaluative scales*, and *creativity*. These searches generated 26,716 items. The first author read abstracts for all items, and full-text documents were obtained for promising items (confirmed by the second author).

We also searched the National Technical Information Service (NTIS) to identify technical reports that met eligibility criteria, and we searched the reference lists of prior meta-analyses (e.g., Gersten & Baker, 2001; Graham et al., 2012; Graham & Perin, 2007; Hillocks, 1984; Sandmel & Graham, 2011). We searched these journals by hand: *Exceptional Children, Journal of Learning Disabilities, Learning Disability Quarterly, Learning Disabilities Research & Practice, Reading & Writing, Remedial & Special Education*, and *The Journal of Special Education*. The reference lists of all collected documents were further examined to find additional studies. Of the 281 documents identified, 43 studies met inclusion criteria. Some studies had more than one writing intervention, so 53 different *ES*s were calculated.

Coding of Study Features

Each study was coded for (a) year of publication, (b) type of publication (journal article, book chapter, dissertation, thesis, conference presentation, or technical report), (c) grade level of participants, (d) learning environment (general education classroom, special education classroom, resource room/pull-out, or after school program), (e) who delivered the intervention (teacher, researcher, or peer), (f) subject in which the treatment was delivered (English/Language Arts, Math, Science, History), (g) genre of writing emphasized during the intervention (narrative, persuasive, or expository), and (h) treatment duration.

Studies were further coded and scored for seven quality indicators: (a) design (true-experiment = 1 point; quasi-experiment = .5 point; within-subject design = zero points), (b) treatment fidelity (1 point if fidelity was .80 or greater), (c) control for instructor effects (1 point if methods were used to control instructor effects; e.g., instructors randomly assigned to conditions, instructors taught both conditions), (d) number of instructors (1 point if two or more instructors were assigned to each condition), (e) study attrition (1 point if at least 80% of students completed the study), (f) equal attrition across conditions (1 point if there was no more than 10% difference in attrition between groups), and (g) reliability of writing quality measure (1 point if reliability was .80 or higher).

Two quality indicators, control for instructor effects and more than one instructor per condition, were not scored when writing was not directly taught (e.g., studies involving dictation or studies where students were asked to use a graphic organizer). Likewise, the equal attrition indicator was not applicable to within-subjects group designs. As a result, we calculated a total quality score for each study as points earned divided by points possible, multiplied by 100%.

The first author coded all 53 writing comparisons. Thirty percent of the studies were randomly chosen and coded by the second author. Interrater reliability was 99%.

Categorizing Studies by Treatment Conditions

After reading the collected papers, the first author placed all studies into the following 15 categories: (a) strategy instruction, which involved modeling how to use specific strategies for planning, writing, revising, and/or editing text and incorporated student practice of the strategies in at least two sessions with the goal of independent use over time; (b) process writing, which consisted of students engaging in cycles of planning, drafting, revising, editing, and publishing their writing, sustained time for writing for authentic purposes and authentic audiences, and instruction conducted in mini-lessons to target students' writing needs as they arose; (c) prewriting, which involved students participating in activities such as brainstorming or using a graphic organizer to help generate and organize ideas for their writing; (d) procedural facilitation, which included supports for students such as verbal prompts or cue cards that facilitated planning, writing, or revising compositions; (e) goal setting, which involved providing students with a goal for their writing (e.g., include elements of a persuasive essay) or students choosing their own goals for writing; (f) peer tutoring, which consisted of peers instructing each other and assisting each other with writing tasks; (g) creativity training, which included activities designed to foster creative thinking abilities; (h) the addition of self-regulation procedures to strategy or skill instruction; (i) dictation to a scribe or into a tape recorder; (j) adding instruction to process writing (students were taught writing strategies while participating in process writing); (k) activities to increase writing motivation; (l) instruction on how to write sentences; (m) self-evaluation using a rubric; (n) collaborative writing where students created compositions with peers; and (o) comprehensive writing programs where multiple writing treatments were combined (e.g., strategy instruction, process writing, and prewriting were combined).

The second author confirmed the placement of all but four studies. These studies were discussed and reassigned until 100% consensus was reached on their placement.

Data Analysis

Effect sizes (ESs). *ES* was calculated by subtracting the control or comparison group's mean writing quality score at posttest from the treatment group's mean writing quality score at posttest, and

then dividing by the pooled standard deviation of the two groups. When pretest scores were available (all quasi-experiments and some true-experiments and within-subject designs), the difference between treatment and control groups was first adjusted by subtracting the mean pretest score for each group from its mean posttest score. We also calculated *ESs* for maintenance and generalization scores when possible (i.e., in 7 of 43 studies).

The following rules were applied when computing *ESs* for writing quality. If a holistic measure (i.e., a single score that encompasses factors such as ideation, organization, vocabulary, mechanics, and voice) was reported, it was used to calculate the *ES* for a study. If a study included a holistic as well as an analytic measure (i.e., separate scores for factors such as ideation, organization, coherence) or norm-referenced outcome, an *ES* was calculated for only the holistic measure. In five instances only an analytic measure was reported, so we computed separate *ESs* for each writing attribute and averaged them to produce a single *ES*. In essence, this reduced the analytic scores to a holistic score. There were also nine instances where only a norm-referenced measure was available for computing an *ES*.

For some *ES*s, it was necessary to aggregate the performance of two or more groups (e.g., boys and girls) using procedures developed by Nouri and Greenberg (Cortina & Nouri, 2000). Missing standard deviations also had to be estimated from the statistics presented in the publication for two studies (Clippard & Nicaise, 1998; Croes, 1990). We corrected all *ESs* for small sample size using procedures recommended by Hedges and Olkin (1985).

Average weighted effects across studies. A random effects model was applied when calculating average weighted *ES*s, statistical significance, and confidence intervals. We also computed two measures of heterogeneity (Q and I^2) to determine if the variability in *ES*s was greater than what would be expected from sampling error alone (Lipsey & Wilson, 2001).

To answer Research Question 1 (Are writing interventions, in general, effective for students with LD?), we calculated a single *ES* for all 43 studies in this review. If a study had multiple writing comparisons, we aggregated scores (see Cortina & Nouri, 2000) for all writing treatment groups and compared the aggregated score to the score for the control condition.

To answer Research Question 2 (Which specific writing interventions are effective?), we calculated an average weighted *ES* for each writing treatment containing four or more *ES*s (i.e., strategy instruction, dictation, procedural facilitation, prewriting, goal setting, and process writing). This was consistent with other writing meta-analyses (e.g., Graham & Perin, 2007).

Nine studies included more than one writing treatment comparison. To avoid violating the assumption of independence of *ES*s (Lipsey & Wilson, 2001), only one *ES* was used per study when computing average weighted *ES*s and when conducting moderator analyses.

Outliers. Prior to computing average weighted *ES*s, we examined the *ES*s and sample sizes of all studies for extreme outliers (any *ES* or sample size falling three times the interquartile range above the 75th percentile or three times the interquartile range below the 25th percentile). One *ES* (Eissa, 2009) met this definition, and it was winsorized to a less extreme value (i.e., an *ES* equivalent to the definition of an extreme outlier above).

Moderator analysis. To determine if specific study characteristics were related to excess variability in *ES*s for Question 1 (Are writing interventions, in general, effective for students with LD?), we conducted a meta-regression (Borenstein et al., 2009), which is similar to a multiple regression. We examined if four moderators accounted for excess variability in *ES*s. Study quality was selected as a moderator because studies of higher quality may produce smaller effects, as methodological rigor may prevent inflated outcomes or erroneous findings. Publication date was chosen as a moderator, because more recent publications may produce larger effects, as researchers may have improved writing interventions over time. Type of publication was selected because journal articles may have larger effects than dissertations, which are generally conducted by less skilled researchers. Who delivered the intervention was also chosen as a moderator, but it was unclear if teacher- or researcher-delivered interventions would have a greater effect. Students may work harder for their teachers, resulting in greater writing gains. In contrast, teachers may be less likely to administer interventions with high fidelity due to classrooms demands, resulting in less effective writing interventions.

For Question 2 (Which specific writing interventions are effective?), we used the ANOVA analog (Hedges & Olkin, 1985) to assess excess variability in *ES*s. Consistent with our decision about the calculation of average weighted *ES*s, we only conducted such an analysis when there were at least four effects in each category of a moderator variable. The only intervention with enough *ES*s was strategy instruction. Three of the same moderators used in the meta-regression (study quality, publication year, and instructor) were used with this analysis. Additionally, we examined differences between studies using Self-Regulated Strategy Development (SRSD) and those not using SRSD. SRSD involves explicit instruction in task-specific writing strategies through a series of criterion-based lessons. The instructor models the strategies and scaffolds students' strategy use until students can apply the writing strategies independently. Students also learn to self-regulate and monitor their progress in learning and using the writing strategies. SRSD differs from other strategy approaches in its emphasis on self-regulation and mastery learning (Harris, Graham, Mason, & Friedlander, 2008).

Finally, we made an a priori decision to use the ANOVA analog to examine the differences between studies with writing process treatments that involved instruction (n = 16) and those that involved minimal to no instruction (n = 10). Dictation and goal setting were excluded from this analysis because they were not focused on writing processes specifically. Studies of the process writing approach were also excluded because the type and extent of instruction in these studies was unclear. For the purposes of this analysis, a study was deemed to include instruction if it had a minimum of two sessions and included instructor modeling, student practice applying the writing process or strategy, and a goal for independent student application. Studies that did not meet these requirements were considered to have minimal or no instruction (e.g., students used cue cards to remind them to include specific elements in their writing).

RESULTS

Table 1 presents individual descriptions for all writing comparisons. Descriptive information (publication type, design, grade level, writing genre emphasized during the intervention, summary of treatment and comparison conditions, and sample size) as well as Hedge's g and the quality score are reported for each study. Writing treatments are ordered from the treatment containing the most studies to the treatment with the least studies, with treatments with an equal number of studies ordered alphabetically. Studies in a category with fewer than four *ES*s are presented at the end of the table.

Quality of Research

Overall, 60% of the quality indicators were met for all studies (see Table 2). Of the studies reporting information about attrition, most (93%) had little attrition; all had equal attrition across treatment and comparison groups. Only 44% of studies employed a true experimental design. Another 42% were quasi-experimental and 14% were within-subjects designs. More than two thirds of studies (67%) reported reliability of writing quality outcome measures. Of these, 79% reported reliability at .80 or higher. Few studies reported treatment fidelity or controlled for instructor effects. Less than half of studies involved multiple instructors in treatment and comparison conditions. As seen in Tables 1 and 2, quality varied across studies and treatments.

Question 1: Are Writing Interventions, In General, Effective for Students With LD?

In 43 studies, researchers evaluated the effectiveness of writing interventions on the writing quality of students with LD. Most studies (n = 35) involved students in upper elementary and middle grades (i.e., Grades 4-8). The remaining studies included students in primary grades (n = 3) and high school (n = 5). Writing interventions were delivered in a variety of settings, including (a) resource room/pullout (n = 15), special education (n = 9), general education (n = 6), and after school programs (n = 3). A majority of studies (n = 22) did not include information about the content area in which a writing intervention was implemented; 17 studies involved writing interventions

TABLE 1

Descriptions of Individual Writing Comparisons

Study	*Type of publication*	*Design*	*Grade level*	*Writing genre*	*Treatment and comparison conditions*	N	*Hedge's* g ES	*Quality score*[a]
Writing treatments that included four or more effect sizes								
Strategy instruction								
Bryson & Scardamalia (1996)	J	E	10	P	Inquiry strategies vs. genre elements	15	1.22	57%
Curcic (2009)	D	E	7-8	EX	Big 6 Skills strategy vs. BAU	20	0.80	71%
Curry (1997)	D	Q	4	N	Plan/write strategies vs. writing skills	48	0.57	50%
De La Paz & Graham (1997)	J	E	5-7	P	Plan/write strategies vs. genre elements	42	0.91 1.08 M	100%
Eissa (2009)	J	E	9	P	Planning strategy vs. BAU	67	3.50[b]	43%
Englert, Raphael, Anderson, Anthony, & Stevens (1991)	J	Q	4-5	EX	Plan/write/revise strategies vs. BAU	55	0.55 0.85 G	64%
Garcia & de Caso (2004)	J	E	5-6	MG	Plan/write strategies vs. BAU	127	0.96	57%
Garcia & de Caso-Fuertes (2007)	J	Q	5-6	MG	Plan/write strategies vs. BAU	100	0.71	50%
Garcia-Sanchez & Fidalgo-Redondo (2006)	J	E	5-6	EX	Plan/write/revise strategies vs. writing skills	121	2.21	71%
MacArthur, Schwartz, & Graham (1991)	J	Q	4-6	N	Revise/edit strategies vs. BAU	29	1.42	64%
Reynolds, Hill, Swassing, & Ward (1988)	J	Q	6-8	CD	Revising strategies vs. BAU	53	0.15	50%
Sawyer, Graham, & Harris (1992)	J	E	5-6	N	Plan/write strategies vs. BAU	21	1.14	86%
Therrien, Hughes, Kapelski, & Mokhtari (2009)	J	E	7-8	EX	Writing prompt strategies vs. BAU	40	0.32	71%
Troia & Graham (2002)	J	E	4-5	N	Planning strategy vs. BAU	20	0.821 .73 M –0.48 G	86%
Welch (1992)	J	Q	6	EX	Plan/write strategies vs. BAU	18	1.79	36%
Dictation								
De La Paz & Graham (1997)	J	E	5-7	P	Dictate to scribe vs. write by hand	42	0.64 0.43 M	100%
Graham (1990)	J	WS	4, 6	P	Dictate to recorder vs. write by hand	23	0.75	50%
Lane & Lewandowski (1994)	J	WS	7-8	N	Dictate to recorder vs. write by hand	19	1.19	50%
MacArthur & Graham (1987)	J	WS	5-6	N	Dictate to recorder vs. write by hand	11	0.61	50%
Montague, Graves, & Leavell (1991)	J	E	7-8	N	Dictate to recorder vs. write by hand	40	–0.20	80%
Portilla-Revollar (1994)	D	E	2-4	N	Dictate to recorder vs. write by hand	24	0.36	80%

continues

TABLE 1. *Continued*

Study	*Type of publication*	*Design*	*Grade level*	*Writing genre*	*Treatment and comparison conditions*	N	*Hedge's* g ES	*Quality score*[a]
				Procedural facilitation				
Graham (1997)	J	WS	5-6	N	Index cards to revise vs. BAU revising	12	0.00	75%
Graham (1990)	J	WS	4, 6	P	Prompt to write more vs. no prompt	23	1.15	50%
Graham et al. (1995)	J	E	4-6	N	Procedure to revise vs. BAU revising	43	0.02	80%
Graves, Montague, & Wong (1990)	J	E	5-6	N	Cue cards for elements vs. no cue cards	30	1.22	60%
Montague et al. (1991)	J	WS	7-8	N	Cue cards for elements vs. no cue cards	40	–0.43	50%
Page-Voth & Graham (1999)	J	E	7-8	P	Procedure to include elements vs. no procedure	20	–0.52	100%
				Prewriting				
Bahr, Nelson, & Van Meter (1996)	J	WS	5, 8	N	Prewriting questions vs. no prewriting	6	0.00	50%
Blair (2003)	D	Q	7-8	EX	Prewriting story webs vs. no prewriting	18	0.01	70%
Bulgren, Marquis, Lenz, Schumaker, & Deshler (2009)	J	E	9-10, 12	EX	Prewriting graphic organizer vs. BAU	18	1.37	80%
Kurtz (1987)	D	Q	4-6	N	Graphic organizer vs. no prewriting	12	0.97	50%
Sturm & Rankin-Erickson (2002)	J	WS	8	EX	Concept map vs. no prewriting	12	–0.46	33%
				Goal setting				
Ferretti, Lewis, & Andrews-Weckerly (2009)	J	E	4, 6	P	Genre elements goal vs. general goal	48	0.36	100%
Ferretti, MacArthur, & Dowdy (2000)	J	E	4, 6	P	Genre elements goal vs. general goal	62	0.34	60%
Graham et al. (1995)	J	E	4-6	N	Goal to add text vs. general goal	43	0.75	80%
Page-Voth & Graham (1999)	J	E	7-8	P	Genre elements goal vs. no goal	20	1.59	100%
				Process writing				
Clippard & Nicaise (1998)	J	Q	4-5	CD	Writer's workshop vs. writing related to content area curriculum	27	0.36	64%
Croes (1990)	D	Q	1-5	MG	Process writing vs. BAU	157	0.34	36%
Curry (1997)	D	Q	4	N	Writer's workshop vs. writing skills	45	0.45	50%
Weiss (1992)	D	Q	2-3	MG	Process writing vs. BAU	24	1.11	36%

continues

TABLE 1. *Continued*

Study	*Type of publication*	*Design*	*Grade level*	*Writing genre*	*Treatment and comparison conditions*	N	*Hedge's* g ES	*Quality score*[a]
Writing treatments that did not include four or more effect sizes								
Brantley & Small (1991)	T	Q	Junior high	CD	Evaluated own writing with rubric vs. no rubric	37	0.23	36%
Bui, Schumaker, & Deshler (2006)	J	Q	5	N	6 Traits; genre elements, plan/ sentence/ paragraph strategies vs. BAU	14	0.18	50%
Curry (1997)	D	Q	4	N	Prewrite/genre strategies and Writer's workshop vs. Writer's workshop	51	0.27	50%
de Caso, Garcia, Diez, Robledo, & Alvarez (2010)	J	E	5-6	N	Self-efficacy and motivation vs. BAU	60	1.10	43%
Fewell (1985)	D	Q	10-12	CD	Intrinsic motivation vs. no motivation	30	0.45	50%
Fewell (1985)	D	Q	10-12	CD	Sentence construction skills vs. BAU	23	–0.79	50%
Fortner (1986)	J	Q	3-6	CD	Creative thinking skills vs. BAU	49	1.03	64%
Garcia and de Caso (2006)	J	Q	5-6	MG	Self-efficacy and motivation vs. BAU	60	1.59 2.04 M	36%
Jolly (1988)	D	Q	9-11	N	Writing with a partner vs. BAU	20	0.55 –0.26 M	70%
Kurtz (1987)	D	Q	3-6	N	Prewriting with self-regulation vs. prewriting with instructor guidance	12	1.21	50%
MacArthur, Graham, Schwartz, & Schafer (1995)	J	Q	5	MG	Writer's workshop; word processor; plan/revise strategies vs. BAU	166	0.43	36%
Sawyer et al. (1992)	J	E	5, 6	N	Strategies with goal setting and self monitoring vs. strategies	22	–0.02 –0.13 M 0.19 G	86%
Utay & Utay (1997)	J	E	2-6	MG	Partners taught writing skills vs. BAU	71	0.00	43%

Note. Several studies were included in multiple categories because they had multiple treatment-control group comparisons. J = journal; D = dissertation; E = experimental; Q = quasi-experimental; WS = within-subjects; P = persuasive; EX = expository; N = narrative; CD = cannot determine; MG = multiple genres; BAU = business as usual; M = maintenance; G = generalization.

[a]Effect size was winsorized because it was an extreme outlier.

[b]Quality score is a percentage of the points possible for each study.

TABLE 2

Percent of Quality Indicators Met for Writing Treatments That Included Four or More Effect Sizes

	Quality indicators						
Writing treatment	*Design*	*Fidelity*	*Instructor effects*	N > *1 Instructor per condition*	*Attrition*	*Equal attrition*	*Reliability*
All studies (*N* = 43)	65% (28/43)	19% (8/43)	33% (9/27)	48% (13/27)	93% (40/43)	100% (37/37)	53% (23/43)
Strategy instruction (*n* = 15)	80% (12/15)	27% (4/15)	40% (6/15)	53% (8/15)	100% (15/15)	100% (15/15)	47% (7/15)
Dictation (*n* = 6)	50% (3/6)	17% (1/6)	NA	NA	100% (6/6)	100% (3/3)	100% (6/6)
Procedural facilitation (*n* = 6)	50% (3/6)	33% (2/6)	NA	NA	100% (6/6)	100% (3/3)	83% (5/6)
Prewriting (*n* = 5)	40% (2/5)	0% (0/5)	100% (1/1)	0% (0/1)	100% (5/5)	100% (3/3)	60% (3/5)
Goal setting (*n* = 4)	100% (4/4)	50% (2/4)	NA	NA	100% (4/4)	100% (4/4)	75% (3/4)
Process writing (*n* = 4)	50% (2/4)	0% (0/4)	0% (0/4)	75% (3/4)	75% (3/4)	100% (4/4)	25% (1/4)

Note. NA = not applicable.

TABLE 3

Average Weighted Effect Sizes and Heterogeneity Statistics for Writing Treatments That Included Four or More Effect Sizes

Writing treatment	*Number of* ES*s*	*Average weighted* ES	SE	*Confidence interval*	p[a]	*Heterogeneity*	
						Q	I^2
All studies	43	0.74	0.10	(0.55, 0.94)	<.001	170.13***	75.30
Strategy instruction	15	1.09	0.19	(0.72, 1.47)	<.001	73.58***	81.00
Dictation	6	0.55	0.20	(0.17, 0.94)	<.01	10.00	50.00
Procedural facilitation	6	0.24	0.31	(–0.37, 0.84)	0.45	26.13***	80.90
Prewriting	5	0.33	0.35	(–0.35, 1.01)	0.34	10.20*	60.80
Goal setting	4	0.57	0.22	(0.14, 0.99)	<.01	5.46	45.10
Process writing	4	0.43	0.13	(0.18, 0.68)	<.01	2.99	0.00

[a]Test of the null hypothesis that *ES* = zero.
*p < .05. **p < .01. ***p < .001.

conducted in English/Language Arts classrooms. Writing treatments lasted from 1 day to 1 school year, and comparison conditions varied as well (see Table 1).

Overall, writing interventions had a statistically significant positive impact (see Table 3) on the writing quality of students with LD (average weighted *ES* = 0.74, p < .001), with 86% of

TABLE 4

Multivariate Regression Model Predicting Average Weighted ES for All Studies (Question 1)

Moderator	B	SE	t
Study quality score	–0.00	0.01	–0.37
Year of publication	–0.01	0.02	–0.99
Type of publication	–0.27	0.23	–1.19
Who delivered the intervention	–0.19	0.17	–1.28

studies yielding a positive *ES*. The Q-statistic for the test of heterogeneity was statistically significant (Q = 170.13, *df* = 42, $p < .001$), and I^2 indicated that 75% of the observed variance between *ES*s was due to true variance between studies. Therefore, we conducted a meta-regression to determine if study quality score, year of publication, type of publication, or who delivered the intervention (i.e., researcher or teacher) explained any of the excess variance.

Table 4 displays the results from the multivariate regression model predicting the average weighted *ES* for all studies with the four study-level moderators. There was no evidence of multicollinearity between the moderator variables and the average weighted *ES*. Together, the four moderators explained 9% of the variance between studies. The Q-residual statistic (Q = 137.91, *df* = 38, $p < .001$) indicated a statistically significant amount of between-study variance was left unexplained with the moderators in the model. Thus, it is not surprising that none of the moderators (i.e., study quality score, year of publication, type of publication, and who delivered the intervention) had statistically significant relationships with the average weighted *ES*. I^2 indicated that 72% of the residual variance was due to between-study factors.

Question 2: Which Specific Writing Interventions are Effective for Improving the Writing Quality of Students with LD?

The average weighted *ES*s for the six writing treatments containing four or more *ES*s were all positive (see Table 3). Four of the writing treatments (i.e., strategy instruction, dictation, goal setting, and process writing) had statistically significant effects on the writing quality of students with LD.

Strategy instruction. Fifteen studies examined the effects of strategy instruction. Most studies ($n = 13$) involved students in Grades 4 to 8, with a majority taking place in resource room/pullout ($n = 7$) or self-contained special education classes ($n = 3$). In 11 studies, students learned strategies for planning and writing texts. Two studies involved strategies for revising and editing texts, and two studies involved strategies for planning, writing, and revising. Comparison conditions varied, with most studies ($n = 11$) using a business-as-usual comparison condition. Students in the other study comparison conditions either practiced writing skills (e.g., grammar, spelling) or learned and practiced using the elements of specific writing genres. Approximately half of the studies involving strategy instruction were delivered by researchers, whereas strategy instruction was delivered by teachers in six studies and by educational psychologists in one study. Length of strategy instruction varied from 7 days to 7 months.

Teaching writing strategies to students with LD had a statistically significant (*ES* = 1.09, $p < .001$) impact on writing quality (see Table 3). The Q-statistic was also statistically significant (Q = 73.58, *df* = 14, $p < .001$), indicating variance between *ES*s was greater than expected from sampling error alone. I^2 indicated that 81% of the variance between *ES*s was due to variance between studies. Thus, we proceeded with moderator analyses to determine if study quality, year of publication, type of instructor, or the use of SRSD could explain excess variability.

The average weighted *ES* for studies with quality scores of 80% and above ($n = 4$) was 0.73; it was 1.05 if study quality was below 80% ($n = 11$). Both *ES*s were statistically significant ($p < .001$), but they were not statistically different from each other (Q = 2.38, *df* = 1, $p = .12$). All of the variance

in *ES*s was accounted for by sampling error alone (Q = 2.89, *df* = 3, *p* = .41; I^2 = 0%) in higher quality studies. A statistically significant amount of heterogeneity between studies remained for lower quality investigations (Q = 68.31, *df* = 10, *p* < .001; I^2 = 85%).

To determine if year of publication accounted for excess variance, we examined differences between studies published in the last 10 years, from 2002 to the present (*n* = 7), and studies published before 2002 (*n* = 8). Both average weighted *ES*s were statistically significant (*p* < .001). The average weighted *ES* for studies published from 2002 to the present (*ES* = 1.14) was statistically larger (Q = 5.51, *df* = 1, *p* = .02) than the average weighted *ES* for studies published before 2002 (*ES* = 0.76). Although variation in *ES*s was accounted for by sampling error alone for studies published before 2002 (Q = 13.30, *df* = 7, *p* = .07; I^2 = 47%), this was not the case for studies published in the last 10 years (Q = 54.77, *df* = 6, *p* < .001; I^2 = 89%).

The average weighted *ES* for strategy interventions delivered by teachers (*n* = 6) was 0.85, whereas the average weighted *ES* for interventions delivered by researchers (*n* = 7) was 0.63. Although both average weighted *ES*s were significantly different from zero (*p* < .001), there was not a statistically significant difference between them (Q = 1.46, *df* = 1, *p* = .23). The variation in the *ES*s was consistent with what would be expected from sampling error alone for studies with interventions delivered by teachers (Q = 7.65, *df* = 5, *p* = .18; I^2 = 35%) and for studies with interventions delivered by researchers (Q = 7.42, *df* = 6, *p* = .28; I^2 = 19%).

Seven of the studies involved strategy instruction using SRSD (Harris et al., 2008). The average weighted *ES* for studies using SRSD was 1.33, which was statistically larger (Q = 12.06, *df* = 1, *p* < .01) than the average weighted *ES* for studies that did not use SRSD (*ES* = 0.76). Both *ES*s were statistically significant (*p* < .001). The variation in the *ES*s was consistent with what would be expected from sampling error alone for studies that did not use SRSD (Q = 10.70, *df* = 7, *p* = .15; I^2 = 35%). However, statistically significant heterogeneity remained between studies that used SRSD for teaching writing strategies (Q = 50.82, *df* = 6, *p* < .001; I^2 = 88%).

Maintenance and generalization were assessed in two studies each. Students who received strategy instruction continued to outperform students in comparison conditions at 2 weeks (*ES* = 1.08; De La Paz & Graham, 1997) and 4 weeks (*ES* = 1.73; Troia & Graham, 2002) postintervention. Generalization effects were mixed. In Englert et al. (1991), students in the strategy condition outperformed comparison students (*ES* = 0.85) when generalizing to a different genre, whereas in Troia and Graham (2002), students in the strategy condition did not outperform comparison students (*ES* = –0.48) when generalizing a strategy to a different genre.

Dictation. The impact of dictating into a tape recorder (*n* = 5) or to a scribe (*n* = 1) was tested in six studies. In all studies, students in comparison conditions composed by hand. Five studies involved students in Grades 4 to 8. One study involved students in Grades 2 to 4. No studies reported data about the content area/subject matter used with dictation, but three reported that dictation was conducted in resource room/pullout settings. Most dictation interventions (*n* = 5) were delivered by researchers and lasted between 1 and 3 days (see Table 1).

Dictation resulted in statistically significant improvements in writing quality (average weighted *ES* = 0.55, *p* < .01; see Table 3), and 83% of studies produced positive effects. The Q-statistic was not statistically significant (Q = 10.00, *df* = 5, *p* = .08), indicating variation in the *ES*s was consistent with sampling error or chance alone. Nonetheless, I^2 indicated 50% of the observed variance was due to between-study factors. One study assessed maintenance effects. In this study, students in the dictation group continued to outperform students in the comparison condition 2 weeks postintervention (*ES* = 0.43; De La Paz & Graham, 1997).

Procedural facilitation. Researchers evaluated the effects of procedural facilitation in six studies with students in Grades 4 through 8. Half of the studies used procedures (e.g., cue cards) to prompt students to include specific genre elements in their written compositions. Two studies incorporated procedures to assist students in making decisions about revising their texts. In the remaining study, students were given verbal prompts to add more information to their texts. Students in comparison conditions wrote (*n* = 4) or revised (*n* = 2) texts

without extended procedures or prompts to assist them while writing. Researchers delivered procedural facilitation interventions in all studies and interventions lasted 2 to 6 days. Although no studies provided information about the content areas where the interventions were implemented, four studies reported students participated in the interventions in resource room/pullout classrooms.

Procedural facilitation interventions had a positive impact on students' writing quality, with an average weighted *ES* of 0.24 (see Table 3), but this was not statistically significant (p = .45). Half of the procedural facilitation studies produced positive effects, whereas two studies produced effects favoring the comparison treatment, and one study produced no effect (*ES* = 0.00). Although there was statistically significant variability between studies (Q = 26.13, df = 5, p < .001) and I^2 indicated 81% of the observed variance was due to between-study factors, we did not conduct follow-up moderator analyses because there were only six studies in this subgroup.

Prewriting. In five studies, researchers investigated the impact of prewriting activities. The majority of prewriting studies (n = 4) involved students completing graphic organizers (e.g., concept maps, webs) to plan and organize text before writing. In one study, students answered prewriting questions to generate and organize ideas before composing. In all studies, comparison conditions involved students composing texts without specific prewriting tasks; in one study, students had the option to take notes before writing, but no directions for how to do so were provided. Studies involved students in Grades 4 through 12. Prewriting interventions were delivered in English/Language Arts (n = 2), Science (n = 1), and multiple content areas (n = 1). Researchers (n = 3) and teachers (n = 2) delivered prewriting treatments: (a) after school (n = 2), (b) in general education (n = 1), (c) in resource rooms/pullout settings (n = 1), and in study hall (n = 1). Interventions lasted between 2 and 9 days, except for one study lasting 39 days.

Four of the five prewriting studies produced positive effects and the average weighted *ES* was 0.33 (see Table 3), but this effect was not statistically significant (p = 0.34). Variability between studies was statistically significant (Q = 10.20, df = 4, p = 0.04) and I^2 indicated 61% of the variance was between studies. However, we did not conduct moderator analyses because there were only five studies testing the effectiveness of this writing treatment.

Goal setting. The effectiveness of goal setting was examined in four studies. In one study, students selected a goal for their compositions from a set of goals provided by the instructor. In other studies, instructors gave students specific goals for revising (n = 1) or for including genre elements in their writing (n = 2). In two studies, control students responded to writing prompts but did not set or select writing goals. Control students in other studies were told to make their papers better (n = 1), or they would share their essays with an instructor who would provide feedback (n = 1). All studies involved students in Grades 4 through 8. Goal setting interventions were delivered by researchers and lasted from 2 to 6 days. The content area for goal setting was not provided in any studies. Three studies incorporated goal setting into resource room/pullout classes and one used goal setting in a general education setting.

Goal setting had a statistically significant (p < .01) effect on the writing quality of students with LD (see Table 3). All goal setting studies produced positive effects, and the average weighted *ES* for goal setting interventions was 0.57. The variability between studies was not statistically significant (Q = 5.46, df = 3, p = 0.41), but I^2 indicated 45% of the observed variance was due to differences between studies within this writing treatment subgroup.

Process writing. Process writing was examined in four studies. All studies involved students in Grades 1 to 5, in English/Language Arts classes. In three studies, students in comparison conditions learned writing skills through worksheets/textbook activities. One study involved a writing comparison group who practiced writing texts related to themes in content area instruction. Although both teachers and researchers delivered process writing in one study, teachers delivered the interventions in the remaining studies. The duration of process writing varied from 2 months to 10 months. Treatment place varied as well. Process writing was carried out in general education classrooms (n = 1), resource room/pullout classrooms (n = 1), and special education classrooms (n = 1). Students in one study participated in

process writing in both general education and resource/room pullout settings.

Involving students in process writing had a statistically significant ($p < .01$) effect on writing quality (see Table 3). All studies in this subgroup produced positive effects, in favor of process writing over comparison conditions. The average weighted *ES* was 0.43. There was no variation in *ES*s (I^2 = 0%) attributed to true study differences; all variance was what would be expected from sampling error, or chance, alone (Q = 2.99, $df = 3$, $p = 0.39$).

Instruction versus minimal to no instruction. Sixteen studies examined the effects of writing process treatments that involved instruction. This included all strategy instruction studies ($n = 15$) and one study (Sturm & Rankin-Erickson, 2002) involving prewriting. Ten studies examined the effects of writing process treatments with minimal to no instruction. These studies included four studies involving prewriting and all procedural facilitation studies ($n = 6$).

The average weighted *ES* for treatments with instruction (*ES* = 0.93) was statistically larger (Q = 25.80, $df = 1$, $p < .001$) than the average weighted *ES* for treatments with minimal/no instruction (*ES* = 0.22). Although the average weighted *ES* for treatments with instruction was statistically significant ($p < .001$), the average weighted *ES* for treatments with minimal to no instruction was not ($p = 0.06$). Both sets of studies had considerable heterogeneity. For studies with instruction (Q = 86.24, $df = 15$, $p < .001$), I^2 indicated 83% of observed variance between *ES*s was due to variance between studies. For studies with treatments with minimal/no instruction (Q = 33.83, $df = 9$, $p < .001$), 73% of variance was due to between-study factors.

DISCUSSION

Are Writing Interventions, In General, Effective for Students with LD?

The writing quality of students with LD was improved through intervention. Writing interventions had a positive impact on the writing quality of students with LD, resulting in an average weighted *ES* of 0.74 across 43 studies. Thirty-eight of the studies produced positive effects favoring the writing treatment. These effects were found across all grades, with most involving students in Grades 4 to 8. Although they reviewed fewer studies with less variety in participant and treatment characteristics, Gersten and Baker (2001) reported similar findings, with an overall *ES* of 0.81 for 13 writing intervention studies conducted with students with LD in Grades 1 through 9.

Despite these promising results, the overall findings must be tempered by the quality of studies (although study quality was not related to variability in effects). It is especially important that future writing intervention studies are true experiments that control for instructor effects, report reliability of outcome measures, and provide treatment fidelity data, as these were weaknesses in the studies reviewed here. Unfortunately, the weaknesses observed in this review are common in educational research (Gersten, Baker, Smith-Johnson, Flojo, & Hagan-Burke, 2004; Pressley & Harris, 1994). Obvious means for correcting these shortcomings are better preparation for researchers and more funding to reduce the compromises researchers often make when they have limited resources.

It is especially important that future writing intervention studies are true experiments that control for instructor effects, report reliability of outcome measures, and provide treatment fidelity data, as these were weaknesses in the studies reviewed here.

With a corpus of just 43 studies, there is considerable need for additional research. The search we conducted was extensive, with no date restrictions, and yet only 43 studies were found. Only five involved students beyond Grade 8. Similarly low numbers of studies for older students were found by Gersten and Baker (2001) and Graham and Harris (2003). More research with older students is needed.

All of the writing interventions assessed here should be the subject of additional research, as most involved six or fewer studies. Other writing interventions tested even less frequently should also be the subject of future research. Emphasis should be placed on assessing maintenance and generalization effects too, as few studies in this review did so.

Which Specific Writing Interventions are Effective with Students with LD?

Of the six writing treatments including four or more studies, strategy instruction, dictation, goal setting, and process writing had positive and statistically significant effects on the writing of students with LD. The practical and theoretical implications of findings for each writing treatment are discussed below.

Strategy instruction. Strategy instruction significantly improved the quality of writing of students with LD. More recent strategy instructional studies had a greater impact on writing quality than studies published before 2002, and SRSD studies produced greater effects than studies that did not use SRSD. The practical implications of these findings are that teaching students with LD to plan, write, and revise using strategy instruction is an effective method for improving their writing. These effects are most pronounced if strategies are taught via SRSD. This approach emphasizes criterion-based instruction and teaches students the background strategies and self-regulation procedures needed to use the target strategies effectively (Harris et al., 2008). These findings are similar to those obtained in other meta-analyses examining strategy instruction in studies conducted with a broad range of students (Graham, 2006; Graham & Harris, 2003; Graham et al., in press).

Most of the positive effects for strategy instruction were for students in Grades 4 to 8, but two studies also produced positive effects for high school students (Bryson & Scardamalia, 1996; Eissa, 2009), so this method appears promising for older students too. The effects of strategy instruction also support Graham's (1997) theoretical contention that the writing difficulties experienced by students with LD are due to strategic difficulties with planning, revising, and editing. When they are taught strategies for carrying out these processes, students with LD show considerable improvement in the quality of their writing.

Although strategy instruction treatments were better represented in the literature than any other writing treatments, additional research is still needed. Few studies assessed strategy instruction for revising and editing. In addition, strategy instruction studies need to be conducted with a wider grade range of students with LD, with a variety of writing genres, and with different writing strategies.

Dictation. Students with LD who dictated their compositions into a tape recorder or to a scribe showed greater writing improvements than students who composed by hand. In terms of classroom practice, short dictation interventions (1 to 3 days) were effective in improving the writing of students with LD in elementary and middle grades. It appears dictation into a tape recorder provides a relatively low cost option for assisting students. However, it must be noted that in each study reviewed here adults transcribed oral compositions, reducing the practicality of dictation in the classroom.

Theoretically, the positive impact of dictation interventions supports the contention that problems with transcription skills (e.g., handwriting, spelling) contribute to the writing difficulties of students with LD (Graham & Harris, 2003). When the demands of text transcription were removed via dictation, students with LD produced texts of higher quality, presumably because interference from mechanical concerns was lessened (Baker et al., 2003).

Future studies should test dictation beyond Grade 8. High school students with LD are less likely to receive instruction in handwriting and spelling; thus, transcription difficulties that still exist are likely to impact their writing. Although the practicality of using dictation procedures remains an open question, high school students may be ideal candidates for dictation interventions, including speech to text synthesis.

Goal setting. Setting goals for writing was also an effective intervention for improving the writing of students with LD. Similar to the findings reported by Graham and Perin (2007), relatively short goal setting interventions, involving goals for revising or including specific genre elements, were effective for students in upper elementary and middle grades. Only four studies of goal setting interventions with students with LD were located, so more research testing this intervention is needed. Despite this limitation, providing students with goals for their writing is a relatively easy process, which can be translated into classroom practice with minimal preparation or use of instructional time.

Theoretically, the positive impact of goal setting in the studies reviewed here suggests students with LD possess greater capabilities for carrying out writing processes than they apply spontaneously. The writing and revising behaviors of these students were positively changed by directing their attention to what needed to be done while writing. Their failure to typically apply capabilities they possess is likely a consequence of multiple factors. For example, many students with LD view writing as a process of simply generating text (Graham & Harris, 2003), potentially limiting the knowledge, skills, and writing processes they apply when writing. Because students with LD often develop negative beliefs about their writing capabilities, they may not be motivated to exert the effort needed to apply their capabilities fully. Additional research is needed to examine why students with LD fail to use relevant resources when writing. Future studies should also test the effects of student-created goals with students with LD, as the studies reviewed here involved instructor-developed goals. Such studies may help to learn more about the types of students (e.g., grade level) and types of goals students with LD can set and achieve on their own.

Process writing. Process writing was effective in improving the writing quality of students with LD in the elementary grades. Our finding differed from the conclusion drawn in a meta-analysis by Sandmel and Graham (2011). They did not find process writing to be effective with struggling writers. The primary difference between the two reviews was that Sandmel and Graham included studies involving English language learners.

Theoretically, process writing may be effective for improving the writing of students with LD because it addresses a number of the difficulties they experience. With process writing, students learn to follow the stages involved in writing, addressing difficulties students with LD may have understanding how to approach writing and what writing entails beyond surface-level components such as text generation or spelling (Graham et al., in press). Process writing also incorporates writing for authentic purposes and audiences, which may provide incentives for students with LD who lack motivation to write (Baker et al., 2003). It further involves direct instruction in writing skills as the need arises, which may serve to bolster the weaknesses students with LD have with specific aspects of writing (Graham, 2006; Graham & Harris, 2003).

As with the other writing treatments examined in this review, additional research is needed. Future studies should examine the impact of this treatment with older students, as the studies reviewed here only involved students in the elementary grades. The long-term impact of process writing also needs to be assessed. Additionally, component analysis studies need to be undertaken to determine which instructional elements of process writing, or combinations of instructional elements, have the greatest positive impacts on students' writing quality.

One caveat for implementing process writing in the classroom is that it may require considerable changes in how some educators teach writing (e.g., instruction is targeted to students' needs as they arise, sustained time for writing is provided). Thus, teachers interested in implementing this approach should be prepared for the time and effort involved in setting up and running an effective process writing classroom.

Treatments designed to enhance a specific writing process were only effective when time was devoted to teaching the writing skill or process.

Instruction versus minimal to no instruction. Treatments designed to enhance a specific writing process were only effective when time was devoted to teaching the writing skill or process. Thus, simply providing students with a graphic organizer or procedure to use while writing, without providing explicit instruction, modeling, and guided practice, is likely insufficient for students with LD. To learn to use these writing processes independently, students with LD need systematic instruction, teacher support, and scaffolding. This finding seems obvious, given what we know about the writing weaknesses of students with LD, as well as theories about the processing and working memory difficulties of these students (Swanson, Harris, & Graham, 2003). Not only does instruction and scaffolding provide students with LD the writing skills they lack, but it likely provides the practice required to internalize these skills. Although other

reviews have suggested that explicit instruction is important to the writing success of students with LD (Gersten & Baker, 2001), this is the first study to test this proposition.

Limitations

Although the findings from this meta-analysis support and extend what is known about effective writing treatments for students with LD, five factors limit interpretation of the results. One, we tried to locate all possible studies using a variety of search methods, but it is possible that a publication bias exists, as studies with smaller *ES*s are less likely to be publically available. Two, conclusions from our analysis must be tempered due to variability in comparison conditions across studies reviewed. Three, as noted earlier, conclusions presented in this article are limited by the quality of the studies available. Four, a majority of studies reviewed involved upper elementary and middle school students, limiting the generalizability of our conclusions. Five, we limited our review to studies where writing quality was the outcome measure. Not all studies, however, applied the same quality measure, and a sole focus on writing quality excluded some types of writing interventions. For example, we located no handwriting or spelling intervention studies where writing quality was assessed.

Future Directions

Taken together, the findings from this review and their theoretical implications lead us to an overarching recommendation for future research. Good writing involves mastery of and simultaneous use of multiple skills (e.g., planning, transcribing, revising) (Gersten & Baker, 2001; Graham & Harris, 2003), and students with LD tend to struggle with many of them. Thus, perhaps most importantly, future research should evaluate comprehensive writing programs and multicomponent interventions that involve teaching a wide range of writing skills to students with LD.

In fact, there is some evidence that programs targeting a range of writing skills are effective for students with LD. In Bui, Schumaker, and Deshler (2006), a program combining several writing strategies, genre elements instruction, and the process approach to writing had a positive impact on the writing quality of students with LD in Grade 5. Similarly, in MacArthur et al. (1995), fifth-graders with LD who participated in a writer's workshop, composed on a word processor, and learned planning and revising strategies outperformed students in a control group who participated in business-as-usual writing instruction. More research is needed to replicate findings for these types of multicomponent programs with other grade levels and with other combinations of evidence-based writing instruction. With more multifaceted evidenced-based approaches to writing instruction, researchers and teachers may be able to better meet the complex writing needs of students with LD.

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