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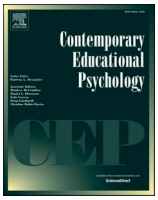

Yes, they can: Developing transcription skills and oral language in tandem with SRSD instruction on close reading of science text to write informative essays at grades 1 and 2☆

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ABSTRACT

This randomized controlled trial with first- and second-grade students is the first experimental study addressing long-running disagreements about whether primary grade students should develop transcription and oral language abilities before learning to compose. It is also the first study at these grade levels to teach close reading (using science text aligned to the Next Generation Science Standards) to plan and write a timed informative essay. Theoretically and evidence-based multi-component writing instruction was developed, termed "Self-Regulated Strategy Development (SRSD) Plus." SRSD Plus integrates evidence-based practices for transcription (handwriting and spelling) and oral language skills (vocabulary and sentence structure) with SRSD instruction for close reading to learn and then write informative essays. A total of 93 children in Grade 1 (n = 46, 50% female) and Grade 2 (n = 47, 51% female) in a high poverty school participated in the study (50% boys; mean age = 6.68; SD = 0.48). Students were randomly assigned to either teacher-led SRSD Plus or business-as-usual (writers workshop) condition within class in each grade. SRSD Plus was implemented with small groups for 45 min, three times a week, for 10 weeks. Outcomes examined included: instructional fidelity, spelling, handwriting fluency, vocabulary, sentence proficiency, discourse knowledge, planning, writing quality, structural elements in informative essays, number of words written, use of transition words, expository text comprehension, and use of source text. Results showed moderate to large effect sizes in writing outcomes, oral language skills (vocabulary and sentence proficiency), spelling, and discourse knowledge. Differential effects due to grade, gender, and race are examined, and directions for future research are discussed.

1. Introduction

Reading and writing are essential tools for functioning in today's world. Both are fundamental for achievement across Grades K-12, performance in the workplace, continuing education, college, personal development, and active citizenship (Harris & McKeown, 2022; Rouse et al., 2021). Concerns regarding inadequate writing abilities among K-12 students have become a worldwide issue (Cumming et al., 2016). In the U.S., however, writing performance has remained stagnant for decades. Only 27% of eighth- and twelfth-grade students scored at or above proficient for writing on the most recent writing assessment from the National Assessment of Educational Progress (NAEP); 20% of eighth graders and 21% of twelfth graders scored "below basic" (Aud et al., 2012).

The NAEP data also evidence significant challenges in reading (National Center for Education Statistics, 2020). Results from the reading assessment indicated that only 35% of fourth graders scored at or above proficient, whereas 34% scored below basic. Among eighth graders, only 34% scored at or above proficient, whereas 27% scored below basic. The picture is even more concerning for students living in high-poverty areas

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and those from marginalized racial and ethnic groups (Harris & Graham, 2016), highlighting inequity in access to high-quality literacy instruction (Harris & Graham, 2016). Effective instruction for *all* students via evidence-based practices is an important part of the solution to address persisting opportunity gaps (Harris, 2018).

1.1. Common core state standards and concerns about skills and process in early grades

The adoption of the Common Core State Standards (CCSS; National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010) further complicates this picture. The majority of the states have adopted or adapted the CCSS, with the remaining developing their own college and career ready standards (Achieve, 2013). The CCSS for language arts include challenging new proficiency goals in both reading and writing across Grades K-12. Further, there is new emphasis on the use of reading and writing to support each other for learning (Harris et al., 2015; Kim et al., 2014, 2015; Rouse et al., 2021). A major focus in the CCSS involves close reading for both learning and writing. Instruction on writing effectively to inform or persuade after close reading of text is not common in the elementary grades to date, especially at Grades 1 and 2, although it is part of the CCSS (Harris et al., in press; Cumming et al., 2016; Rouse et al., 2021).

1.2. Skills, writing process, strategies, or a combination in the primary grades?

Disagreements have long endured regarding whether young children can learn to effectively engage in the writing process before transcription skills are sufficiently developed (cf. Fayol, 1999; Graham, 2019; Kim et al., 2014; McCutchen, 2011). Teaching transcription skills and sentence construction while simultaneously teaching writing strategies and the writing process has been discouraged by those who claim this approach may cause working memory constraints, cognitive overload, problems due to lack of discourse knowledge, problems due to motor skills and handwriting fluency, and other difficulties (see Hochman & Wexler, 2017; Torrance et al., 2020). Others, however, have noted that these arguments are largely theoretical and not based on research (see Arrimada et al., 2019; Graham, 2019; Torrance et al., 2020; Wen & Coker, 2020 for detailed discussions).

Thus, some recommend instruction in the writing process not begin until transcription skills, oral language, sentence construction, and grammar are sufficiently developed, often referred to as a skills-based or traditional approach (Graham, 2019). For example, an approach termed The Writing Revolution begins with lengthy and intense instruction on recognizing and constructing simple and complex sentences, then moving on to constructing paragraphs, and finally to composition (Hochman & Wexler, 2017). Contrarily, others have argued that the process approach, also known as writers workshop, should not emphasize development of skills, abilities, or strategies foundational to writing, as these will develop in due time with rich immersion in reading and the writing process (Kissel, 2021).

1.3. Combining skills, strategies, and writing process instruction

Yet others have argued for an approach that combines development of skills, abilities, and strategies for writing and self-regulating the writing process within the process approach/writers workshop (Harris, 2021; Harris & Graham, 2016). Teaching general and genre-based writing strategies has had meaningful effects on students' writing, particularly in research involving the Self-Regulated Strategy Development (SRSD) model of instruction, discussed further shortly.

Graham (2019) reviewed 28 studies in contemporary classrooms, involving differing methodologies and over 7,000 teachers, on teachers' instructional practices in writing. He found that the majority of elementary grade teachers combined process and skills instruction (but not writing strategies instruction), creating their own approach. At the primary grades level, however, a majority of teachers reported spending most of their instructional time on teaching mechanics, grammar, and usage. Based on this review, Graham concluded that teachers at the primary grades need to create a better balance between skills, strategies, and process instruction; make more adaptations for writers; and that more time needs to be spent writing, particularly in expository writing (to inform or to persuade). Authors of the What Works Clearinghouse Practice Guide for teaching elementary writing also reviewed the research base, and recommended that beginning in Grade 1, instruction should focus on combining skills and abilities, using the writing process, and writing strategies (Graham et al., 2018).

Relevant information about the CCSS for close reading followed by writing is provided next. Implications of the research reviewed thus far are then addressed.

1.4. The CCSS and close reading of science texts to learn and write informative essays

The terms "close reading," "close, analytical reading," and "read closely" are used frequently in the CCSS for reading and the Revised Publishers' Criteria for the CCSS, which were designed to assist publishers and curriculum developers in aligning their content with the standards (Coleman & Pimental, 2012; see Pearson, 2013, for a detailed discussion). The 10 CCSS Anchor Standards for Reading in Grades K-5 are structured around "the skills and understandings that all students must demonstrate" (p. 10) in three areas: key ideas and details, craft and structure, and integration of knowledge and facts. Instruction in close reading in the current study was aligned with the following aspects of the CCSS first- and second-grade standards for reading informational text: (a) identify the main topic of the text; (b) demonstrate understanding of key ideas and details; (c) understand the structure and purpose of informational text; (d) identify, discuss, and understand words and phrases used in text; and (e) understand how and why key ideas and details are used in informational text. In the current study, the science content for first graders focused on plants; at second grade the focus was on earth and space.

The CCSS for writing at first grade require writing informative/explanatory texts where the topic is named, some facts about the topic are supplied, and there is some sense of closure. At second grade, students are expected to write informative/explanatory texts that introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section. Students in first and second grade are required to recall information from experiences or gather information from provided sources to write (with support from adults in first grade). The CCSS for close reading to learn and writing to inform or explain were not guided by research at these grades, due to the lack of a sufficient research base regarding what first- and second-grade students are capable of when provided evidence-based instruction in reading to support learning and writing (Harris et al., 2015).

Further, reading and learning from informational text has not been a strong focus in the primary grades (Duke, 2000; Rouse et al., 2021). Pearson (2013) referred to informational texts as "truly marginalized" in the early grades (p. 245), although he noted that the science area had been leading the way in content learning and literacy practices. Beginning science learning in the early grades is pivotal to later science learning and achievement and has become a high priority in our schools (Duschl et al., 2007). Thus, we chose science as the content area for this study. The Next Generation Science Standards (National Research Council, 2013) explicitly link science learning with reading and writing practices specified in the CCSS, such as recalling and gathering information from provided sources and texts, and participating in conversations about a science topic; these standards informed and are aligned with SRSD Plus.

1.4.1. Implications for this study

Based on the literature and research reviewed thus far, we designed the present study to directly address the controversies regarding teaching transcription skills and oral language in tandem with teaching writing strategies and the writing process in the early grades. This is the first experimental study we are aware of involving first- and second-grade students receiving such combined instruction. All students attended school in a high-poverty, under-resourced area in the U.S. Evidence-based instructional practices in writing were carefully selected to create an intervention called "SRSD Plus." SRSD Plus instruction integrates instructional practices for (a) transcription (handwriting and spelling), (b) oral language skills (vocabulary and sentence structures), and (c) SRSD instruction for close reading of informative science texts to learn and to write informative essays. This is also the first experimental study of the integration of close reading to learn and writing to inform in first and second grade.

The theoretical and evidence bases for SRSD Plus instruction are addressed next, beginning with the Direct and Indirect Effects Model of Writing (DIEW). SRSD's theoretical and evidence bases and the instructional process are then examined, followed by a description of the present study.

1.5. Theoretical and evidence base of the direct and indirect effects model of writing

Writing and reading both involve multiple, complex processes that draw on numerous skills, abilities, and knowledge. The theoretical base for the DIEW (Kim, 2020; Kim & Graham, 2022; Kim & Park, 2019) addresses these complex processes. The DIEW model posits that writing requires transcription skills, reading skills, oral language skills, higher order cognitive skills and self-regulation (e.g., reasoning, perspective taking, inferencing, goal-setting, monitoring), background knowledge that includes word, content, and discourse knowledge, and socio-emotional aspects (e.g., attitude, beliefs, motivation, emotions). These are all supported by domain-general cognitions or executive function (e.g., working memory, attentional control). SRSD Plus instruction addresses the following key skills and knowledge identified in DIEW: transcription skills, oral language, background knowledge (content and discourse knowledge), socio-emotional aspects, executive function, and self-regulation. The SRSD model addresses several of these foci, as discussed shortly.

1.5.1. Transcription

Transcription, the process of encoding ideas from oral language into written form, includes handwriting/keyboarding and spelling. A robust body of evidence indicates that lack of accuracy and fluency in transcription skills can constrain writing by interfering with working memory and higher order processes such as planning and content generation. Such interference results in problems with writing quality, content, and output (Berninger et al., 2002; Harris et al., 2012; Kim et al., 2014, 2015; Limpo & Alves, 2013; Wanzek et al., 2017). Research indicates that weak transcription skills has a particularly pronounced impact on writing development (Torrance et al., 2020). In addition, a meta-analysis on writing instruction for students in the elementary grades found that elementary students who were taught transcription skills performed significantly better than comparison groups on writing quality with an average weighted effect size of 0.55 (Graham & Harris, 2018).

1.5.2. Oral language

Oral language skills are necessary for writing text because generated ideas and thoughts have to be encoded into oral language before being transcribed into written texts (Berninger et al., 2002; Kim et al., 2011, 2015; McCutchen, 2006). Oral language skills that affect writing include appropriate and effective vocabulary use and sentence construction. These effects have been independently related to effective writing for primary-grade students after accounting for transcription skills (Coker, 2006; Olinghouse & Leaird, 2009). Similarly, vocabulary and grammatical knowledge were independently related to writing for primary-grade children after accounting for transcription skills (Kim et al., 2011, 2014). With regard to sentence construction skills, an important quality of good writing is purposeful use of syntactically mature and varied sentence structures (Strong, 1986). Poor or novice writing is typically characterized by choppy and short sentences.

The evidence base on teaching effective transcription skills and oral language skills provided the basis for teaching handwriting, spelling, vocabulary, and sentence proficiency in SRSD Plus. Transcription instruction was informed by prior work on spelling (Apel et al., 2004; Graham et al., 2002; Wanzek et al., 2017) and handwriting fluency (Berninger et al., 1997; Jones & Christensen, 1999), indicating the need for explicit and systematic instruction on developmentally appropriate orthographic patterns. Vocabulary instruction targeted Tier 2 words that are of high utility value (e.g., essential, contrast) as well as science content words (e.g., photosynthesis, habitat), and included evidence-based practices such as providing child-friendly definitions and example sentences (Beck et al., 2002; Biemiller & Boote, 2006; Coyne et al., 2007). Sentence proficiency instruction was guided by prior work on sentence combination and completion (Saddler & Graham, 2005; Strong, 1986).

We turn next to the SRSD model of instruction in reading and writing. SRSD instruction addresses content and discourse knowledge, socio-emotional aspects, motivation, self-efficacy, and executive function, as well as self-regulation of the writing process and accompanying cognitions, emotions, and behaviors critical to effective writing and emphasized in the DIEW model (Harris et al., 2008, 2018, in press; Harris & Graham, 2016; Kim, 2020; McCutchen, 2011; Wen & Coker, 2020).

1.6. Theoretical and evidence base of SRSD for reading to learn and writing to inform

Since its inception, the SRSD model of instruction for complex learning has been based on theoretical integration (Harris, 1990; Harris & Graham, 2018; Harris et al., 2008; Graham & Harris, 2018), sometimes referred to as metatheory. Reading and writing, as well as integrating the two, require complex learning. Kirschner and Van Merriënboer (2008) provided this explanation, noting the importance of integrating knowledge:

Complex learning is the integration of knowledge, skills, and attitudes … [instructional design models for complex learning] all focus on authentic learning tasks as the driving force for teaching and learning because such tasks are instrumental in helping learners to integrate knowledge, skills, and attitudes, … stimulate the coordination of skills constituent to solving problems or carrying out tasks, and facilitate the transfer of what has been learned to new and often unique tasks and problem solutions. (p. 244).

Single theories prevalent today cannot capture the complex nature of learning, contexts for learning, and the diversity among learners—yet each can contribute to effective instruction (Harris, 1990, 2018; see also Ivanič & Weldon, 2014; Klein & Boscolo, 2016; Prain & Hand, 2016). SRSD was initially developed and continues to be refined based on the rich evidence base available across theories about effective teaching and learning, with frequent triangulation of evidence-based practices across theories, although similar/overlapping constructs often have different names (see Harris & Graham, 2009, 2016, 2018 for detailed discussions). Theoretical integrationists recognize that critical attributes of effective teachers and characteristics of effective instruction belong to no single theory, but rather are supported by many (Harris, 2018). SRSD is, therefore, a complex, multicomponent instructional approach that supports differentiation across students based on strengths and needs. SRSD instruction is not scripted and reflects strong respect for and reliance on teacher judgement based on their knowledge of their

students, the task, and formative assessment (Harris & Graham, 2018; Harris et al., 2008, 2015; Harris & McKeown, 2022).

1.6.1. Knowledge building and development of self-regulation

SRSD instruction is characterized by active, discourse-based, scaffolded, and explicit learning of knowledge of the writing process, general and genre-specific knowledge, academic vocabulary, and powerful, validated strategies for reading and/or writing. SRSD instruction also focuses on the knowledge (e.g., academic and general vocabulary, background knowledge, declarative knowledge, procedural knowledge, and conditional knowledge) needed to use these strategies. Students develop strategies for self-regulating strategy use (e.g., goal setting, self-assessment of writing performance, self-instructions, and self-reinforcement) and reading/writing behavior (e.g., persistence, engagement, strategy use). Students are active collaborators in the learning process; group and peer collaborations and discussions are integral (Harris et al., 2006, 2008; Ray & Graham, 2021). Aspects of topic, audience, purpose, text structure, sentence structure, and writing quality are investigated and discussed in authentic ways (e.g., reading strong texts, rewriting poor texts, and during peer feedback). Generalizable characteristics of effective writing (i.e., "grab your reader") are identified and discussed throughout instruction, and goals are set regarding both content and quality of students' writing (Harris et al., 2019).

Genre elements and text structure are also identified and discussed during reading and learning to write in SRSD instruction. Comprehending text is necessary for effective close reading and marking up text, planning, and writing to inform. Knowledge and use of text structure in support of each of these processes is integral to SRSD instruction. Further, scaffolded instruction in text structure and close reading can improve not only writing, but also expository reading comprehension (Armbruster et al., 1987; Hebert et al., 2016).

1.6.2. Social, emotional, and behavioral development

Readers and writers face multiple affective, social-emotional, behavioral, and cognitive/metacognitive/executivefunction/self-regulation challenges (Harris et al., 2008, 2018; Harris & Graham, 2018; McKeown et al., 2019). Multiple elements of SRSD instruction help teachers support student development across these areas (e.g., development of attributions for effort and use of powerful strategies; goal-setting, self-monitoring and celebrating progress toward goals; self-talk for coping with emotional, behavioral and other challenges during the writing process). Further, SRSD instruction explicitly targets development of students' motivation, persistence, positive attitudes toward reading/writing, and belief in themselves as capable readers and writers (i.e., self-efficacy). SRSD instruction takes place across six adaptable and recursive stages (referred to as Develop Background Knowledge, Discuss It, Model It, Memorize It, Support It, and Independent Performance) that are criterion based rather than time based (cf. Emery et al., 2018), with gradual release of responsibility for writing to students (Harris & Graham, 2016; Harris & McKeown, 2022).

1.6.3. Evidence base for SRSD

SRSD for writing is deemed an evidence-based practice at the elementary grades in inclusive classrooms by the IES What Works Clearinghouse (Graham et al., 2018) and in multiple meta-analyses (Graham & Harris, 2018; Graham et al., 2013). Teacher led SRSD instruction for writing has been effective at the whole class, small group, and individual levels from Grades 1 to 12 (Harris et al., in press, 2012, 2015). Researchers have found SRSD instruction effective among students in racially diverse classrooms, across countries, and across SES levels (Graham et al., 2013, 2019; Harris et al., in press; Salas et al., 2020). SRSD for close reading for writing (e.g., to persuade, narrate, summarize, or for quick writes) enhances content knowledge and improves writing outcomes for students from third grade to secondary grades (cf. Collins et al., 2021; Harris et al, 2019; Mason, 2017; Mason et al., 2012; Ray & Graham, 2021).

Researchers have found that SRSD instruction in writing, however, has been effective with second grade students for writing stories and persuasive essays (e.g., Harris et al., 2012, 2015; Salas et al., 2020). Two published studies of SRSD were found at first grade, focused on story writing. Zumbrunn and Bruning (2013) found SRSD effective for improving story writing in a single-case design study across story writing components, length, quality, and writing knowledge, with some variance among individual students. Arrimada et al. (2018) used an SRSD-like intervention in an innovative experimental study that combined in-school and home-based instruction with first graders in Spain and found strong effects across all writing outcomes: spelling, handwriting speed, and story writing quality. These studies, however, did not investigate combining SRSD instruction with evidence-based development of additional early writing skills and abilities or with close reading, and did not address informative writing.

1.7. The present study

In this randomized controlled trial involving first- and second-grade students, we examined the efficacy of practice-based professional development (PBPD) followed by teacher led, small group SRSD Plus instruction for close reading of informative science texts to learn and write informative essays. Explicit instruction in transcription skills (handwriting and spelling) was integrated with SRSD instruction to reduce interference with working memory and higher order skills such as planning and content generation. Instruction in oral language skills (vocabulary and sentence structure) was also integrated with SRSD instruction to assist students in encoding their thoughts and ideas into oral language before creating a plan and writing. SRSD instruction focused on the complex abilities needed for close reading and marking up text, planning, and writing to inform. Finally, use of what students had learned in a timed testing situation (both pre- and posttests were timed) was examined.

This is the first experimental study we are aware of to directly address: the controversy regarding teaching transcription and oral language in tandem with teaching the writing process and writing strategies, integration of close reading to learn and writing to inform in first and second grade in the science area (or for any purpose), and students' ability to use what they had learned on a timed writing test. This study could lead to further research in these critical primary grades; replication and further research may also influence practice and policy issues in primary grades literacy.

We examined teacher instructional fidelity for SRSD Plus in terms of quantity of components used and quality of instruction for the Plus and SRSD components (see Proctor et al., 2011). Student outcomes included: spelling, handwriting fluency, vocabulary, sentence proficiency, discourse knowledge, planning, writing quality, structural elements in informative essays, number of words written, use of transition words, and use of source text. Effective planning and use of source text in writing also served as indicators of expository text comprehension (cf. Armbruster et al., 1987; Hebert et al., 2016), as comprehension of the text is necessary for both. Based on the evidence available and our experiences working with second graders, we predicted that students would show meaningful outcomes at both grade levels for all measures and that strong instructional fidelity would be found. Although results for composition length are mixed in SRSD research (Graham & Harris, 2018), we believed number of words written would increase based on research on use of source text and teaching sentence construction.

2. Method

2.1. Research design and participants

A randomized controlled trial was conducted to examine the feasibility and potential promise of SRSD Plus in Grades 1 and 2. A total of 93 students in Grade 1 ($n = 46$, 50% female, from 8 classrooms) and Grade

2 (n = 47, 51% female, from 6 classrooms) in a high-poverty school (50% boys; mean age = 6.68; SD = 0.48) in the southeastern region of the United States participated in the study. The racial and ethnic characteristics of the sample were as follows: approximately 44% White, 39% African American, 11% multiracial in Grade 1; approximately 55% White, 28% African American, 9% multiracial in Grade 2. All the students in the district received free lunch through a grant due to the high poverty level.

The comparison teachers (i.e., business as usual, or BAU, condition) reported that writers workshop was their instructional approach for writing. No commercial programs were reported as being used. Unfortunately, however, we were unable to collect observation data to describe how writers workshop was implemented in the BAU condition.

Students with identified intellectual disabilities and severe behavioral problems were excluded from the study. Nine students and six students in Grades 1 and 2, respectively, received speech and language impairment services. One student in each grade was identified as an English language learner. Three students (two in the business-as-usual [BAU] condition, writers workshop, and one in the treatment condition) left the study, so the sample size at posttest was 90. Students were randomly assigned to either SRSD Plus (n = 47 across grades) or BAU condition (n = 46 across grades) within class in each grade. When within-class random assignment was not possible to form small groups due to a different number of consented students across classes, students were combined across classes to form a small instruction group within a grade level.

2.2. General SRSD plus instructional procedures

SRSD Plus was composed of the SRSD portion and the Plus portion (both detailed in the next section), and was aligned with CCSS and similar state standards. Anchor informational texts in science content (plants in Grade 1; earth and space in Grade 2) were developed, aligned with the Next Generation Science Standards (NGSS; National Research Council, 2013). These anchor texts included targeted vocabulary words, sentence structures, spelling patterns, genre elements, and aspects of writing quality (e.g., "catch the reader").

SRSD Plus instruction was implemented for 45 min, three times a week, for 10 weeks in the winter and spring. SRSD Plus was designed for approximately 12 weeks of instruction based on previous research, but was implemented for 10 weeks due to school-level time constraints. All instruction was delivered to small groups of 3–4 students in a pull-out setting. The SRSD Plus Instructional Coordinator and the four SRSD Plus teachers were all certified teachers (one in special education, the remaining four in general education) with 2 to 30 years of teaching experience. All five received practice-based professional development (PBPD, described next) for the SRSD Plus instructional procedures. The Instructional Coordinator served as organizer and primary liaison to the research team. Students in the BAU condition received the typical writing instruction from their teachers.

2.3. Professional development for SRSD plus teachers and implementation support

The research team provided implementation support in multiple ways: (a) practice-based professional development (PBPD) for SRSD Plus teachers, with one day focusing on the Plus components and two days focusing on the SRSD instruction; (b) feedback in the first 2 to 3 weeks of implementation; and (c) on-going support via the Instructional Coordinator, weekly hour-long conference calls, and additional virtual meetings and support as needed. The professional development provided an overview of goals, relevant research, content of SRSD Plus, and hands-on practice until teachers and the Instructional Coordinator reached criteria in leading each lesson for both SRSD and Plus instruction. Detailed descriptions of PBPD for SRSD are available (Harris et al., in press; McKeown et al., 2019). SRSD instruction for both close reading to learn and writing to inform is described next, followed by description of the Plus instruction.

2.4. SRSD instruction for close reading of informational text for writing to inform

Teacher led SRSD instruction for close reading to write informative essays included all of the components and adhered to all of the SRSD characteristics described previously. Six lessons were developed that incorporate all six stages of SRSD instruction. The number of class sessions needed to complete each lesson varied across lessons and sometimes across teachers because students needed to meet initial criterions before proceeding. Teachers were provided with a notebook that contained professional learning lesson plans (not to be used as scripts) for implementing all lessons and activities, a checklist of steps for each lesson, and all materials needed for students and the teacher. Teachers developed their own lesson plans; these were shared with the research team to confirm that all steps were included for each lesson. Across all six lessons, teachers incorporated what students were learning in the Plus part regarding science vocabulary, sentence structure, and spelling. The same science text was used the same week in SRSD instruction and the Plus instruction; teachers had additional texts (not focused on the science curriculum) to use in SRSD instruction as needed, given that students wrote frequently. No texts in instruction covered the same topics as those covered in the pre- and posttest texts.

Teachers had the flexibility to respond to individual student needs, backing up and repeating a step if necessary, reordering steps, and so on. Rich discussion occurred across all stages of instruction. Teachers had students work together, either in pairs or as a small group, as they deemed appropriate (e.g. evaluate essays, plan and/or write together). Observations of and discussions with teachers supported the use of peer activities and indicated teachers used these well. Teachers worked with small groups of 3–4 students and differentiated instruction across their students. At times teachers worked with one or two students while the other group members completed peer activities to reinforce learning. Space precludes a detailed description of the SRSD instruction, as it is complex. A thorough description of instruction for Grade 2, with differences for Grade 1 noted where they occurred, is provided in the online supplemental materials for this paper. Finally, concepts and content from the Plus instruction, described next, were integrated into student writing during SRSD instruction.

2.5. "Plus" instruction

The Plus instruction (spelling, handwriting fluency, vocabulary, and sentence structures) was delivered three times per week for 20 min per session in 5-day units (5 days per unit * 6 units = 30 sessions). Day 1 of each unit included close reading of the anchor texts, and introduction of target vocabulary words and sentence structure. Day 2 continued with instruction on vocabulary and sentence proficiency. Days 3, 4, and 5 focused on spelling and handwriting fluency instruction. Vocabulary instruction targeted Tier 2 words that are of high utility value (e.g., essential, contrast) as well as science content words (e.g., photosynthesis, habitat), and included evidence-based practices such as providing child-friendly definitions and example sentences in addition to the sentence in the anchor text (Beck et al., 2002; Biemiller & Boote, 2006; Coyne et al., 2007).

Sentence proficiency instruction in Grade 1 targeted the concept of a sentence, accurate use of '*and*' and '*but*,' high frequency conjunctions such as '*when*, *because*, *after*,' and adding adverbs to enrich expression. Sentence proficiency instruction in Grade 2 included the concept of a sentence, accurate use of '*but*' and '*so*,' adding adverbs to enrich expression, use of adjectives in the '*so* (adjective) *that*,' and '*too* (adjective) *to* (verb)' structures, and a conjunctive adverb, '*however*.' These were taught using sentence combination and completion activities informed by previous evidence (Saddler & Graham, 2005; Strong,

1986).

Spelling was taught with attention to phonological, orthographic, and morphological structures of a word, using a word study approach. Students were introduced to words with target patterns (e.g., -ake) and engaged in sorting using orthographic, phonological, and morphological information (Apel et al., 2004; Bear et al., 2016). Target patterns in Grade 1 included, for example, CVC (e.g., run), CVCe (e.g., take), and CVVC (e.g., seed); Grade 2 patterns included CVCe (e.g., -ide, -ice; -ace, -ame), diphthongs (oi & oy), and complex phonograms (-ight). Handwriting fluency was taught using validated approaches of writing letters and words from memory using various activities (e.g., Berninger et al., 1997; Wanzek et al., 2017). All these were taught using evidence-based instructional approaches of modeling ("I do"), guided practice ("We do"), and independent practice ("You do"); Rosenshine, 2012).

2.6. Instructional fidelity

Fidelity of instruction is a critical teacher outcome in instructional research as teachers must be capable of implementing instruction with high fidelity if scaling up in schools is to be feasible (Pressley et al., 2006; Proctor et al., 2011). Development of instructional fidelity was supported in multiple ways for both the SRSD and Plus components of instruction.

First, during PBPD for both, teachers met criteria for implementing instruction (as described previously). Second, during instruction, the SRSD Plus Instructional Coordinator and/or teachers met by phone or zoom at least once a week (typically two to three times) with members of the research team to discuss instructional progress and any questions or issues (e.g., students' challenges with materials or pacing, approaches to individualize instruction).

Fidelity data were collected by observing three sessions a week in Weeks 5, 7, and 9. The fidelity measures for the SRSD and Plus instruction (aligned with the SRSD Plus components and quality of instruction) are described next (cf. Proctor et al., 2011). The Instructional Coordinator and a former teacher practiced using the observational forms during Week 1 and met with research staff to answer any questions and resolve any issues.

2.6.1. SRSD instruction fidelity

Two observational measures were used for fidelity of SRSD instruction. The first was an observation of instructional components, using a checklist for the lesson components for instruction that day. Lesson fidelity was computed by dividing the number of lesson steps taught by the total number of steps possible for that lesson, and multiplying the quantity by 100. The second was an observation of seven aspects of the quality of SRSD instruction (teacher well-prepared, instruction well-done, reasonable progress made, support for appropriate behavior, teacher motivated and enthusiastic, teacher bought-in, students responsive and engaged) on a scale of 1 (not evident) to 5 (strongly evident). Eight instructional sessions were observed by the SRSD Plus Instructional Coordinator and a former teacher during Week 2 to assess interrater reliability for lesson components and lesson quality. Percent agreement for both measures across all sessions was 1.00. Fidelity observations during Weeks 5, 7, and 9 indicated that an average of 89.5%, 100%, and 100% of instructional steps were completed, respectively. Quality observations for the 3 weeks found average ratings of 4.92 for preparation, 4.83 for implementation, 4.5 for reasonable progress, 4.67 for behavioral support, 4.67 for teacher enthusiasm, 4.92 for buy-in, and 4.5 for student responsiveness and engagement.

2.6.2. Plus instruction fidelity

Two observational measures were used for fidelity of Plus instruction. Similar to the fidelity measure for SRSD instruction, the first measure was a checklist indicating whether the components expected to be taught on a specific day (e.g., Day 1 of a unit) were taught (yes or no). The number of components taught was divided by the total number of components expected for that day, then multiplied by 100. The second measure assessed how well the lessons were implemented in terms of adherence to the lesson, quality of instructional delivery, and effectiveness of scaffolding. Each of these three aspects were rated on a scale of 1 to 5 (a score of 1 indicated that 0–59% of the activities or lesson was implemented; a score of 2 indicated 60–69% of the activities or lesson was implemented; a score of 3 for 70–79% of the activities or lesson; a score of 4 for 80–89%; and a score of 5 for 90–99%). The same scale was used for instructional quality and scaffolding. Eight instructional sessions were observed by the SRSD Plus Instructional Coordinator and one former teacher during Week 2, again to determine interrater reliability. Percent agreement for all measures was 1.00. Fidelity observations during Weeks 5, 7, and 9 revealed that the expected lesson components were 100% completed and the average ratings for adherence to the lesson, quality of instructional delivery, and effectiveness of scaffolding were high with average ratings of 4.67, 4.83, and 4.92, respectively.

2.7. Measures

Students were assessed on multiple aspects of written composition: spelling, handwriting fluency, vocabulary, sentence proficiency, and discourse knowledge immediately before (pretest) and after (posttest) SRSD Plus instruction. Unless otherwise noted, students' responses were scored dichotomously (1 = correct; 0 = incorrect) for each item, and all the items were administered to the child. Students were assessed by rigorously trained research assistants in a quiet space in the school. Assessors were blind to the students' treatment condition. Writing, spelling, and handwriting fluency tasks were administered in a group setting (3–4 students), and the other tasks were individually administered.

2.7.1. Written composition and expository text comprehension

No normed writing measures of close reading for writing informative essays, or of writing informative essays, were available for Grades 1 and 2. Four researcher-developed source-based writing assessments were randomly administered, two at pretest and two at posttest. At pre- and posttest, students received no instruction in relevant vocabulary; they marked up text, planned, and wrote independently in the 30 min allowed. Students read along on their copy of the informational text (e.g., on body hair) while the assessor read it aloud only once. Then, the child was asked to write about the given text (e.g., write about reasons why our bodies have hair). The source texts were as follows: Hair (136 words; Lexile = 410–600) and Animal Tails (136 words; Lexile = 410–600) in Grade 1, and Birds (130 words; Lexile = 610–800) and Cats (180 words; Lexile = 410–600) in Grade 2. In addition, Superman (151 words; Lexile = 410–600) and Arbor Day (145 words; Lexile = 610–800) were used in both grades. These tasks were counter-balanced. For example, half of the Grade 1 sample were given either Hair or Animal Tails as well as either Superman or Arbor Day at pretest, while the other half of the Grade 1 students were given the two other tasks in the pretest. This was reversed in the posttest. Students were provided with a blank sheet of paper for planning and two pages of lined sheets for writing. Both the pre-and posttests were timed; students could take up to 30 min to complete their writing.

Students' handwritten compositions were typed by members of the researcher team before scoring and used to evaluate: planning, writing quality, writing productivity (number of words written), structural elements of informative writing, transition words (number used), and use of source text (number of idea units based in source text). Reliability was estimated using 40 compositions and two raters/scorers. Raters were trained using rubric or number of occurrences scoring guidelines with anchor compositions. For each aspect of evaluation, raters had several practice sessions in which prior student compositions were scored and differences in rating/scores were discussed. A minimum of 90% exact agreement had to be met for each of the aspects before the writing assessments were scored. All rubrics are available from the second author

upon request.

Writing quality rubric. Writing quality was evaluated for the extent and clarity of idea development and organization on a rating scale of 0 to 7 (e.g., Hooper et al., 2002; Kim et al., 2015; Olinghouse, 2008). Compositions that were clearly off-topic and illegible, or copied verbatim from source text (which rarely occurred) were given a 0. Those with clear and rich ideas in a logical organization were rated higher. This rubric was aligned with expectations expressed in the CCSS and state standards at these grade levels and with expectations for this genre in writing research. Inter-rater reliability, Cohen's kappa, was 0.87.

Writing productivity, structural elements rubric, and transition words. Writing productivity was evaluated by the number of words written. Misspelled words that were reasonably decodable were counted as words. Exact percent agreement was 0.95. The structural elements scoring rubric evaluated the extent to which the following elements of informational texts were included: introduction, topic statement, big ideas, important details, and conclusion. This rubric was aligned with CCSS and state standards and expectations in this genre in writing research. Each of these elements was rated on a 0–2 scale. A score of 0 was assigned when a target element (e.g., conclusion) was absent; a score of 1 was assigned when the target element was present, but elementary; and a score of 2 was assigned when the target element was developed and advanced. Cohen's kappa in each element ranged from 0.77 to 1. Transition words were defined as a word or phrase that signals unique information to the reader (including elaboration). Total number of transition words was determined for each essay. Examples included '*first*,' '*second*,' '*one fact*,' and '*in addition*.' Conjunctions (e.g., *and*, *but*) were not counted as transition words. Percent agreement was 0.96.

Planning rubric and use of source text. Students' construction of a writing plan on a blank sheet of paper was evaluated for four aspects: (a) use of planning for composition, (b) the number of ideas, (c) organization of planning, and (d) organizational notes for text elements (cf. Silver et al, 2011). The use of planning for composition refers to the extent to which text on the planning sheet was related to the final product of written composition on a scale of 1 (no relation) to 4 (composition includes text from planning sheet as well as other information students added). The number of ideas was the total number of ideas on the planning sheet that were relevant to the prompt. The organization of planning refers to structural organization of ideas, which was evaluated on a scale of 1 (ideas have no organizational structure—e.g., a string of words) to 7 (ideas have a clear macro [beginning, middle, and end] and micro structure [ideas within each macro structure are logically sequenced]). Finally, organizational notes for text elements captured how effectively students used organizational supports such as numbering, arrows, symbols, or mnemonics for text structural elements (e.g., topic sentence, big ideas, details, conclusion) on a scale of 1 (no structural elements are found in planning) to 5 (all structural elements are found). Blank planning sheets were given a zero on all four aspects. Percent agreement was 0.95.

Finally, use of source text was evaluated by counting the number of relevant, on-topic idea units present in the text written that were based on the given source text. Percent agreement was 0.90. Students read along as assessors read the pre- and posttest texts out loud to them, but assessors neither provided any form of pre-reading instruction on the topic nor assisted the students in planning or writing. As noted previously, both effective planning and use of source text serve not only as writing outcomes, but also as indicators of expository reading comprehension (Armbruster et al., 1987; Hebert et al., 2016; Silver et al, 2011).

Comprehension of expository text. Writing informative essays relied on reading and understanding a source text and using that source text for both planning and writing. At pre- and posttest, students received the source text, followed along as the assessor read the text once, and then reread, planned, and wrote independently. No instruction in vocabulary was provided. Students abilities in both planning and use of source text were examined as an indicator of expository reading comprehension, as previously noted.

2.7.2. Transcription and oral language skills

Spelling. A researcher-developed dictation task was developed. The items included proximal words (directly taught, 14 items; e.g., *date* in Grade 1), near-distal words (taught pattern but not words, 6 items; e.g., *gate*), and distal words (untaught pattern and words, 6 items; e.g., *gave*). Target words were presented in isolation, in a sentence, and in isolation again. Cronbach's alpha estimates ranged from 0.84 to 0.89.

Handwriting fluency. Two tasks were used: the WIAT Alphabetic Writing Fluency and a sentence copying task. In the former, the child was asked to write as many lower-case alphabet letters as possible in 30 s. In the sentence copying task, the child was asked to accurately copy a pangram sentence, *The quick brown fox jumps over the lazy dog,* as many times as possible in 1 min (e.g., Connelly et al., 2007; Kim et al., 2015; Wagner et al., 2011). Students' responses were scored by counting the number of letters copied correctly. Interrater reliability, percent agreement, was 0.98.

Vocabulary and sentence proficiency. A researcher-developed proximal task included words that were taught in SRSD Plus. The child was orally presented with a sentence that included the definition of a target word and was asked to select one of four options. For example, '*Something very important and necessary is ___. a) essential; b) extra; c) even; d) easy*.' One practice item was provided; 16 test items were included. Cronbach's alpha estimates across the 16 items were as follows: 0.70 for pretest and 0.84 for posttest for first graders, and 0.63 for pretest and 0.70 for posttest for second graders. A researcher-developed proximal task was used to measure sentence proficiency. Items included sentence combination (10 items; e.g., *I am happy. I can't stop smiling. Combine these two sentences using 'so-that.'*) and sentence completion (5 items; e.g., *It is raining so* ___). There was one practice item for sentence combination and sentence completion, respectively. Cronbach's alpha estimates were 0.87 for pretest and 0.82 for posttest for first graders, and 0.65 for pretest and 0.74 for posttest for second graders.

2.7.3. Discourse knowledge

The following 10 open-ended questions were adapted from previous work (e.g., Olinghouse et al., 2015): 1) What do good writers do when they write? 2) Why do you think some kids have trouble writing? 3) When asked to write a paper for class or homework, what kinds of things can you do that help you plan and write your paper? 4) When you write, do you think about whether your teacher can understand your writing? 5) When you write, do you think about whether your friend can understand your writing? 6) Why do kids write? 7) Why do grown-ups write? 8) When you write, do you reread your writing? If you do, why do you reread your writing? 9) Imagine your friend has to write an informational essay for a class. What would you tell him or her the parts of an informational essay are? 10) What else would you tell your friend is important when you write an informational essay?

Each question was read aloud to individual students. Students' oral responses to each question were written down verbatim, and the number of relevant ideas in various aspects (e.g., writing process, productive procedure, structural elements, appeal to the reader, motivation; see Olinghouse et al., 2015) were counted. Exact percent agreement was 0.98.

2.8. Data analysis strategy

Multilevel modeling using SAS 9.4 was employed to account for students being nested within classes. Hedges' *g* effect sizes (ES; What Works Clearing House, 2022; see p. 163 for equation) were estimated for writing outcomes (writing quality, writing productivity [number of words], elements, number of transition words, use of source text), transcription skills (spelling, handwriting fluency), oral language skills (vocabulary, grammatical knowledge), and discourse knowledge. Students' pretest performance, gender (female = 1), grade (Grade 2 = 1), and racial background (White = 1, 0 = African American children or mixed race) were included as control variables. The racial background

was dichotomized given that the vast majority of students were either White or African American. To investigate potential moderation by grade, gender, and racial backgrounds, an interaction term between treatment status and grade was included for each outcome. The Benjamini-Hochberg procedure (Benjamini & Hochberg, 1995) was applied to address false discovery rate.

3. Results

Table 1 displays descriptive statistics by grade and treatment status. A multivariate analysis of variance indicated that there were no statistically significant differences on any of the pretest scores by treatment status in either grade: Wilks's $\lambda = 0.86$, $F(11, 34) = 0.51$, $p = .89$ in Grade 1; Wilks's $\lambda = 0.87$, $F(11, 35) = 0.48$, $p = .90$ in Grade 2. Across all of the measures, there was sufficient variation around the means. Bivariate correlations among variables are included in the online supplemental materials.

To examine the effects of SRSD Plus on written composition, oral language, transcription skills, and discourse knowledge, multilevel models were fitted with students' performance on pretest and students' demographic characteristics (grade, gender, race) as covariates in all the models. To examine whether effects differed by students' background variables, two-way interaction terms between treatment status and pretest, grade, gender, and race were tested. Three-way interaction terms were tested when two-way interactions were statistically significant.

3.1. Written composition outcomes

Table 2 summarizes results for written composition outcomes. Students in the SRSD Plus condition outperformed those in the BAU/writers workshop condition on all outcomes: planning, use of source text, number of structural elements, and writing quality ($ps < 0.05$). The average writing quality score for students in the SRSD Plus condition was 2.93 points higher than those in the BAU condition with a large effect size of 1.02. Furthermore, students in the SRSD Plus condition created planning sheets for their written compositions to a greater extent and more effectively (ES = 1.40), included a greater number of structural elements (ES = 0.29), and used the source texts more frequently (ES = 0.48). For the number of words and transition words, effects were different such that the treatment effects were larger for students in Grade 2 (ES = 1.39 for the number of words, and ES = 2.46 for transition words) than those in Grade 1 (ES = 0.82 for the number of words, and ES = 1.33 for transition words).

Two-way interactions indicated that for the number of words written, the treatment effects differed by grade and gender with a larger effect size for second graders (ES = 0.94) than for first graders (ES = 0.25), and for girls (ES = 0.92) than for boys (ES = 0.21). For the number of transition words, effects were larger for White students (ES = 1.32) than for African American and multiracial students (ES = 0.53). For the number of transition words, additionally, the three-way interaction for treatment*female*grade 2 was statistically significant such that second-grade girls had a larger effect size than the other groups with the following effect sizes ($p < .001$): ES = 2.40 for second-grade girls, ES = 0.18 for second-grade boys, ES = 0.59 for first-grade girls, and ES = 0.64 for first-grade boys.

3.2. Transcription skills, oral language skills, and discourse knowledge outcomes

Table 3 summarizes multilevel model results for transcription skills, oral language skills, and discourse knowledge. There were no statistically significant differences between SRSD Plus and BAU/writers workshop in handwriting skills ($ps \geq 0.44$), with effect sizes of -0.02 in alphabet fluency and 0.11 in sentence copying. The effect size for spelling was large (ES = 1.18). Interestingly, there was a statistically significant interaction between baseline (pretest) performance and treatment for spelling. Students who had high pretest scores had a smaller effect than those with low pretest scores in spelling (B = -0.30, $p = .02$).

The effect was large in vocabulary (ES = 2.29). Furthermore, there was a statistically significant two-way interaction for vocabulary between pretest performance and treatment such that those who had a high score in pretest had a smaller effect than those with low pretest

Table 1
Descriptive statistics by grade and treatment status.

Variable	Grade 1						Grade 2					
	Treatment			Control			Treatment			Control		
	Mean	*SD*	Min-Max	Mean	*SD*	Min-Max	Mean	*SD*	Min-Max	Mean	*SD*	Min-Max
Writing: Quality: Pretest	1.57	1.08	0–4	2.04	1.74	0–5	4.13	1.42	2–7	4.09	2.63	0–12
Writing: Quality: Posttest	5.43	3.12	0–10	2.50	2.39	0–8	8.17	2.46	3–11	5.14	2.14	1–10
Writing: Words: Pretest	16.00	10.03	0–36	15.74	12.79	2–55	44.83	24.92	18–110	54.00	43.72	19–196
Writing: Words: Posttest	52.52	25.97	10–114	29.86	19.74	6–74	95.78	40.75	43–192	49.77	29.30	10–127
Writing: Elements: Pretest	1.65	1.30	0–4	2.48	2.56	0–8	5.25	3.27	0–13	6.26	6.13	0–28
Writing: Elements: Posttest	3.43	2.89	0–9	2.82	2.30	0–9	7.63	4.75	1–19	6.32	4.03	0–19
Writing: Transition: Pretest	0.13	0.63	0–3	0.04	0.21	0–1	0.13	0.45	0–2	0.35	1.03	0–4
Writing: Transition: Posttest	2.22	3.00	0–8	0.18	0.50	0–2	4.33	3.03	0–8	0.32	0.95	0–4
Writing: Use of source text: Pretest	1.09	1.04	0–4	1.48	1.68	0–5	3.79	2.84	0–10	4.83	3.98	0–17
Writing: Use of source text: Posttest	3.22	2.52	0–10	2.05	2.46	0–7	7.50	4.38	0–19	5.05	3.48	0–13
Writing: Planning: Pretest	5.09	4.80	0–13	7.26	5.86	0–21	7.00	4.85	0–16	6.26	5.24	0–15
Writing: Planning: Posttest	12.74	7.38	6–32	4.91	4.77	0–14	22.74	12.15	3–54	5.36	4.52	0–14
Alphabet fluency: Pretest	9.26	4.54	1–18	8.35	5.36	0–21	13.79	5.62	3–25	15.09	5.50	8–25
Alphabet fluency: Posttest	11.48	5.43	3–23	10.00	5.43	0–19	14.92	3.96	8–24	16.59	6.10	5–25
Sentence copying: Pretest	22.96	6.83	15–39	25.52	9.97	5–48	35.71	15.28	8–73	38.09	13.10	8–62
Sentence copying: Posttest	32.09	13.06	0–61	33.64	12.03	10–61	54.33	11.84	38–78	51.27	10.07	34–72
Spelling: Pretest	18.65	5.04	8–26	17.65	4.73	10–24	17.46	4.93	5–24	16.96	6.13	0–25
Spelling: Posttest	19.35	5.20	2–26	19.36	4.64	10–26	20.74	4.04	10–26	18.91	5.31	7–25
Vocabulary: Pretest	5.96	2.67	1–11	6.43	2.84	2–12	9.75	2.23	7–14	9.74	3.19	4–15
Vocabulary: Posttest	12.09	2.89	6–15	7.50	3.08	3–12	14.00	1.93	10–16	11.32	2.51	7–16
Sentence proficiency: Pretest	9.39	4.02	2–15	8.74	4.10	3–15	7.67	1.86	4–11	7.26	2.94	2–13
Sentence proficiency: Posttest	11.39	3.14	3–15	10.55	3.70	2–15	8.52	2.48	4–13	6.45	2.84	0–12
Discourse knowledge: Pretest	7.83	3.96	0–17	8.52	3.64	2–19	12.50	8.12	2–42	10.22	5.13	3–22
Discourse knowledge: Posttest	13.30	4.28	8–24	9.86	4.02	3–24	16.48	4.95	10–26	14.68	7.00	4–36

Note. Words = Number of words.

Table 2
Coefficients (standard errors) of multilevel model results for writing outcomes.

Effects	Quality	Number of Words	Elements	Transition Words	Use of Source Text	Planning
Fixed effects						
Intercept	0.87 (0.58)	18.16 (7.52)*	−1.34 (0.97)	0.31 (0.55)	−2.31 (1.26)	−1.03 (1.97)
Pretest	0.58 (0.13)***	0.47 (0.10)***	0.58 (0.08)***	0.80 (0.31)*	0.36 (0.12)**	0.27 (0.16)
Grade 2	1.33 (0.62)*	2.36 (9.50)	1.40 (0.62)*	-0.10 (0.56)	2.52 (0.83)**	4.77 (1.80)**
Female	0.13 (0.47)	−3.59 (7.27)	0.66 (0.57)	-0.02 (0.56)	0.59 (0.64)	0.74 (1.65)
White	1.13 (0.47)*	15.32 (5.16)**	2.15 (0.57)***	-0.43 (0.57)	1.62 (0.64)*	4.05 (1.65)*
Treat	2.93 (0.47)***	6.28 (8.98)	1.18 (0.57)*	1.16 (0.85)	1.80 (0.64)**	12.09 (1.61)***
Treat*Grade 2	–	25.86 (9.97)*	–	-0.68 (1.06)	–	–
Treat*Female	–	25.59 (10.17)*	–	-0.18 (0.95)	–	–
Treat*White	–	–	–	2.00 (0.79)*		
Treat*Female*G2	–	–	–	4.03 (1.11)***	–	–
Random effects						
Level 1: Child	4.69 (0.76)***	542.61 (88.62)***	6.93 (1.02)***	3.35 (0.50)***	8.72 (1.42)***	55.55 (8.86)***
Level 2: Class	0.26 (0.41)	77.76 (68.90)	0	0	0.50	2.16 (3.94)
ICC	0.05	0.13	0	0	0.05	0.04
Effect size (g)	1.02	see the note below	0.29	see the note below	0.48	1.40

Note. The effect sizes for Number of Words are as follows: 0.94 for G2 and .25 for G1; 0.92 for girls and 0.21 for boys.
The effect sizes for Transition Words are as follows: 1.32 for White students; 0.53 for African American and multiracial students; 2.40 for G2 girls, 0.18 for G2 boys, 0.59 for G1 girls, and 0.64 for G1 boys.
Treat = SRSD Plus treatment condition; G2 = Grade 1; G1 = Grade 1; ICC = Intraclass correlation.
*** $p < .001$.
** $p < .01$.
* $p < .05$.

Table 3
Coefficients (standard errors) of multilevel model results for transcription and language skills, and discourse knowledge.

Effects	Alphabet Fluency	Sentence Copying	Spelling	Vocabulary	Sentence Proficiency	Discourse Knowledge
Fixed effects						
Intercept	6.09 (1.47)**	18.97 (3.37)***	4.62 (1.64)*	2.36 (0.85)*	5.44 (0.92)***	7.14 (1.34)***
Pretest	0.44 (0.09)***	0.46 (0.09)***	0.81 (0.09)***	0.74 (0.09)***	0.44 (0.08)***	0.40 (0.09)***
Grade 2	2.01 (1.49)	14.28 (2.68)***	1.11 (0.77)	0.79 (0.56)	−2.84 (0.55)***	2.64 (1.03)*
Female	0.43 (0.93)	3.31 (2.14)	−1.37 (0.67)*	0.51 (0.41)	0.84 (0.54)	0.07 (0.98)
White	1.42 (0.95)	0.13 (2.16)	1.58 (0.67)*	0.94 (0.41)*	1.18 (0.55)*	-0.03 (1.03)
Treat	-0.17 (0.92)	1.67 (2.12)	5.64 (2.28)*	6.43 (1.08)***	1.03 (0.54)+	2.37 (0.99)**
Treat*Pretest	–	–	-0.30 (0.12)*	-0.34 (0.13)**	–	–
Random effects						
Level 1: Child	18.13 (2.91)***	96.94 (15.64)***	8.92 (1.44)***	3.47 (0.56)***	6.33 (0.94)***	21.05 (3.14)***
Level 2: Class	3.41 (2.44)	4.88 (8.21)	0.57 (0.81)	0.26 (0.33)	0	0
ICC	0.16	0.05	0.06	0.07	0	0
Effect size (g)	-0.02	0.11	1.18	2.29	0.29	0.43

Note. Treat = SRSD Plus treatment condition; ICC = Intraclass correlation.
*** $p < .001$.
** $p < .01$.
* $p < .05$. + < 0.10.

score (B = -0.34, $p = .008$). Sentence proficiency had a moderate effect size (ES = 0.29). The *p*-value for sentence proficiency was 0.06, missing the statistical significance level of 0.05, but the magnitude of the effect indicates practical importance and significance (Valentine & Cooper, 2003). The effect size for discourse knowledge was also moderate (ES = 0.43). Finally, there was little variation attributable to class differences across all the outcomes (see level 2 residuals in the random effects section). This is likely due to students having been randomly assigned to the conditions within class to the extent possible.

3.3. Comprehension of expository text

Controlling for pretest, grade, gender, and race, students in the SRSD Plus condition produced written plans that were more effective than students in the BAU/writers workshop condition, with a large effect size of 1.40. Students in the SRSD Plus instruction also used the source texts to a greater extent (ES = 0.48) than students in BAU. Thus, performance in both planning and use of source text indicates that students were able to comprehend the text independently, as text comprehension is necessary for effective planning and use of source text (cf. Armbruster et al., 1987; Hebert et al., 2016; Silver et al., 2011).

4. Discussion

4.1. Techer led SRSD plus: outcomes and implications

In the present study, we examined the efficacy of teacher-led SRSD Plus, a theory- and evidence-based multi-component approach to instruction in close reading and writing to inform with Grade 1 and 2 students in a high poverty school. Combining evidence-based practices in writing instruction is emphasized in the WWC practice guide for the elementary grades (Graham et al., 2018) in order to improve writing instruction.

SRSD Plus is aligned with the DIEW model of writing and research (Kim, 2020; Kim & Graham, 2022; Kim & Schatschneider, 2017) and the theoretical and research base for SRSD instruction. SRSD Plus instruction is active, dialogic, explicit, systematic, and engaging. Instruction attends to oral language (vocabulary and sentence proficiency), transcription skills (spelling and handwriting fluency), reading and writing processes (close reading to learn followed by planning and writing to inform), academic vocabulary, and discourse knowledge (knowledge of text structure and writing strategies). PBPD for teachers who led SRSD Plus instruction with small groups of students was provided. We

developed SRSD Plus in the informational genre, aligned with CCSS and NGSS (National Research Council, 2013).

SRSD Plus instruction took place for 45 min per session three times per week, for 10 weeks. The What Works Clearinghouse practice guide for writing instruction in the elementary grades recommends 1 hour of writing instruction per day from Grades 1 up (Graham et al., 2018). SRSD Plus fit easily inside this guideline, leaving substantial time for additional aspects of writing instruction, such as incorporating these abilities within content area learning.

Teacher outcomes included fidelity for SRSD and Plus instruction for use of core components and for quality of instruction. Student outcomes included: spelling, handwriting fluency, vocabulary, sentence proficiency, discourse knowledge, use of source text, planning, expository text comprehension, writing quality, structural elements in informative essays, number of words written, and use of transition words. Students' use of what they had learned when they had 30 min to markup text, plan, and write was also examined.

This is the first experimental study to address: the integration of instruction in transcription skills and oral language skills with SRSD writing instruction; SRSD for close reading (of science texts) to learn and writing informative essays in first and second grades; and the ability of these young students to use what they had learned to during a timed writing test. Some researchers and practitioners have posited that learning transcription skills, oral language skills, and close reading to learn and writing to inform is too much at one time for young learners due to cognitive overload and other interfering difficulties (cf. Torrance et al., 2020; Wen & Coker, 2020). Integrating close reading and writing informative essays is rare at Grades 1 and 2, yet writing standards indicate this is expected in instruction. Using what they have learned in a timed writing condition is important as students will frequently take timed assessments. Based on previous research and our experiences with second graders, we predicted that instructional fidelity would be strong and students would show significant and meaningful outcomes at both grade levels for all measures.

4.1.1. Fidelity of instruction

Over 20 studies have shown that PBPD for SRSD is effective in terms of teacher fidelity and leads to significant and meaningful student outcomes typically equal to those found in researcher led instruction (Graham et al., 2013; Harris et al., in press, 2012, 2015; McKeown et al., 2019). Teacher observations in this study provided teacher outcome data on both percent of instructional components correctly completed and quality of instruction (on a scale of 1 to 5) for the SRSD and the Plus instruction. For SRSD instruction, percent of instructional components completed ranged from 89.5% to 100% and quality scores ranged from 4.5 to 4.92. All Plus instruction lessons scored 100% on implementation of instructional components; quality scores ranged from 4.67 to 4.92. Our prediction that PBPD would result in effective instruction for SRSD Plus was upheld. Further evidence of the effectiveness of PBPD for SRSD Plus is found in the significant and meaningful student outcomes in a timed writing condition following teacher-implemented SRSD Plus instruction in small groups. This study adds to a growing body of research on PBPD for SRSD, extending this research by working with Grade 1 and 2 students and integrating PBPD for oral language and transcription skills at early grades. Future research should examine SRSD Plus not only at Grades 1 and 2 in high poverty schools, but also in later elementary grades and differing school SES contexts.

4.1.2. Written composition and expository reading comprehension outcomes

Writing. As predicted, SRSD Plus instruction had significant and meaningful results on all outcomes for written composition. Large effect sizes were observed in writing quality (ES = 1.02) and writing productivity (ES = 0.82 to 1.39). Students in the SRSD Plus condition wrote higher quality and longer compositions compared to those in BAU/writers workshop. The large effect is also important in a different comparison—*first graders in the SRSD Plus condition wrote at the same quality level (M = 5.43) and as many words (M = 52.52) as second graders in the BAU condition at posttest (M = 5.14 in quality; M = 49.77 in words)*. Large effects were also found in the number of transition words, with effects sizes of 1.33 and 2.46 at Grades 1 and 2, respectively. Students in the SRSD Plus condition also showed improvements in structural elements in their writing (ES = 0.29). These findings offer initial evidence that SRSD Plus had strong outcomes across critical aspects of writing performance at both first and second grade. Replication of these results needs to be established in future research.

One important finding of this study is the large effect of SRSD Plus instruction on students' planning. During the planning process, students learned to set goals, mark up text for big ideas (and details for students at second grade ready to do this), generate initial ideas related to text structure, consider important vocabulary and consider transition words, and establish a writing plan to achieve their goals. After controlling for pretest, grade, gender, and race, students in the SRSD Plus condition produced written plans that were more effective than students in the BAU/writers workshop condition, with a large effect size of 1.40. Students in the SRSD Plus instruction also used the source texts to a greater extent (ES = 0.48) than students in BAU. This is the first study we are aware of where first and second graders were asked to read source text to learn and write informative essays, or any other writing purpose. The results across all written composition outcomes are encouraging and break new ground, but further research is needed to see if these findings replicate and to learn more about the processes of change.

Comprehension of source text. Writing informative essays in this study relied on reading and understanding a source text and using that source text for both planning and writing. At pre- and posttest, students received no instruction in relevant vocabulary, followed along as the assessor read the text once, and then reread, planned, and wrote independently. Thus, performance in both planning and use of source text indicates that students were able to comprehend the text independently, as text comprehension is a precursor for effective planning and use of source text (cf. Armbruster et al., 1987; Hebert et al., 2016; Silver et al., 2011). However, as this study did not include a direct measure of reading comprehension, future research should examine this question more thoroughly, including use of direct measures of reading comprehension.

4.1.3. Effects of grade, gender, and race for writing outcomes

Grade. SRSD Plus instruction had differential effects for Grade 1 versus Grade 2 in the number of words written and transition words. The larger effects for both in Grade 2 may potentially be attributed to at least two reasons. The first is a developmental reason, specifically the constraining role of transcription skills. Transcription skills are important to different aspects of writing outcomes such as writing quality and productivity (number of words written), but more so for writing productivity (Kim et al., 2014, 2015; Kim & Graham, 2022). Students in primary grades are developing handwriting and spelling skills at a fast rate, and students in Grade 1 versus Grade 2 could be differentially constrained by these transcription skills. Some support for this speculation is found in Table 1. At pretest, the average number of words written in Grade 1 was 16 (in both conditions) in comparison to 45 (SRSD Plus condition) and 54 (BAU/writers workshop) in Grade 2. These findings suggest that such a constraining role may have been stronger in Grade 1 than in Grade 2, in other words, the effects of SRSD Plus instruction on writing productivity (and potentially on the number of transition words) may have been constrained by transcription skills and overall writing development to a greater extent for first graders.

A second potential reason for the greater number of words written and the use of more transition words at Grade 2 may be the fact that most of the Grade 1 teachers needed to reduce the number of big ideas targeted for inclusion in writing to one or two, rather than three or more, as this was not yet appropriate for most of their students. As noted previously, teachers had this option if including three big ideas in

students' writing was initially overwhelming. Teachers did find this difficult for many of their first graders. Some students were able to start with one big idea and then stayed there or increased to two or three; some were able to start with three big ideas in their planning and writing. This finding is important to further refining the SRSD instruction at Grade 1. Continued development and research are needed here, exploring whether the differences remain across differing school contexts, as students in this study were attending school in a high-poverty area. As noted, poverty and inequity in access to literacy learning opportunities are strongly related to both writing and reading performance (Aud et al., 2012; National Center for Education Statistics, 2020). The positive findings in this study add to the urgency for further research on evidence-based literacy instruction in underserved schools; in particular, for students at the important foundational stages of literacy learning in the primary grades.

Gender. A differential effect was also found for gender for number of words written, with a larger effect for girls than boys. In addition, the three-way interaction indicated that a larger effect was found for girls for use of transition words in second grade than for all other groups (boys in second grade, and girls and boys in first grade). These gender results are in line with existing data regarding differences in achievement in writing among girls and boys (Kim et al., 2015; Reilly et al., 2019), but replication needs to be examined in future research.

Race. Only one differential effect for race was found in this study. For the number of transition words, effects were larger for White students (ES = 1.32) than for African American and multiracial students (ES = 0.53). Future research is needed to learn if this difference replicates, and to consider how this might affect differentiation of instruction. Given that differential effects for race were not found for any of the other written composition outcomes, this study adds to the evidence that SRSD instruction is effective among students in racially diverse classrooms and across SES levels (Graham et al., 2013, 2019; Salas et al., 2020). Further research on SRSD for writing, and SRSD Plus, is needed to explore how instruction can be more responsive to students' diverse backgrounds and experiences (e.g., identifying students' cultural expectations regarding writing; providing varied opportunities and tasks for which to write; considerations for content foci; and fostering the development of students' unique writing identities).

4.1.4. Transcription and oral language skills

Spelling and handwriting. The results on transcription present a mixed picture. SRSD Plus instruction resulted in a large effect on students' spelling skill (ES = 1.18), although its effect was smaller for students who had higher performance on spelling at pretest. These findings suggest that explicit and systematic spelling instruction is particularly needed and beneficial for students with lower spelling skills, and differentiation in spelling instruction should be examined. In contrast to the positive and large effects in spelling, SRSD Plus instruction did not yield any effects on handwriting fluency skills. This finding was surprising partly because of consistent positive feedback from the SRSD Plus teachers during weekly conference calls noting their observation of improvement in students' handwriting. However, upon reflection, teachers' comments were most frequently about well-formed handwriting, not about automaticity, which is a theoretically critical aspect for the purpose of releasing cognitive resources (Berninger & Winn, 2006; Graham et al., 1997; Kim & Park, 2019). The SRSD Plus lessons focused on both well-formedness and automaticity, but the dosage may not have been sufficient to improve automaticity of handwriting. Instruction should be refined to address this issue in future research on SRSD Plus at first grade.

Vocabulary and sentence proficiency. SRSD Plus had positive effects on the proximal tasks of vocabulary and sentence proficiency with a large effect in vocabulary (ES = 2.29) and a medium effect in sentence proficiency (ES = 0.29). These results indicate that students in SRSD Plus made meaningful progress on the target vocabulary words and sentence structures. Two observations are noteworthy. First, the effect in vocabulary was smaller for students who scored higher at pretest, indicating a need for systematic instruction in vocabulary, particularly for students with lower vocabulary knowledge. The second observation is that although positive, the effect was smaller in sentence proficiency.

Causes for the smaller effect sizes in sentence proficiency are unclear. However, upon inspecting students' performance on the items in the sentence proficiency task, the positive effects were driven more by the sentence combination items than the completion items. The target structures in instruction may have been too easy to adequately capture the effect of instruction particularly when using the sentence completion items. For example, for students' performance on their ability to use '*but*' correctly, both combination and completion items were used. The correct answer in the combination items was confined by the given stimuli (e.g., *I woke up early. I missed the school bus*. Use '*but*.') whereas this was too easy in the completion task (e.g., *Mary can't swim but I can*).

4.1.5. Discourse knowledge

As noted previously, discourse knowledge is an important contributor to writing performance (Bereiter & Scardamalia, 1987; Olinghouse et al., 2015). Good writing requires knowledge about how to approach a writing task and how to organize ideas effectively, and such knowledge affects writing quality. Students in the SRSD Plus condition gained greater knowledge about various aspects related to writing process (e.g., structural elements, production procedure, appealing to the audience; ES = 0.43). Comparison of students' responses before and after SRSD Plus instruction helps illustrate this. In response to the question, "*Imagine your friend has to write an informational essay for a class. What would you tell him or her the parts of an informational essay are?*" (Question 9 of the Discourse Knowledge task). Student A was not able to state anything ("*Not sure*") at pretest. At posttest, Student A, a second grader, responded as follows: *"To make a hook and a topic sentence and three big ideas or more and an ending. And I think that's it."* Similarly, Student B, a first grader, stated "*Don't know*" at pretest, but elaborated as follows at posttest: *"To use TIDE because it helps you, it helps with the writer tell it what they're writing about and ID is use big ideas, 1, 2, 3, or more. And ending is when we wrap it up, and wrap it up right."* As with other outcomes of this study, further research is needed to examine replication of this finding.

4.2. Debates regarding early instruction in writing

The findings in this study regarding SRSD Plus do not support the view that learning transcription skills, oral language skills, and close reading to learn and write informative essays will overwhelm young learners due to cognitive overload and other interfering difficulties (cf. Graham, 2019; Torrance et al., 2020; Wen & Coker, 2020). Rather, students thrived in SRSD Plus instruction: Grade 1 and 2 students were able to learn close reading to write informative essays, and were able to do so on timed posttests. This may be due in part to the focus on individualizing instruction for students, the rich scaffolding provided, small group instruction, and other aspects of instruction.

Future research, perhaps using mixed methods, should be conducted to further illuminate salient aspects of instruction for all students or for some students. Given the outcomes of SRSD Plus instruction here, however, waiting for students to learn transcription skills and multiple sentence structures before introducing effective instruction in writing does not appear necessary. Such an approach, in fact, may hinder writing development, and this should also be addressed in future research.

5. Limitations and future directions

Several limitations and associated future research directions are worth noting. First, generalizability of the findings is limited to populations and contexts similar to the sample in this study—small group instruction for students in Grades 1 and 2 in high-poverty schools.

Similarly, the results should be interpreted in the context of the counterfactual; that is, the reported effect sizes are in relation to the BAU condition. In the present study, the BAU condition was writers' workshop; no commercial programs were reported as part of instruction. Unfortunately, however, we did not have observation data to document how writers' workshop was taught in the control condition. Therefore, a future replication that includes a detailed description of typical instruction in the comparison group is needed. Second, the sample size was relatively small. As an implementation study designed to estimate potential effects of SRSD Plus, we worked with a limited number of students in Grades 1 and 2, which was underpowered to fully capture the effect of SRSD Plus. This was evident in the statistical significance in the sentence proficiency task which had a moderate, practically important effect size (0.29), but was shy of the conventional statistical significance of 0.05. Finally, reliability estimates were less than ideal in the vocabulary and sentence proficiency tasks in the pretest for second grade students. Reasons for these are unclear, and future replications with larger samples should examine this further.

Third, future research is needed to examine the effect of SRSD Plus with small groups using a larger sample size after revision and refinement of SRSD Plus instruction. Null effects in handwriting fluency skills indicate a need to revise the transcription lessons of SRSD Plus. Greater attention and opportunities for development of automaticity, in addition to well-formedness of letters, is needed in future handwriting lessons, and both should be assessed. In addition, effects of SRSD Plus at the whole class level, and how these compare to small group instruction, should be addressed in future studies, as should the effects of SRSD Plus across students not attending high poverty schools.

Fourth, SRSD instruction addresses several aspects of social-emotional learning which have been examined in other studies (Graham & Harris, 2018; Graham et al., 2013; Harris et al., in press), but were not assessed here (e.g., attitudes about and self-efficacy for writing, persistence/engagement, managing of emotions, goal setting and tracking of performance toward goals, working effectively with peers). Future studies should address such outcomes, although assessment challenges exist with young students.

Fifth, writing outcome measures for planning, structural elements of informative essays, and essay quality were assessed using rubrics. These rubrics have high inter-rater reliability and face validity, and were developed in alignment with expectations in the CCSS for reading and writing at Grades 1 and 2, common expectations in state and national writing tests, and rubrics used in the field for writing assessment. Rubrics that meet these standards are considered essential in the assessment of writing, and have advantages over standardized testing for schools, districts, states, national assessments, and other large-scale assessments, despite the push for norm-referenced assessments in writing practice and research (Conley & Darling-Hammond, 2013; Darling-Hammond & Adamson, 2010; Lane, 2010; Silver et al., 2011; Stanford School Redesign Network, 2008). The What Works Clearinghouse (WWC, 2020) has four criteria for a measurement to meet their design standards: face validity, reliability, not overaligned with instruction, and collected the same way for intervention and comparison groups.

Writing assessment rubrics such as those used here are not "overaligned" with intervention, contrary to recent claims. The WWC (2020) states: "…this rule [overalignment] does not apply when material covered by an outcome measure must be explicitly taught" (p. 84), as in this study. When intervention requires explicit instruction, an outcome measure is overaligned only when gaming the measure is evident, such as using the same writing prompt in intervention and in posttesting.

Many newer writing assessments, in fact, use rubrics to evaluate writing performance and then standardize these scores, such as the most recent NAEP writing assessment and the Weschler Individual Achievement Test-III essay composition measure. There are relatively few norm-referenced, standardized assessments in writing, and none for assessing writing informative essays with or without source text. Such measures need to be developed. Research will then be needed comparing these standardized measures at differing scales to rubrics-based assessment that meets stringent criteria in terms of correlation, cost, and usefulness.

Finally, SRSD Plus is composed of multiple evidence-based practices in writing instruction. The What Work Clearinghouse (WWC, 2022) no longer considers combined (or bundled) interventions a confound in research "because a bundled intervention can produce a valid impact estimate for the 'package' of interventions" (p.3). Future research is needed, however, to identify the relative effects of differing components among students and teachers, although such research is challenging and costly. Quantitative, qualitative, and mixed-methods studies are needed to illuminate both group and individual student and teacher outcomes. A complexity science approach (using mixed methods to look at complex relationships in teacher and student learning) may help deepen our understanding of how, why, and for whom SRSD Plus is effective (Marchand & Hilpert, 2018; Harris, 2018; Harris & Graham, 2016).

6. Conclusion

In an effort to support writing development among first and second graders, a theoretically and empirically-based multi-component writing instruction called SRSD Plus was developed and examined. Results were positive and promising; 10 weeks (45 min, three times per week) of explicit and systematic instruction yielded large differences in students' ability in writing and component skills of writing. Effective instruction integrating evidence-based practices for transcription, oral language skills, and reading to learn and writing to inform starting in the early grades has the potential to improve student writing and use of what they have learned. Replication and further research have the potential to influence both practice and policy in primary grades writing instruction.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cedpsych.2023.102150.

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