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"Breathe, Plan, Write, and Evaluate": the effects of an SRSD intervention and instructional feedback on 4th graders' writing and motivation

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Introduction: Over the years, extensive literature attested to the value of the Self-Regulation Strategy Development model (SRSD) for writing. Additionally, feedback has been recognized as essential to the teaching and learning of writing, and as supporting evidence-based instructional models for writing. However, little is known of the effects of combining evidence-based practice models, such as SRSD, with instructional feedback, as well as with a component of meditation. The present study aimed to study the effects of an SRSD intervention and to study the importance of instructional feedback within an SRSD intervention.

Method: A total of 69 primary students (4th graders) participated in this study. The study was divided into two phases: in Phase 1, two classes participated in a SRSD intervention program (SRSD-1 group; $N = 33$), whereas two others received regular writing instruction (control group; $N = 36$); in Phase 2, the previous control group received the SRSD intervention with or without instructional feedback (SRSD-2 with feedback, $N = 19$, vs. SRSD-2 without feedback, $N = 17$, groups), while the SRSD received regular writing instruction (SRSD-1 group).

Results: The effectiveness of the intervention was confirmed in both phases for the writing outcomes variables, but not for motivation. Overall, our study showed that the SRSD intervention with an additional meditation component was effective in improving students' writing planning for all intervention participants. Additionally, writing quality and writing structure improved among those with lower scores at the pretest. Concerning motivation, we only found an effect on self-efficacy for ideation.

Discussion: We expect the current research to stimulate future examinations of the value of providing students with instructional feedback in writing interventions.

KEYWORDS

writing, feedback, motivation, SRSD, attention, children, primary grades, intervention

1 Introduction

Writing is an essential ability in our daily lives, as it serves many communication, learning, and social purposes (Harris and Graham, 2009). Achieving expertise in writing is required to access high-valued jobs and foster personal development. In formal education, writing is the tool used by students to demonstrate what they learned, and it is through writing that teachers evaluate their performance (Graham, 1982). Throughout schooling, students are expected to initially acquire the basic writing process of transcription (i.e., handwriting/typing and spelling), followed by the progressive development of more complex high-level processes (Limpo and Alves, 2013a). The importance of transcription and high-level processes has been acknowledged in recent cognitive writing models, such as the writers-within-community (WWC) (Graham, 2018).

The WWC model embraces both sociocultural and cognitive components to provide a comprehensive view of writing (Graham, 2018). The sociocultural component includes the writing community, which refers to a group of people who share a basic set of goals and assumptions and use writing to achieve their purposes. The cognitive component of the model includes the production processes, which refer to the mental and physical operations used by writers to compose a text, which includes: the conceptualization (i.e., constructing a mental representation of the writing task), the ideation (i.e., drawing ideas for the text from internal and/or external sources), the translation (i.e., transforming ideas into acceptable sentences), the transcription (i.e., transcribing sentences into text on paper or digitally), and the reconceptualization (i.e., rethinking and revising what has been produced so far, including writing goals, plans, notes, and text). It also includes writers' long-term memory resources related to their knowledge and beliefs about writing. Among these resources, is the motivation to write. As writing is a complex and cognitively demanding activity, this may pose motivational challenges for students (Alves and Limpo, 2015). Motivation is perceived as an essential construct for achieving success in writing (Alves-Wold et al., 2023). The role of motivation in writing has been explored over the years. Several studies showed that motivation-related variables are often associated with writing achievement in school-age children (Limpo and Alves, 2014, 2017; Graham et al., 2017). One of the most studied variables within the field of writing motivation is self-efficacy, which refers to students' perceptions about their ability to successfully learn or perform academic tasks such as writing a text (Bandura, 1997). Research has shown that this perception of ability has been one of the strongest motivation-related predictors of writing achievement (Limpo and Alves, 2013a; Graham et al., 2017). Writing attitudes is another construct that has also been studied (Ekholm et al., 2017). This construct has been defined by Graham et al. (2007) as an affective disposition involving how writing makes the writer feel, ranging from positive to negative emotional responses to writing. As self-efficacy, writing attitudes have been shown to influence writing performance, with writers' positive attitudes toward writing leading to better texts (Graham et al., 2007).

The WWC model also includes writers' control mechanisms, such as attention, working memory, and executive control (Graham, 2018). The role of control mechanisms in writing was also emphasized in Berninger and Winn's (2006). Not-So-Simple View of Writing model. Executive functions, including supervisory attention, goal setting and planning, reviewing and revising, and strategies for self-monitoring and regulation, are perceived as critical to proficiency in text generation (Berninger and Winn, 2006).

Given the complexity of writing well depicted in the WWC model, the adoption of strategies is recognized as essential to simplify and organize the complex subtasks required to successfully complete writing assignments (Santangelo et al., 2007). Thus, over the years, scientific research has developed several evidence-based strategy-instruction approaches for teaching writing in the classroom. Among these, one of the most effective is the Self-Regulated Strategy Development (SRSD) model (Graham and Harris, 1993).

The SRSD model is an instructional approach for teaching writing designed to improve students' writing skills through the teaching of specific writing and self-regulation strategies (Graham and Harris, 1993; Harris and Graham, 2009, 2016). SRSD has been used in primary and middle grades, high-school and even in university settings (Graham and Harris, 1993; Harris and Graham, 2009, 2016; Al Shammari, 2018; Chen et al., 2021). These strategies are taught together across six stages (Harris et al., 2008; Harris and Graham, 2009, 2016; Harris et al., 2013). In Stage 1 – develop background knowledge – students develop and activate knowledge about writing in the genre being addressed (e.g., the definition of persuasive writing). In stage 2 – discuss the strategy – students reflect on their current abilities, including their attitudes and beliefs about writing, and reflect on how these factors influence their writing. In stage 3 – model the strategy – teachers model the use of writing and self-regulation strategies, discussing them with the students. In stage 4 – memorize the strategy – the memorization of strategies is reinforced through application and rehearsal. In stage 5 – support the strategy – students use the writing and self-regulation strategies previously learned in their writing process, and teachers scaffold students' work, providing feedback to their writing. Finally, in stage 6 – independent performance – students are able to use the writing and self-regulation strategies autonomously. Across the stages of instruction, teachers' support is gradually released, so students are able to independently apply the strategies by the end of the intervention (Harris et al., 2008).

SRSD offers several benefits for writing instruction and learning (Harris and Graham, 2009, 2016), with sound evidence of effectiveness in primary graders' writing. In a study with Grade 3 students, SRSD instruction in planning and writing of stories and persuasive essays improved the writing performance of students who were experiencing difficulty in the writing learning process (Graham et al., 2006). Another study with Grade 2 students at-risk for failure in writing also reported benefits of an SRSD intervention (Harris et al., 2015). In a meta-analysis focused on elementary grades, the use of the SRSD strategy improved students' writing quality (Graham et al., 2012). In general, SRSD interventions have showed gains in several aspects, such as genre elements and writing quality (for an extensive evidence summary, see Harris and Graham, 2009). The success of using SRSD in writing interventions seems to rely on essential characteristics related to its instructional features, a critical one being the use of constructive feedback (Graham and Harris, 2005; Santangelo et al., 2007). Indeed, several studies provided additional evidence on the positive effects of SRSD interventions on writing when combined with feedback provided by automated writing evaluation systems (Araújo et al., 2017; Palermo and Thomson, 2018; Nunes et al., 2021).

Feedback has been recognized as having an essential value to the teaching and learning of writing. Graham and Harris (2005) pointed out that feedback is critical to improve students' writing and should

be present in every instructional model. However, more than focusing on students' writing errors – which can negatively impact performance, perceptions, and motivations (Graham, 1982) – feedback should be instructional and used as part of a classroom-based formative writing assessment (Graham et al., 2015). Instructional feedback goes a step further than traditional feedback, not only by providing information, but also adding indications on how to improve performance or understanding (Hattie and Timperley, 2007). This feedback can be delivered by adults (e.g., teachers and parents), peers, and technology, or it can even occur through self-assessment (Sadler, 1989; Graham et al., 2015). Also, it can be delivered in different modes (i.e., pen-and-paper, electronic, or automated) and in different types (i.e., commentaries, responses, or corrections) (Sadler, 1989; Nurmukhamedov, 2009). In a meta-analysis covering grades 1–8, Graham et al. (2015) showed that classroom-based formative assessment including feedback on students' written products and writing skills resulted in positive gains in written composition. The effects of instructional feedback on writing quality can be explained by Vygotsky's (Vygotsky, 1978) notion of the zone of proximal development (ZPD). The agent of feedback creates a space for development, called the ZDP, where students gradually internalize the information given to them and achieve a new level of independent performance (Wilson et al., 2014). Following this theory, the knowledge and experience of both the feedback agent (i.e., teacher, peer or technology) and its recipient are key components of effective instructional feedback (Wilson et al., 2014).

Hattie and Timperley (2007) identified four levels of feedback: (1) task level, the so-called corrective feedback aimed to distinguish the correct from the incorrect, (2) process level, aimed at the process to complete a task, (3) self-regulation level, aimed to boost confidence to engage further on a task, and (4) self-level, focused on personal qualities and often unrelated to performance on the task. Despite recognizing the value of feedback at the task level, the authors pointed out that feedback at the process and self-regulation levels was the most effective, above praise, reward, and punishment (Hattie and Timperley, 2007). This is particularly noted in evidence-based instructional models as the SRSD, where feedback is used in a supportive way, combined with self-regulations strategies, such as goal setting, progress monitoring, self-instructions, and self-statements (Graham and Harris, 2005). The main goal of combining feedback with self-regulation strategies is to develop students' skills in applying the acquired writing strategy in an independent way (Santangelo et al., 2007).

As mentioned before, writing is such a complex task that to effectively implement writing and self-regulation strategies following teachers' feedback, several control mechanisms must be in place. A control mechanism that has received scant attention in the writing field is attention. Yet, the importance of attentional skills has already been highlighted in writing models such as the WWC (Graham, 2018) and the Not-So-Simple View of Writing (Berninger and Winn, 2006). Moreover, there is some empirical evidence suggesting that attention contributes to writing achievement in early school years (Cordeiro et al., 2021). The question raised by these evidence is how to improve children's attention in order to boost their writing performance?

Recent data suggest that a promising way to improve attention is through mediation, which has attentional processes at its heart (Malinowski, 2013). Meditation is a technique in which the practitioner is asked to focus their attention in an inner (e.g., breathing) or outer (e.g., sound) stimulus. The focus on breathing provided by meditation may be a useful tool in the process of writing, as well as in other academic activities, as breathing is always present and is easy to replicate, therefore allowing students to focus their attention in several contexts (Farhi, 2000). Also, as writing is a reflective process, a clear mind provided by meditation is more likely to create clear writing (Williamson, 2016).

Typically, meditation is the core instructional technique within mindfulness interventions, which have been shown to be beneficial. In a comprehensive meta-analysis of mindfulness-based interventions conducted with 4- to 18-year-olds, Klingbeil et al. (2017) found significant improvements on cognitive performance as well as on indicators of academic achievement. Recent studies directly connecting mindfulness-related practices with writing showed positive outcomes. For example, Limpo et al. (2023) showed that a mindfulness-based program resulted in higher levels of internal and external awareness and in better grades in writing quality and mathematics. Another study found that a meditation-based intervention led to attentional improvements and better grades in Portuguese, Mathematics and Social Studies (Magalhães et al., 2022). Cordeiro et al. (2021) found that students' ability to approach their own thoughts and feelings with an acceptance orientation (i.e., mindful acceptance) predicted their writing achievement in Grade 6. Rocha et al. (2023) combined SRSD interventions with a meditation component and found that meditation was essential for 3rd grade students, especially for those with poor results on writing performance at pretest which achieved better academic performance in posttest; also, the intervention showed general improvements in planning skills, complexity of the texts and better executive functioning. This study served as preliminary evidence that combining a meditation component in writing interventions would be promising.

The effects of SRSD on writing are overall positive, as recognized in the extensive literature putting it to test. However, there is a gap in the literature examining the combination of meditation with evidence-based practice models and instructional feedback. Thus, in the present study, we had a twofold goal: (1) to study the effects of an SRSD intervention with a meditation component; and (2) to study the importance of instructional feedback within that version of an SRSD intervention. We expected that students receiving the SRSD intervention would show greater improvements in writing outcomes and motivation, and that students who received instructional feedback would perform better than students who did not receive this feedback on their writing.

2 Method

2.1 Participants and experimental design

The present study was implemented with primary students (4th graders) from a public school, with a middle socioeconomic level, in a small town in the most populated district from the North of Portugal, which were authorized by their legal guardians and agreed to participate. The study was approved by the Ethics Committee of the Faculty of Psychology and Education Sciences at the University of Porto. The study was divided in two phases. In Phase 1, four classes (ranging from 11 to 24 students in each class) were randomly divided

into two conditions: two classes participated in a SRSD plus meditation intervention program (SRSD-1 group), whereas the other two classes received regular writing instruction (control group). In Phase 2, the control group of Phase 1 received the SRSD intervention with or without instructional feedback (SRSD-2 with feedback vs. SRSD-2 without feedback groups), and the SRSD-1 group in Phase 1 received regular writing instruction (SRSD-1 group). In Phase 2, SRSD-2 students within each class were randomly selected to the feedback vs. no feedback group using random.org.

For ethical reasons, all students participated in the intervention program ($n = 87$). However, to define the data-analytic sample we excluded children with special education needs ($n = 11$) and with missing values in one or more variables ($n = 7$). The final sample included 69 students, with a chronological age between 8.75 and 10.17 years ($M = 9.35$; $SD = 0.31$), with 37 males and 32 females. The majority of students' mothers had completed Grade 9 (31.9%) and Grade 12 (24.6%). In Phase 1, 33 students were in the SRSD-1 group and 36 in the control group; in Phase 2, the previous control group was randomly split, with 19 in SRSD-2 with feedback group, and 17 in SRSD-2 without feedback group. Table 1 presents a complete characterization of the groups, which did not differ in terms of gender, $\chi^2(2) = 1.20$, $p = 0.55$, age, $F(2, 68) = 0.12$, $p = 0.89$, $p = 0.55$, and mothers' educational level, $\chi^2(10) = 12.90$, $p = 0.23$.

2.2 Intervention program

The intervention program was aimed to develop the writing skills of fourth graders, through teaching writing and self-regulation strategies as well as meditation techniques. The program was implemented by a trained psychologist in each intact classroom (ranging from 11 to 24 students), during two 60-min weekly sessions across five weeks. Because meditation requires continuous practice (Van Vugt, 2015), in addition to the 5-min practice embedded in the 60- min writing sessions, students also practiced meditation in the other three days of the week during 5 min. For that, an audio file was given to each schoolteacher, whose unique task was to play the file, which contained all the instructions for students to practice guided meditation by themselves.

TABLE 1 Characteristics of the groups.

	Phase 1		Phase 2	
	SRSD-1 ($n = 33$)	Control ($n = 36$)	SRSD-2 with feedback ($n = 19$)	SRSD-2 without feedback ($n = 17$)
Gender (*n* girls)	16	16	10	6
Age (in years)				
M (SD)	9.33 (0.34)	9.35 (0.28)	9.33 (0.32)	9.38 (0.24)
Min-Max	8.92–10.17	8.75–9.75	8.75–9.75	9.00–9.75
Mother educational level (n)				
Grade 4	0	1	0	1
Grade 6	6	2	2	0
Grade 9	11	11	5	6
Grade 12	6	11	5	6
University degree	5	11	7	4
No information	5	0	0	0

The control group in Phase 1 corresponds to the two SRSD-2 groups (with and without feedback) in Phase 2.

Throughout the sessions, the intervention program followed the SRSD stages (Harris et al., 2008; Harris and Graham, 2009, 2016) (*viz.* Supplementary Table 1 for more details). To develop background knowledge (SRSD Stage 1), the intervention program was presented to students, namely its goal: writing good argumentative texts composed by six parts. Then, the strategy to achieve this goal – named SETA – was discussed with the students (SRSD Stage 2). SETA is a mnemonic of the self-instruction strategy aimed to guide students through the main steps involved in writing argumentative texts: *Silêncio* (silence), *Esquema* (plan), *Texto* (text), and *Avaliar* (evaluate).

The Silence (S) step was aimed to calm students' minds through the implementation of a 5-min audio-guided meditation. Students were instructed to focus on the sensation of their breathing, to consciously return their attention to their breath instead of engaging with their thoughts. The main goal was to calm their emotions and focus on the present moment, that is, writing the essay.

In the Plan (E) step, students implemented the planning strategy "*2P2EAcaba!*." This mnemonic helped students to remember the six parts of an argumentative text: *2P* – Diz o que pensas e porquê (Say what you think and why); *2E* – Explain each reason with examples; and *Acaba!* (End) – end your text with a new idea. To facilitate memorization, students used graphic organizers divided in six parts corresponding to each one of the planning steps.

After finishing the plan, students learned how to write their texts based on the plan – the Text (T) step. Students were encouraged to go a step further from the plan and develop their ideas. Finally, students evaluated their writing – the Evalute (A) step. The self-monitoring of writing by students was done through the use of a target-shaped chart, where students had to read their text while checking if each part of the planning strategy was present in the text.

All tasks were first modeled by the psychologist (SRSD Stage 3), such as the demonstration on how to elaborate a plan and how to write a text based on it. Throughout the sessions, students were encouraged to memorize the strategies (SRSD Stage 4) through recollection of main points in group and systematic practice. At an early stage, the students' work was provided with materials (e.g., the graphic organizers for the plan) and strongly guided by the psychologist (SRSD Stage 5). Gradually, this support was withdrawn and students became increasingly autonomous (SRSD Stage 6), achieving independent performance in the process of writing argumentative texts.

2.2.1 Instructional feedback

Instructional feedback was present throughout the whole intervention, as it is an essential part of the SRSD intervention for students to achieve progressive independent performance in writing (Graham et al., 2015). Regularly, students were encouraged to actively participate in all activities and received individualized feedback on their performance and progress. However, following previous work (Limpo and Alves, 2013b, 2018), the SRSD intervention program included a specific feedback session (session 7). In this session, students were organized in groups of 4–6 with similar difficulties to receive individualized feedback on their plans and opinion texts. Before this session, the psychologist analyzed all plans and opinion

texts written by the students during the sessions, and grouped them by similarity. For that we used a tool in Excel to divide the class in three groups: (1) students who correctly used the strategies in both planning and writing; (2) students who correctly used the strategies in the plan, but needed to improve their text; and (3) students who needed to improve both their plan and their text. All students received one document that explained which aspects they needed to improve, and the psychologist explored this feedback with them individually. In our study, all students in the SRSD-1 (Phase 1) received this individualized feedback. However, as described before, to understand the impact of instructional feedback, in Phase 2 only half of the students received it (i.e., SRSD-2 with feedback). The other half had group meetings with the psychologist where they were encouraged to keep up their work without providing instructional feedback.

2.3 Writing instruction in the control group

Students in the control group received regular writing instruction, in agreement with the Portuguese curriculum for Grade 4. This is characterized by teaching students to write longer and more complex sentences to express sequences and relationships of consequence and purpose, to teach them how to write texts with the correct use of the forms of written representation (e.g., spelling and punctuation), and to teach them to use planning and revision processes when they write (Direção-Geral da Educação, 2018).

2.4 Treatment fidelity

To ensure that the interventions were delivered as intended, we applied four procedures. First, the psychologist who delivered the interventions participated in a 6-week pre-intervention course, where she received the instructional manuals and discussed intervention procedures. Second, during the interventions, instructors had weekly meetings to discuss previous sessions and prepare the next ones. Though rare, deviations from instructional plans were solved in the subsequent sessions. Third, at the end of each session, the instructor completed a checklist with all the steps that had been implemented. Except for four sessions, in which one of steps was not done due to time constraints, all steps were completed in all sessions. Fourth, the instructors recorded three sessions (session 2, 4, and 6), which were later analyzed by a researcher assistant, who confirmed full compliance with the manuals.

2.5 Assessment procedures and measures

All students participated in 30-min group sessions at three time points: in October 2021 (T1 – pretest of Phase 1), December 2021 (T2 – posttest of Phase 1 and pretest of Phase 2), and in March/May 2022 (T3 – posttest of Phase 2 and follow-up of Phase 1). Across all sessions, they completed the tasks described below.

2.5.1 Writing outcomes: planning, quality, and structure

Students performed two writing tasks: first, they were told they had to write their opinion about a topic, but before writing they needed to plan their text for 15 min. After planning, students were given 10 min to write their text (T1: "Do you think teachers should give homework every day?"; T2: "Do you think there should be more field trips at school?"; T3: "Do you think parents should give money to their children every week?"). To avoid biased judgements, we removed text identification, randomly organized all texts, and typed the texts correcting for spelling errors (Berninger and Swanson, 1994). Both plans and texts were evaluated by two trained judges, blind to the study purposes.

Concerning the text plan, judges had to evaluate it in a scale ranging from 1 (*no planning*) to 7 (*structural relations*), based on the type of plan (i.e., text, topics or scheme) (Rocha et al., 2023). The inter-judge agreement was 0.95 at T1, 0.99 at T2, and 0.91 at T3, as indicated by the intraclass correlation coefficients.

Concerning the opinion text, judges evaluated two components: text quality and text structure. In text quality, judges gave an overall quality judgment ranging from 1 (*low quality*) to 7 (*high quality*), based on the quality of ideas, organization, sentence structure, and vocabulary (based on Cooper, 1997). This procedure has been shown to be valid across different genres and grade levels (Graham et al., 2006; Limpo and Alves, 2018). ICCs were 0.84, 0.71, and 0.74 at T1, T2, and T3, respectively. In text structure, the presence of the following elements was evaluated: premises, reasons, elaborations, and conclusions (based on Limpo and Alves, 2013a,b). ICCs were 0.97, 0.99, and 0.85 at T1, T2, and T3, respectively.

2.5.2 Writing motivation: attitudes and self-efficacy

To measure writing motivation, we used two self-report questionnaires that measured writing attitudes and writing self-efficacy.

Concerning writing attitudes, we used a questionnaire that evaluate students' attitudes toward writing in and out of school (Graham et al., 2017), adapted to Portuguese by Rocha et al. (2019). This questionnaire is composed of five items (e.g., "Writing is fun"), and answers were given in a scale of 1 (*strongly disagree*) to 5 (*strongly agree*). This is a unifactorial measure, obtained through the average of all 5 items, and, in the present study, internal consistency measured with Cronbach's alpha was 0.84, 0.88, and 0.86 at T1, T2, and T3, respectively (see means and standard deviations at Table 2).

To measure writing self-efficacy we used the reduced version of the Self-Efficacy for Writing Scale (SEWS; Ekholm et al., 2014). This 9-item questionnaire included three dimensions, with three items each: ideation, questioning confidence in generating ideas (e.g., "I can think of many ideas for my writing"); conventions, questioning confidence to express ideas using tools related to written language (e.g., "I can write complete sentences"); and self-regulation, questioning confidence to make decisions and manage writing behaviors (e.g., "I can concentrate on my writing for a long time"). The three dimensions (i.e., ideation, conventions, and self-regulation) were calculated through the average of the 3 items included in each dimension (see means and standard deviations for the three dimensions at Table 2). Answers were given in a continuous scale ranging from 0 (*absolutely sure that I cannot do it*) to 100 (*absolutely sure that I can do it*). Internal consistency was measured for each subscale. Cronbach's alpha at T1, T2, and T3 was as follows: 0.84, 0.64, and 0.74 for conventions; 0.84, 0.82, and 0.73 for ideation; and 0.76, 0.57, and 0.80 for self-regulation.

TABLE 2 Descriptive statistics for all measures across time by group.

	SRSD-1 (n = 33)						SRSD-2 with feedback (n = 19)						SRSD-2 without feedback (n = 17)					
	T1		T2		T3		T1		T2		T3		T1		T2		T3	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Writing outcomes																		
Planning	2.58	1.00	5.03	2.30	5.33	1.96	2.84	1.26	2.84	1.30	6.63	1.38	3.29	1.21	3.71	1.31	6.94	0.24
Quality	3.24	1.40	4.20	1.14	4.15	1.16	3.84	1.36	3.76	1.15	5.16	1.37	3.79	1.06	4.21	1.17	4.77	0.95
Structure	3.06	1.85	5.85	1.20	5.24	1.66	3.32	1.83	4.21	2.55	6.47	1.26	3.65	1.80	3.94	2.77	6.24	0.97
Writing motivation																		
Attitudes	3.95	0.82	3.70	1.15	3.75	0.99	4.09	0.84	4.05	0.69	3.86	1.01		3.89	1.09	3.91	0.99	3.74	0.96
SE - Conventions	75.54	20.57	78.56	17.53	75.61	19.45	85.67	16.46	91.95	9.83	86.89	15.87		83.88	23.04	82.35	16.34	86.61	10.84
SE – Ideation	77.28	21.51	85.05	20.83	79.12	17.25	86.61	17.27	89.07	16.27	91.23	10.60		71.53	28.28	75.82	21.42	84.25	16.99
SE – Self-Regulation	74.42	23.66	72.42	21.08	71.74	25.33	81.74	23.07	81.37	24.66	75.04	25.80		67.90	29.68	72.55	22.29	64.84	29.34

SE, Self-efficacy.

2.6 Data analysis strategy

We aimed to study the effects of an SRSD intervention (Phase 1), and the effects of instructional feedback the SRSD intervention (Phase 2). The dependent measures were writing outcomes variables (i.e., quality, structure, and planning), and writing motivation variables (i.e., attitudes and self-efficacy). The following analyses were conducted as follows.

First, we calculated preliminary analyses to check any distributional problems, analyzing the absolute value of skewness and kurtosis (cut off points: 3 and 10, respectively) (Kline, 2005).

Second, we conducted one-way analyses of co-variance (ANCOVAs) to test for differences between conditions in the two phases of intervention. First, we examined Phase 1 results, by testing the differences between SRSD-1 and control groups on all T2 variables, using the respective T1 scores as covariates. Second, we examined Phase 2 results, by testing the differences between SRSD-1, SRSD-2 with feedback, and SRSD-2 without feedback on all T3 variables, using the respective T1 scores as covariates. As groups size were unequal, we used the Type III Sum-of-Squares method (Tabachnick and Fidell, 2007). As it is a central assumption of ANCOVA, we examined the homogeneity of the regression slopes across groups before examining group effects on dependent variables. The rejection of the assumption of homogeneous regression slopes (i.e., presence of significant interactions) indicates that group effects were moderated by the covariate; in these cases, we used the Johnson-Neyman (J-N) procedure to determine the regions of significance for the Condition × Covariate interaction (Aiken and West, 1991). This procedure was implemented with the PROCESS macro for SPSS, version 3.5 (Hayes, 2013).

Finally, as the ANCOVAs were conducted separately by phase, they did not allow us to analyze the progress over time of the intervention. So, we conducted additional longitudinal analyses to study the effects of the SRSD intervention throughout the three assessment moments. For that, we conducted a repeated measures ANOVA. We used a 3 × 3 factorial design in which intervention group (SRSD-1, SRSD-2 with feedback, and SRSD-2 without feedback) was entered as the between-subjects factor and evaluation time (T1, T2, and T3) as the repeated-measures factor. The Greenhouse–Geisser correction was used as the statistical method of adjusting in cases of lack of sphericity (Greenhouse and Geisser, 1959).

3 Results

3.1 Writing outcomes: planning, quality, and structure

3.1.1 Preliminary analyses

Preliminary analyses showed no distributional problems in any of the groups for T1 and T2, as the absolute values of skewness and kurtosis for all variables were below |0.97| and |1.71|, respectively (Kline, 2005). In T3, some ceiling effects were found for writing planning in two groups, as the absolute values of skewness and kurtosis were |-4.18| and |17.79| for SRSD-2 with feedback, and |-4.12| and |17| for SRSD-2 without feedback. These effects may be caused by the intervention; however, as it is a major variable in our study we proceeded with the analysis, whose results should be read keeping this issue in mind.

3.1.2 Phase 1: comparison between SRSD-1 and control groups

The assumption of homogeneous regression slopes was met only for writing planning (*cf.* Table 3). ANCOVA results showed condition effects on writing planning, $F(1, 66) = 22.25$, $p < 0.001$, $\eta^2_p = 0.25$. Specifically, the SRSD-1 group had better scores on writing planning in T2 ($M = 5.03$, $SD = 2.30$) when compared with the control group ($M = 3.25$, $SD = 1.36$).

For writing quality, we found an interaction between condition and quality scores on T1, $F(1, 65) = 4.22$, $p = 0.04$, $\eta^2_p = 0.06$. The J-N procedure showed that for students with T1 quality scores equal or below 3.08 (45% of the sample), the intervention resulted in higher scores in writing quality in the SRSD-1 group than in the control group, $b = -0.57$, $t = -2.00$, $p = 0.05$. This means that only students who produced texts with poorer quality at pretest improved significantly with the intervention.

For writing structure, we found an interaction between condition and structure scores on T1, $F(1, 65) = 34.85$, $p < 0.001$, $\eta^2_p = 0.35$. The J-N procedure revealed that for students with T1 structure scores equal or below 4.26 (78% of the sample), the intervention resulted in higher scores in writing structure in the SRSD-1 group than in the control group, $b = -0.82$, $t = -2.00$, $p = 0.05$. However, students in the control group with T1 structure scores equal or above 6.10 (4% of the sample, corresponding to one student), showed higher scores in writing structure when compared with the SRSD-1 group, $b = 1.33$, $t = 2.00$, $p = 0.05$. This means that only students with weaker and average scores at pretest showed improvement in this outcome.

3.1.3 Phase 2: comparison between SRSD-1, SRSD-2 with feedback, and SRSD-2 without feedback

The assumption of homogeneous regression slopes was met for all writing outcomes. ANCOVA results showed condition effects for all writing outcomes (*cf.* Table 3).

For writing planning, SRSD-2 with feedback ($M = 6.63$, $SD = 1.38$), and SRSD-2 without feedback ($M = 6.94$, $SD = 0.24$) groups produced T3 texts with a more complete structure than the SRSD-1 group ($M = 5.33$, $SD = 1.96$), $F(2, 65) = 7.15$, $p = 0.002$, $\eta^2_p = 0.18$.

For writing quality, the SRSD-2 with feedback group had better scores at T3 ($M = 5.16$, $SD = 1.37$) when compared with the SRSD-1 group ($M = 4.15$, $SD = 1.16$), $F(2, 65) = 3.26$, $p = 0.045$, $\eta^2_p = 0.09$.

TABLE 3 Complete ANCOVA results.

	Phase 1			Phase 2		
	F	*p*	η^2_p	*F*	*p*	η^2_p
Planning	22.25	<0.001	0.25	7.15	0.002	0.18
Quality	–	–	–	3.26	0.045	0.09
Structure	–	–	–	5.41	0.007	0.14
Attitudes	–	–	–	0.02	0.98	0.001
SE - Conventions	2.05	0.16	0.03	1.88	0.16	0.06
SE – Ideation	0.68	0.41	0.01	3.16	0.049	0.09
SE – Self-Regulation	1.14	0.29	0.02	0.09	0.91	0.003

SE, Self-efficacy. Results are not presented for Quality, Structure, and Attitudes in SRSD-1 vs. control group due to the violation of the assumption of homogeneity of the regression slopes. In these cases, the Johnson-Neyman (J-N) procedure was used instead of the ANCOVA.

For writing structure, students in the SRSD-2 with feedback ($M = 6.47$, $SD = 1.26$), as well as in the SRSD-2 without feedback ($M = 6.24$, $SD = 0.97$), group had significantly better scores at T3 than SRSD-1 ($M = 5.24$, $SD = 1.66$), $F(2, 65) = 5.41$, $p = 0.007$, $\eta^2_p = 0.14$.

3.1.4 Comparison between assessment moments (T1 vs. T2 vs. T3)

Concerning writing planning, a repeated measures ANOVA with a Greenhouse–Geisser correction showed that there was a significant main effect of time on students' writing planning, $F(1.82, 120.18) = 93.86$, $p < 0.001$, $\eta^2_p = 0.59$. Specifically, writing planning improved significantly across all times. Also, there was a significant interaction between time and group, $F(3.64, 120.18) = 11.53$, $p < 0.001$, $\eta^2_p = 0.26$. Students from all groups improved significantly from T1 to T3 (all $p < 0.001$), as well as students from SRSD-1 from T1 to T2 ($p < 0.001$). Also, students from both groups of intervention 2 improved in writing planning from T2 to T3 ($p < 0.001$). The effect of time in writing planning is greater for the SRSD-1 group, $\eta^2_p = 0.61$.

Concerning writing quality, there was a significant main effect of time on students' writing quality, $F(2, 132) = 17.18$, $p < 0.001$, $\eta^2_p = 0.21$. Writing quality improved significantly from T1 to T3. Also, there was a significant interaction between time and group, $F(4, 132) = 3.17$, $p = 0.02$, $\eta^2_p = 0.09$. Even though all groups improved significantly from T1 to T3 (all $ps < 0.007$), only students in the SRSD-1 group wrote better texts at T2 than T1 ($p < 0.001$). Moreover, only students in the SRSD-2 with feedback group produced better essays at T3 than T2 ($p < 0.001$). The effect of time in writing quality was greater for the SRSD-2 with feedback group, $\eta^2_p = 0.26$.

Concerning writing structure, a repeated measures ANOVA with a Greenhouse–Geisser correction showed that there was a significant main effect of time, $F(1.77, 116.98) = 39.64$, $p < 0.001$. $\eta^2_p = 0.38$. Writing structure improved significantly across all times. There was also a significant interaction between time and group, $F(3.55, 116.98) = 7.14$, $p < 0.001$, $\eta^2_p = 0.18$. Students from all groups improved significantly from T1 to T3 (all $p < 0.001$), and students from the SRSD-1 group from T1 to T2 ($p < 0.001$). Also, students from both groups of intervention 2 improved in text structure from T2 to T3 ($ps < =0.001$). The effect of time in writing structure was greater for the group SRSD-1, $\eta^2_p = 0.55$.

3.2 Writing motivation: attitudes and self-efficacy

3.2.1 Preliminary analyses

Concerning writing motivation, preliminary analyses showed no distributional problems in any of the groups in the three times, as the absolute values of skewness and kurtosis for all variables were below |-2.56| and |1.26|, respectively.

3.2.2 Phase 1: comparison between SRSD-1 and control groups

The assumption of homogeneous regression slopes was only met for writing self-efficacy variables. However, ANCOVA results showed no condition effects on any dimension of self-efficacy (*cf.* Table 3).

Regarding writing attitudes, we found a significant interaction between group and T1 scores, $F(1, 65) = 4.54$, $p = 0.04$, $\eta^2_p = 0.07$. The J-N procedure showed that students from the control group with T1

attitudes scores below 3.77 (29% of the sample) showed higher T2 scores in than those in the SRSD-1 group, $b = 0.31$, $t = 2.00$, $p = 0.05$.

3.2.3 Phase 2: comparison between SRSD-1, SRSD-2 with feedback, and SRSD-2 without feedback

The assumption of homogeneous regression slopes was met for all writing motivation variables. ANCOVA results showed group effects only in self-efficacy for ideation, $F(2, 65) = 3.16$, $p = 0.049$, $\eta^2_p = 0.09$. Specifically, the SRSD-2 with feedback group reported higher T3 self-efficacy for ideation ($M = 91.23$, $SD = 10.60$) than the SRSD-1 group ($M = 79.12$, $SD = 17.24$).

3.2.4 Comparison between assessment moments (T1 vs. T2 vs. T3)

Concerning writing attitudes, there was no significant main effect of time, $F(2, 132) = 2.56$, $p = 0.08$, $\eta^2_p = 0.04$, and no significant interaction between time and intervention group, $F(4, 132) = 0.67$, $p = 0.61$, $\eta^2_p = 0.02$.

Concerning self-efficacy, there was no significant main effect of time on self-efficacy for conventions, $F(1.60, 105.34) = 1.05$, $p = 0.34$, $\eta^2_p = 0.02$, and self-regulation, $F(2, 132) = 2.09$, $p = 0.13$, $\eta^2_p = 0.03$. However, there was a time main effect on self-efficacy for ideation, $F(2, 132) = 3.81$, $p = 0.03$, $\eta^2_p = 0.06$, which significantly increased from T1 to T3 ($M_{T1} = 78.48$; $M_{T3} = 84.87$). No significant interaction was found between time and group in any self-efficacy dimension (all Fs < 2) (*cf.* Table 2 for all means and standard deviations).

4 Discussion

The present study aimed to study the effects of an SRSD intervention with a meditation component, as well as to examine the value of instructional feedback within that intervention. Overall, our study showed that the SRSD intervention with an additional meditation component was effective in improving students' writing planning for all intervention participants. Additionally, writing quality and writing structure improved among those with lower grades at pretest. Concerning writing motivation, adding instructional feedback to the intervention seemed to benefit students' self-efficacy for ideation. These findings are discussed below.

4.1 Effects on writing outcomes

The effectiveness on writing outcomes of the SRSD intervention with an additional meditation component was confirmed in both intervention phases.

Writing planning was the only writing outcome to show a clear condition effect in both phases. In Phase 1, the SRSD-1 group produced more complex and structured written plans than the control group. In Phase 2, both SRSD groups (i.e., with and without feedback) produced better plans than the SRSD-1 group, who kept the planning gains obtained in their intervention in Phase 1. Two notes on these findings are worth presenting. On the one hand, as anticipated, the SRSD intervention helped students to plan their texts ahead of writing them, and these results showed some stability across time. These findings replicate past research showing the benefits of SRSD with or without meditation components (Limpo and Alves, 2018; Rocha et al., 2023) on primary students writing skills. On the other hand, despite receiving the same intervention, the SRSD-2 with feedback group showed better performance than the SRSD-1 group. We believe these results can be explained by the staggered delivery of SRDS instruction (i.e., first vs. second school term). As one of the main goals of Grade 4 Portuguese curriculum is to teach students how to plan their texts, it seems likely that the regular writing instruction that occurred during the 1st school term may have created fruitful bases that magnified the impact of SRSD implemented on Phase 2.

Concerning writing quality and writing structure, the intervention groups in both phases significantly improved in both outcomes. In Phase 1, students with more difficulties concerning writing quality seemed to benefit more from the intervention than students with less difficulties as observed at the pretest. Indeed, only students who produced texts with poorer quality at pretest improved significantly with the intervention. A similar result was obtained concerning writing structure, as only students with weaker and average scores at pretest showed improvement in this outcome. An extensive body of research has supported the positive effects of SRSD among students of varying ages and ability levels, but especially those with learning disabilities. For example, Graham et al. (2006) found that third graders with difficulties in the writing learning process improved their writing performance through SRSD instruction. Also, second graders at-risk for failure in writing also benefited from an SRSD intervention (Harris et al., 2015). The results of the present study suggest that the addition of a meditation component to an SRSD intervention does not hinder the positive results obtained by struggling writers. Struggling writers tend to write texts that are typically shorter, more poorly organized and of less quality than their more accomplished peers (Graham and Harris, 1989; Graham and Harris, 1991; Troia, 2006). Also, the role of planning is minimized as students with more difficulties spend less time planning and revising their text, which make them write without much thought (Troia, 2007). Thus, the combination of writing and self-regulation strategies with attention training may be especially beneficial for children that tend to have more difficulties to concentrate their attention during their writing process.

In Phase 2 students from both SRSD-2 groups produced texts with better quality and more well-structured than the texts from the SRSD-1 group. Several studies shown these benefits of SRSD instruction on writing in primary grades, even without a meditation component (Graham et al., 2006, 2012; Harris et al., 2015). The gains in both variables obtained by the SRSD-1 group in Phase 1 were maintained in Phase 2, despite a slight decrease in Phase 2, where these students received regular writing instruction. These results show that the positive outcome derived from the SRSD intervention with a meditation component may have some stability over time.

4.2 Effects on writing motivation

Contrary to our expectations, we did not find any condition effects on students' self-efficacy for conventions and self-regulation. Only self-efficacy for ideation showed improvements on T3 in the SRSD-2 with feedback group. Even though the SRSD intervention aims to improve students' self-efficacy (Graham and Harris, 1993; Harris and Graham, 2009, 2016), several studies already failed to empirically support this claim (Graham et al., 2006; Limpo and Alves,

2013a; Camacho et al., 2023; Rocha et al., 2023). Similarly, we did not find any benefits of SRSD training on students' attitudes toward writing. A similar result was recently found among third graders by Rocha et al. (2023), who stressed out the need to conduct additional research on the factors that may moderate the impact of SRSD on students' attitudes toward writing, as few studies analyzed SRSD effects on attitudes.

The lack of motivational gains of the SRSD intervention observed here and in past studies may be explained by several reasons. One possible reason may be the short duration of the intervention. The two 60-min sessions per week, in a total of 10 sessions in five weeks, may not have been intense enough to produce significant changes in the motivation of students. Another possible explanation is the use of self-report measures to assess motivation. The children may have some difficulty to evaluate themselves and choose socially desired responses. Graham et al. (2006) explained that the lack of motivational effects of SRSD interventions may be because primary grade students are not able to accurately assess their own capabilities. Indeed, to date, research on writing has yet to establish a consistent framework for assessing writing motivation (Alves-Wold et al., 2023). In our study, at the end of the program students reported positive feelings related to the intervention, even if these were not reflected in motivation outcomes. Therefore, listening to students' perspective on the motivation to write is an important step in the quest to understand this issue (Alves-Wold et al., 2023). Thus, adding a qualitative measure to this kind of intervention, such as interviews, could help better understand the impact that it had on students' motivations through their own voice.

4.3 The role of instructional feedback

As previously noted, in Phase 2, we aimed to understand the importance of instructional feedback within the intervention. Our results shown that both SRSD-2 with and without feedback showed significantly more improvements than SRSD-1, in all writing outcomes. However, when directly comparing the groups with and without feedback, no differences in any of the T3 writing outcomes emerged. Indeed, both groups improved with the writing intervention. A possible explanation for this may be the fact that both groups received an intervention and SRSD is a model that naturally uses feedback in different stages of its process (Graham et al., 2015). The presence of a unique session of instructional feedback may not be enough to produce results in the writing outcomes, especially when compared with active controls. This is particularly relevant as practice writing *per se* is not enough to develop writing skills, demanding not only sustained practice but also frequent, appropriate and effective feedback from other writers (Hattie and Timperley, 2007). Another possible explanation, as referred by Wilson et al. (2014), is that feedback did not reach within students' ZPD. Indeed, writing is a complex task and the feedback may have been too simple for some children or too difficult for others. Thus, despite the general improvement on writing outcomes, the results produced by this unique session of feedback may not be enough to be advantageous in comparison to the group without this specific session for feedback. Clearly, further research is needed to ascertain the importance of including a specific feedback session within an SRSD intervention program.

Concerning writing motivation, there was an effect of the feedback session on self-efficacy for ideation. However, this is only true when comparing the SRSD-2 with feedback group with the SRSD-1 group at the end of Phase 2. This means that students who received instructional feedback in Phase 2 seems to feel more capable to generate good ideas, when compared to students that received the regular intervention without that session of instructional feedback on Phase 1, even though the intervention is the same for both groups. This result reinforces the value that instructional feedback may play on students' motivation to write. Feedback was an integral part of all SRSD intervention for both groups. However, the additional feedback session on SRSD-2 with feedback group seemed to boost their confidence in producing more ideas for their texts. As the feedback given to students was applied at a process and self-regulation level, not only the writing benefitted from it, but also it boosted confidence to engage further on writing and to feel capable of producing more ideas (Hattie and Timperley, 2007). Despite promising, the benefits of instructional feedback on self-efficacy for ideation should be interpreted cautiously. As previously noted, the use of self-report measures to assess children's motivation may raise reliability issues, as motivation-related constructs requires considerable self-reflection and abstraction (Karabenick et al., 2007). This is challenging for children, who may face difficulties to accurately report about themselves. Thus, it would be worthwhile to replicate current findings with additional measures, including qualitative ones, which value students' perspective on their motivational states through their own voices (Alves-Wold et al., 2023).

4.4 Limitations and futures directions

The findings reported here should be considered in view of at least six limitations, which indicate relevant avenues for future research.

First, we used a quasi-experimental design. Moreover, despite the use of randomization to create the feedback groups, we used natural intact classes. Future studies should develop randomized controlled trials to collect stronger evidence.

Second, as the study was conducted during the pandemic, when access to school and students was restricted, we ended up with a sample smaller than desirable ($N = 69$). Consequently, it is possible that the study lacked enough power to detect some effects, which may explain the unexpected and non-significant findings. Clearly, more replication studies with larger samples are needed.

Third, children with special educational needs were excluded from our final sample. The inclusion of these children in future studies may provide more information on the effectiveness of this kind of intervention in this population. Future studies should aim for more heterogenous samples to provide further conclusions about the use of these interventions at different educational stages.

Fourth, our study lacked a SRSD-only intervention, thus the value of the additional component of meditation needs to be interpreted with caution. Futures studies may include a SRSD-only intervention group, comparing it to a group with a meditation component in order to achieve a better understanding of its value to SRSD intervention.

Fifth, in Phase 2, there was not a control group without the intervention, as both interventions groups were compared to the

previous experimental group from Phase 1. As explained before, the lack of feedback effects on writing outcomes may reflect the absence of a control group in this phase.

Finally, the study was conducted during the COVID-19 pandemic. Although all the intervention was conducted in person, we do not know the extent to which the massive use of online learning in the previous months affected our findings, namely those related with motivation. Future research should explore the impact of this pandemic in the teaching and learning of writing.

5 Conclusion

As writing is a complex activity, writers need to focus, maintain, inhibit, and switch their attention through all stages of the writing process (Graham, 2018). Thus, the use of writing and self-regulation strategies seems to hold a great potential, especially with children, as it allows them to focus their attention on the writing task. Our study provided further evidence on the effectiveness of SRSD combined with a meditation component, whose potential should be further researched in the future. Our study also aimed to examine the added value of instructional feedback in both writing and motivation outcomes. Despite the limited findings, we expect the current research to inspire future examinations of the importance of providing students with instructional feedback in writing interventions. We believe this study highlighted important reflections about the value of attention and instructional feedback in writing interventions to be considered in the future.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Ethics Committee of the Faculty of Psychology and Education Sciences of the University of Porto. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

AN: Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing, Conceptualization. CC: Formal analysis, Writing – review & editing. RR: Conceptualization, Methodology, Writing – review & editing. TL: Conceptualization, Methodology, Supervision, Writing – review & editing, Formal analysis. SC: Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The author(s) declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2024.1305771/full#supplementary-material

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