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Abstract

Students with writing difficulties and learning disabilities struggle with many aspects of the writing process, including use of sentence-level skills. This literature review summarizes results from 19 published articles that used single-case or group-experimental and quasi-experimental designs to investigate effects of intervention on the sentence-level skills of handwriting, sentence construction, and grammar/usage. Results suggest struggling writers benefited from intervention, particularly in handwriting and sentence construction, and transferred acquired skills to more complex tasks such as sentence writing and extended composition. Also presented are the implications for research and practice.

Keywords

sentence construction, handwriting, grammar and usage, learning disabilities

Many social, academic, and vocational outcomes require proficient written expression. Individuals increasingly use electronic correspondence through email or blogs to communicate socially (Boyd, 2008). Proficient written expression also correlates to success in writing and reading intensive undergraduate classes (Arum, Roksa, & Cho, 2011) and salaried employment and promotion (National Commission on Writing, 2004). Furthermore, school students from primary to high school grades use written expression to communicate academic knowledge on state-wide assessments mandated by No Child Left Behind (NCLB, 2001). NCLB mandated assessment of all students, regardless of disability, toward grade-level state standards (Cho & Kingston, 2011).

On broad measures, many students struggle with one or more aspect of written expression, achieving only a basic or below level of performance. In 2007, 6% of 8th-grade students with disabilities and 34% of students without disabilities scored proficient or above on the writing subtest of the National Assessment of Educational Progress. Proficiency means adequate performance on challenging writing tasks, but scoring at a basic level or below indicates difficulty with one or more aspect of writing (Salahu-Din, Persky, & Miller, 2008). Performance further decreases in upper grade levels. In 12th grade, 5% of students with exceptionalities scored proficient or above, compared with 26% of typically developing students (U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, 2009).

Intervention researchers have found that many struggling writers or writers with learning disabilities (LD) have not acquired appropriate strategies and skills, and report low motivation to engage in writing tasks (Graham & Harris, 2009). During composition, students with LD display nonfluent handwriting (Weintraub & Graham, 1998) and construct short, choppy, or incomplete sentences with numerous errors in spelling, punctuation, grammar, and capitalization (Kline, Schumaker, & Deshler, 1991; Newcomer & Barenbaum, 1991).

Constraints to Proficient Written Expression

Berninger and colleagues (1992) suggest the path to proficient written expression rests on three dynamic and interactive levels of writing development: neurodevelopment, linguistics, and cognitive. Neurodevelopment describes the physical and neurological maturation needed for visual-motor tasks of handwriting and spelling. At the linguistic level are sentence-level skills needed to produce letters, words, and sentences of appropriate syntax. The cognitive

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level refers to skills of composing extended text and strategies to regulate the writing process.

The three levels of development form an interactive system of written expression: levels interact with each other, maintaining conservative growth and preventing drastic changes in written expression. For example, difficulty with visual-motor development constrains written expression to a low frequency and results in more difficulty acquiring handwriting and spelling. Conversely, adequate neurodevelopment constrains written expression to a moderate-high frequency, making acquisition of handwriting easier in comparison.

Because multiple levels constrain written expression, the research literature would benefit from identification of multiple and related interventions capable of immediate change in linguistic skills and distal change in related skills. Kameenui and Simmons (1990) proposed researchers and practitioners view constraints along a continuum of component-composite skills. Writing constraints have smaller component skills that build into larger composite skills and repertoires. Smaller component skills of linguistics begin at the sentence level (Graham, 2006), including handwriting, sentence construction, and grammar/usage. Handwriting refers to legible transcription of letters. Sentence construction occurs when writers arrange words or phrases into sentence types, such as simple or compound sentences. Grammar/usage describes conventions of appropriate grammar, punctuation, and capitalization.

Prior reviews of the literature have typically investigated effects of intervention on a single or a few sentence-level skills. In a narrative review of the handwriting literature, Graham and Weintraub (1996) found increased performance following direct instruction of handwriting with visual and verbal models of letter formation. In addition, several meta-analyses found students benefited from instruction on sentence construction (Graham & Perin, 2007; Hillocks, 1986; Mason & Graham, 2008; Rogers & Graham, 2008), and capitalization and punctuation (Rogers & Graham, 2008), but found mixed results on grammar instruction (Graham & Perin, 2007; Rogers & Graham, 2008). No review has collectively synthesized the sentence-level skill literature, including grammar/usage, sentence construction, and handwriting.

The field stands to benefit from a narrative review of the intervention literature on sentence-level skills for students with difficulties or exceptionalities. A narrative review synthesizes results and intervention components across a range of design types, including single-case, group, or quasi-experimental studies. The process of aggregating results into a single effect size (ES) makes it difficult for meta-analyses to include studies of a full range of design types. In addition, the primary ES used to aggregate single-case research, percentage of non-overlapping data, has come under increasing scrutiny for potential inaccuracies in

detecting experimental effects (Wolery, Busick, Reichow, & Barton, 2010). A narrative review of the literature avoids these complications in favor of a descriptive delineation of each study. Precisely identifying results and intervention components across studies may lead to recommendations useful to practitioners and test the boundaries of an assumed relationship between component and composite writing skills.

The present narrative literature review synthesized effects of intervention on sentence-level skills of handwriting, sentence construction, and grammar/usage. The review sought to answer two main questions. What interventions have researchers used to teach sentence-level writing skills to students with writing difficulties or LD? What effect has intervention had on sentence-level skills, component skills, and transfer of those skills to more complicated, composite tasks?

Method

Location and Selection of Articles

Studies included for review had to meet four criteria. First, studies used an experimental, quasi-experimental, or single-case research design with quantitative results. Second, studies directly manipulated an independent variable designed to teach grammar/usage, sentence construction, or handwriting. Given a previous review of the handwriting literature (Graham & Weintraub, 1996), the review did not include handwriting studies published prior to 1994 but included grammar/usage and sentence construction studies prior to 1994. Third, participants enrolled in Grades K–12 and received special education services for LD. Participants with writing difficulties in Grades K–4 also met inclusion criteria because referral for special education services tend not to emerge until upper elementary grades (Berninger & Amtmann, 2003; Levine, Oberklaid, & Meltzer, 1981). This review relied on each study to define participant characteristics of LD and writing difficulties. Fourth, the article appeared in a peer-reviewed journal.

The search process consisted of four distinct phases. An electronic search of PsychInfo and ERIC databases included descriptors related to expressive writing: *alphabetic, alphabets, basic skills, basic writing, capitalization, context free grammar, duplication, grammar, handwriting, handwriting legibility, printing, punctuation, sentences, sentence diagramming, sentence structure, writing ability, written communication, writing composition, writing exercises, writing instruction, writing research, writing skills, academic failure, at risk populations, disabilities, learning disabilities, learning disorders, and writing difficulties*. The search revealed 998 articles. The lead author read the abstract of each article and retained articles meeting the above criteria. Several articles did not qualify that investigated effects of

concurrent spelling intervention (e.g., Berninger, Abbott, Whitaker, & Sylvester, 1995; Berninger et al., 2002; Brooks, Vaughan, & Berninger, 1999), accommodations of extended time, (e.g., Crawford, Helwig, & Tindal, 2004), and student graphing of performance (e.g., Kasper-Ferguson & Moxley, 2002; Stotz, Itoi, Konrad, & Alber-Morgan, 2008).

A total of 17 articles met inclusion criteria. Next, a hand search of all journals containing an identified article revealed two additional articles meeting criteria. An ancestral search of identified articles revealed no additional articles meeting inclusion criteria. A total of 19 articles met inclusion criteria. To ensure accuracy of search procedures, a graduate assistant independently duplicated electronic and hand search procedures. The search revealed no additional articles meeting inclusion criteria.

Following location and selection of articles, coding for each study fell into three distinct categories used in prior studies and literature reviews (Berninger, Cartwright, Yates, Swanson, & Abbott, 1994; Graham & Perin, 2007; Hillocks, 1986; Rogers & Graham, 2008). Handwriting encompassed teaching participants legible formation of alphabetic letters or words. Sentence construction studies delivered instruction or taught use of a strategy and reported measures of sentences or word sequences. For grammar/usage studies, students were taught skills of grammar, punctuation, and/or capitalization. Studies reporting measures for more than one skill received a code in multiple categories. Final categories included grammar and usage (3 studies), sentence construction (9 studies), and handwriting (10 studies). The lead author taught category definitions to an independent rater using a set of example articles. Instruction continued until the rater achieved 100% accuracy placing example articles into the proper category. Following instruction, the rater independently coded all selected articles and achieved 100% agreement with the lead author.

Evaluating Effects of Intervention

To evaluate effects of interventions using group designs, the authors calculated an ES or Cohen's *d* for each individual study but did not aggregate ESs across studies into a single statistic as commonly found in meta-analyses. The ES was the difference in means of a single group from pretest to posttest or between two groups at posttest divided by the pooled standard deviation (Lipsey & Wilson, 2001). General guidelines to interpret significance of the ES include .20 as small, .50 as medium, and .80 as large (Cohen, 1988). The authors described effects of interventions when studies did not report statistics needed to calculate ES.

For single-case designs, the authors evaluated effects by looking for multiple replications of experimental control across behaviors and/or participants (Horner, Carr, Halle, Odom, & Wolery, 2005; Kratochwill et al., 2010). A functional relationship occurred when introduction of an

independent variable corresponded to a predictable and consistent change in the dependent variable. Due to concerns with several statistics used to evaluate replications within single-case designs, experimenters used visual analysis of data on graphic displays to discern replications. Kazdin (2011) suggested visual analysis for changes in magnitude and rate. Magnitude refers to changes in mean or average across experimental phases and level or immediate increases or decreases following intervention. Rate refers to the direction, increase or decrease, and the degree or steepness of trend.

Results

This section presents results according to categories of handwriting, sentence construction, and grammar/usage. Each category describes study and participant characters then intervention components.

Handwriting

Study and participant characteristics. Ten studies investigated effects of intervention on handwriting (Berninger et al., 1997; Berninger et al., 2006; Burns, Ganuza, & London, 2009; Graham, Harris, & Fink, 2000; Jones & Christensen, 1999; Mackay, McCluskey, & Mayes, 2010; Sudsawad, Trombly, Henderson, & Tickle-Degnen, 2002; Veena, Romate, & Bhogle, 2002; Zwicker & Hadwin, 2009). Table 1 summarizes participant demographics, study characteristics, and results. Handwriting studies included a total of 394 participants. All participants were enrolled in primary grades. The age of participants ranged from a mean of 6 to 10 years. Researchers described all participants as struggling in handwriting.

Dependent variables used to measure handwriting performance prior to intervention varied across studies. Six studies included participants with low scores on alphabet and copy tasks (Berninger et al., 1997; Berninger et al., 2006; Jones & Christensen, 1999; Veena et al., 2002; Zwicker & Hadwin, 2009). During alphabet tasks, participants sequentially wrote alphabet letters from memory. Copy tasks required participants to copy letters of the alphabet or text taken from grade-level passages. Two studies (Mackay et al., 2010; Sudsawad et al., 2002) included participants nominated by teachers as having difficulty and displaying below-average performance on the Kinesthetic Sensitivity Test (Laszlo & Bairstow, 1985) and the Minnesota Handwriting Assessment (Reisman, 1999).

Intervention components. Handwriting is defined as the legible formation of alphabetic letters (Graham & Weintraub, 1996). Multiple processes support handwriting (Berninger et al., 1992): orthographic coding, fine-motor, and visual-motor processes. To form alphabetic letters, writers must store images of the alphabet and words in

Table 1. Summary of Handwriting Studies.

Authors	Participants (n, Grade, M Age)	Study Design	Study Duration	Independent Variables	Results
Berninger et al. (1997)	114, 1st grade, 6 years old	TC	24 sessions, 20 min each	(a) Motor imitation (b) Visual cue (c) Memory retrieval (d) Visual cue + memory retrieval (e) Copy (f) Phonological awareness	(d) Highest growth on alphabet task, ES = 1.71, and copy task, ES = 1.12
Berninger et al. (2006), Study 1	14, 1st grade, NA	TC	10 sessions, 30 min each	(a) Handwriting, orthographic, and motor (b) Handwriting only	(b) Superior in all speed measures, (a) Better alphabet task accuracy
Berninger et al. (2006), Study 2	20, 1st grade, 6 years old	TC	10 sessions, 30 min each	(a) Handwriting, orthographic (b) Handwriting, motor	(a) and (b) equally effective
Burns, Ganuza, and London (2009)	1, 2nd grade, NA	SC	3 to 4 sessions per week, 8 weeks	(a) Cover–copy–compare (b) Baseline	Participant improved on two of three sets of letters: percentage of correctly formed letters changed in mean and accelerated in trend.
Graham, Harris, and Fink (2000)	38, 1st grade, 6 years old	TC	27 sessions, 15 min each	(a) Handwriting, orthographic (b) Phonological awareness	(a) Superior to (b) on alphabet task, ES = 1.17
Jones and Christensen (1999)	38, 2nd grade, 6 years old	TC	8 weeks, 10 min daily	(a) Handwriting, orthographic (b) No treatment	(a) Superior growth on alphabet task, ES = 2.09
MacKay, McCluskey, and Mayes (2010)	16, NA, 6.8 years old	SG	8 sessions, 45 min each	(a) Log handwriting program	(a) Copy tasks improved in legibility, form, and size, ES = 1.59, but decreased in speed
Sudsawad, Trombly, Henderson, and Tickle- Degnen (2002)	45, 1st grade, 6 years old	TC	6 sessions, 30 min each	(a) Kinesthetic (b) Handwriting (c) Control	No significant differences but (a) scored higher word legibility, ES = 0.13, and lower letter legibility, ES = -0.11 than (b)
Veena, Romate, and Bhogle (2002)	36, NA, 7 to 9 years old	TC	12 sessions, 30-40 min each	(a) Handwriting only (b) Handwriting, behavior intervention (c) No treatment	(a) and (b) superior to (c), ES = 3.22
Zwicker and Hadwin (2009)	72, 1st to 2nd grade, NA	TC	10 sessions, 30 min each	(a) Cognitive (b) Multisensory (c) No treatment	No significant differences but (a) ES = 0.50 and (b) ES = 0.39 scored higher than (c)

Note. TC = treatment comparison; ES = effect size; SC = single case; SG = single group.

memory, known as orthographic coding; transcribe letters using fine-motor processes; and adjust motor movement according to visual input (e.g., legibility and writing within margins). Handwriting studies varied on their focus, either teaching letter formation or expanding to one of the related processes.

Letter formation. Two studies focused on teaching letter formation. Berninger et al. (1997) found a combination of memory retrieval and visual cues resulted in the highest performance across time on an alphabet task (ES = 1.71)

and copy task (ES = 1.12). Visual cues featured numbers and arrows surrounding each letter to prompt correct letter formation and sequence. Memory retrieval required participants to examine a fully formed letter before covering it up for an increasing amount of time. Participants wrote the letter from memory and following a delay, uncovered the model letter to compare for accuracy.

Burns and colleagues (2009) successfully used a cover–copy–compare (CCC) approach to letter formation, similar in topography to memory retrieval, with one participant across three sets of distinct alphabetic letters. The

participant viewed a model of correct letter formation, covering the model, copying it from memory, and compared it with the original model. If the copied letter compared favorably with the model, then the participant transcribed the letter five additional times.

Letter formation and orthographic coding. Two studies intervened on letter formation and the related process of orthographic coding. One study (Graham et al., 2000) emphasized visual cues of arrows and numbered strokes to guide correct letter formation. To teach orthographic coding, participants sang the alphabet with and without prompting and orally responded to sets of letters with the names of letters before or after the set. At posttest, alphabet task scores differed significantly from a control group that received phonological awareness instruction ($ES = 1.17$).

Jones and Christensen (1999) delivered a similar letter formation intervention, but orthographic coding procedures differed slightly. For orthographic coding, participants had to write missing letters within an alphabetic sequence. Across time, the alphabet sequence contained more blanks for participants to fill with the correct letter. Prior to intervention, participants in the intervention group differed significantly from a control group of high-performing writers on the alphabet task; however, no difference remained at posttest ($ES = 2.09$).

Letter formation and motor intervention. Three studies investigated the benefits of adding a motor-process component to handwriting interventions. The first study of a multiple study article (Berninger et al., 2006) found participants receiving instruction in letter formation displayed faster speed but less accuracy on an alphabet task compared with a group that received multiple interventions of letter formation, motor skills, and orthographic coding. Motor intervention included activities designed to affect hand strength, kinesthetic awareness in fingers and hands, dexterity, and motor planning. In the second study of a multiple study article, Berninger et al. (2006) separated effects of motor skill from orthographic coding but found no difference.

Veena and colleagues (2002) delivered motor intervention and tangible reinforcement contingent upon performance in addition to letter formation instruction. The authors stated use of motor interventions to improve muscular control and eye–hand coordination but did not provide detailed procedures. Experimenters adapted a rubric from the Test of Written Language–2 (TOWL-2; Hammill & Larsen, 1988) to provide a holistic score on handwriting. At posttest, both treatment groups that received only instruction or instruction with tangible reinforcement outperformed a control group of no treatment ($ES = 3.22$).

MacKay et al. (2010) combined motor and handwriting instruction. Motor intervention included kinesthetic activities such as finger movements and multisensory activities like clay manipulation and letter tracing in rice kernels.

During handwriting, participants copied letters, words, and sentences. Instruction featured visual cues of lines, dots, and images to prompt correct letter height and spacing. For example, participants transcribed letters between two lines that looked like wooden logs and a finger puppet image prompted correct spacing between words. Participants increased in legibility of copy tasks on the Minnesota Handwriting Assessment (Reisman, 1999) from pretest to posttest ($ES = 1.59$) but decreased in speed.

Letter formation or motor intervention. Two studies compared handwriting outcomes from participants who received either motor intervention or letter formation. Sudsawad and colleagues (2002) had participants complete activities designed to improve kinesthetic movement or the position and sensation of body parts without visual input. Activities included identifying the height of various arm positions and tracing stencil patterns without the benefit of viewing the stencil or coordinating eyesight with hand movements. For handwriting instruction, participants copied individual letters, words, and sentences, and received feedback on incorrect letter formation from the instructor. At posttest, the handwriting group improved slightly on word legibility in comparison with the fine-motor group ($ES = 0.13$) but scored lower on letter legibility ($ES = -0.11$) as measured by a composite score that combined results from alphabet and copy tasks (Amundson, 1995). The scores failed to differ from a control group that received no intervention.

One study (Zwicker & Hadwin, 2009) compared motor instruction to handwriting with orthographic coding. Motor instruction focused on multisensory activities with various tactile sensations. Participants traced letters with an index finger on different surfaces, such as sand, cornmeal, or on letters written in glue or glitter. Instruction in handwriting and orthographic coding replicated procedures from Graham and colleagues (2000). Compared with a control group of no intervention, the handwriting with orthographic coding group ($ES = 0.50$) and motor intervention group ($ES = 0.39$) scored higher at posttest on a composite measure of alphabet and copy tasks (Amundson, 1995). Scores did not differ significantly, however, from the control.

Sentence Construction

Nine studies investigated the effects of intervention on sentence construction (Anderson & Keel, 2002; Bui, Schumaker, & Deshler, 2006; Dowis & Schloss, 1992; McCurdy, Skinner, Watson, & Shriver, 2008; Saddler, Asaro, & Behforooz, 2008; Saddler, Behforooz, & Asaro, 2008; Saddler & Graham, 2005; Viel-Ruma, Houchins, Jolivet, Fredrick, & Gama, 2010; Walker, Shippen, Alberto, Houchins, & Cihak, 2005). Table 2 summarizes participant demographics, study characteristics, and results. Studies included a total of 207 participants. The majority of participants enrolled in primary and middle school grades

Table 2. Summary of Sentence Construction Studies.

Authors	Participants (<i>n</i> , Grade, <i>M</i> Age)	Study Design	Study Duration	Independent Variables	Results
Anderson and Keel (2002)	10 (5 LD, 5 EBD), 4th to 5th grade, NA	SG	25 sessions, 35-50 min each	(a) Reasoning and writing	Majority improved from pre to post on the TOWL-2 syntactic maturity subtest. ES = 0.48
Bui, Schumaker, and Deshler (2006)	113 (14 LD), 5th grade, NA	TC	30 sessions, 45-60 min each	(a) Demand writing instruction model (DWIM) (b) Typical instruction	(a) Grew significantly from pre to post on proportion of complete sentences, ES = 1.64, and complicated sentences, ES = 1.18
Dowis and Schloss (1992) ^a	4 LD, 6th grade, 12 years old	SC	5 to 8 sessions, 10 min each	(a) Possessives instruction (b) Complex sentence instruction (c) No treatment	Three of four participants had changes in mean, level, and trend on percentage of correct complex sentences
McCurdy, Skinner, Watson, and Shriver (2008)	17 (15 LD, 2 MR), 9th grade, 14 years old	SC	Average 23 sessions, 10 min each	(a) Comprehensive writing program (CWP) (b) No treatment	One out of three classrooms had immediate changes in level and trend of percentage of sentences; two other classrooms had positive but more modest increases; maintenance had high variability
Saddler, Asaro, and Behforooz (2008)	4 LD, 4th grade, 9 to 10 years old	SC	18 sessions, 35 min each	(a) Sentence combining (b) No treatment	Both dyads showed changes in level, mean, and had an accelerating trend
Saddler, Behforooz, and Asaro (2008)	6 (3 LD), 4th grade, 9 to 10 years old	SC	Avg. 23 sessions, 10 min each	(a) Sentence combining (b) No treatment	Two out of three dyads showed improved mean performance and/or immediate changes in level
Saddler and Graham (2005) ^a	44, 4th grade, 9 years old	TC	30 sessions, 25 min each	(a) Sentence combining (b) Grammar instruction	(a) superior to (b) on TOWL-3 sentence-combining subtest, ES = 0.83
Viel-Ruma, Houchins, Jolivet, Fredrick, and Gama (2010)	6 LD (3 ELL), 9th to 11th grade, 14 to 17 years old	SC	26 sessions, 30-45 min each	(a) Expressive writing program (b) No treatment	Two of six participants displayed immediate changes in level. All mean performances increased an average of 12 percentage points
Walker, Shippen, Alberto, Houchins, and Cihak (2005)	3 LD, NA, 15 to 16 years old	SC	50 sessions, 50 min each	(a) Expressive writing program (b) No treatment	All three participants increased in mean with gradual ascending trends

Note. LD = learning disabilities; EBD = emotional behavioral disability; SG = single group; TOWL = Test of Written Language; ES = effect size; TC = treatment comparison; SC = single case; MR = mental retardation; ELL = English language learner.

^aStudy also examined grammar/usage.

with a few studies including high school students. The age of participants ranged from a mean of 9 to 17 years. All studies but one (Saddler & Graham, 2005) specifically included participants with disabilities. Prior to intervention, participants across studies displayed similar performance on measures of written expression.

Five studies (Saddler, Asaro, et al., 2008; Saddler, Behforooz, et al., 2008; Saddler & Graham, 2005; Viel-Ruma et al., 2010; Walker et al., 2005) found low performance on the TOWL-3 (Hammill & Larsen, 1996). In addition, participants wrote very few complete sentences when compared with their typically developing peers (Bui et al., 2006; McCurdy et al., 2008) and had low percentages

of complex sentences (Dowis & Schloss, 1992). Two studies noted low amounts of correct word sequences (CWS). CWS serves as a sensitive, global measure of writing performance (McMaster et al., 2011) and calculates instances of correct capitalization, spelling, and syntactically appropriate words.

Intervention components. Studies included for review either started intervention on simple sentences before progressing to more complicated sentence types or started with more complicated sentences. Simple sentences contain at least one subject and predicate. More complicated constructions include compound or complex sentences. Compound

sentences have at least two simple sentences combined together with a conjunction and comma. Complex sentences feature at least one simple sentence joined together with a dependent phrase, such as a phrase describing when or why an action occurred.

Starting with simple sentences. Four studies found improved syntactic and sentence performance following instruction featuring model–lead–test formats (Archer & Hughes, 2011). Three model–lead–test studies (Anderson & Keel, 2002; Viel-Ruma et al., 2010; Walker et al., 2005) used commercially available programs (Adams & Engelmann, 1996). Instructors modeled simple sentence construction with picture–word prompts. For example, participants saw a picture of a female carrying logs with the words “Sara” and “logs.” Using the prompted words, participants vocally described pictures, and instructors provided immediate error correction. If vocal responses proved correct, then participants transcribed their responses onto paper. Instructors gradually faded assistance until participants transcribed sentences without having to provide a vocal response beforehand. Sentence constructions gradually became more sophisticated, progressing to compound and complex constructions, as instructors taught irregular verb usage, subject–verb agreement, and appropriate capitalization and punctuation. Participants eventually acquired either compound or complex sentence types.

McCurdy and colleagues (2008) also used the model–lead–test instructional format (Archer & Hughes, 2011) as part of a multicomponent intervention to teach simple sentences, sentences with adjectives, and compound sentences across three classrooms. Instead of using picture–word prompts, instructional materials presented examples of complete and incomplete sentences. Following instruction, participants chose one of two story starters and wrote an extended composition. Instructors graded compositions for the percentage of complete sentences, adjectives, and compound sentences. Participants received individual feedback on performance, and instructors posted classroom averages from each composition within the classroom. Instructors delivered reinforcement contingent on classroom averages.

One study (Bui et al., 2006) used *Fundamentals of Sentence Writing* (Schumaker & Sheldon, 1998) to teach simple and compound sentence construction. Following procedures from the Strategic Instruction Model (Deshler & Schumaker, 1988), instructors modeled the PENS MARK writing strategy and gradually faded assistance to guided and independent application of the strategy. PENS MARK stood for Pick a sentence formula, Explore words to fit the formula, Note the words, Search and check, Mark out the imposters, Ask if there is a verb, Root out the subject, and Key in on the beginning, ending, and meaning. Participants who received the intervention increased significantly on the proportion of complete sentences ($ES = 1.64$) and the proportion of complicated sentences ($ES = 1.18$) from pretest to

posttest. In comparison, a control group that received no intervention decreased in the proportion of complete sentences and showed no improvement on complicated sentences.

Starting with complicated sentences. Four studies began instruction with complicated sentence constructions and found increased performance. Three studies (Saddler, Asaro, et al., 2008; Saddler, Behforooz, et al., 2008; Saddler & Graham, 2005) used sentence-combining techniques to produce gains in complicated sentences. Instructors modeled combining two or more simple sentences, called kernel sentences, with connectors. Connectors included adjectives, underlined phrases within kernels, and conjunctions. In each study, students partnered into same skilled or different skilled dyads. Dyads followed protocols from peer-assisted learning strategies (Fuchs, Fuchs, Mathes, & Simmons, 1997). One partner served as the “player” and the other served as “coach.” The coach provided feedback and encouragement during practice and partners alternated roles.

Saddler and Graham (2005) paired less skilled writers with more skilled writers into instructional dyads. Less skilled writers who received sentence-combining instruction significantly outperformed less skilled writers who received grammar instruction at posttest on the TOWL-3 sentence-combining subtest ($ES = 0.83$). Two other sentence-combining studies (Saddler, Asaro, et al., 2008; Saddler, Behforooz, et al., 2008) paired students with LD into dyads and found similar results.

Using a similar technique to sentence combining, Dowis and Schloss (1992) taught complex sentences construction to four students with LD. Instructors provided a rule that adverbial phrases tell when, how, or where an action occurred. Participants created complex sentences by generating adverbial phrases to append to complete sentences. Following intervention in a multiple baseline design, three of the four participants displayed changes in mean, level, and trend on percentage of correct complex sentences found in probes.

Grammar and Usage

Study and participant characteristics. Three studies investigated effects of grammar/usage instruction (Campbell, Brady, & Linehan, 1991; Dowis & Schloss, 1992; Saddler & Graham, 2005). Table 3 describes participant demographics, study characteristics, and results. Studies included a total of 51 participants. All the studies included participants enrolled in primary and middle school grades. The age of participants ranged from a mean of 9 to 12 years. Studies used varying measures to describe participant performance prior to intervention. One grammar study noted low performance on the Sentence-Combining subtest from the TOWL-3 (Hammill & Larsen, 1996). Two grammar/usage

Table 3. Summary of Grammar/Usage Studies.

Authors	Participants (<i>n</i> , Grade, <i>M</i> Age)	Study Design	Study Duration	Independent Variables	Results
Campbell, Brady, and Linehan (1991)	3 (2 LD, 1 MR), NA, 9 years old	SC	17 to 28 days, 15 to 20 min each	(a) Capitalization instruction (b) No treatment	One participant had high amounts of variability, but all participants improved in mean, level, and trend
Dowis and Schloss (1992) ^a	4 LD, 6th grade, 12 years old	SC	5 to 8 sessions, 10 min each	(a) Possessives instruction (b) Complex sentence instruction (c) No treatment	Three of four participants had changes in mean across phases. Two participants immediately increased level and mean, rising from 0% to 10% to 90% to 100%
Saddler and Graham (2005) ^a	44, 4th grade, 9 years old	TC	30 sessions, 25 min each	(a) Sentence combining (b) Grammar instruction	(a) Superior to (b) on TOWL-3 sentence-combining subtest, ES = 0.83

Note. LD = learning disabilities; MR = mental retardation; SC = single case; TC = treatment comparison; TOWL = Test of Written Language; ES = effect size.

^aStudy also examined sentence construction.

studies (Campbell et al., 1991; Dowis & Schloss, 1992) reported low performance on correct capitalization and possessive use.

Intervention components. Two studies taught appropriate rules of usage (Campbell et al., 1991; Dowis & Schloss, 1992). Campbell et al. (1991) taught more skilled writers to tutor less skilled writers with LD on correct capitalization rules. Participants acquired either one or two sets of capitalization rules, including capitalizing the first word of each sentence, proper nouns, days of the week, and holidays. Tutors quizzed students on the rules, modeled correct usage of the rules, and guided students during practice. Dowis and Schloss (1992) taught participants correct use of possessives. Instructors modeled correct usage of possessive and guided participants to independent performance.

Only one study investigated effects of grammar instruction (Saddler & Graham, 2005). In a comparison between sentence combining and grammar instruction, researchers paired less skilled writers with more skilled writers into instructional dyads. Instructors modeled identifying several parts of speech: nouns, verbs, adjectives, and adverbs. Once participants acquired the parts of speech, they made incomplete sentences complete by inserting a missing part of speech. Grammar included several parts of speech: nouns, verbs, adjectives, and adverbs. Participants increased from pretest to posttest on the Sentence-Combining subtest from the TOWL-3 (ES = 1.9). Gains fell significantly below a comparison group that received sentence combining.

Transfer of Intervention to Distal Outcomes

Three studies (Berninger et al., 2006; Graham et al., 2000; Jones & Christensen, 1999) directly intervened on handwriting and measured transfer to sentence construction and

composition. Two studies (Berninger et al., 2006; Graham et al., 2000) measured concurrent increases in sentence construction with the Writing Fluency subtest from the Woodcock-Johnson Psycho-Educational Battery-Revised (WJ-R; Woodcock & Johnson, 1990). One study (Berninger et al., 2006) found significant growth from pretest to posttest as measured by difference in slope from another treatment group ($t = 2.57, p \leq .05$). Graham and colleagues (2000) noted gains from pretest to posttest (ES = 0.57) and improved compositional length (ES = 0.58).

In addition, one study (Jones & Christensen, 1999) noted gains in handwriting coincided with gains in compositional quality as measured by an experimenter-created rubric that measured four areas: ideas, spelling and grammar, syntax, and fluency. The rubric had 20 possible points and participants increased in means from 7.42 at baseline to 12.47 following intervention (ES = 2.34).

All sentence construction studies using sentence-combining techniques (Saddler, Asaro, et al., 2008; Saddler, Behforooz, et al., 2008; Saddler & Graham, 2005) obtained increases in writing quality as measured by an experimenter-created rubric used previously in research (Cooper, 1977; Graham & Harris, 1989). The rubric provided a composite measure of several areas: ideation, organization, grammar, sentence structure, word choice, and mechanics. Despite gains in quality, students tended to use only modest amounts of sentence combinations in extended composition. In a direct comparison of sentence combining and grammar, Saddler and Graham (2005) noted students who received grammar instruction displayed no increase in writing quality.

Discussion

This review sought to answer two questions: What interventions have researchers used to teach sentence-level

writing skills to students with writing difficulties or LD, and what effect has intervention had on proximal, component skills and more distal, composite tasks? The following section arranges discussion into three categories of handwriting, sentence construction, and grammar/usage. Then the discussion addresses transfer of intervention to other linguistic or cognitive constraints.

Handwriting

Before intervention, writers displayed characteristically poor performance on measures shown to correlate well to handwriting development (Berninger et al., 1992), such as alphabet and copy tasks. The similar performance across studies suggests commonality in how researchers defined writing difficulties and strengthens comparisons between studies.

Consistent with Graham and Weintraub's (1996) review of the handwriting literature, the vast majority of studies featured models of letter formation. One study compared different types of letter formation models and found visual cues paired with memory retrieval outperformed other model types, including visual cues or memory retrieval alone (Berninger et al., 1997). However, the majority of studies reviewed did not include a memory retrieval component. Instruction in letter formation featuring only visual cues consistently led to increased handwriting performance.

The processes targeted for intervention varied across studies: letter formation, orthographic coding, and motor processes. Interventions targeting letter formation and orthographic coding proved effective, but motor-process interventions did not produce significant outcomes. The inability to capture more significant results suggests participants with writing difficulties, in absence of orthopedic impairment, may benefit more from letter formation and orthographic coding instruction. One study (Veena et al., 2002) found significant results for motor intervention, but researchers should cautiously interpret the study's large ES ($ES = 3.22$). Several problems concerning methodology limit the internal validity of findings, namely, failure to report fidelity of intervention and interobserver agreement on the dependent variable.

Sentence Construction

Consistent with findings from several meta-analyses (Graham & Perin, 2007; Hillocks, 1986; Rogers & Graham, 2008), the present literature review found improved measures of sentence construction. Students with LD displayed improved sentence construction following instruction in simple or complicated sentence types. Studies either started intervention on simple sentences before progressing onto complicated sentences or started with complicated sentences.

The majority of studies beginning with simple sentences followed model-lead-test (Archer & Hughes, 2011) instructional formats. Participants read complete and incomplete sentences and responded to picture-word prompts by constructing simple sentences. Picture-word prompts potentially eases difficulty in writing sentences: shifting task demands from idea generation to picture description (Kameenui & Simmons, 1990).

All but one study starting intervention on complicated sentences used sentence-combining techniques with a peer-assisted learning strategy. The peer-assisted learning strategy was equally effective for students with writing difficulty or students with LD. Sentence combining required peers to combine phrase into complicated constructions such as compound sentence or sentences with adjectives.

Grammar/Usage

In a small number of total studies, instruction in usage of capitalization and possessives proved beneficial to participants. Grammar instruction proved beneficial but less so than sentence-combining instruction. In a direct comparison between instruction in sentence combining or grammar, sentence combining resulted in higher performance, lending support to recommendations that sentence combining may prove more beneficial to remediate sentence construction difficulties (Graham & Perin, 2007; Hillocks, 1986).

Transfer of Intervention to Distal Outcomes

Several studies solely intervening on sentence-level skills, particularly handwriting and sentence construction, found concurrent gains in sentence writing, compositional quality, and compositional length. This finding supports prior research that found relationships from handwriting to composition (Graham, Berninger, Abbott, Abbott, & Whitaker, 1997) and sentence combining to composition (Hillocks, 1986). Both sentence-combining studies, however, did not find a concurrent increase in the amount of taught instances of sentences to extended composition suggesting that increases in quality may not stem from inclusion of more complicated sentence types.

Limitations and Future Directions

The present narrative literature review differed from prior meta-analyses (Graham & Perin, 2007; Rogers & Graham, 2008) in several important ways. The present review did not calculate ESs from single-case experimental designs or aggregate ESs across group design studies. The purpose of this review was to precisely delineate interventions practitioners may find useful, not to provide a measure of statistical inference to a larger population (Shadish, 2007). In addition, the larger field of special education researchers

continues to disagree on whether present ES metrics sufficiently encapsulate the complexities of single-case design results (Wolery et al., 2010). As the literature continues to refine techniques for reviews of the literature, future researchers can build on the present review by calculating single-case design ESs and aggregating ESs across studies.

The small number of studies and participant characteristics tempers results. The present review relied on each study to define characteristics of struggling writers and writers with LD. Studies can differ in demographic and functional descriptions of participants (Wolery & Ezell, 1993) limiting external validity of results. The present review also included only three grammar/usage studies. All three grammar/usage studies reported positive findings, but the studies varied in scope of grammar skills, used different dependent variables, and produced mixed results in a direct comparison with sentence combining. Future research can continue to investigate multiple sentence-level skills permitting a more robust review and synthesis of recommendations.

Future research can also investigate durations needed to affect handwriting. Handwriting remains an important and significant contributor to writing output, but in a recent survey (Graham et al., 2008), 56% of primary-grade teachers reported spending 10 min or less per day on handwriting. The vast majority of studies included for review spent at least twice as much time per day.

Researchers can also investigate the impact of computer use to compensate for difficulty with sentence-level skills and to aid in composition of extended discourse, such as persuasive or expository essays. Keyboarding remains an important transcription skill (Berninger et al., 2002), along with spelling and handwriting, but research on keyboarding remains sparse (Berninger & Amtmann, 2003).

Implications for Practice

The section provides implications for practice for handwriting and sentence construction. Implications for each skill include research-based practices from reviewed studies, steps teachers can immediately take to begin implementation, and potential results.

Handwriting. This review found four specific results teachers of primary-grade students with writing difficulties may want to consider (a) modeling letter formation with visual cues and memory retrieval, (b) using alphabet or copy tasks to monitor student progress, (c) including orthographic coding activities that reinforce letter names and shapes, (d) intervening on motor processes in isolation from alphabetic letters may not improve handwriting performance.

Teachers can quickly assess student handwriting with an alphabet or copy task. During an alphabet task, students write as many letters of the alphabet from memory in 1 min or less depending on student grade level with younger students possibly receiving fewer seconds. In a copy task,

students view words or sentences to copy within a predetermined amount of time. Teachers score the alphabet or copy task for speed and legibility and provide instruction on any errors. Depending on instructional time available, teachers can set aside specific time for handwriting or efficiently teach handwriting within reading and spelling lessons that introduce letter sounds and words. For example, when teaching pronunciation of the sounds /m/ or /a/ also require students to write and practice correct letter formation.

Following the above-mentioned recommendations, teacher can expect improved accuracy and speed of letter formation. Growth on alphabet or copy tasks will also depend on the amount of time available for handwriting instruction and characteristics of their individual students; students with orthopedic impairments may require additional interventions not addressed in this review. In addition to improved handwriting performance, students may display concurrent gains in writing output of words and sentences.

Sentence construction. Teachers of students with LD enrolled in later primary to early high school grades may consider six practices to improve sentence construction: (a) make instructional decisions by analyzing writing for proportion of complete sentences or CWS, (b) follow model–lead–test instructional formats, (c) provide picture–word prompts to teach simple sentences, (d) use sentence combining for more complicated sentences, and (e) gradually increase sentence complexity from simple to more complicated constructions.

To determine whether their students would benefit from intervention on sentence construction, teachers can collect a writing sample from their students. Students should respond to a written or picture prompts for a minimum of 3 to 5 min (Parker, McMaster, & Burns, 2011; Videen, Deno, & Marston, 1982) to capture a sufficient sample of their sentence construction skills. Teachers can score the writing sample for the proportion of complete sentences or CWS, which provide a global measure of capitalization, punctuation, and syntax. Using scores from the writing samples, teachers can schedule time specifically for sentence instruction or embed lessons within story or essay writing tasks. For example, during a narrative story assignment, teachers can model writing sentences with adjectives within the story, lead students through guided practice, and test for independent performance within the students' narrative story.

Following the above-mentioned recommendations, teachers can expect an improved proportion of complete sentences and an increase in syntactically correct words. As a result of increased sentence construction, students may show concurrent gains in how readers judge their writing using a quality rubric (e.g., story cohesion, clear expression of ideas, etc.).

Conclusion

Students with LD or writing difficulties display similar struggles with skills and strategies needed for writing and report less motivation to engage in writing tasks. Problems with written composition partly stem from a relationship between poorly developed sentence-level writing skills and its detrimental impact on more complex writing tasks. The need for effective interventions in sentence-level writing skills remains a concern for both the research community and practitioners who can benefit from the identification of evidence-based practice.

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