An Experimental Examination of Quick Writing in the Middle School Science Classroom

Elizabeth Benedek-Wood*
The Pennsylvania State University

Linda H. Mason
The University of North Carolina at Chapel Hill

Philip H. Wood
West Branch Area School District

Katie E. Hoffman & Ashley McGuire
The Pennsylvania State University

A staggered A-B design study was used to evaluate the effects of Self-Regulated Strategy Development (SRSD) instruction for quick writing in middle school science across four classrooms. A sixth-grade science teacher delivered all students' writing assessment and SRSD instruction for informative quick writing. Results indicated that performance in organizational writing quality and number of words written improved for both students with and without disabilities, with large effects. Student knowledge was improved, but with smaller and more variable effects. Results of a questionnaire indicated that students were positive about the intervention.

Keywords: Self-regulated strategy development (SRSD), quick writing, writing quality, composition writing, middle school.

Writing plays a critical role across content classrooms in supporting learning and comprehension across the curriculum (Deshler, Palincsar, Biancarosa, & Nair, 2007), as well as encouraging critical thinking (Tierney & Shanahan, 1991). Therefore, it is no surprise that short and extended writing is emphasized across content areas and narrative, persuasive, and informative genres in the Common Core State Standards (CCSS, 2013). When students struggle with writing, however, they are less likely to use writing to extend learning across content areas (Graham & Perin, 2007), thereby negatively affecting academic performance (Graham, 2006). Despite the importance of writing, only 27% of students in eighth and twelfth grade performed at or above the proficient level (24% at the proficient level and 3% at the advanced level) while 20% of eighth grade students and 21% of twelfth grade students performed at the below basic level in writing according to the U.S. National Assessment of Educational Progress (NAEP, 2011).

Researchers have identified a number of reasons for students' writing difficulties. Writing challenges may result from a lack of metacognitive skills, such as planning, organizing, generating, and revising, that are necessary to carry out the writing process (Graham & Harris, 2009). Students who struggle with writing often lack the self-regulation skills required to start a task, stay on task, and finish a

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*Please send correspondence to: Elizabeth Benedek-Wood, College of Education, Pennsylvania State University, 274 Chambers Building, University Park, PA 16802, eab172@psu.edu.

task (Graham & Harris, 2003). In addition, struggling writers may not have benefited from writing instruction that meets their needs, and/or may have had limited opportunities to practice and apply writing skills in the classroom (Graham & Perin, 2007). In fact, researchers have reported that many adolescents demonstrate difficulty writing across narrative, persuasive, and informative writing genres (Coker & Lewis, 2008). Therefore, effective content teacher-led instruction that supports (a) metacognitive and self-regulation skill development, and (b) opportunities for practice and skill application across settings, tasks, and genre to promote independence and generalization should be considered.

Writing to Learn

Writing activities often require students to communicate understanding of information and make connections (Mason, Benedek-Wood, & Valasa, 2009). Providing students with writing opportunities across academic content areas influences their writing performance and builds comprehension and vocabulary knowledge. To improve students' writing performance so that writing can be used as a tool for learning, researchers recommend fully integrating writing across content area curriculum (Graham & Harris, 2013). One method for fostering writing-to-learn opportunities is by including short constructed responses, such as summary writing and quickwrites in classroom activities. These short formats for written expression serve as an opportunity for students to express their thoughts, knowledge, and questions about the information presented in the classroom (Fisher & Frey, 2012; Tierney & Dorroh, 2004). Quick writing is the focus of the current study.

Quick Writes. The purpose of a quick write is to present an informal writing activity where students are asked to respond to a prompt within a short time period (Mason et al., 2009). One advantage of the quick write is that it provides a nonthreatening writing opportunity that encourages students to write about a topic without being concerned about punctuation, spelling, and grammar (Daniel & Bizar, 2005). In other words, the goal of quick writing is to promote written expression by asking students to focus on message content rather than mechanics (Fisher & Frey, 2012). Another advantage of the quick write is that it is intended to be a brief activity (e.g., 10 min), making it a practical task that can be integrated in any classroom. Finally, given the flexible nature of the quick write, teachers can use the activity for a variety of reasons, such as (a) assessing students' prior knowledge or comprehension; (b) asking students to perform a specific skill, such as summarizing information or writing a persuasive response; and (c) providing students with an opportunity to ask questions and/or express opinions and reactions.

Although providing writing opportunities is important, it is not sufficient for improving the skills of learners who struggle with writing. Providing effective instruction is critical in teaching students to establish goals, create a plan, generate and organize ideas, compose text, revise text, and self-monitor progress for writing (Harris & Graham, 1999). One approach, Self-Regulated Strategy Development (SRSD) instruction has proven effective for improving the writing quality by explicitly teaching students to use strategies throughout the writing process (Graham & Perin, 2007). In a review of SRSD literature, Baker and colleagues (Baker, Chard, Ketterlin-Geller, Apichatabutra, & Doabler, 2005) found that the research base for SRSD instruction

met the standards of an evidence-based practice as indicated by the proposed criteria for group (Gersten et al., 2005) and single-subject designs (Horner et al., 2005). Furthermore, the researchers concluded that SRSD instruction would likely have a significant impact on students' writing performance in schools when implemented with fidelity (Baker et al.).

SRSD Instruction

SRSD instruction combines elements of explicit instruction with strategy instruction to teach students to how to apply metacognitive and self-regulation strategies during writing tasks (Harris & Graham, 1992). SRSD includes six stages of strategy instruction: (a) Develop Background Knowledge, (b) Discuss It, (c) Model It, (d) Memorize It, (e) Support It, and (f) Independent Performance (Harris, Graham, Mason, & Friedlander, 2008). The four components of self-regulation (goal-setting, self-monitoring, self-instructions, and self-reinforcement) are addressed and integrated throughout the six stages of instruction. SRSD uses instructional scaffolding to provide the support needed for maintaining high levels of student success while also promoting independence by gradually fading supports as students master the writing process. SRSD instruction is also designed to support maintenance and generalization of skills over time and across settings. Researchers have found SRSD instruction to be effective for teaching writing skills to adolescents with disabilities (Mason & Graham, 2008).

SRSD Instruction for Persuasive Quick Writing. Researchers have validated the use of SRSD instruction for persuasive quick writing in six single subject studies [Benedek-Wood, Mason, & Wood, 2013; Hoover, Kubina, & Mason, 2012; Mason, Kubina, & Hoover, 2013; Mason, Mason et al., 2011 (2 studies); Mason, Kubina, Valasa, & Mong Cramer, 2010] and one quasi-experimental study (Mason, Kubina, Kostewicz, Mong Cramer, & Datchuk, 2013). Each study implemented the POW (Pick my idea, Organize my notes, Write and say more) + TREE (Topic sentence – Tell what you believe, Reasons – three or more, Explanations – three or more, Ending-Wrap it up right, and Examine – Do I have all my parts?) strategy. The goal of each study was to teach students how to independently apply the strategies to construct a persuasive response in a 10 min time frame. In each study, all stages of SRSD as well as self-regulation procedures were included across five to seven lessons. Additionally, each study included one to five practice sessions to support students in achieving independence in using the strategies to meet their writing goal within the 10 min time period (for complete lesson plans see Mason, Reid, & Hagaman, 2012).

Mason, Kubina, & Taft (2011) examined the effects of small group SRSD instruction (2 to 4 students) for teaching SRSD for quick writing to middle school students with high-incidence disabilities in two studies. In the first study, a graduate student delivered the instruction on writing a persuasive response with a minimum of 8 parts: a topic sentence, three or more reasons, an explanation for each reason, and an ending sentence. In the second study, special education teachers taught students to write a minimum of 10 parts (8 parts as noted in the first study plus 1 counter reason for why someone might have an opposing view and 1 refute explaining why the writer's belief was not changed by the counter reason). In both studies, results indicated that the 16 students demonstrated an increase in the number of parts writ-

ten, the number of words written, and the quality of the response, as well as a decrease in variability.

In three studies, Mason and colleagues (Hoover et al., 2012; Mason et al., 2010; Mason et al., 2013) investigated the effects of SRSD for quick writing for teaching students to write 10 or more parts in a 10 min quick write. One study took place in an alternative middle school where a graduate student delivered instruction (Mason et al., 2010); two studies took place in an inclusive high school where a special education teacher delivered instruction (Hoover et al., 2012; Mason, Kubina, & Hoover, 2013). In the middle school study, results indicated a decrease in word count; however, students' performance increased in both number of parts written and writing quality and decreased in variability. The students in the two high school studies demonstrated an increase in number of parts written, number of words written, and writing quality and a decrease in variability.

In the sixth single-subject study (Benedek-Wood et al., 2013), the first SRSD for quick writing study to be implemented by a general education teacher, a sixth-grade science teacher delivered one-to-one SRSD quick writing instruction to students with high-incidence disabilities in a rural school district. The teacher taught students how to use POW+TREE to include 10 or more parts in a persuasive quick write. All three students showed an increase in the number of parts written, the quality of the response, and the number of words written and decreased in variability for the number of parts written and the number of words written.

In the quasi-experimental study, Mason and colleagues (2013) investigated the effects of SRSD quick writing instruction delivered to 23 middle school students in an urban school district. In this study, the researchers examined two levels of response quality: the organizational quality of the response (i.e., Did the response include all the necessary elements of a persuasive response?) as well as the quality of the student's argument (i.e., Did the student do a convincing job of persuading the reader?). Students in the treatment group showed an increase in number of parts written and organizational quality as indicated by large effect sizes (ES = 1.38 for number of parts and ES = 1.49 for organization quality) when compared to a comparison business-as-usual student group. Results demonstrated a large effect size for an increase in persuasive quality (ES = 0.74).

Current study. Given the positive results of SRSD instruction on students' *persuasive quick writing* performance, we hypothesized similar positive effects for *informative writing*. Previous SRSD writing research has focused mainly on the performance of students who struggle with writing; however, one aim of this study was to examine the impact of SRSD instruction on all students in a general education science classroom. The rationale for this was twofold. First, due to the complexity of the writing process, any student can experience writing difficulties (Baker et al., 2009). Approximately one-quarter of eighth and twelfth grade students in the United States demonstrated proficiency in writing (NAEP, 2011); therefore, this suggests that the majority of students can benefit from interventions that address writing skills. Furthermore, applying literacy skills across content area classrooms can present additional challenges for students due to the unfamiliar information, vocabulary, and text structure encountered in these subjects (Harris, Graham, & Mason, 2003; Mason & Hedin, 2011; Saenz & Fuchs, 2002). Second, as a result of these challenges, students

may struggle with comprehending and composing text in content area classrooms, which can impede learning (Snow, Burns, & Griffin, 1998).

Due to the demands associated with content area writing and because writing promotes learning and comprehension (Deshler et al., 2007), the purpose of this study was to investigate the impact of an informative writing intervention on all students in an inclusive general education science classroom. Specifically, this study examined the effects of science teacher-led SRSD instruction on the students' informative quick writing performance and knowledge about the topic. Given that writing difficulties are often exacerbated for students with special needs (Harris et al., 2008; Swanson, Hoskyn, & Lee, 1999), this study also examined the performance of the participating students with a documented disability. The following research questions guided this study:

1. What are the effects of science teacher-led SRSD instruction for informative quick writing on students' writing performance?
2. What are the effects of science teacher-led SRSD instruction for informative quick writing on students' science knowledge?
3. Is science teacher-led SRSD instruction for informative quick writing effective for improving the writing performance of students with disabilities?
4. Is science teacher-led SRSD instruction for informative quick writing effective for improving the science knowledge of students with disabilities?
5. Is science teacher-led SRSD instruction for informative quick writing acceptable to participants?

Method

Before beginning the study, the researchers received the university's Internal Review Board (IRB) approval and received permission to conduct the study from the school district's school board and administration. The researchers provided the participating teacher and parents of all students with IRB-approved information letters and informed consent forms. After consent was obtained, students were given IRB-approved information letters and assent forms.

The intervention in this study, POW+TIDE[2], was based on the POW+TIDE (Topic sentence, Important Details, Ending sentence) strategy developed by Mason and colleagues (2012) for teaching informative quick writing. POW+TIDE was modeled after the POW+TREE strategy and designed to meet the criteria for informative writing. Mason and colleagues noted the importance of elaborating on each detail, but this was not included as a separate step within the original POW+TIDE mnemonic. In this study, the authors modified POW+TIDE to include *Elaborate* as an individual step, which is similar to the *Explain* step in the POW+TREE strategy. Adding this step resulted in the mnemonic, POW+TIDE[2] (Topic sentence, Important Details, Elaborations, Ending sentence). This is the first study to investigate the effects of the POW+TIDE strategy.

Setting

The study took place in four sixth-grade classrooms in a rural school district located in the Mid-Atlantic region of the United States. At the time of the study, the school district (K-12) had an enrollment of approximately 1,073 students and contained all grade levels within one building which were divided in three sections for elementary (K-5), middle (6-8), and high school (9-12). Approximately 97.6% of the students were Caucasian/white, 41.8% of the students were eligible for free or reduced lunch, and 22.9% of the students received special education services.

Participants

In this study, the sixth grade general education science teacher delivered the writing intervention and assessments to all participants during their regular science class. At the time of the study, the participating teacher had ten years teaching experience, and was completing a Master of Science degree in education.

In order to be eligible to participate in this study, students needed to demonstrate that they could independently write a complete sentence when given a writing prompt (e.g., What did you learn in science class today?). Eligibility was determined by classroom writing assessments delivered by the participating teacher. Students were eligible to participate in the study if they could independently write at least one complete sentence in their response. The participating teacher and first author reviewed students' writing performance to determine eligibility. Two students were not eligible to participate, as they were still learning how to independently write complete sentences. Eighty-eight students across four classes were eligible to participate and 82 students' parents gave consent by signing the informed consent form. All 82 students (44 girls and 38 boys) agreed to participate by signing the assent form. Four students were dropped from the study due to moving to another district or changing educational placement, which resulted in 78 students participating in the study (41 girls and 37 boys). All participating students were Caucasian and ranged in age from 10.4 years to 12.4 years. See Table 1 for the characteristics of students in each of the four classes.

Table 1. *Class characteristics*

Class	Mean Age	*n*	SWD
Class A	11.76	23	1
Class B	11.9	16	3
Class C	11.82	19	3
Class D	11.79	20	3
Total	11.79	78	10

Note. SWD = Students with disabilities

Table 2. Student characteristics

Student	Class	Gender	Age (year – month)	Disability	Literacy and Behavior Goals
Cody	Class A	M	12-0	ADHD	Including details; organizing and editing writing; writing accurate responses to comprehension questions.
Suzi	Class B	F	11-11	SLD	Including details; organizing and editing writing.
Jasper	Class B	M	11-7	EBD	Writing paragraphs; following directions; interacting.
Violet	Class B	F	12-5	SLD	N/A – student did not have literacy or behavior goals in IEP.
Chad	Class C	M	12-0	SLD	N/A – student did not have literacy or behavior goals in IEP.
Cara	Class C	F	11-3	SLD	Including details; organizing and editing writing; writing accurate responses; retelling and summarizing information.
Helena	Class C	F	12-1	SLD	Including details; organizing and editing writing; writing accurate responses to comprehension questions.
Noah	Class D	M	11-3	SLD	Including details; organizing and editing writing; writing accurate responses to comprehension questions.
Bridget	Class D	F	11-9	SLD	Including details; organizing and editing writing; writing accurate responses to comprehension questions: interacting.
Liam	Class D	M	11-2	ADHD	Attending to tasks; completing assignments.

Ten students received special education IEP or 504 Plan services. Seven students were diagnosed with a specific learning disability (SLD), two students were diagnosed with attention deficit hyperactivity disorder (ADHD), and one student was diagnosed with an emotional behavioral disability (EBD). The ages of the students receiving special education services ranged from 11.2 to 12.4 years. See Table 2 for the characteristics of each participating student receiving special education services at the time of the study.

Procedures

Given that the teacher had experience in SRSD instruction, the first author provided training that focused specifically on teaching the steps of POW+TIDE[2]. Training sessions included review and discussion of each lesson, demonstrations of lesson delivery, and practice opportunities with feedback. To ensure that the teacher completed instruction as designed by the researchers, a number of steps were taken. First, the teacher communicated with the first author on a daily basis to review the upcoming lesson. Second, the teacher was provided with an outline of steps in each lesson and used this outline to check the steps as he completed them. Third, each lesson was videotaped and reviewed regularly by the first author to ensure that the teacher was delivering the lessons with fidelity. The first author provided ongoing support to the participating teacher by meeting with the teacher after each lesson to discuss performance, answer questions, and prepare for the next lesson.

Before instruction, the teacher collected baseline performance data by administering quick write informative responses to prompts that focused on the current science content (e.g., *"What did you learn about weather factors such as: energy from the sun, heat transfer, and wind?"*). The teacher then delivered five SRSD lessons plus four fluency practice sessions (see Experimental Design). During the five SRSD lessons students learned how to apply the POW+TIDE[2] strategy to plan and write a complete response in 10 min. The four practice sessions provided the teacher with time to conference with students and provide feedback to support them in meeting an 8-part criterion (1 part for the topic sentence, 6 parts for important details and elaborations, 1 part for the ending sentence) before moving to post-instruction. Throughout instruction, the teacher met with students individually to discuss performance and to assist students in using the strategy successfully.

Experimental design. A staggered A-B design (Morgan & Morgan, 2005), across-classes was used to assess student performance on informative quick writing before and after science teacher-led SRSD instruction for POW+TIDE[2]. A minimum of five baseline points were collected. In order to accommodate the school's schedule, two additional baseline points were collected during the initial baseline phase, resulting in a minimum of 7 baseline probes for each class.

SRSD lessons were imbedded into science units. The teacher moved through each SRSD lesson based on students' performance in learning the writing strategies rather than delaying SRSD instruction until students met all objectives in the assigned science unit. Because each class needed to complete a science section before completing a writing prompt, the first post-instruction prompt was completed approximately one week after the last SRSD lesson. Therefore, students had to maintain

use of the strategy when completing each post-instruction probe. At least three post-instruction prompts were administered to three classes. Due to the end of the school year, the fourth class completed only two post-instruction prompts. To ensure SRSD and science instruction was delivered at a reasonable pace, each class began the intervention once the previous class had completed SRSD Lesson 3.

Measures

The teacher followed standardized procedures when administering each prompt during baseline and post-instruction, which included verbal directions, materials (pencil and two pieces of paper), and a time limit of 10 min for students to plan and write their response.

The teacher presented the following directions to students: "*Please listen carefully as I read the prompt. Please write a response on the paper when I say 'begin.' Listen carefully as I read the prompt again. You will have ten minutes to write. Do you have ay questions? You may begin.*" If a student finished early, the teacher asked the student if they were finished, but did not provide encouragement for continued writing. If students were still writing at 9 min, the teacher announced that they had 1 min remaining. At the end of the 10 min, the teacher said, "*Stop,*" and thanked them for working hard.

The first author, second author, and the classroom science teacher developed prompts that corresponded with the unit sections in the school's sixth-grade science curriculum. Each prompt asked the students, "*What did you learn about*" followed by the main topic (e.g., weather predicting methods). The writing prompt also provided examples to support students in addressing the information they learned in science class (e.g., What did you learn about weather predicting methods, such as weather forecasting, weather technology, and weather maps?).

The 10 min informative quick write assessment sessions occurred during baseline and post-instruction. Given that every student handwrote their responses, each response was typed by a research assistant and saved in a Word document. All identifying information was removed and each response was given an identification code number. Spelling, punctuation, and capitalization errors were corrected, but grammar was not changed. These procedures were used in previous SRSD quick writing studies (Mason, et al., 2009; Mason et al., 2010) to reduce the likelihood of scorer bias, which may result from poor handwriting and/or mechanical errors (Graham, 2006). Once typing was completed, transcription accuracy was checked by one of the authors. Transcription accuracy was evaluated by comparing the typed response to the student's written response to ensure that the research assistant accurately typed what the student wrote and applied the typing guidelines noted previously. Students' writing performance was evaluated by scoring each response for organizational quality as measured on a 6-point scale, number of science knowledge units included, and number of words written.

Organizational Quality. Organizational quality was scored using a 6-point rating scale (0=lowest quality score; 6=highest quality score) to evaluate whether students included the essential elements of a paragraph (i.e., topic sentence, details, ending) and used transition words (e.g., First, Next, Finally). The organizational quality score differentiates between the student who wrote a topic sentence, three details, and

an ending sentence (5 parts, 3 elements) versus the student who wrote five details without a topic and ending sentence (5 parts, 1 element). Each scorer was given a rubric that detailed the criteria for each score (See Appendix A for scoring rubric).

Knowledge. Knowledge was scored by counting the number of knowledge units the student included in a response. A knowledge unit was defined as an accurate piece of information about the topic. Scorers received a listing of acceptable knowledge units for each science unit that were developed by the first and second author after collaborating with the classroom science teacher. When scoring knowledge units, the scorers applied Brown and Day's (1983) definitions for summarizing information by counting a list of examples or related items as one unit. For example, if a student wrote, "I learned that there are different types of storms such as thunderstorms, hurricanes, tornadoes, and snowstorms," this would count as two knowledge units: (1) stating that there are different types of storms and (2) providing examples of the types of storm.

Number of words. The number of words was calculated for each response by using the Microsoft Word word-count function. This was completed when the research assistant typed the response. The first, fourth, or fifth author checked the number of words for each response.

Social validity. Following post-instruction data, all students were given an eight-item written social validity questionnaire. Six of the items included statements that the students were asked to rate using a Likert scale (1=*Strongly disagree*; 5=*Strongly agree*). The questionnaire included the following statements: (1) The POW+TIDE[2] strategy helped me become a better writer; (2) I learned a lot about writing in using the POW+TIDE[2]; (3) I liked learning the POW+TIDE[2] strategy; (4) I will continue to use POW+TIDE[2] in other classes; (5) I think POW+TIDE[2] could help other students with their writing; (6) I think my teacher should teach POW+TIDE[2] to students next year. The questionnaire also included the following open-ended questions about learning and using the strategy POW+TIDE[2]: (1) What helped you the most during the lessons? (2) What would you add or change in the lessons?

Scoring. The first and second author trained six research assistants to score the responses. Each scorer was blind to the purpose of the study, the intervention, and which probes were completed before and after receiving instruction. Five of the six research assistants were trained for both typing and scoring. The authors provided instruction on how to score each response and provided scorers with a training packet that included anchor responses to show scoring examples. Training continued until each scorer met the criterion of scoring within 1-point, for at least 9 out of 10 consecutive responses. The six research assistants collectively scored 914 responses for organizational quality and knowledge. Interrater reliability was calculated by dividing the scorer agreements by the total number of probes. Interrater reliability was computed for organizational quality at 86.1% for exact agreement and 96.7% for within 1-point agreement. For knowledge, reliability was computed at 68.88% for exact agreement and 90.4% for within 1-point. For scores that were not in exact agreement, the scores were averaged.

Instruction

SRSD instruction for POW+TIDE[2] included five lessons to teach the strategy and self-regulation skills to mastery. The students' goal for each response was to write at least 8 parts (topic sentence, at least 3 details, an elaboration for each detail, and an ending sentence).

Across the lessons, instruction progressed through the six stages of strategy instruction (develop background knowledge, discuss the strategy, model the strategy, memorize the strategy, support the strategy, and provide independent practice) as well as the four components of self-regulation (goal-setting, self-instructions, self-monitoring, and self-reinforcement). The lessons were designed to provide students with high levels of support when first learning the strategy and self-regulation components through teacher modeling, visual supports, and collaborative practice. Supports were then gradually faded (e.g., removing visual supports and decreasing teacher assistance) until students were ready to demonstrate independent use of the strategy and self-regulation during practice opportunities. Each lesson was delivered over the course of two to four class sessions depending on the lesson's length. In addition to delivering the lessons, the teacher conferenced with each student, and provided feedback about writing performance. The individual conferencing contributed to the varied range of time across lessons. After completing five lessons, the students participated in four 10 min practice sessions over the course of four class sessions.

Lesson 1. In Lesson 1, the teacher began the lesson by discussing the words "strategy," "informative," and "response," as well as what makes a "good informative response." The teacher then introduced the POW+TIDE[2] strategy and provided the students with a mnemonic chart that outlined each step of the strategy. After reviewing the steps of the strategy, the teacher introduced transition words, million dollar words (i.e., unique and interesting words), and a graphic organizer designed to help students plan and organize their informative writing using the parts of TIDE[2]. Next, the teacher gave each student two examples of informative responses, read each response out loud, and asked students to find the writing parts in each response and record the parts in the graphic organizer. The students then read and recorded the parts in their own writing, which was collected during baseline. After recording the parts on a graphic organizer, students conferenced with the teacher to discuss their writing and graph their performance. In the final part of this lesson the teacher and students developed a goal (to write an informative response that included at least 8 parts: 1 Topic, 3 or more Important details, an Elaboration for each Detail, and an Ending sentence), and signed a learning contract. The teacher wrapped up this lesson and each subsequent lesson by reviewing the steps of POW+TIDE[2] and reminding students to use POW+TIDE[2] in other classes when writing an informative response.

Lesson 2. In Lesson 2, the teacher asked the students to recall the steps of POW+TIDE[2]. The teacher repeated this memorization exercise at the beginning of each subsequent lesson. The teacher then modeled how to use POW+TIDE[2] to write an informative response. The teacher explained that he would think aloud while writing so that the students could hear how he thinks through the writing process. The teacher modeled how to apply the steps of the strategy and the components of self-regulation as well as how to use the materials throughout the process. After modeling, the teacher asked students to add notes to their baseline response in order to meet the

goal of 8 or more TIDE[2] parts. Once they completed their notes, the students then used these notes to write a revised response. After revising their responses, the students counted the number of writing parts and graphed their performance. Students counted and graphed the number of parts written in their responses during each subsequent lesson.

Lesson 3. During Lesson 3, the teacher provided a collaborative practice opportunity. After presenting the students with a prompt, the teacher and students wrote notes on their own graphic organizers to plan their response, used self-statements, checked off the steps as they completed them, and used their notes to write an informative response.

Lesson 4. Lesson 4 included another guided practice opportunity, but this time the teacher faded materials. The teacher modeled how to create a POW+TIDE[2] graphic organizer by writing POW+TIDE[2] down the side of a piece of a notebook paper leaving space between each letter. The teacher then modeled taking notes beside each letter in TIDE[2] and crossing off each letter after completing a step. Next, the teacher presented the writing prompt and told students to create their own organizer for their notes. The teacher reminded students to review their notes, use transition and million dollar words, and to add more to their notes when possible. The students used their notes to construct their written response.

Lesson 5. The purpose of Lesson 5 was to introduce the element of timed writing to students. At this point, students demonstrated using POW+TIDE[2] with minimal support. The teacher instructed students to apply what they learned during a 10-min writing period. First, the teacher modeled how to use POW+TIDE[2] to plan and write a response in 10 min. Then, the teacher presented students with a writing prompt to provide them with practice in planning and writing a response independently in 10 min.

Practice Sessions. The purpose of the next sessions was to provide students with additional practice in independently applying POW+TIDE[2] to plan and write an informative response in a 10-min time period. The teacher provided four practice sessions, which mirrored the assessment procedures for baseline and post-instruction. Unlike baseline and post-instruction, the teacher provided assistance when necessary to support students in applying the strategy quickly and accurately. These sessions allowed students to build fluency and gave the teacher multiple opportunities to provide feedback to students.

Treatment Fidelity

One research assistant received an instructional outline and reviewed 25% of the lessons by listening to an audio recording of the delivered lesson. While reviewing the lessons, the research assistant checked the steps completed correctly by the teacher. Treatment fidelity was calculated by dividing the total number of steps completed correctly by the total number of steps observed and multiplied by 100. Treatment fidelity was 100% based on the research assistant's check sheet.

Data Analysis.

The data for each measure was averaged by adding the participants' scores in one class for a given probe and then dividing by the total number of responses scored

to get a mean score. The total number of probes each day varied based on students attendance (see Table 3). The mean scores were calculated for each probe within each class across each of the following measures: organizational quality, knowledge, and word count. Visual analysis of trend and level was used to evaluate the effects of student performance across writing measures. Percentage of non-overlapping (*PND*) data points were calculated for writing measures across classes to evaluate the effects of the intervention. *PND* was calculated by dividing the total number of post-instruction data points that were above the highest baseline point within one class and dividing by the total number of post-instruction data points for that class. A *PND* of 90% and above indicates a *large* effect, 70-89% indicates a *medium* effect, and below 70% indicates a *small* effect (Scruggs, Mastropieri, & Castro, 1987). Descriptive statistics (i.e., means and standard deviations) for each measure were calculated for organizational quality, knowledge, word count, and the number of transition words written for each class and for each participating student with a disability. Social validity data was analyzed descriptively.

Table 3. *Class Means and Standard Deviations During Baseline and Post-Instruction*

Class	Phase	Organizational Quality M (SD)	Knowledge M (SD)	Word Count M (SD)	Transition Words M (SD)
Class A*	Baseline	1.17 (0.11)	3.35 (1.06)	49.61 (6.56)	0.18 (0.10)
	Post-Instruction	5.85 (0.03)	6.88 (0.88)	125.47 (5.29)	3.57 (0.60)
Class B**	Baseline	1.87 (0.36)	3.62 (1.26)	69.36 (8.66)	0.76 (0.26)
	Post-Instruction	5.73 (0.16)	5.53 (0.26)	115.50 (10.23)	4.09 (0.42)
Class C***	Baseline	1.23 (0.06)	3.32 (1.22)	51.28 (14.67)	0.21 (0.12)
	Post-Instruction	5.70 (0.04)	6.62 (0.93)	109.31 (6.49)	3.13 (0.28)
Class D****	Baseline	1.15 (0.10)	4.07 (1.55)	60.31 (9.40)	0.36 (0.12)
	Post-Instruction	5.88 (0.18)	6.39 (0.30)	112.25 (6.72)	3.50 (0.00)

* Six students missed one probe during baseline.
** Four students missed one probe during baseline, and one student missed one probe during post-instruction.
***Three students missed one probe during baseline.
**** Three students missed 1 to 3 probes during baseline, one student missed one probe during post-instruction, and one student missed one probe during baseline and post-instruction.

Table 4. *Means and Standard Deviations Across Phases for Students with Disabilities.*

Student (Class)	Phase	Quality M (SD)	Knowledge M (SD)	Word Count M (SD)	Transition Words M (SD)
Cody (Class A)	Baseline*	1.36 (0.63)	1.29 (0.49)	37.29 (10.80)	0.07 (0.19)
	Post-Instruction*	4.25 (2.06)	2.50 (0.58)	74.25 (21.28)	2.13 (0.25)
Suzi (Class B)	Baseline*	1.13 (0.36)	3.13 (1.96)	72.25 (32.57)	0.00 (0.00)
	Post-Instruction	6.00 (0.00)	2.67 (0.58)	73.33 (26.03)	4.33 (0.58)
Jasper (Class B)	Baseline	1.00 (0.00)	1.50 (1.31)	22.50 (3.55)	0.00 (0.00)
	Post-Instruction	3.25 (0.96)	3.00 (0.82)	56.50 (11.39)	0.25 (0.50)
Violet (Class B)	Baseline	2.38 (0.74)	3.94 (1.82)	120.88 (26.34)	0.44 (0.82)
	Post-Instruction	6.00 (0.00)	5.75 (2.22)	104.75 (11.35)	3.75 (2.06)
Chad (Class C)	Baseline	1.00 (0.00)	2.06 (0.95)	30.33 (8.75)	0.00 (0.00)
	Post-Instruction	4.33 (0.58)	2.67 (0.58)	55.00 (2.65)	0.67 (1.15)
Cara (Class C)	Baseline	1.00 (0.00)	0.67 (0.87)	27.33 (12.00)	0.00 (0.00)
	Post-Instruction	3.33 (1.15)	3.33 (0.58)	58.67 (13.58)	0.00 (0.00)
Helena (Class C)	Baseline	1.06 (0.17)	1.44 (0.88)	35.89 (9.79)	0.11 (0.33)
	Post-Instruction	6.00 (0.00)	5.00 (2.00)	100.67 (10.79)	3.00 (1.00)
Noah (Class D)	Baseline	1.00 (0.00)	1.70 (1.49)	33.80 (17.59)	0.10 (0.32)
	Post-Instruction**	6.00 (N/A)	3.00 (N/A)	51.00 (N/A)	1.00 (N/A)
Brenda (Class D)	Baseline*	0.78 (0.44)	1.22 (1.09)	22.56 (11.96)	0.00 (0.00)
	Post-Instruction**	5.00 (N/A)	3.00 (N/A)	89.00 (N/A)	3.00 (N/A)
Liam (Class D)	Baseline***	1.00 (0.00)	2.43 (1.72)	34.00 (16.06)	0.14 (0.38)
	Post-Instruction	4.50 (2.12)	2.50 (0.71)	46.00 (5.66)	2.00 (1.41)

*Student missed one probe due to absence.
**Student missed two probes due to absences.
***Student missed three probes due to absences.
N/A – Not applicable due to one probe collected during post-instruction.

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RESULTS

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The mean scores for the four classes demonstrated students' improved informative quick writing across measures after SRSD instruction for POW+TIDE[2]. *Figures 1, 2,* and *3,* respectively display the classes' performance during baseline and post-instruction for organizational quality, knowledge, and number of words written. Means (*M*) and standard deviations (*SD*) for organizational quality, knowledge, number of words written, and number of transition words written for each class are presented in Table 3. Table 4 presents *M* and *SD* for each student with a disability.

Organizational Quality

All classes demonstrated an increase in level and mean increases for organizational quality (see Figure 1) after instruction. The mean quality score for all classes ranged from $M = 1.15$ to 1.87 at baseline and $M = 5.73$ to 5.88 at post-instruction. As noted in the quality rubric (see Appendix A), students earned a quality score of 2 if they included two different types of writing parts (i.e., topic sentence, details, ending sentence). A score of 5 required a topic sentence, at least three details, an ending sentence *and* at least one transition word. Before instruction, students' writing performance averaged 1 to 2 types of writing parts and an average of less than one transition word per response. After instruction, students' performance averaged 3 types of writing parts (topic, details, ending), including at least three details, as well as 3 to 4 transition words. Group *PND* at post-instruction was 100%, indicating a *large* effect. Visual analysis and SD indicated that variability was relatively stable across baseline and post-instruction. Class A, B, and C demonstrated a slight decrease in variability after instruction and trend remained stable. Visual analysis of variability and trend could not be determined for Class D based on the limited number of post-instruction probes.

Transition Words. All classes increased the average number of transition words included in their responses. Performance at baseline ranged from $M = .18$ to $M = .76$. Performance after instruction ranged from $M = 3.13$ to $M = 4.09$. Variability (*SD*) was relatively stable across baseline and post-instruction.

Knowledge

After receiving instruction, all classes improved in the mean number of knowledge units presented in writing probes (see Table 3). Three of the classes demonstrated an increase in level (see Figure 3). The average knowledge score for all classes ranged from $M = 3.35$ to 4.07 at baseline and $M = 5.53$ to 6.88 at post-instruction. Group PND at post-instruction for knowledge was 71% indicating a *medium* effect.

After instruction, Class A displayed an increase in mean and decrease in variability (*SD*) for knowledge. Visual analysis indicated variability increased from baseline to post-instruction and a slight increase in the trend. The mean number of knowledge units for Class B increased at post-instruction and variability (*SD*) decreased. Visual analysis indicated variability decreased from baseline to post-instruction and the trend was stable. Mean number of knowledge units for Class C increased and variability (*SD*) decreased. Visual analysis indicated a declining trend with stability, slightly above baseline, for the last two probes. Students' performance in Class D demonstrated a mean increase in knowledge units and variability (*SD*) decreased. Visual analysis of variability and trend could not be determined due to the limited number of post-instruction data.

Figure 1. *Average organizational quality scores across classes before and after instruction.*
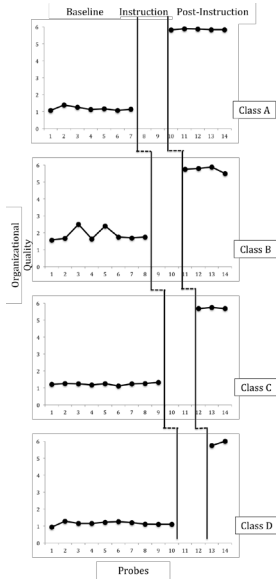

Figure 2. Average number of knowledge units across classes before and after instruction.
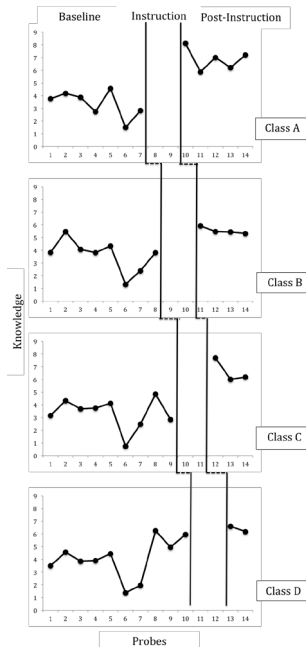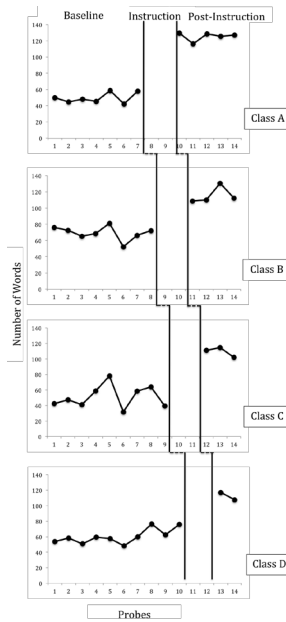
Figure 3. Average number of words written across classes before and after instruction.

Number of Words Written

Visual analysis indicated that all classes demonstrated an increase in level after receiving instruction (See Figure 3), with 100% *PND* at post-instruction, indicating a *large* effect. The average number of words written ranged from *M* = 49.61 to 69.36 at baseline and *M* = 109.31 to 125.47 at post-instruction. Variability (*SD*) decreased from baseline to post-instruction for three of the classes – Class A, C, and D.

At post-instruction, Class A, Class B, and Class C increased in level for the number of words written as noted in visual analysis and in the average number of words written. Visual analysis also indicated that variability and trend remained about the same from baseline to post-instruction. Word counts for Class D indicated an increase in the number of words. However, visual analysis of variability and trend could not be determined based on the limited number of post-instruction probes.

Performance of Students with Disabilities

During baseline, all ten students with disabilities demonstrated mean increases in the organizational quality scores from baseline to post-instruction. Seven of the students increased their mean number of knowledge units and number of words written from baseline to post-instruction. The performance results for students with disabilities are presented in Table 4.

Organizational Quality. Students' mean scores for organizational quality scores ranged from 0.78 to 2.43 during baseline to 3.25 to 6.00 during post-instruction. Eight students demonstrated mean quality scores of more than 4.0 during post-

instruction, indicating that these students included a topic sentence, at least three details/elaborations, and an ending sentence after receiving instruction. Furthermore, nine students increased the mean number of transition words used from baseline to post-instruction.

Transition Words. All students, with the exception of Cara, demonstrated improvement in using transition words after instruction. Students' mean performance ranged from 0.00 to 0.44 at baseline to 0.00 to 4.33 at post-instruction.

Knowledge. The mean knowledge scores ranged from 0.67 to 3.94 during baseline to 2.50 to 5.75 during post-instruction. Eight of the ten students demonstrated an average increase of at least 0.5 knowledge units, ranging from 0.51 to 3.56. Liam's performance remained about the same from baseline to post-instruction (2.43 to 2.50), and Suzi demonstrated a decrease from 3.13 at baseline to 2.67 at post-instruction.

Word Count. The students with disabilities had mean word count scores ranging from 22.50 to 120.88 during baseline and 56.50 to 104.75 during post-instruction. One student, Violet, demonstrated a mean decrease from 120.88 at baseline to 104.75 at post-instruction.

Social Validity

Student responses on the social validity questionnaire indicated that they felt POW+TIDE[2] strategy was effective. The average rating (1=*Strongly disagree*; 5=*Strongly agree*) for the students' opinions of each statement include: (1) The POW+TIDE[2] strategy helped me become a better writer = 4.2; (2) I learned a lot about writing in using the POW+TIDE[2] = 4.0; (3) I liked learning the POW+TIDE[2] strategy = 3.2; (4) I will continue to use POW+TIDE[2] in other classes = 3.7; (5) I think POW+TIDE[2] could help other students with their writing = 4.0 (6) I think my teacher should teach POW+TIDE[2] to students next year = 4.2. For the open-ended questions, common themes for the question, *How has POW+TIDE[2] helped you become a better writer,* included using the graphic organizer, learning how to use transition words, and receiving daily practice. When asked what they would change, students reported that they would prefer to write less and to add more time during the quick write assessment.

DISCUSSION

The results from this study provide evidence that sixth grade students with and without disabilities improved writing performance, as indicated by the organizational quality of the response, number of words written, and number of transition words written after receiving science teacher-led SRSD instruction for POW+TIDE[2] quick writing. These findings extend Mason and colleagues previous research by demonstrating that SRSD for quick writing can enhance the informative writing performance of middle school students with and without disabilities in an inclusive science classroom. This was the first SRSD for quick writing study to examine informative writing and the first to consider the effects of writing on knowledge.

As noted in prior SRSD quick write studies, an increase was found across writing measures; however, the greatest gains resulted in organizational response quality for all students (e.g., Mason et al., 2013). Although some students included several TIDE[2] parts in their baseline response, the majority of students did not in-

clude all traditional paragraph elements such as a topic sentence and ending sentence. Only 1.4% of students' baseline responses earned a quality score of 6 at baseline. Furthermore, the majority of students did not include transition words in their writing during baseline; only 23% of baseline probes included transition words. A similar writing pattern prior to instruction was also documented in the Mason et al. (2010) persuasive quick writing study. After instruction, 96% percent of the post-instruction responses included at least one transition word; and students scored a quality score of 6, the highest possible score, on 88% of the post-instruction probes.

The majority of students with disabilities also demonstrated an increase in organizational quality after receiving instruction. During baseline, the students with disabilities received an organizational quality score of 3 or lower on 99% of the responses and 7% of the responses included transition words. After receiving instruction, the students with disabilities earned an organizational quality score of 4 or higher on 82% of the responses and 71% of the responses included transition words. Furthermore, none of the students with disabilities earned a score of 6 during baseline; however, they earned an organizational quality score of 6 on 50% of the post-instruction probes.

Knowledge gains were *medium* for all classes and variable for students with disabilities as indicated by group PND. However, it should be noted that group PND for knowledge is not consistent with the means of performance, which suggest considerable gains across classes and for 8 out of the 10 students with disabilities. Although Liam's knowledge performance remained about the same and Suzi demonstrated a decrease, the remaining students demonstrated average increases ranging from 0.51 to 3.56 knowledge units. One limitation of PND is that it ignores all baseline points except for the highest point, which may be an outlier (Parker, Hagan-Burke, & Vannest, 2007); therefore, reviewing all performance data, including the performance means may provide a more complete picture of students' knowledge scores from baseline to post-instruction.

As noted previously, SRSD instructional lessons moved forward regardless of content mastery. However, given that prior knowledge for science content was not considered in the design of the current study, growth of knowledge for a specified unit is unknown. In other words, given that each writing probe represented different content knowledge, the effects of quick writing for improving knowledge by writing about what was learned, at this time, is at best speculative. Future studies should account for and control for students' knowledge prior to science instruction. Including a reading comprehension strategy with writing such as in Mason, Dunn Davison, Miller, Hammer, and Glutting (2013) may be beneficial for students, like Suzi, struggling with content text and material.

Students noted that SRSD for quick writing was beneficial for improving their writing. Unfortunately, the lowest average ratings were for "liking" to learn the strategies and using the strategies in other classrooms. Interestingly, although students felt they learned, they were less favorable in their perceptions of that learning. Additionally, we would hope that students would want to use what was learned across classrooms. More explicit teacher guidance to support generalization appears to be warranted.

Limitations and Future Research

To increase generalizability, future research should include students from diverse ethnicities, locations, and communities. The current population in the current study was fairly homogeneous; all participating students were Caucasian students attending a rural school district located within a low-socioeconomic community. In addition, future research should address the knowledge constructs while teaching and evaluating informative writing. Our design and application to the real science classroom has limited findings for knowledge measurement. Finally, given the importance of generalization and the emphasis placed on generalization in the SRSD lessons, future research should investigate students' use of the learned strategy in other classrooms.

In order for the teacher to maintain the objectives in the science curriculum, it was necessary to continue with POW+ TIDE[2] instruction for each class at a consistent pace. If students demonstrated difficulty grasping a skill from a lesson or if a student was absent, the teacher conferenced with that student to provide support and/or re-taught the lesson so that the student could successfully participate in the next lesson. In addition, although the teacher provided support to all students as needed, it was not required for each student to meet the goal of eight TIDE[2] parts before moving on to the next lesson. In order to move on to the next lesson, it was required that the majority of the class met the goal of eight TIDE[2] writing parts as demonstrated by students' graphs and the teacher's grading. SRSD researchers stress that student performance is enhanced when delivered so that all students reach criterion performance (Graham & Harris, 2009). Developing methods for "juggling" the many demands of curriculum in content classes so that all students are successful across tasks, especially given the initiatives in CCSS (2013), should be a research priority.

As a result of student absences and time constraints, data collection was inconsistent for some probes. For example, 16 students missed one probe and three students missed two to three probes due to absences (see Tables 3 and 4). Given time constraints, it was not possible to collect a third post-instruction probe for Class D before the end of the school year, nor was it possible to collect long-term maintenance data after instruction ended. As noted previously, each post-instruction probe was administered at least one week after instruction ended, but long-term maintenance data (i.e., more than 5 weeks after instruction ended) was not obtained. Future research is needed to determine whether students maintain the strategy over longer periods of time after instruction has ended.

Implications for Classroom Instruction

Results from this study replicate previous findings that suggest that students with disabilities improve writing instruction for organizational quality and word count after receiving SRSD instruction for learning a writing strategy (Graham, 2006; Graham & Perin, 2007). Prior studies (e.g., Mason et al., 2011) and results of the current study indicate that additional practice is often necessary for students with disabilities to independently and fluently apply learned strategies. It is important for general education teachers to provide independent practice opportunities to support students, especially struggling writers, in achieving independence when teaching writing strategies in an inclusive classroom.

As noted previously, students' perceptions for liking the strategy were lower compared to other items on the Social Validity Questionnaire. Students also noted that if given the choice, they would change the amount they were asked to write during the intervention. This is an important factor for researchers and teachers to consider when delivering writing instruction. Although practice is necessary for acquiring writing skills and developing writing fluency, it is critical not to "burn students out" as this will likely have a negative impact on students' attitudes toward writing. Finding a balance for providing a sufficient number of writing opportunities without overloading students with writing is a noteworthy consideration for researchers and teachers. Additionally, identifying ways to make the writing experience more fun and motivating for students may also improve perceptions about learning the strategy.

It is important to note, the teacher in this study implemented all components of SRSD instruction with treatment fidelity. As Graham and Harris (2003) reported, implementing SRSD instruction with fidelity is central to students' success in learning, applying, and maintaining the strategy. Therefore, it is critical for teachers to implement SRSD for POW+ TIDE[2] with high treatment fidelity by following the procedures outlined in this study and identified as SRSD best practice (see Harris et al., 2009; Mason et al., 2012). That being said, given the various demands teachers face when it comes to meeting curriculum standards within a limited amount of time, identifying ways to effectively imbed SRSD writing instruction and assessments within the teacher's current curriculum may support teachers in implementing the intervention across content areas.

SRSD instruction for the POW+ TIDE[2] strategy improved students' writing performance as well as supported the number of knowledge units (i.e., information learned) as communicated in a written response. Prior research reinforces these findings, providing evidence that writing and comprehension are strongly correlated (Dahl & Farnan, 1998; Deshler, et al., 2007). Results of this study indicate that SRSD writing instruction in a science classroom has great promise for enhancing students' ability to demonstrate learning and, ultimately positively impacting students' academic performance.

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APPENDIX A

ORGANIZATIONAL QUALITY SCORING RUBRIC FOR INFORMATIVE RESPONSES

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Score of 6. Informative response includes six or more of the following part types: topic sentence, more than three details/elaborations, an ending sentence, AND at least one transition words.

Score of 5. Informative response includes five of the following part types: a topic sentence, three details/elaborations, an ending sentence, AND at least one transition word.

Score of 4. Informative response includes at least five of the following part types: a topic sentence, at least three details/elaborations, AND an ending sentence.

Score of 3. Informative response includes four of the following part types: a topic sentence, two details/elaborations, AND an ending sentence.

Score of 2. Informative response includes at least two of the following part types: topic sentence, detail/elaboration, AND/OR an ending sentence (has at least a topic OR ending sentence).

Score of 1. Informative response includes one of the following part types: topic sentence, detail/elaboration, OR an ending sentence.

Score of 0. Response includes no sentences (e.g., blank response or just words or phrases) OR student only copies the prompt verbatim.

***Note that a prompt that is copied verbatim does not count as a part. If student rearranges words to create a topic sentence (e.g., This is what I learned about...), then it can be counted
Note that a prompt that is copied verbatim does not count as a part. If student rearranges words to create a topic sentence (e.g., This is what I learned about...), then it can be counted.