Adapting a Sentence Intervention with Spelling and Handwriting Support for Elementary Students with Writing Difficulties: A Preliminary Investigation

Shawn M. Datchuk, Ph.D.
University of Iowa

Ginny A. Dembek, Ph.D.
Brooklyn College, CUNY

Difficulties with two critical transcription skills, handwriting and spelling, can hinder acquisition and use of simple sentences during writing for elementary students. This preliminary investigation used a framework of data-based individualization to adapt and study effects of a multi-component intervention designed to teach simple sentence construction. Two adaptations to the intervention included a modified form of cover-copy-compare procedures for spelling difficulties and extended time for handwriting difficulties. Intervention was delivered across two small groups of elementary students at-risk for or with identified learning disabilities. All students showed gains in simple sentence construction; however, results must be viewed with caution given high variability for some students in performance and several design limitations.

Keywords: **Handwriting, Spelling, Teaching Sentence Construction, Learning Disabilities, Elementary Students**

INTRODUCTION

Written expression can be conceptualized as stemming from multiple cognitive, behavioral, and socio-cultural factors. To express meaning in writing, students draw upon cognitive and behavioral resources to communicate to other readers, writers, and collaborators within their socio-cultural communities (Graham, in press). The cognitive and behavioral skills needed for a robust repertoire of written expression gradually accumulate across K-12 grade levels (Berninger & Winn, 2006). The *Common Core State Standards* adopted by the majority of states and recommendations of researchers both describe the elementary grades as a critical time to acquire foundational writing skills and engage in writing to fulfill a variety of purposes (Graham & Harris, 2013; National Governors Association Center for Best Practices, 2010). Specific recommendations include developing fluency in the foundational writing skills of handwriting, spelling, and sentence construction (Graham, Bollinger, et al., 2012).

A cognitive model of writing development, the not-so simple view of writing, describes the importance of developing fluent foundational skills, such as handwriting, spelling, and sentence construction (Berninger & Chanquoy, 2012). The model includes three composite areas: text generation, transcription, and executive functions. Each composite area is comprised of individual skills (e.g., transcription includes handwriting and spelling; text generation includes sentence construction) that compete for cognitive resources during writing. Proficiency or fluency in one composite area or skill strengthens written expression and allows for easier acquisition of more complex skills. For example, teaching transcription skills has been found to improve measures of writing quality (Graham, McKeown, Kiuhara, & Harris, 2012) and teaching simple sentences has promoted acquisition of paragraph composition (Datchuk, 2016).

In order to ensure development of complex written expression, it is imperative to deliver interventions during elementary grades for students with and at-risk for learning disabilities (LD). One of the text generation skills, sentence construction, refers to the writing of a variety of sentence types that follow conventions of grammar, usage, and meaning (Saddler, 2013). Fluency with simple sentence construction (i.e., a sentence comprised of least one subject and verb) is foundational for continued writing growth and serves as a connection point to more advanced writing skills such as construction of compound or complex sentence types and paragraphs (Arfe & Pizzocaro, 2016; Berninger, Nagy, & Beers, 2011). Additionally, fluency with sentence construction is thought to help students more effectively and efficiently communicate with other members of their communities inside and outside of school (Graham, in press).

Data-Based Individualization as a Framework for Intervention

An inductive and experimental approach to intervention could serve as a useful framework for intervention with simple sentence construction because of the multiple and overlapping composite areas and skills within writing development. Experimental, data-based individualization is a problem-solving approach to intervention (Fuchs, McMasters, Fuchs, & Al Otaiba, 2013; Kuchle, Edmonds, Danielson, Peterson, & Riley-Tillman, 2015). There are several variations of the individualization process but at a minimum it includes (a) implementation of a research-based intervention, (b) measurement of student performance through progress monitoring and diagnostics, (c) adaptation of the intervention in response to student data, and (d) continual monitoring and further adaptation as needed (Danielson & Rosenquist, 2014). Research-based interventions refer to manualized, commercially available curriculum or strategic use of instructional procedures. Adaptations include accommodations (e.g., extended time or read-aloud), alterations to instructional procedures (e.g., increased amounts of guided practice), and changes in instructional focus (e.g., addition of other writing skills). Use of data-based individualization and other

variations of problem-solving, experimental approaches stemming from the applied behavior analysis literature have been found to improve the academic and behavioral performance of students (Hughes & Dexter, 2011; Stecker, Fuchs, & Fuchs, 2005; Vargas, 2013; Wehby & Kern, 2014).

Research Based Instruction for Simple Sentence Construction

Research findings on improving the simple sentence construction of students with disabilities and writing difficulties have discovered some instructional techniques to serve as the core of intervention (Datchuk & Kubina, 2013). Several studies have used systematic and explicit instruction with picture-word prompts to teach simple sentence construction (Archer & Hughes, 2011). During systematic and explicit instruction, instructors model writing simple sentences to small pictures with several accompanying words, lead students through guided practice writing sentences, and test for independence. For example, a small picture of a man holding a large stack of books accompanied by the words *the man* and *carried* could prompt the sentence *The man carried the stack of books.* Picture-word prompts are thought to provide a targeted way for instructors to prompt student responses and allow precise feedback on specific details of a simple sentence (Kame'enui & Simmons, 1990).

Seven studies have used systematic and explicit instruction with picture-word prompts to improve the sentence construction of students with disabilities and writing difficulties (Datchuk, 2016; Datchuk & Kubina, 2017; Datchuk, Kubina, & Mason, 2015; Viel-Ruma, Houchins, Jolivette, Fredrick, & Gama, 2010; Walker, Shippen, Alberto, Houchins, & Cihak, 2005; Walker, Shippen, Houchins, & Cihak, 2007; White, Houchins, Viel-Ruma, & Dever, 2014). Four of the studies investigated effects of the manualized curriculum *Expressive Writing* (Engelmann & Silbert, 2005) on high school aged students with disabilities (Viel-Ruma et al., 2010; Walker et al., 2005, 2007; White et al., 2014). The program starts with simple sentence construction before progressing onto multiple related skills, such as extended composition and verb tense. Three of the studies used single-case designs (Viel-Ruma et al., 2010; Walker et al., 2005, 2007) and one study used a quasi-experimental comparison between two treatment groups (White et al., 2014). All four studies found gradual increases in either the number of correct word sequences (CWS) or the percentage of correct word sequences (PCWS). CWS is a measure of each word with correct capitalization, punctuation, spelling, and grammar (Ritchey et al., 2016). PCWS is the ratio of CWS to the total number of word sequences written (White et al., 2014).

Three other studies investigated effects of a supplemental intervention on elementary, intermediate, and secondary students with disabilities and writing difficulties (Datchuk, 2016; Datchuk & Kubina, 2017; Datchuk et al., 2015). The studies used a combination of systematic and explicit instruction

and timed practice constructing simple sentences referred to as sentence instruction and frequency building to a performance criterion (SI and FBPC). The intervention procedures are designed to achieve high accuracy constructing simple sentences through instruction then fluency through a deliberate practice routine of short, timed trials. During timed trials, students construct simple sentences to a series of picture-word prompts for 1 minute. At the end of each 1-minute timed trial, an instructor provides feedback, error correction, and encouragement to obtain the performance criterion (i.e., 30 CWS with 0 to 3 errors). All three studies used single-case designs and measured effects of intervention on the number of complete sentences and a modified version of CWS that included words that were spelled incorrectly but phonologically similar to the intended word (e.g., skool for school). All studies reported gradual increases in the number of complete sentences and CWS.

The studies investigating effects of SI and FBPC included only students with proficient spelling and handwriting (Datchuk, 2016; Datchuk & Kubina, 2017; Datchuk et al., 2015). On screening measures prior to intervention, students in all three studies showed at least 90% accuracy on a spelling probe of high frequency words and at least 80 correct letters per minute on a handwriting copy task. The present study extends the SI and FBPC literature by including adaptations for students struggling with both spelling and handwriting.

Adaptations for Instruction in Sentence Construction

Spelling and handwriting are two transcription skills that moderate the development of continued writing growth (Berninger & Chanquoy, 2012). Errors in spelling can impact writing accuracy and fluency. In an analysis of student writing during implementation of the *Expressive Writing* curriculum (Engelmann & Silbert, 2005), misspellings accounted for 20% to 60% of the errors (Walker et al., 2007). Similarly, slow and non-fluent handwriting can impact writing; handwriting speed can account for approximately 25% to 42% of the variance in writing quality for elementary and intermediate grade level students (Graham, Berninger, Abbott, Abbott, & Whitaker, 1997). Spelling and handwriting are also important to simple sentence construction; handwritten simple sentences require the legible formation of letters into correctly spelled words that make grammatical and syntactic sense (Kame'enui & Simmons, 1990). The success of interventions targeting simple sentence construction can be hindered without additional adaptations or accommodations for spelling and handwriting.

One instructional adaptation to support students with spelling difficulties includes cover-copy-compare procedures (Skinner, McLaughlin, & Logan, 1997). During cover-copy-compare, students view a word, cover the word and spell it from memory, then uncover the word and compare their response to the original word. In a variation of the steps, model-copy-cover-compare has

students (a) view the presented word and copy it, (b) cover the word, (c) copy the word from memory, and (d) uncover the word and compare their response. A recent meta-analysis of cover-copy-compare and its variations, synthesized the results of 17 single-case design studies (Joseph et al., 2012). The majority of studies used variations of the model-copy-cover-compare procedures and found students improved their performance on the count and percentage of correctly spelled words. Overall, the meta-analysis found the use of cover-copy-compare and its variations were moderately effective (percentage of non-overlapping data = 73.5) at promoting the acquisition of spelling words. In addition to adaptations that change the focus or content of sentence construction interventions to include spelling, accommodations can be used.

An accommodation promotes student success with the task without changing the instructional focus or content of the intervention (Friend & Bursuck, 2015). Providing extended time to complete writing tasks is one of the most widely used accommodations by elementary school teachers (Graham, Harris, Bartlett, Popadopoulou, & Santoro, 2016). Extended time has primarily been studied as an accommodation for testing, and research has shown mixed results (Crawford, Helwig, & Tindal, 2004; Gregg & Nelson, 2012). A recent meta-analysis found that the performance of students with learning disabilities on tests improved but still lagged behind their typically developing peers (Gregg & Nelson, 2012). It is hypothesized that the extended time for writing allows students to engage more fully in all aspects of the writing process, including planning, composition, and revision (Crawford et al., 2004). At a minimum, extended time should help with composition when handwriting speed is less than fluent.

Research Questions

Using a framework of data-based individualization, the present study was a preliminary investigation of the effects of SI and FBPC and adaptations for spelling and handwriting. Specifically, two adaptations were used. First, a variation of the model-copy-cover-compare procedures was added to all timed practice sessions of simple sentence writing. This adaptation was designed to help students who showed inaccurate spelling performance on screening measures prior to intervention. Second, an accommodation of extended time for instructional activities and probes was given to some students as needed.

The present study included two research questions. First, what are the effects a multi-component intervention of SI and FBPC with adaptations on the number of correct minus incorrect word sequences (CIWS) on sentence construction probes? Second, what is the maintenance of the experimental effects following completion of instruction and practice?

Table 1. *Student characteristics*

		Students				
Variable	*Level*	*Claire*	*Nate*	*Alicia*	*Jim*	*David*
Demographics	Gender	F	M	F	M	M
	Age	8-7	8-7	9-5	9-10	9-5
	Grade	3	3	4	4	4
	Exceptionality	N/A	N/A	N/A	SLD	SLD
Sentence Construction	CIWS (%)	13 (74)	7 (77)	4 (70)	4 (70)	5 (86)
Spelling	Percent correct	71	75	75	71	54
Handwriting	CLPM	60	51	49	37	29
Reading	CWRPM (%)	82 (93)	103 (95)	84 (96)	93 (98)	53 (98)

Note. F = female; M = male; N/A = not applicable; SLD = specific learning disability; CIWS = correct minus incorrect word sequences; CLPM = correct letters per minute; CWRPM = correct words read per minute.

Method

Participants

Table 1 shows student characteristics. Five students enrolled in third and fourth grades participated in the study. Students were nominated by teachers at the participating school as struggling to consistently construct complete, simple sentences. Several probes of sentence construction, spelling, handwriting, and reading were administered to determine potential adaptations needed during intervention (i.e., extended time and spelling instruction).

Two of the students (Jim and David) received special education services for LD. The other three students (Claire, Nate, and Alicia) were deemed at-risk for LD and received supplemental support services as part of a secondary tier of support within the school's RtI system. Jim and David had a similar schedule of special education services: both received small group reading decoding and spelling instruction three times per week for 30 minutes. Additionally, twice per week for 30 minutes they participated in small group reading comprehension instruction and received in class writing support. Claire, Alicia, and Nate all received in class writing support two times per week for 30 minutes. Alicia also had a reading fluency intervention three times per week for 20 minutes.

Ms. Halick served as the instructor. She was employed by the participating school as a special education teacher. She taught third and fourth grade students and delivered math and literacy interventions to students at-risk or with identified LD. She had over 10 years of experience as a special education teacher.

Setting

The study took place at an elementary school in a suburban area of New England. Intervention sessions took place in a special education resource room. The resource room was adjacent to the student's general education classroom. Students sat around a C shaped desk, and the instructor sat or stood in the middle and in front of a dry erase board. The majority of sessions occurred once per day, but on several days two sessions were delivered. The majority of sessions occurred within small groups, but some of the sessions were delivered one-on-one due to scheduling conflicts or student absences.

Materials

Sentence construction probes. Sentence construction probes featured 10 small pictures, measuring 4 cm by 4 cm with two to three accompanying words each. Figure 1 shows examples of picture-word prompts. Three horizontal lines were adjacent to each picture for students to write their response. Picture-word prompts shared no overlap to intervention materials (i.e., no picture-word prompts were repeated across any materials).
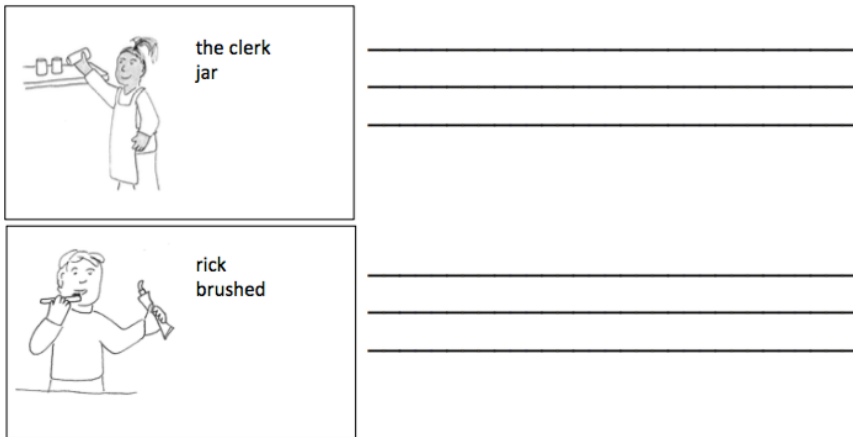

Figure 1. **Examples of picture-word prompts used on intervention materials and sentence construction probes.**

Intervention lessons. Intervention materials featured 15 distinct instruction and practice sets taken from prior studies (Datchuk, 2016; Datchuk & Kubina, 2017; Datchuk et al., 2015). The materials had complete sentences, incomplete sentences, phrases, and fill-in-the-blank items. The sentences and phrases were written at an approximate second to third grade level. The materials also featured picture-word prompts, formatted similarly to sentence construction probes, as shown in Figure 1.

In addition to the instruction and practice sets taken from prior studies (Datchuk, 2015; Datchuk et al., 2015), the lead author created 12 model-copy-cover-compare spelling sheets. Figure 2 shows an example of one of the spelling sheets. Each spelling sheet featured three sections: (a) horizontal lines to copy the words, (b) fill-in-the-blank items to write missing letters, and (c) an area to write the three spelling words. Spelling sheets for lessons 4 to 6 featured the words *carried, put,* and *drove.* Spelling sheets for lessons 7 to 9 had the words *cleaned, stood,* and *cut.* Spelling sheets for lessons 10 to 12 had the words *held, rode,* and *was.* Spelling sheets 13 to 15 showed the words *had, cooked,* and *grabbed.* The spelling words were selected by the lead author as potentially useful for constructing complete, simple sentences on the picture-word prompts. For example, the spelling word *drove* appeared on the same lesson where a picture showed a man sitting in the driver seat of a van.

Dependent Variables and Scoring Procedures

The dependent variable was the number of CIWS per 1 minute or 2 minutes on sentence construction probes. To arrive at CIWS, the number of incorrect word sequences was subtracted from the number of correct word sequences (McMaster, Du, & Petursdottir, 2009). A correct word sequence occurred each time a response started with a capitalized letter, between each word with correct grammar/syntax, and ended with a correct punctuation mark. An incorrect word sequence happened for the inverse: a response started with a lower-case letter, between each word with incorrect grammar/syntax, and ended without a punctuation mark. Words that were misspelled but were similar phonologically (e.g., stayja for stage) or missing one or two letters (e.g., yelow for yellow) were counted as correct, similar to research on morphological derivations (McCutchen & Stull, 2015). As an example, "-The-night-sky-was-brite-." has six possible word sequences as shown by the hyphens. There are six correct word sequences and zero incorrect ("brite" is misspelled but phonologically similar to "bright"), for a total of 6 CIWS.

Interobserver Agreement

The lead author scored all sentence construction probes following each session. An observer naïve to the purpose of the study was taught scoring procedures, reaching 100% agreement with the lead author on multiple examples of sentence construction probes. The observer scored a third of all probes, randomly selected across groups and experimental phases. A total agreement formula was used: number of agreements divided by the total number of agreements and disagreements, multiplied by 100 (Johnston & Pennypacker, 2009). The average agreement during the baseline phase was 84%, the SI and FBPC with spelling phase averaged 93%, and the maintenance phase was 98%.

Administration of Probes

At the end of each session, the instructor administered a sentence construction probe. Students were given a probe and told to write their name and date, then to put their pen or pencil down. The instructor said, "You will write as many complete sentences as possible using the pictures and words given." The instructor read the word prompts aloud and answered any questions on pronunciation. The students picked up their pen or pencil and the instructor said, "Please begin," and started a countdown timer. Group 1 was consistently given 1 minute for sentence construction probes. Group 2 was given 1 minute during the entire baseline phase and the first five intervention sessions. The time limit for Group 2 was increased to 2 minutes starting with the sixth session and for all remaining sessions of intervention. The time limit for sentence construction probes was increased concurrently with the time limit for frequency building activities due to concerns regarding student performance. At the end of the time limit, the instructor collected sentence construction probes and did not provide any feedback on performance.

Experimental Design and Procedures

The study featured a mixed method experimental approach. A multiple baseline across small groups, similar to an across participants design (Gast, 2010), was used. The staggered introduction of intervention allowed detection and replication of an experimental effect. However, the inclusion of only two small groups did not permit detection of a functional relation between the intervention and dependent variable (Kennedy, 2005). Additionally, structured interviews and questionnaires were used to gather student and teacher perceptions of the intervention procedures, outcomes, and goals. Visual analysis of the single-case design data was used to detect experimental effects, and a narrative review of the major trends and themes was conducted on the qualitative data. Given the preliminary nature of the investigation, additional data analysis procedures, such as the calculation of effect size metrics and significance tests, were not conducted.

Independent Variable

The independent variable was a multi-component intervention of SI and FBPC with adaptations for spelling and extended time. The spelling adaptation, a variation of model-copy-cover-compare procedures (Joseph et al., 2012), was delivered to all participants due to inaccurate performance on screening measures prior to intervention (i.e., the adaptation was made a priori). The extended time adaptation was provided only to Group 2 as a result of close monitoring of student performance and reports of student frustration with the handwriting demands (i.e., the adaptation was made a posteriori).

The SI and FBPC procedures were replicated from prior studies (Datchuk, 2016; Datchuk & Kubina, 2017; Datchuk et al., 2015). The in-

tervention phase included delivery of 15 lessons. The first three lessons were sentence instruction and lasted approximately 30 minutes each. Across the first three lessons, the instructor used systematic and explicit instructional techniques (Archer & Hughes, 2011). The instructor modeled examples of constructing complete, simple sentences, guided students through practice by providing immediate error correction and praise for correct responses, and tested for independent performance.

The remaining lessons, starting with lesson four, featured FBPC with spelling. Each lesson lasted approximately 15 minutes each. These lessons included (a) a model-copy-cover-compare spelling activity, (b) modeling of complete simple sentences by the instructor, (c) two timed trials of simple sentence construction, and (d) feedback, error correction, and encouragement following each timed trial. The words presented during model-copy-cover-compare and picture-word prompts during FBPC were repeated for three consecutive lessons (e.g., the same words and pictures were presented for lessons 4, 5, and 6).

Procedures

Baseline. During the baseline phase, all students participated in the typical writing instruction delivered by the general education teacher. Writing instruction occurred approximately two to three times per week for a total of 1 hour to 1 hour and 30 minutes. The writing instruction followed a typical schedule: a mini-lesson on a grammar/usage skill, assignment of a writing topic and genre, and time to engage in extended composition. During the composition time, students used the newly taught grammar/usage skill to write a persuasive, informative, or narrative piece. The general education teacher monitored the composition time and met with each student once a week or once every other week to review their writing.

During the baseline phase, all participating students were administered a sentence construction probe. The first group was selected to begin intervention. After the first group completed the first three lessons of intervention with at least 90% accuracy then the second group began intervention.

SI and FBPC with spelling. Lessons one to three were sentence instruction designed to increase the accuracy of constructing complete, simple sentences. Lessons four to fifteen were frequency building with spelling, designed to increase the accuracy and frequency of three spelling words and the construction of complete, simple sentences. During the first lesson, a simple sentence was defined as containing two parts: a part that names someone or something and a part that tells more. A complete simple sentence contained both parts and started with a capital letter and ended with an appropriate punctuation mark.

The first lesson featured fill-in-the-blank activities that required students to fill in the missing part of a simple sentence by looking at picture-word prompts. During the second lesson, students continued similar activities and identified the two main parts of a simple sentence within complete and incomplete sentences and corrected for errors in capitalization and punctuation. During the third lesson, students constructed simple sentences to picture-word prompts formatted similarly to sentence construction probes. To proceed to the remaining lessons of the intervention phase, students had to achieve at least 90% accuracy on the first three lessons. If students showed inaccurate performance, then the lessons repeated until they achieved the 90% criterion.

Starting with lesson four and lasting until lesson fifteen, students completed a model-copy-cover-compare spelling activity and timed trials of sentence construction. During each of these lessons, students were given a spelling sheet featuring three spelling words. Figure 2 shows an example of these sheets. The spelling sheet was divided into three parts. For the first part, students copied three words. During the second part, students completed three fill-in-the-blank prompts by writing in the missing letters. For the third part, students covered the top half of the sheet, wrote the words, then uncovered the sheet and compared their responses.

Following the model-copy-cover-compare spelling activity, the instructor handed students three copies of a simple sentence practice sheet. Each copy of the practice sheet had the same 10 picture-word prompts. With the first copy of the practice sheet, the instructor modeled writing complete, simple sentences to the first five picture-word prompts and students copied the sentences. Students provided suggestions on possible simple sentences, and the instructor encouraged using the three spelling words from the model-copy-cover-compare activity. The students put the first copy out of sight. On the second copy of the practice sheet, students were given one minute to write as many complete sentences as possible. At the end of 1 minute, students were told to stop and the instructor provided feedback by scoring their responses for the number of correct and incorrect word sequences. The instructor corrected any errors in capitalization, punctuation, and grammar, and praised the use of any of the taught spelling words. The students put the second copy out of sight. On the third copy, students were again given one minute to write as many complete sentences as possible and encouraged to increase their score from the previous timing. At the end of the timing, students were provided feedback, error correction, and encouragement by the instructor.

Directions: Fill in every blank with the correct letter.

[**1**]

    1 carried   __ __ __ __ __ __ __

    2 put   __ __ __

    3 drove   __ __ __ __ __

    4 _c_ __ _r_ __ __ __ __

    5 __ __ _t_

    6 __ __ __ _v_ __

fold your paper along this line

Directions: Without looking back, try to correctly spell these words.

    7 _____

    8 _____

    9 _____

Figure 2. **An example of a model-copy-cover-compare spelling sheet used during intervention.**

       Two-minute extended time accommodation. Following five lessons of the SI and FBPC with spelling phase, the instructor reported that the students in Group 2 were frustrated with the short amount of time for practice and sentence construction probes. A review of their performance revealed that the students were typically only able to construct one to two sentences within one minute. The three students comprising Group 2 also had the slowest handwriting of all the participants, as shown in Table 1. The decision was made to increase the time limit for both practice and sentence construction probes from 1 minute to 2 minutes for lessons 6 to 15.

       Maintenance. Following the last lesson of the SI and FBPC with spelling phase, one sentence construction probe was administered per day for three days. Students completed the maintenance probes individually. All students completed three sentence construction probes except Jim, who completed only one sentence construction probe due to absences.

Procedural Integrity

Prior to the start of intervention, the instructor, Ms. Halick, attended three, one-hour professional development seminars on implementing the intervention. To further help implementation, each intervention session had an accompanying script or checklist with suggested language and level of instructor prompting (i.e., modeling, guided practice, and independent practice).

The majority of intervention sessions were videotaped (37 of the 47 sessions). Following each session, the instructor sent the videotapes to the lead author. The lead author viewed the videotapes and provided any notes on fidelity or adjustments when necessary. An independent observer was trained on the intervention procedures. The observer viewed one-third of videotaped sessions randomly selected across groups and experimental phases. Using a checklist of procedures, the baseline and maintenance phases were delivered with 90% fidelity. Sentence instruction was delivered with 100% fidelity, and FBPC with spelling was 88%.

Treatment Acceptability

At the end of the maintenance phase, students were individually asked three questions by the instructor. First, "What do you feel is the purpose of sentence writing?" Second, "What did you like or not like about instruction and practice? What would you change?" Third, "How do you feel about your sentence writing after being taught this skill and then practicing doing it?" The lead author asked similar questions to the instructor, Ms. Halick. The first two questions were the same, but the third question focused on student performance, "How do you feel about the students' sentence writing after the intervention?"

RESULTS

Figure 3 displays the number of CIWS on sentence construction probes across experimental phases. Dashed horizontal lines connect data points across participants, and vertical lines indicate phase changes.

The first small group of Claire and Nate both completed four baseline sessions. In the second small group, Alicia and David both completed seven baseline sessions and Jim completed six baseline sessions. Across both groups, students on average displayed their smallest number of CIWS and their least amount of accuracy during baseline. In the first group, Claire averaged 7.0 CIWS and 65% accuracy. Nate showed a slight upward trend of CIWS across baseline and averaged 7.3 CIWS and 76% accuracy. In the second group, Alicia's performance reached an average of 5.3 CIWS with 78% accuracy, Jim had an average of 3.5 CIWS with 67% accuracy, and David showed an average of 3.0 CIWS with 68% accuracy.

The first small group of Claire and Nate entered the SI and FBPC with spelling phase. Claire and Nate both completed 15 sessions of intervention.

They both showed upward trends in performance and increases in the mean of CIWS and percentage correct. Claire averaged 17.4 CIWS with 87% accuracy, and Nate averaged 15.0 CIWS with 96% accuracy.

The second small group of Alicia, Jim, and David entered the SI and FBPC with spelling phase next. Alicia completed 15 sessions, Jim completed 12 sessions, and David completed 13 sessions. Jim and David completed fewer sessions due to absences and schedule conflicts. During the first five sessions of the SI and FBPC with spelling phase, performance only slightly increased from baseline. All students in the second small group displayed upward trends in performance but with only minimal changes in level. Alicia's average performance during this time was 9.0 CIWS with 89% accuracy. Jim's performance had high variability and averaged 4.0 CIWS with 71% accuracy. David averaged 7.0 CIWS with 89% accuracy.

Due to concerns with their progress (i.e., the teacher reported that students in the second small group only had time to respond to a few picture-word prompts during practice and sentence probes), an accommodation was made to the procedures for intervention and administration of probes. The time limit of both timed trials during SI and FBPC and sentence construction probes was increased from one minute to two minutes. A phase change line was added to the graph to indicate the procedural changes. As a result, the graph in the 2-minute accommodation and maintenance phases display performance on sentence construction probes per 2 minutes instead of 1 minute.

Students completed more sessions within the 2-minute accommodation phase. Alicia completed 10 sessions, Jim completed 7 sessions, and David completed 8 sessions. With the extended time on sentence construction probes, an immediate increase in level occurred. Alicia averaged 25.2 CIWS with 99% accuracy. Both Jim and David displayed highly variable performance. Jim averaged 13.1 CIWS with 85% accuracy, and David averaged 16.6 CIWS with 93% accuracy.

During maintenance all students across the groups completed three sessions except Jim, who completed only one session. In the first group, Claire and Nate showed performance comparable to the end of intervention. Claire showed an average of 19.3 CIWS with 94% accuracy. Nate had an average of 14.3 CIWS with 100% accuracy. In the second group, Alicia and David both showed performance comparable to the end of intervention. Alicia averaged 25.0 CIWS with 100% accuracy, and David averaged 12.0 CIWS with 95% accuracy. Jim showed a drop from the end of the previous phase in his only maintenance session, scoring 6.0 CIWS with 80% accuracy.
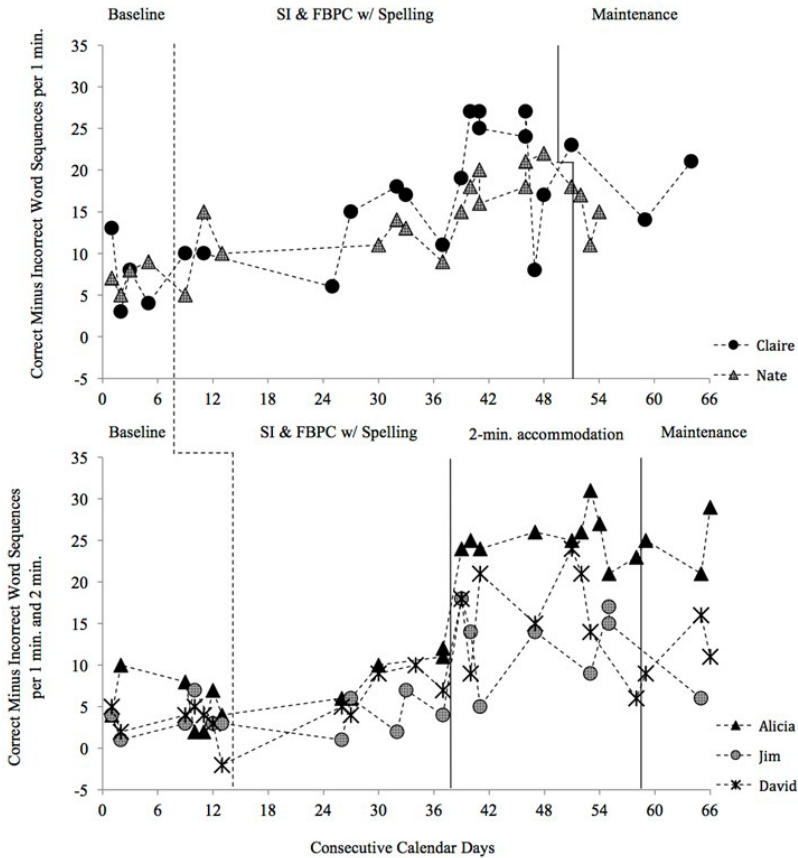
Figure 3. The number of correct minus incorrect word sequences per 1 minute and 2 minutes on sentence construction probes across experimental phases.

Treatment Acceptability

Most students gave non-applicable answers to the first question on the purpose of sentence writing. Alicia said, "…to tell your feelings, like a diary, or what you like, or what you did in the day." All students reported liking the instruction. Nate said, "I liked it because I can write faster. I would change nothing." Alicia said, "I liked how we got timed and how we were writing sentences that made sense." Jim reported that he liked the instruction and practice but thought it was challenging. Claire reported similar feelings and said, "I liked the instruction but didn't like the timed parts." David said he enjoyed the instruction and practice but wished more words were included in picture-word prompts. All students felt that their sentence writing improved as a result of intervention. Claire said, "I feel good about it. It made a difference." Alicia said,

"I feel good because it makes me think I'm getting better at writing."

Ms. Halick said the purpose of sentence writing was, "to communicate with others." She liked the explicit instruction and structure of practice, but felt "writing three times before assessment was too much for my group of struggling writers (i.e., Group 2)." Overall, she felt the intervention improved the writing skills of all students across the board.

DISCUSSION

Sentence construction is a foundational aspect of written expression that draws upon numerous cognitive, behavioral, and socio-cultural factors (Graham, in press). Using a framework of data-based individualization (Kuchle et al., 2015), the present study was a preliminary investigation on the effects of a multi-component intervention, SI and FBPC (Datchuk, 2016). The intervention also included two adaptations to help with spelling and handwriting difficulties. All students received the adaptation of a modified form of cover-copy-compare for spelling (Skinner et al., 1997). Only some of the students received an extended time accommodation, increasing the time for completion of timed practice trials and sentence probes from 1 minute to 2 minutes following a period of flat performance during intervention.

Overall results show that all students improved their frequency and accuracy of writing during intervention. However, given the preliminary nature of the study, a functional relation was not detected between the intervention and dependent variable. The first small group included two students: Claire and Nate. Claire showed clear improvement during and following the intervention. Nate's performance improved during intervention but a slight increase in trend during baseline makes it difficult to determine the effects attributable solely to the intervention. The second small group included three students: Alicia, Jim, and David. Alicia's performance improved across intervention phases (SI and FBPC with spelling, extended time, and maintenance). Jim and David showed improvement during intervention but performance was highly variable.

The mixed results for students, particularly the students in the second small group, may stem from several factors. First, students with the most variable performance during intervention had some of the lowest scores on pre-screening measures. David displayed the lowest scores of all participating students in spelling, handwriting, and reading. Jim had the second lowest rate of handwriting. Second, students with the most variable performance (David and Jim) participated in the fewest number of intervention sessions due to absences and scheduling conflicts. Third, effects of intervention appeared to differ by disability status. The students displaying the most improvement (Claire, Nate, and Alicia) were all deemed at-risk for LD and received secondary supports and services through the school's RtI system. Both students with more variable

performance (David and Jim) had identified LD and received additional special education services.

The findings must be viewed with caution but overall results extend several lines of research. Results suggest a framework of data-based individualization can help tailor sentence construction intervention for students with spelling and handwriting difficulties (Fuchs et al., 2013; Kuchle et al., 2015). Prescreening measures indicated all students struggled with multiple writing skills: spelling, handwriting, and sentence construction. These three skills are interrelated, as proficiency with transcription skills of spelling and handwriting promote text generation and the construction of sentences (Berninger & Amtmann, 2003; Datchuk & Kubina, 2013; Graham et al., 1997). Overall improvement in writing scores suggests the data-based individualization process allowed students with difficulties in both handwriting and spelling to benefit from instruction and practice in simple sentences. Prior research has found that explicit instruction and practice in spelling and handwriting help remediate difficulties in writing for elementary students (Berninger & Amtmann, 2003; Graham et al., 2012). The high variability in student performance, specifically both students receiving special education services for LD, suggests that adaptations alone may not be sufficient and that core, robust instruction in spelling and handwriting needs to be delivered for continued writing growth.

Similar to prior SI and FBPC studies, systematic and explicit instructional procedures with picture-word prompts were an efficient way to improve the simple sentence writing of students with disabilities and writing difficulties (Datchuk, 2016; Datchuk & Kubina, 2013). Delivered as a supplemental intervention to core writing instruction and secondary/tertiary supports, all students were able to improve their writing performance in a short amount of time. The procedures used in the present study differed from prior studies in several ways (Datchuk, 2016; Datchuk & Kubina, in press; Datchuk et al., 2015). First, prior studies typically only included students with proficient spelling and handwriting scores. The present study included students struggling with spelling, handwriting, and sentence construction. Second, a static performance criterion (e.g., 30 CWS with 0 to 3 IWS) was used in prior studies to guide instructor feedback during practice. In the present study, students were encouraged to increase their prior score but no specific criterion or goal was set. Third, prior studies typically used different picture-word prompts each session, but timed trials were conducted with the same picture-word prompts for three consecutive sessions in the present study.

Two adaptations to the SI and FBPC procedures were used to tailor the sentence construction intervention for students with spelling and handwriting difficulties: a variation of cover-copy compare spelling procedures (Skinner et al., 1997) and an extended time accommodation. Results extend prior studies that

used a model-copy-cover-compare procedure to teach spelling when paired with additional instructional procedures (Joseph et al., 2012). The extended time accommodation also appeared to be a beneficial adaptation. All three students in the second small group receiving extended time showed a higher accuracy and frequency of CIWS on dependent measures. However, similar to prior studies investigating the effects of extended time as a testing accommodation, students with disabilities still lagged behind their same aged peers without disabilities (Gregg & Nelson, 2012). Researchers have theorized that extended time may allow students to engage in all stages of the writing process, including planning, writing, revising, and re-writing (Crawford et al., 2004). Given the short duration of the timings (1 to 2 minutes), students in the present study very likely did not focus on aspects of the writing process other than writing.

Overall results provide tentative support for implementing SI and FBPC with spelling and handwriting adaptations. The process of data-based individualization served as a useful framework to implement research-based instructional procedures and adaptations as needed. Results extend the research literature on instructional procedures to improve the simple sentence construction of students at-risk and identified with LD. All students improved their simple sentence construction as measured through CIWS; however, high variability in student performance and limitations with design mean the results should be viewed with caution. The lower performance of students with LD suggests that robust, research-based instruction in spelling and handwriting is a priority to ensure sufficient growth in sentence construction and that adaptation and accommodations can help but are not sufficient alone.

Limitations and Future Directions

This preliminary investigation has three main limitations and future directions. First, the introduction of intervention was staggered across two small groups of students. Future research should increase the number of small groups as the intervention needs to be introduced in at least three different points in time to detect a functional relation (Kennedy, 2005). Second, the extended time accommodation was delivered a posteriori and to only one of the small groups, making detection of experimental effects more difficult. Future research could better study the effects of extended time by creating decision rules to implement the adaptation a priori. Third, students constructed sentences to picture-word prompts during intervention and assessment. The materials used for intervention and assessment featured more picture-word prompts than students could complete within the allotted time of 1 minute to 2 minutes, so students had the opportunity to select or choose prompts they deemed more desirable or relevant. However, students did not have the opportunity to apply sentence construction to other related writing tasks (e.g., fictional stories, notes, or essays) or to involve other members of their writing communities (e.g., other students or general

education teachers). Involving different types of writing tasks and other community members could promote the generality of sentence construction and make it more meaningful and useful to students and members of their writing communities.

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Authors' Note

For correspondence regarding this article, please contact: Shawn M. Datchuk, Ph.D., Assistant Professor, University of Iowa, Department of Teaching and Learning, 254 Lindquist Center North, Iowa City, IA 52242, Phone: 319-335-1184, Email: shawn-datchuk@uiowa.edu.