

## **A Paragraph Text-Writing Intervention for Adolescents with Intellectual and Developmental Disabilities**

Derek B. Rodgers, Shawn M. Datchuk, & Lanqi Wang  
Department of Teaching and Learning, University of Iowa

Paragraph text-writing refers to constructing multiple words and sentences into the form of a paragraph. It is critical to overall written expression; unfortunately, many students with disabilities struggle to develop it to fluency. The present study investigated the effects of a multicomponent intervention on the accuracy and fluency of paragraph text writing skills of three adolescents with intellectual and developmental disabilities. The intervention procedures featured a combination of explicit instruction and timed practice delivered through a series of short, supplemental lessons. Intervention was delivered one-on-one, and a multiple probe across participants designed was used. Results were mixed, with two of three students showing an improvement in multiple skills related to paragraph text-writing, including sentences with appropriate syntax, semantics, capitalization, and punctuation. The limitations of this study as well as implications for practice are discussed.

*Keywords:* autism spectrum disorders, intellectual disability, text writing, writing fluency, explicit instruction

Correspondence concerning this article should be addressed to Derek B. Rodgers, 259 Lindquist Center, University of Iowa, Iowa City IA 52242. Email: [derek-rodgers@uiowa.edu](mailto:derek-rodgers@uiowa.edu)

Writing is a critical aspect of academic success, and students need adequate writing abilities for a variety of purposes. For example, adolescent students often use writing to share their thinking regarding important curriculum, and their teachers use their written products to evaluate students' knowledge (Bangert-Drowns et al., 2004; Graham & Hebert, 2011). For transition-aged students, writing continues to be an important set of skills: Writing abilities are positively associated with improved vocational outcomes (National Commission on Writing, 2004). Socially, the ability to write well is needed to maximize the opportunities offered by social media and text messaging (Penner-Williams et al., 2009).

Written expression is a collection of multifaceted skills, an important set of which is multiple text-writing skills: the composition of multiple words that follow the rules of appropriate spelling, syntax, semantics, and usage (Kim et al., 2018). Adolescent students often write at the discourse-level (e.g., paragraphs or more), and must therefore develop adequate paragraph text-writing skills, or the construction of several grammatically sound sentences about a singular topic. Indeed, teachers rate complete sentences as an important part of high-quality writing (Gansle et al., 2002). Unfortunately, the evidence suggests that many students with disabilities struggle to develop adequate writing skills. According to the National Assessment of Educational Progress (NAEP), a national assessment of academic skills including writing, 60% of eighth graders and 63% of twelfth graders with disabilities scored at the Below Basic level on the NAEP writing assessment (National Center for Educational Statistics, 2011). Comparatively, only 15% of eighth graders and 17% of twelfth graders without disabilities scored at the Below Basic level on the same assessment. Those who scored in the Below Basic category demonstrated challenges associated appropriate grammar, usage, mechanics, and semantics at the discourse-level.

Difficulties in one or more of the skills involved in text writing can persist across grade levels for some students (Troia et al., 2019), and students with disabilities—including those with intellectual and developmental disabilities (IDD)—tend to experience considerable difficulty (Joseph & Konrad, 2008). Specifically, research has shown that students with autism spectrum disorder (ASD) tend to write sentences that are shorter and less complex than their peers without disabilities (Pennington et al., 2014) and can produce numerous errors in syntax and

grammar (Menyuk & Quill, 1985). Similarly, students with intellectual disabilities have also been shown to have difficulty composing text without syntactical and grammatical errors (Monroe & Troia, 2006). These difficulties are further complicated by the fact that students with IDD tend to have cognitive deficits that impact organizational skills, working memory, and self-regulation abilities (Gabig, 2008; Moore, 2002)—which can make it more difficult for them to learn and transfer academic skills (Gargiulo & Bouck, 2018; Richards et al., 2015).

For adolescent students with IDD, difficulties with paragraph text-writing may stem from multiple related components of written expression exemplified in the simple view of writing (Berninger & Amtmann, 2003). Often used to describe the writing development of elementary-aged writers, preliminary research found the simple view of writing to be a useful way of understanding the written expression of struggling and non-struggling adolescent writers (Limpo et al., 2017; Poch & Lembke, 2017). The simple view of writing describes written expression as stemming from an interplay of transcription (i.e., handwriting, spelling, typing), text generation (i.e., multiple words into sentences and paragraphs that make semantic and syntactic sense), and executive functioning skills (i.e., planning, revising, self-regulation), all of which are affected by the writer's finite working memory (Berninger & Amtmann, 2003). The model posits that students who are learning to write rely upon a finite resource of working memory. For example, a student working on transcription skills may devote much of their working memory to handwriting, leaving little working memory to dedicate to more complicated skills (e.g., text generation and executive functioning skills). However, as the writer develops transcription skills to fluency, she or he can dedicate further working memory to more complex writing skills. Writing researchers have validated these developmental aspects of the simple view of writing. For example, fluency in the transcription skills of handwriting and spelling have been found to promote the quantity and quality of text generation (Datchuk & Kubina, 2013; Garcia et al., 2017). Furthermore, fluency in the simple sentence text writing has been found to ease acquisition of paragraph composition (Datchuk, 2016).

### **Behavioral Fluency: Intervention Framework and Prior Studies**

Given the interrelated nature of writing skills and the importance of fluency to working memory, developing the multiple, related skills involved in paragraph text-writing to fluency is

critical. Behavioral fluency is a complimentary theory that helps explain the importance of fluency, defined as a behavior or skill performed a specified level of accuracy and speed (Kubina & Yurich, 2012). Behavioral fluency is thought to have several benefits (Datchuk, 2017). First, the fluent skill should show immediate improvement in both accuracy and speed. Second, the skill should maintain with little change in performance after instruction. Third, fluency should promote the development of closely related skills. With these principles of behavioral fluency applied to written expression, interventions that target fluent paragraph text-writing should theoretically (a) show an immediate increase in multiple related skills of sentence construction, syntax, semantics, punctuation, and capitalization and (b) produce experimental effects that maintain following intervention. Broadly, students ought to be able to generate more text in a given time with improved accuracy (e.g., improved grammar, punctuation, capitalization).

Most writing interventions for students with IDD focus on writing strategy use and the effects of such strategies on the quality of students' essays and stories (e.g., Asaro-Saddler & Bak, 2012; Asaro-Saddler & Bak, 2014; Woods-Groves et al., 2020). To date, no studies have investigated the effects of text-writing interventions for students with IDD (e.g., sentences or paragraph composition). However, the broader intervention literature for students with disabilities suggests a combination of explicit instruction and timed practice may serve as an appropriate framework for intervention to improve text writing. For example, to improve the accuracy of text-writing of students with learning disabilities (LD), emotional-behavioral disorders (EBD), and other writing challenges, multiple studies have used explicit instruction with picture-word prompts (Anderson & Keel, 2002; Datchuk, 2016; Datchuk & Rodgers, 2019; Viel-Ruma et al., 2010; Walker et al., 2005). These procedures were used to develop text-writing skills to accuracy, which is the first component of behavioral fluency.

Explicit instruction follows a model-lead-test instructional framework where the scaffolding that students receive at the beginning of instruction is gradually removed as students develop autonomy and mastery over the targeted skills (Archer & Hughes, 2011). Explicit instruction procedures have been shown to be effective at improving the writing skills of students with disabilities (Sturm, 2012). The reduction of complex material into smaller instructional units may also benefit students with IDD specifically, given this population's

challenges with cognition that were described earlier. Across the studies mentioned in the previous paragraph, instructors provided explicit instruction using picture-word prompts to provide a focal point for instruction and allow instructors to quickly deliver feedback and error correction. The prompts depicted a subject engaged in an action with several accompanying words that help describe the image. As a result of intervention, participants improved their text-writing as measured by modified correct and incorrect writing sequences (CWS and IWS; Ritchey et al., 2016). A CWS measures the appropriateness of adjacent writing units, and a student earns a CWS when a sentence begins with a capital letter and adjacent writing units include appropriate grammar and semantics. Any writing unit that does not meet these criteria is considered an IWS.

Similarly, to improve text-writing fluency, several studies have paired explicit instruction with a type of timed practice referred to as sentence instruction and frequency building to a performance criterion (SI and FBPC; Datchuk, 2017; Datchuk & Kubina, 2013; Datchuk et al., 2015; Datchuk, 2016). The SI component used explicit instruction to improve text-writing accuracy within simple sentence, and the FBPC component used timed practice trials to target text-writing fluency. During each FBPC lesson, students completed multiple 1-minute practice trials with picture-word prompts. After each practice trial, students received error correction and performance feedback on their specific rate of a modified form of CWS. The FBPC lessons continued until students completed 10 to 15 FBPC lessons, or they met a performance criterion set from a small sample of high-performing writers (i.e., at least 30 CWS per 1 minute). Students in each study demonstrated improved levels of CWS. However, the SI and FBPC studies did not investigate the effects of explicit instruction procedures on paragraph text-writing; the studies focused only on sentences. One study (Datchuk et al., 2016) investigated the transfer effects of SI on descriptive paragraph probes. Students did not receive paragraph instruction, but they completed paragraph probes during baseline at after intervention to evaluate the effects on writing paragraph. Therefore, no such study has yet examined the effects of explicit paragraph instruction on paragraph-text writing skill.

### **Purpose of the Present Study**

To improve the paragraph text-writing of adolescents with IDD, the present study extends prior research with a new population of learners. Prior studies have examined the impact of SI and FBPC on the accuracy and fluency of simple sentence text-writing for students with LD, EBD, and writing challenges. In this study, we evaluated the effects of paragraph instruction (PI) and FBPC on the paragraph text-writing skills of adolescents with IDD. The PI and FBPC procedures included the construction of multiple, related simple sentences into a paragraph. The present study was guided by the following research question: What are the effects of PI and FBPC intervention on the paragraph text-writing skills of adolescent students with IDD?

## **Methods**

### **Participants and Setting**

Three students participated in the study, all of whom were receiving special education services in a suburban, Midwestern high school. All students were recommended to the lead investigator by their special education teacher and were recommended because they had difficulties composing paragraphs. No other individuals were considered for participation in the study. The first student, Amelia, was a white female in 11<sup>th</sup> grade who was 17 years old at the time of intervention. She was diagnosed with ID and had a full-scale IQ of 63. Stuart was a 15-year-old white male in 9<sup>th</sup> grade. He was diagnosed with ASD and had a full-scale IQ of 89. The final participant, Loretta, was a white female in 10<sup>th</sup> grade who was 16 years old at the time of intervention. She was also diagnosed with ASD and had a full-scale IQ of 84.

The first author was the lead investigator and conducted the intervention. He was a graduate student with a master's degree in special education and seven years of experience working with adolescents with IDD. All sessions took place in a special education classroom during the same free period in the students' schedules. The interventionist worked individually with each student. He sat next to the student at a small, round table in the corner of the room.

### **Materials**

There were 13 unique sets of intervention stimuli: 3 for the PI lesson and 10 for the FBPC lessons. The PI materials included paragraphs with complete and incomplete sentences, verb conjugation activities (i.e., present to past tense), and picture-word prompts. Each FBPC

set had picture-word prompts with space for students to handwrite their response and record their goal and actual score. Picture-word prompts appeared as three rectangular panels and three words associated with the pictures. The first and third panels were hand-drawn images that corresponded to the beginning and end, respectively, of an action. The middle panel was empty.

There were 30 unique sets of 3-minute descriptive paragraph probes used for the dependent variable. The paragraph probes were formatted similarly to FBPC materials: picture-word prompts of three rectangular panels and words associated with the pictures. However, paragraph probe image and word combinations did not overlap with those used for intervention.

### **Definition and Measurement of the Dependent Variables**

The interventionist administered a 3-minute descriptive paragraph probe at the end of every session. The interventionist handed the student a probe and said, "Write your name and date at the top, then put your pen or pencil down. You're going to write a paragraph that describes these pictures. The first picture shows the beginning. The middle is missing. The last picture shows how it ended. There are some words you can use below the pictures." The interventionist then read aloud the words below the images. "Do you have any questions on what the pictures show or the words?" The interventionist responded to any questions and began the timer. The interventionist did not provide any feedback during the timing or after the student was finished writing. Three dependent variables (described below) were observed on each probe.

**Correct and incorrect writing sequences.** Similar to previous studies (e.g., Datchuk, 2016; Datchuk & Rodgers, 2019; Ritchey et al., 2016), we used a modified version of CWS and IWS that ignored spelling errors provided misspelled words were phonetically similar to the intended word (e.g., fone for phone). For example, the sentence "\_tammy\_playz\_basketbal\_." contains four total writing sequences, as indicated by the underlined spaces. This sentence would be scored as such: "x^tammy^xplayz^basketbal^." Both 'playz' and 'basketbal' are acceptable despite the spelling errors, given that they are phonetically similar to the intended word. 'Tammy' is incorrect on both sides because it was not capitalized. Prior research has

identified CWS and IWS as valid measures for evaluating the writing of young adults with IDD (Hosp et al., 2014).

**Paragraph text-writing rubric.** The authors developed a trait-based paragraph text-writing rubric to address text-writing elements targeted by instruction that might escape CWS and IWS. For example, CWS and IWS do not explicitly measure the number of complete sentences. In addition, because CWS and IWS evaluate only adjacent writing units and not the entirety of the composition (Romig et al., 2017), it is possible to achieve a high number of word sequences by writing an ungrammatical, lengthy run-on sentence. Other writing studies with student with IDD used holistic rubrics (Asaro-Saddler & Bak, 2012; Asaro-Saddler & Bak, 2014) to measure students' writing. However, these rubrics generally measure overall quality do not evaluate the specific text-writing components targeted by this intervention. Therefore, the authors created the paragraph text-writing rubric evaluate the appropriateness of each individual sentence within the context of the entire composition.

The rubric evaluated students' paragraphs on several elements. First, the presence of an indentation was scored dichotomously (1 = yes, 0 = no). Then, each sentence within the paragraph was scored for three elements (i.e., syntax/semantics, capitalization, and punctuation) on a 0-3-point scale (3 = no error, 2 = one error, 1 = two errors, 0 = two or more errors). Therefore, individual sentences were worth a possible nine points. Syntax/semantics referred to rules of appropriate grammar and meaning. Rules of grammar included subject-verb agreement and consistent verb tense. Semantics referred to the issues affecting the interpretability of a sentence. Capitalization referred to the appropriate capitalization of the first letter of a sentence and proper nouns. Punctuation was the appropriate placement of an end punctuation mark. A student who wrote three complete sentences with an initial indentation would receive a score of 28 points (i.e., 9 points for each sentence and 1 point for the indentation). The number of sentences was dependent upon punctuation; students who omitted a punctuation mark between sentences were evaluated as having written a single run-on sentence.



**Interobserver Agreement**

The first author scored all probes, and a graduate student unaffiliated with the study served as a second rater. The lead author trained the graduate student on the dependent measures until reaching at least 95% agreement on sample probes. The graduate student scored a randomly selected 35% of the total probes across all phases. The following Pearson correlation coefficients were found: 0.97 for CWS, 0.97 for IWS, and 0.99 for the rubric.

**Independent Variable**

The independent variable was a multi-component intervention of PI and FBPC. The PI component was three 25-minute instructional lessons (Lessons 1 – 3). The three PI lessons featured explicit instructional techniques of model-lead-test (Archer & Hughes, 2011): the interventionist modeled new skills, led students through guided practice, and tested for independent performance. The interventionist provided the students with praise for correct responses and immediate error correction for errors. For example, when the student successfully started their paragraph with an indentation, the interventionist praised the student by saying, “Good job on starting your paragraph with an indentation,” or a similar phrase. When the student made an error (e.g., their sentence lacked punctuation) the interventionist said, “You did not use punctuation at the end of this sentence. Each sentence needs to end with punctuation. Please write a period at the end of the sentence.” The PI lessons ended once students achieved the at least 90% on an activity at the end of the third lesson. The FBPC component was a maximum of 10 practice lessons (Lessons 4 to 13) that each lasted approximately 15 minutes. Each FBPC lesson featured two, 3-minute practice trials of paragraph writing, goal setting, performance feedback, and error correction. The FBPC lessons ended in one of two ways: either when a student earned 42 points on the paragraph text-writing rubric on at least one practice trial for two out of three consecutive lessons or after Lesson 13, whichever occurred first.

**Experimental Design and Data Analysis**

A multiple-baseline across participants design was used, with intervention staggered across students to detect to detect a functional relation between the intervention and the dependent measures (Kazdin, 2011). Intervention began when one student established a steady

baseline across the dependent variables. The other students entered intervention only after the previous student successfully completed the first three PI lessons. We used visual analysis to evaluate the effects of the intervention (Kazdin, 2011), bolstered with Tau-U effect sizes. Tau-U is an overlap index that ranges from -1 to 1, with higher values corresponding to higher proportions of intervention data showing improvement from baseline (Parker et al., 2011). Tau-U is preferable to other non-overlap indices, such as percentage of non-overlapping data, because it allows researchers to control for baseline trend. In addition, Tau-U yields an estimate of variance in addition to the effect size; other single-case effect sizes do not. Vannest and Ninci (2015) recommend the following interpretational guidelines for effects: < 0.20 is small, 0.20 to 0.59 is moderate, 0.60 to 0.80 is large, and > 0.80 is very large.

## **Procedures**

### ***Screening***

Three students who displayed difficulty with paragraph composition were recommended for intervention by their teacher. Students completed four tasks used in previous studies (Datchuk, 2017; Datchuk et al., 2015) to evaluate pre-intervention skills related to paragraph text-writing: handwriting, reading, spelling, and construction of simple sentences. These data were meant for descriptive purposes to inform the interventionist's understanding of students' writing skills that were not targeted by intervention. The 1-minute handwriting copy task was administered and scored for the number of correct, legible letters. Second, students read aloud sentences taken from the intervention materials for a 1-minute oral reading probe. Responses were scored for the number of words read correctly per minute. Third, during a 1-minute sentence construction probe, students wrote sentences to a series of picture-word prompts, and the probes were scored for correct and incorrect writing sequences. Fourth, a list of 25 high frequency words were dictated to students. The spelling probe was untimed and was scored for the percentage of correctly spelled words. Screening data was used to identify challenges associated with handwriting, spelling, and sentence construction skills. Because the participating school did not have IQ information for the students, the lead author also administered the Kaufman Brief Intelligence Test – second edition (KBIT – 2; Kaufman & Kaufman, 2004). The results of these screening measures are presented in Table 1.

**Table 1**  
*Student Characteristics*

Variable	Level	Student		
		Amelia	Stuart	Loretta
Demographics	Gender	F	M	F
	Grade	11	9	10
	Age	17	15	16
	Race	W	W	W
	Disability	ID	ASD	ASD
	IQ	63	89	84
Screening Data	Sentence Construction – CWS (IWS)	18 (2)	26 (1)	17 (2)
	Spelling – % Correct	96%	100%	88%
	Handwriting – CLPM	98	109	63
	Reading – WRCPM	144	146	120

*Note:* F = Female, M = Male, W = White; ID = intellectual disability; ASD = Autism Spectrum Disorder; CWS = Correct Writing Sequence; IWS = Incorrect Writing Sequence; CLPM = Correct Letters per Minute; WRCPM = Words Read Correctly per Minute. All IQ scores were calculated with the Kaufman Brief Intelligence Test, Second Edition (Kaufman & Kaufman, 2004).

### ***Baseline***

During baseline, students completed descriptive paragraph probes and no PI and FBPC lessons were delivered. All students received their typical writing instruction during the baseline, intervention, and maintenance phases. For Amelia, this consisted of 80-minutes per day of combined reading and writing instruction in a special education setting that emphasized decoding, reading comprehension strategies, spelling, and construction of grammatically correct sentences. She received this instruction in a self-contained classroom. For Stuart and Loretta, their writing instruction aligned with the states core standards for writing in the 9<sup>th</sup> and 10<sup>th</sup> grades, respectively. They received their writing instruction in the general education setting.

**Lessons 1 to 3: PI.** In the first lesson, the interventionist defined a simple sentence (i.e., contains a part that names and a part that tells more) and identified important aspects of sentences: starts with a capital letter, includes capital letters for names and titles, and ends with a punctuation mark. A paragraph was defined as a collection of five simple sentences about the same topic that begins with an indentation. The interventionist modeled and

students practiced identifying the part of a sentence that names someone or something and editing paragraphs for capitalization and punctuation errors. For example, the interventionist would read a paragraph that included capitalization and punctuation errors. The interventionist would then verbally identify those errors and physically model how to correct the error (e.g., crossing out the first letter of the sentence and writing the capital version). In addition, students practiced transforming present tense verbs into past tense. The interventionist ended the lessons by modeling paragraph-writing using a picture-word prompt and the paragraph text-writing rubric.

In the second lesson, students completed additional practice with content from the first lesson, but now the interventionists than in the previous lesson and students were responsible for providing independent vocal and written answers. In addition, the verb conjugation activity included irregular verbs. The lesson ended with students writing their own paragraphs to picture-word prompts with feedback from the interventionist using the rubric. For example, the interventionist would explicitly indicate that a student forgot to include an indentation and would ask the student to revise their paragraph.

The third and final lesson focused solely on paragraph-writing. First, students wrote a paragraph. Then, the interventionist evaluated the paragraph using the text-writing rubric and provided students with specific praise (e.g., praise for including an indentation) and error correction (e.g., identifying instances in which the student used inappropriate grammar). Next, students independently wrote paragraphs. Once the students were done writing, the interventionist again evaluated the paragraph. The lesson ended with a cumulative check-out activity that sampled instructional topics from all three lessons. Students completed the check-out activity independently and had to earn at least 90% on the activity to advance to the FBPC phase of the intervention. Amelia had to repeat the third lesson a single time before she achieved 90% on the check-out activity. Stuart and Loretta achieved 90% on their first attempt. Students completed probes from which the dependent variables were measured after every session.

**Lessons 4 to 13: FBPC.** At the beginning of the first FBPC lesson, the interventionist identified the performance goal of 42 points on the rubric. At the start of each FBPC lesson

thereafter, the interventionists reviewed the student's prior performance and re-stated the goal of at least 42 points on the rubric. The authors selected 42 as the goal because that value approximated a five-sentence paragraph with 90% accuracy. Students wrote their goal at the top of the page and were asked to vocally describe the picture-word prompts presented to them. Students were also asked to identify two additional words that described the pictures, which they wrote those next to the pictures. Then students began their first 3-minute practice trial. After the allotted time, the interventionist told students to stop. The interventionist provided performance feedback by scoring the paragraph with the rubric and corrected errors by vocally stating the correct response and having students make the correction. The interventionist praised correct aspects of the first practice trial and then placed it out of sight. Next, the participant completed another 3-minute practice trial with another copy of the identical picture-word prompts. The same picture-word prompts were used for both practice trials, but different picture-word prompts were used across lessons (i.e., Set A for Lesson 4, Set B for Lesson 5, etc.). After, the interventionist again provided performance feedback, error correction, and praise. The students identified their highest score, determined whether they met their goal, and graphed their performance. All three students ended FBPC after two lessons; each student earned more than 42 points on the paragraph rubric on one of their FBPC stimuli for their first and second sessions. Again, students completed probes from which the dependent variables were measured after every session.

With respect to total instructional lessons completed, Amelia completed six lesson (i.e., the three PI lessons, a repeat of the third PI lesson, and two FBPC sessions). Both Stuart and Loretta completed five instructional sessions (i.e., the three PI lessons and two FBPC sessions).

### ***Maintenance***

Maintenance data was collected for each student two weeks after the last FBPC lesson. No PI and FBPC lessons were delivered during the maintenance phase, and procedures mirrored the baseline phase.

### **Fidelity of Implementation**

To aid the fidelity of the intervention, sessions were recorded with an audio-video camera. A graduate student who was trained on the intervention lessons reviewed 30% of the

recorded sessions across all phases. Using a checklist of instructional procedures, the observer found 95% fidelity for the investigation. All fidelity errors were due to complications with the video files: the device stopped recording before three of the sessions concluded. The unrecorded components of these lessons were scored as having no fidelity to obtain a conservative estimate.

### **Treatment Acceptability**

On the last session, each student completed a three-item questionnaire about the intervention, which asked, “How do you feel about the instruction and timed practice with pictures and word prompts?”, “How do you feel about your paragraph writing skills after the instruction and practice?”, and “Is there anything you would change to the instruction or practice?” The first two questions were answered via a 1-4 Likert-style scale (1 = poor; 4 = great). The third question was an open-response item.

### **Results**

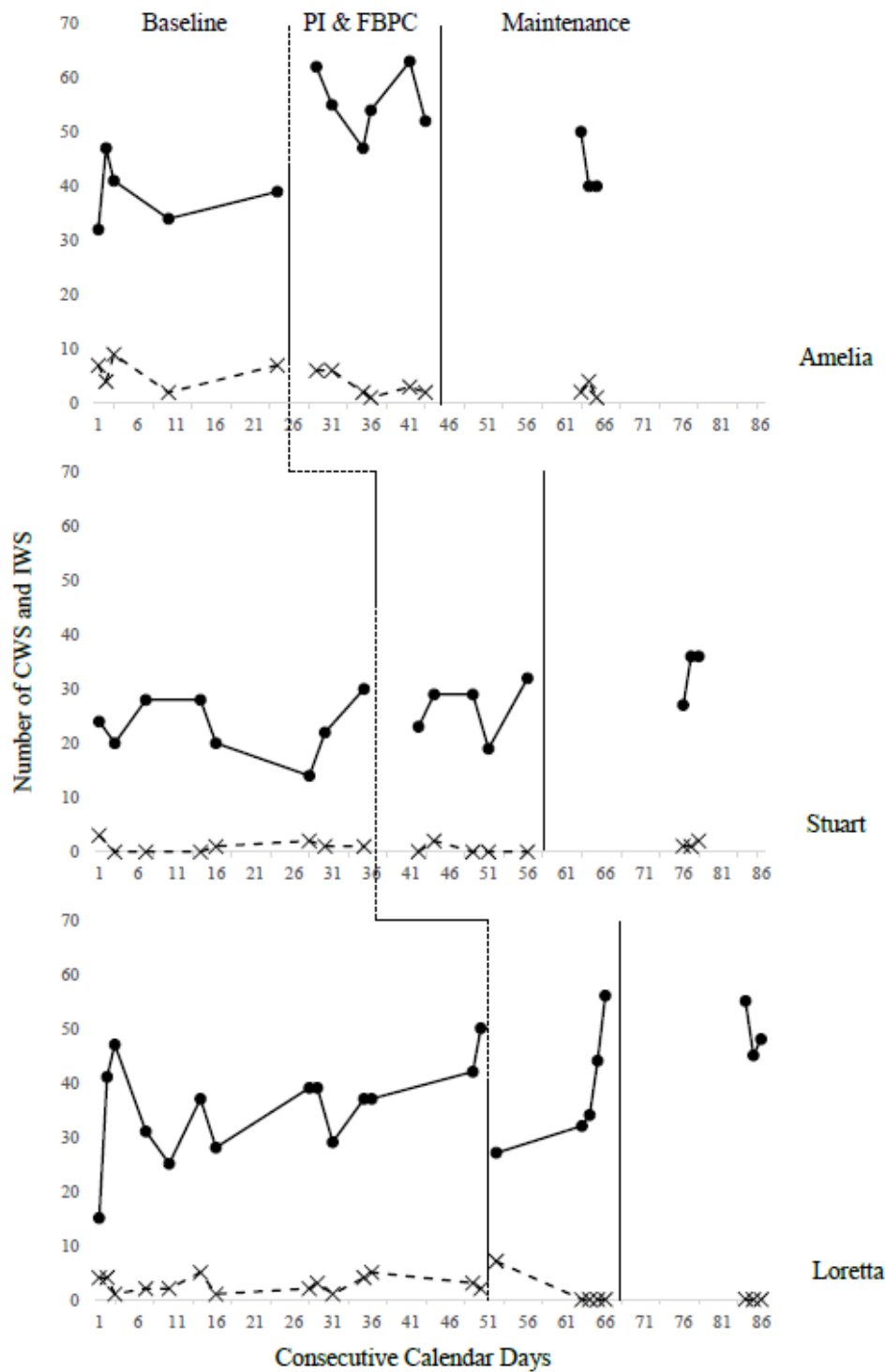
Figures 1 and 2 present students’ CWS/IWS and paragraph rubric data, respectively.

### **Correct and Incorrect Writing Sequences**

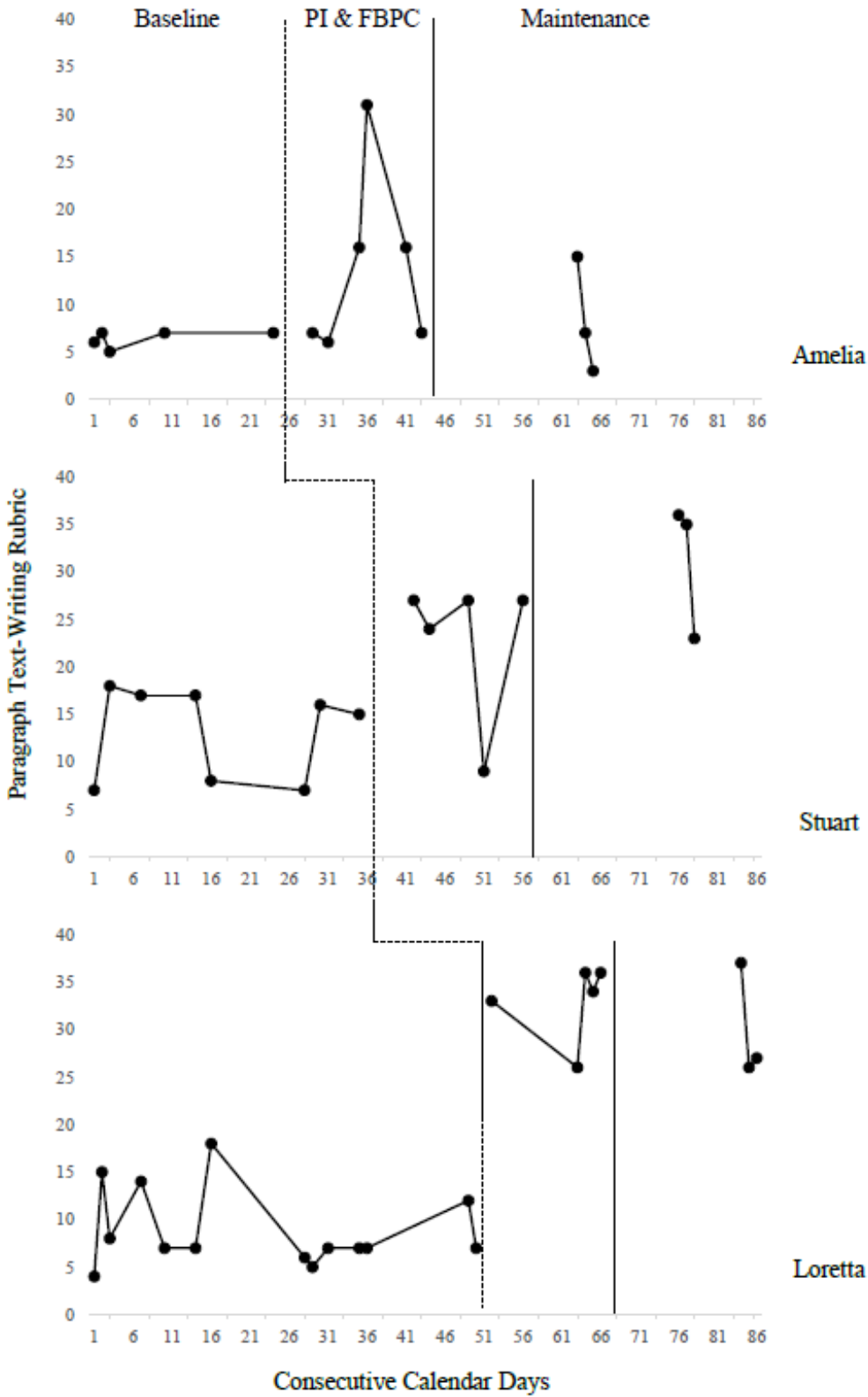
#### ***Amelia***

During baseline, Amelia showed high levels of frequency with varying levels of inaccuracy. Her CWS data path showed an initial upward trend that later stabilized, with a mean of 38.6 CWS (Range: 32 – 47). Conversely, her IWS path showed an initial downward trend and ended with an upward trend, indicating that Amelia was beginning to make more errors on her baseline paragraphs. She averaged 5.8 IWS (Range: 4 – 9) during baseline. Amelia showed an immediate improvement during intervention: Her CWS data path changed in level, while her IWS path showed an overall downward trend. The data indicated that Amelia wrote more with greater accuracy compared to baseline. Her CWS average improved to 55.5 CWS (Range: 47 – 63), and her IWS average decreased to 3.3 IWS (Range: 1 – 6). Amelia did not maintain the

**Figure 2**  
*Participants' Performance on Correct (Closed Circles) and Incorrect (X Symbol) Writing Sequences*



**Figure 3.**  
*Participants' Performance on the Paragraph Text-Writing Rubric*





same performance two weeks after intervention. Her CWS data path returned to near-baseline performance, but her IWS data path remained similar to her intervention-phase performance. Therefore, Amelia maintained an improved level of accuracy after intervention, averaging 43.3 CWS (Range: 40 – 50) and 2.3 IWS (Range: 1 – 4).

### ***Stuart***

During baseline, Stuart produced a moderate amount of text with minimal errors. That is, he did not write much, but his writing was accurate. His CWS data path showed overall stability with some variability towards the end of baseline, and his IWS data path showed stability. He averaged 24.3 CWS (Range: 16 – 31) and 1.0 IWS (Range = 0 – 3) during the baseline phase. His intervention phase CWS and IWS data paths showed no change, indicating that Stuart wrote a similar amount during intervention with less variability. His average CWS and IWS showed a small improvement to 26.8 CWS (Range: 19 – 32) and 0.4 (Range: 0 – 2), respectively. Stuart maintained his performance and showed a modest improvement. His CWS data path showed an upward trend, with an improved average of 34.3 CWS (Range: 28 – 38). His IWS data path did not change from the intervention phase, suggesting that Stuart started to write more with greater accuracy. He averaged 1.3 IWS (Range: 1 – 2) during maintenance.

### ***Loretta***

Loretta showed considerable variability in her CWS performance during baseline. Her CWS data path showed an overall upward trend that did not stabilize, while her IWS data path showed overall stability. That is, she was writing more with greater accuracy during baseline. She averaged 38.3 CWS (Range: 19 – 52) and 2.8 IWS (Range: 1 – 5). Her intervention phase data showed an initial drop CWS and an increase in IWS. That is, she initially wrote less with decreased accuracy. However, her CWS data path later showed a steep, upward trend. This indicates that she also wrote more during the probes during intervention. After her first intervention-phase probe, Loretta made no errors and was writing with perfect accuracy on most probes. Her average CWS and IWS were 40.0 (Range: 32 – 56) and 1.4 (Range: 0 – 7), respectively. Her maintenance performance was similar to her intervention performance. She showed less variability, and Loretta continued to make no errors. She averaged was 30.0 CWS (Range: 45 – 55) and 0.0 IWS (Range: 0).

**Paragraph Text-Writing Rubric*****Amelia***

During baseline, Amelia often wrote a long run-on sentence, so she earned minimal points on grammar, capitalization, and punctuation. These low scores remained stable throughout baseline, averaging 6.4 points (Range: 5 – 7 ) during the phase. Amelia did not show an immediate change in rubric scores during intervention, but her data path showed an initial steep increase in performance. During this time, Amelia wrote more sentences and included punctuation and capitalization. However, her data then showed a steep, negative slope, with the final intervention data point returning to baseline-level. Her writing during these last probes mirrored her baseline writing: She often wrote one run-on sentence that was scored as a single sentence, and she lost additional points for errors with grammar, punctuation, and capitalization. Overall, she showed an increased average of 13.8 (Range: 6 – 31) on the rubric during the intervention phase. Amelia's maintenance data followed the same overall: the initial data point showed improvement, but the later data points returned to near baseline-level. She averaged 8.3 (Range: 3 – 15) on the rubric during this phase.

***Stuart***

During baseline, Stuart demonstrated an overall low but variable performance on the rubric. His paragraphs usually included appropriate grammar, capitalization, and punctuation, but he often wrote only two sentences. Overall, his baseline data path showed a slight downward trend with an average of 13.1 (Range: 7 – 18) on the rubric. During intervention, Stuart showed moderate improvement by maintaining appropriate grammar, capitalization, and punctuation and by writing more than two sentences. His data path showed a clear change in level: All but one of his intervention data points were higher than his baseline performance. He had an improved average paragraph rubric score of 22.8 (Range: 9 – 27) during intervention. Stuart showed a continued improvement during the maintenance phase by continuing to write more sentences and maintaining appropriate grammar, capitalization, and punctuation. Overall, he averaged 30.3 points (Range: 23 – 36) during the maintenance phase.

***Loretta***

During baseline, Loretta initially showed considerable variability, with overall low scores on the paragraph text-writing rubric. Her initial baseline paragraphs consisted of 1-2 sentences, one of which was typically a run-on sentence without punctuation. In addition, she inconsistently used appropriate grammar, specifically subject-verb agreement. Her performance eventually stabilized and averaged 8.6 (Range: 4 – 18) points on the rubric during baseline. Loretta demonstrated an immediate increase in performance during intervention: She consistently wrote 3-4 sentences with more appropriate grammar and punctuation. She occasionally included a run-on sentence that contributed to some variation in her performance. Consequently, all rubric scores were superior to baseline, and her average rubric score increased to 32.8 (Range: 26 – 36). Loretta sustained a similar level of performance two weeks later, averaging 30 points (Range: 26 – 37) on the rubric. Her maintenance phase paragraphs were typically 3-4 sentences long and included appropriate grammar and punctuation.

### **Tau-U Effect Sizes**

We evaluated each of the student's baselines prior to calculating the Tau-U effect size. Vannest and Ninci (2015) recommend controlling for baselines that meet or exceed a Tau value of 0.30. Only Loretta's baseline proved to have a significant trend, so her individual contribution to the Tau-U effect size was modified to reflect this. The aggregated Tau-U effect sizes for each outcome measure ranged from moderate to large effects. The CWS (Tau-U: 0.45, SD = 0.42) and IWS (Tau-U: 0.51, SD = 0.42) were moderate, whereas the effect on the rubric score (Tau-U: 0.79, SD = 0.42) was large.

### **Treatment Acceptability**

All students rated the instruction and timed practice as a 4 (great) on the 4-point Likert-style scale (i.e., 1- poor to 4-great). In addition, students indicated that they felt positively about their paragraph writing skills after the intervention: Two students rated their post-intervention skills as a 4 (great), and one student rated themselves as a 3 (good). Only one student completed the open-response item, writing, "It's all good."

### **Discussion**

Writing skills are a critical component of academic, vocational, and social endeavors. Students with IDD can struggle with several aspects of written expression, including text-writing

within paragraphs. Unfortunately, there is a dearth of text writing interventions for students with IDD. To that end, the present study described a multi-component intervention of PI and FBPC designed to improve the accuracy and fluency of paragraph text-writing of adolescents with IDD.

Visual analysis of the data yielded a promising yet nuanced set of results. With respect to CWS and IWS, only Amelia showed an improvement: She showed growth in both the amount of text generated and her accuracy (i.e., she earned fewer IWS). During intervention, she her data showed a noticeable change in level with respect to how much she wrote (i.e., improved text generation). She also showed an improved level of accuracy. Conversely, Stuart and Loretta showed changes only with respect to accuracy. Stuart showed a minimal improvement in accuracy (he showed high levels of accuracy throughout the entire intervention), whereas Loretta demonstrated perfect accuracy for all intervention-phase probes except her first. However, neither student generated more text during intervention. The moderate Tau-U values for CWS and IWS (0.43 and 0.51, respectively) complement the results of the visual analysis.

With respect to the paragraph text-writing rubric, Stuart and Loretta showed an experimental effect, but Amelia showed a mixed effect. During the PI and FBPC phase, Stuart wrote paragraphs with more sentences using appropriate syntax/semantics, capitalization, and punctuation. Loretta wrote more sentences and showed improved syntax, particularly in her subject-verb agreement. These changes in their writing resulted in changes in the students' rubric data paths, particularly for Loretta who demonstrated a clear change in level. Amelia showed an initial change in performance as measured by the rubric, but this behavior quickly returned to baseline level. The Tau-U value (0.79) for the paragraph rubric was large, suggesting that, overall, the intervention led to a larger change in the paragraph text-writing rubric data.

The CWS, IWS, and rubric data combined show a nuanced set of results. Stuart and Loretta made no change with respect to the amount of text they wrote, but they did show improvements in overall accuracy. They also showed improvements with the text-writing skills measured by the paragraph text-writing rubric. That is, they tended to write shorter sentences with improved grammar, capitalization, and punctuation. Both students maintained intervention-level performance or greater two weeks after intervention. Alternatively, Amelia

showed an improvement in both text generation and accuracy, but she yielded no effects with respect to the paragraph rubric. Though she later reverted to baseline-level performance, she continued to write more. This suggests that the intervention led to an increase in text generation, but those increases did not guarantee improvement in the paragraph text-writing skills identified in the rubric.

Several factors may have influenced the results of this study. For Amelia, specific characteristics may have hindered a more robust performance on the paragraph text-writing rubric. She was the only student with an intellectual disability; her IQ was approximately 20 points lower than that of the other students. Comparatively, Stuart and Loretta had higher IQ scores and had a diagnosis of ASD. These students yielded experimental effects, whereas Amelia did not. Therefore, for students with more moderate needs, instruction and practice procedures may need to be further modified to promote the achievement of students with ID (Spooner et al., 2019). Second, the PI and FBPC intervention was delivered for a shorter duration than prior studies that used similar procedures for simple sentence text-writing. The intervention phase lasted approximately five lessons (i.e., two PI lessons and three FBPC lessons) and ended upon achievement of 42 points on the paragraph text-writing rubric, roughly corresponding to an indented, five-sentence paragraph with 90% accuracy. Prior research using similar procedures for sentence text-writing have typically lasted longer, approximately 10 to 15 lessons, and ended upon achievement of a performance criterion based on a small sample of high-performing, typically developing writers (e.g., Datchuk et al., 2015). To promote additional gains in student achievement, more intervention lessons and a more stringent performance criterion set on local or national norms may be needed for paragraph text-writing.

The promising yet mixed results warrant caution when interpreting findings. However, overall results extend several complimentary lines of research. First, this study addresses the considerable gap in the literature regarding writing interventions for students with IDD. Most writing studies that include students with IDD focus on strategy use with dependent measures that examine holistic writing quality (Asaro-Saddler & Bak, 2012; Asaro-Saddler & Bak, 2014);

no studies yet published have described a multicomponent intervention designed to improve students' text-writing skills at the discourse level.

Findings also extend research on the development of adolescent written expression (Berninger & Amtmann, 2003; Poch & Lembke, 2017) and the role of behavioral fluency (Kubina & Yurich, 2012). Prior to intervention, all students were nominated as adolescents struggling to compose paragraphs. Screening measures indicated students had proficiency with many skills related to paragraph text writing: simple sentence construction, spelling, handwriting, and reading (see Table 1). However, these skills did not coalesce into adequate paragraph text-writing. As a result of intervention that focused on extending these skills into accurate and fluent paragraph text writing, students improved their frequency of constructing multiple, related simple sentences with appropriate syntax/semantics, capitalization, and punctuation. These skills also maintained for two of the three students (Stuart and Loretta), suggesting fluency promoted an enduring change in writing performance.

Additionally, findings extend research on the use of explicit instruction procedures to teach text-writing to students with disabilities. Prior studies have found the use of explicit instruction steps of model-lead-test with picture-word prompts to be an efficient and effective means of improving the text writing of students with LD, EBD, and other writing challenges (Anderson & Keel, 2002; Datchuk, 2016; Viel-Ruma, et al., 2010; Walker, et al., 2005). The results of the present study extend this prior research and provides novel evidence that a combined intervention of explicit instruction and timed practice can improve the text writing abilities of young adults with IDD: both Stuart and Loretta yielded experimental effects.

Furthermore, the findings extend research that has paired explicit instruction with deliberate practice procedures to achieve fluency in text-writing. Prior research has used SI and FBPC procedures to achieve fluency in simple sentence text writing (Datchuk, 2017; Datchuk, 2017; Datchuk et al., 2015). The present study used similar procedures with two key differences. First, the present study focused on timed practice composing descriptive paragraphs of at least five simple sentences to a series of related picture-word prompts (e.g., a person washing their dog). Prior studies did not address paragraph composition and instead focused on construction of multiple, unrelated simple sentences (e.g., Datchuk et al., 2015).

Second, text-writing was measured with a paragraph text-writing rubric to better capture the effects of intervention. Previous studies have used either traditional or modified CWS/IWS measures (e.g., Datchuk, 2017). However, CWS measures adjacent units that are spelled correctly and grammatically appropriate (Romig et al., 2017) but does not capture the appropriateness of the units within the context of the entire composition. That is, students who write long, run-on sentences may earn a high number of CWS and correcting the composition for appropriate punctuation may add little to the CWS total. For example, Amelia's baseline paragraphs consisted of long, run-on sentences and would have received a large number of CWS. Her increased use of punctuation her additional sentences during intervention would have resulted in negligible increases in her CWS scores despite the improvement in punctuation.

### **Limitations and Future Directions**

The study contains several limitations. First, Loretta did not achieve stability on her CWS data prior to the start of intervention, which has occurred in previous studies (e.g., Viel-Ruma et al., 2010). This would make it impossible to attribute any changes to intervention alone. However, no apparent changes were observed. Second, only three students participated, one of whom (Amelia) differed from the other two students on several characteristics (e.g., IQ). Future researchers should seek to include a larger sample of more homogenous students. Third, the paragraph text-writing rubric did not explicitly measure aspects of transcription (i.e., handwriting and spelling) because it fell outside the scope of intervention. Transcription can account for a significant proportion of variance in text-writing (Limpo et al., 2016), and future research could include such a measure.

### **Implications for Practice**

Results from this study support several recommendations. First, the paragraph text-writing of students with IDD may improve following short, supplemental intervention. These short lessons (15 – 25 minutes) can complement core writing instruction. Second, explicit instruction and timed practice procedures may be an effective way to improve multiple skills related to paragraph text-writing, including the number of sentences with appropriate grammar, capitalization, and punctuation. Explicit instruction emphasizes accuracy and uses

model-lead-test delivery steps and can feature picture-word prompts to aid student writing. Timed practice emphasizes fluency and entails short, timed writing with performance feedback, error correction, and praise. Third, some students may need further modifications (e.g., increased lesson duration, additional lessons, more ambitious goals) based upon individual characteristics.

### **Conclusion**

Research shows that students with IDD can struggle to develop important writing skills. Most writing research for this population focuses on the use of essay and story-writing strategies. This investigation demonstrates that an intervention with explicit instruction, timed practice, and picture-word prompts has the potential to improve the accuracy and fluency of the paragraph text writing of learners with IDD. However, further attention to the development and evaluation of writing interventions for these learners is warranted.



### References

- Anderson, D. M., & Keel, M. C. (2002). Using "reasoning and writing" to teach writing skills to students with learning disabilities and behavioral disorders. *Journal of Direct Instruction*, 2(1), 49-55. <https://eric.ed.gov/?id=EJ650270>
- Archer, A., & Hughes, C. (2011). *Explicit instruction: Efficient and effective teaching*. New York, NY: Guilford Press.
- Asaro-Saddler, K., & Bak, N. (2012). Teaching children with high-functioning autism spectrum disorders to write persuasive essays. *Top Language Disorders*, 32(4), 361-378. <https://doi.org/10.1097/TLD.0b013e318271813f>
- Bangert-Drowns R. L., Hurley, M. M., & Wilkinson, B. (2004). The effects of school-based writing-to-learn interventions on academic achievement: A meta-analysis. *Review of Educational Research*, 74(1), 29-55. <https://doi.org/10.3102/00346543074001029>
- Berninger, V. W., & Amtmann (2003). Preventing written expression disabilities through early and continuing assessment and intervention for handwriting and/or spelling problems: Research into practice. In H. L. Swanson, K. R. Harris, & S. Graham (Eds.), *Handbook of learning disabilities* (pp. 345-363). New York, NY: Guilford Press.
- Datchuk, S. M. (2016). Writing simple sentences and descriptive paragraphs: Effects of an intervention on adolescents with writing difficulties. *Journal of Behavioral Education*, 25(2), 166-188. <https://doi.org/10.1007/s10864-015-9236-x>
- Datchuk, S. M. (2017). A direct instruction and precision teaching intervention to improve the sentence construction of middle school students with writing difficulties. *The Journal of Special Education*, 51(2), 62-71. <https://doi.org/10.1177/0022466916665588>
- Datchuk, S., & Kubina, R. M. (2013). A review of teaching sentence-level writing skills to students with writing difficulties and learning disabilities. *Remedial and Special Education*, 34(3), 180-192. <https://doi.org/10.1177/0741932512448254>
- Datchuk, S., Kubina, R. M., & Mason, L. H. (2015). Teaching simple sentence construction with acquisition and frequency building to a performance criterion to students with learning disabilities. *Exceptionality*, 23(1), 34-53. <https://doi.org/10.1080/09362835.2014.986604>
- Datchuk, S. M., & Rodgers, D. B. (2019). Text writing within simple sentences: A writing fluency intervention for students with high-incidence disabilities. *Learning Disabilities Research and Practice*, 34(1), 23-34. <https://doi.org/10.1111/ldrp.12185>
- Gabig, C. (2008). Verbal working memory and story retelling in school-age children with autism. *Language, Speech, and Hearing Services in Schools*, 39(4), 498-511. [https://doi.org/10.1044/0161-1461\(2008/07-0023\)](https://doi.org/10.1044/0161-1461(2008/07-0023))
- Gansle, K. A., Noell, G. H., VanDerHeyden, A. M., Naquin, G. M., Slider, N. J. (2002). Moving beyond total words written: The reliability, criterion validity, and time cost of alternate measures for curriculum-based measurement in writing. *School Psychology Review*, 31, 477-497. <https://doi.org/10.1080/02796015.2002.12086169>
- Garcia, E., Crespo, P., & Bermúdez, I. (2017). Writing an independently composed sentence by Spanish-speaking children with and without poor transcription skills: A writing-level match design. *Journal of Learning Disabilities*, 50, 511-521. <https://doi.org/10.1177/0022219416633862>

- Gargiulo, R. M., & Bouck, E. C. (2018). *Special education in contemporary society: An introduction to exceptionality*. (6<sup>th</sup> ed.). Los Angeles, CA: Sage.
- Graham, S., & Hebert, M. (2011). Writing to read: A meta-analysis of the impact of writing and writing instruction on reading. *Harvard Educational Review*, 81(4), 710-744. <https://doi.org/10.17763/haer.81.4.t2k0m13756113566>
- Hosp, J. L., Hensley, K., Huddle, S. M., & Ford, J. W. (2014). Using curriculum-based measures with postsecondary students with intellectual and developmental disabilities. *Remedial and Special Education*, 35(4), 247-257. <https://doi.org/10.1177/0741932514530572>
- Joseph, L. M., & Konrad, M. (2008). Teaching students with intellectual or developmental disabilities to write: A review of the literature. *Research in Developmental Disabilities*, 30, 1-19. <https://doi.org/10.1016/j.ridd.2008.01.001>
- Kaufman, A. S., & Kaufman, N. L. (2004). *Kaufman brief intelligence test*. John Wiley & Sons, Inc.
- Kazdin, A. E. (2011). *Single-case research designs: Methods for clinical and applied settings* (2<sup>nd</sup> ed.). New York: Oxford University Press.
- Kim, Y-S., Gatlin, B., Al Otaiba, S., & Wanzek, J. (2018). Theorization and an empirical investigation of the component-based and developmental text writing fluency construct. *Journal of Learning Disabilities*, 51(4), 320-335. <https://doi.org/10.1177/0022219417712016>
- Kubina, R. M., & Yurich, K. K. L. (2012). *The precision teaching book*. Lemon, PA: Greatness Achieved.
- Limpo, T., Alves, R. A., Connelly, V. (2016). Examining the transcription-writing link: Effects of handwriting fluency and spelling accuracy on writing performance via planning and translating in middle grades. *Learning and Individual Differences*, 53, 26-36. <http://dx.doi.org/10.1016/j.lindif.2016.11.004>
- Menyuk, P., & Quill, K. (1985). Semantic problems in autistic children. In E. Schopler & G. B. Mesibov (Eds.), *Communication problems in autism* (pp.127-145). New York: Plenum Press. [https://link.springer.com/chapter/10.1007/978-1-4757-4806-2\\_8](https://link.springer.com/chapter/10.1007/978-1-4757-4806-2_8)
- Monroe, B. W., & Troia, G. A. (2006). Teaching writing strategies to middle school students with disabilities. *The Journal of Educational Research*, 100(1), 21-33. <https://doi.org/10.3200/JOER.11.1.21-33>
- Moore, S. T. (2002). *Asperger syndrome and the elementary school experience*. Shawnee Mission, KS: Autism Asperger Publishing Company.
- National Center for Education Statistics. (2015). *NAEP data explorer*. Washington, DC: Institute of Education Sciences.
- National Commission on Writing in America's Schools and Colleges. (2004). *Writing: A ticket to work . . . or a ticket out*. New York, NY: The College Board. <https://archive.nwp.org/cs/public/print/resource/2540>
- Parker, R., I., Vannest, K. J., Davis, J. L., & Sauber, S. B. (2011). Combining nonoverlap and trend analysis for single-case research: Tau-U. *Behavior Therapy*, 42(2), 284-299. <https://doi.org/10.1016/j.beth.2010.08.006>
- Penner-Williams, J. Smith, T. E. C., & Gartin, B. C. (2009). Written language expression: Assessment instruments and teacher tools. *Assessment for Effective Intervention*, 34(3), 162-169. <https://doi.org/10.1177/1534508508318805>

- Pennington, R. C., Collins, B. C., Stenhoff, D. M., Turner, K. & Gunselman, K. (2014). Using simultaneous prompting and computer-assisted instruction to teach narrative writing skills to students with autism. *Education and Training in Autism and Developmental Disabilities, 49*(3), 396-414. <https://www.jstor.org/stable/23881260>
- Poch, A. L., & Lembke, E. S. (2017). A not-so-simple view of adolescent writing. *International Journal for Research in Learning Disabilities, 3*(2), 27-44. <https://doi.org/10.28987/ijrld.3.2.27>
- Richards, S., Brady, M., & Taylor, R. (2015). *Cognitive and intellectual disabilities* (2<sup>nd</sup> ed.). New York, NY: Routledge.
- Ritchey, K. D., McMaster, K. L., Al Otaiba, S., Puranik, C. S., Kim, Y. G., Parker, D. C., & Ortiz, M. (2016). Indicators of Fluent Writing in Beginning Writers. In K. D. Cummings & Y. Petscher (Eds.), *The fluency construct: Curriculum-based measurement concept and applications*. New York, NY: Springer. <https://doi.org/10.1107/978-1-4939-2803-3>
- Romig, J. E., Therrien, W. J., & Lloyd, J. W. (2017). Meta-analysis of criterion validity for curriculum-based measurement in written language. *The Journal of Special Education, 5*(12), 77-82. <https://doi.org/10.1177/0022466916670637>
- Spooner, F., Root, J. R., Saunders, A. F., & Browder, D. M. (2019). An updated evidence-based practice review on teaching mathematics to students with moderate and severe developmental disabilities. *Remedial and Special Education, 40*(30), 150-165. <https://doi.org/10.1177/0741932517751055>
- Strum, J. M. (2012). An enriched writer's workshop for beginning writers with developmental disabilities. *Topics in Language Disorders, 32*(4), 335-360. <http://doi.org/10.1097/TLD.0b013e318272609b>
- Troia, G. A., Shen, M., & Brandon, D. L. (2019). Multidimensional levels of language writing measures in grades four to six. *Written Communication, 36*(2), 231-266. <https://doi.org/10.1177/0741088318819473>
- Vannest, K. J., & Ninci, J. (2015). Evaluating intervention effects in single-case research designs. *Journal of Counseling & Development, 93*, 403-411. <https://doi.org/10.1002/jcad.12038>
- Viel-Ruma, K., Houchins, D. E., Jolivet, K., Fredrick, L. D., & Gama, R. (2010). Direct instruction in written expression: The effects of English speakers and English language learners with disabilities. *Learning Disabilities Research & Practice, 25*(2), 97-108. <https://doi.org/10.1111/j.1540-5826.2010.00307.x>
- Walker, B., Shippen, M. E., Alberto, P., Houchins, D. E., & Cihak, D. F. (2005). Using the Expressive Writing program to improve the writing skills of high school students with learning disabilities. *Learning Disabilities Research & Practice, 20*(3), 175-183. <https://doi.org/10.1111/j.1540-5826.2005.00131>
- Woods-Groves, S., Hughes, C. A., Rodgers, D. B., Balint-Langel, K., Alqahtani, S., S., Neil, K. M., & Hinzeman, M. (2020). Efficacy of a computer-based strategy with postsecondary students with intellectual and developmental disabilities. *Education and Training in Autism and Developmental Disabilities, 55*(2), 142-157. <https://files.eric.ed.gov/fulltext/EJ1254210.pdf>