



## Promoting transcription in third-grade classrooms: Effects on handwriting and spelling skills, composing, and motivation



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### ABSTRACT

Transcription can be defined as the externalization of language into written text, which involves spelling and handwriting. There is now a small, but growing body of research demonstrating the importance of transcription in beginning writing. This study aimed to test the effects of transcription training on third graders' writing skills and motivation. Seventy-seven students receiving transcription training were compared with 89 students receiving drawing training. Within each group, half of the students was given either a composing or a drawing homework assignment. Compared to students in the drawing condition, students who received transcription instruction evidenced greater gains in handwriting and spelling, as well as in the amount and quality of their writing. Although transcription training did not influence self-efficacy, it had a negative impact on motivation to write, resulting in a decrease in intrinsic motivation. Finally, the type of homework assignment (composing or drawing) had virtually no impact on students' writing skills and motivation. Overall, these findings provided evidence on the key role of transcription in producing good texts. Moreover, they demonstrated the need to enhance the motivational ingredients in transcription interventions.

### 1. Introduction

It is now well-established that one of the first skills that beginning writers need to acquire is transcription (Berninger & Winn, 2006; Berninger et al., 1992; Graham & Harris, 2000). Transcription can be defined as the externalization of language into written text. This process relies on the integration of two sub-processes: spelling and handwriting (or typing). Writers retrieve and select the most appropriate orthographic symbols, which are produced through the execution of motor movements required by a particular writing tool (Abbott & Berninger, 1993).

In recent years, research has gathered consistent evidence on the importance of accurate spelling and fluent handwriting for composing high-quality texts (Alves & Limpo, 2015; Alves et al., 2016; Graham, Berninger, Abbott, Abbott, & Whitaker, 1997; Limpo & Alves, 2013a, 2017b, 2018; Limpo, Alves, & Connelly, 2017). Compelling findings have emerged from intervention studies, which showed that promoting transcription improves elementary students' handwriting and spelling skills as well as their ability to produce texts (Graham & Santangelo, 2014; Graham, McKeown, Kiuahara, & Harris, 2012; Santangelo & Graham, 2016). Nevertheless, there are still open questions regarding

the effects of transcription training, which is here operationalized as explicit instruction and practice in handwriting coupled with implicit instruction and practice in spelling. First, does the benefits of transcription training depend upon including frequent composing opportunities? Second, does transcription training influence key aspects of students' writing motivation? Guided by these questions, this study aimed to examine the effects of a transcription training program with or without a text production component on third-grade students' transcription skills (handwriting and spelling), composing skills (amount and quality of story writing), and motivation to writing (self-efficacy and motives to write).

#### 1.1. Beginning writers' transcription and composing skills

Recently, Graham (2018a, 2018b) proposed the Writer(s)-Within-Community (WWC) model. This model, which merges the sociocultural and cognitive perspectives prevalent in the field of writing research, includes two main components: the writing community where writing occurs; and the cognitive resources and capabilities of its members. Writing communities are potentially permeable and flexible structures, which share interrelated characteristics: writing purposes, members,

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writing tools, actions to achieve writing purposes, written products, physical and social environments, collective history, and macro-level forces (social, cultural, political, institutional, and historical influences). The members of a writing community apply control mechanisms (attention, working memory, and executive control) to regulate the mental and physical processes used to produce text, which draw on long-term memory resources.

The current study adopted the WWC model as the underlying theoretical framework because it provides a very good and up-to-date illustration of the complexity of writing as well as of the cognitive and motivational processes involved in it. From a cognitive perspective, producing a good text requires so many competing processes, that writers may experience cognitive overload (McCutchen, 1996, 2006). Because beginning writers are still acquiring spelling and handwriting skills, these processes require a large amount of attentional resources. Therefore, the act of putting words onto paper may tax writers' processing capacity, which may result in less cognitive resources for other processes (Bourdin & Fayol, 1994, 2000; Olive & Kellogg, 2002). For instance, having to consciously think about the precise movement needed to produce letters may lead children to forget already developed ideas held in working memory, interrupting the writing as the writer tries to recover the intended message. Having to consciously think about transcription skills may also result in writers paying less attention to the selection of the best possible ideas for their writing, and may result in them failing to consider fully appropriate linguistic forms to express the ideas that are selected.

Research has shown that a reduced automaticity in spelling and handwriting is a major constraint to young writers' composing abilities. Correlational studies provided evidence that transcription influences text production directly (Graham et al., 1997) or indirectly via higher order processes (Limpo & Alves, 2013a; Limpo et al., 2017). In line with these findings, intervention studies found that transcription instruction increased beginning writers' transcription skills as well as the amount and quality of their writing (Graham & Santangelo, 2014; Santangelo & Graham, 2016). Despite the growing evidence of the benefits of transcription training, more research into its characteristics and effects is warranted. Though past research hinted at the importance of including composing opportunities into transcription interventions to improve writing quality, to the best of our knowledge, this claim has never been tested (for a transcription program without composing that did not increase writing quality, see Graham, Harris, & Fink-Chorzempa, 2000). Also, little is known about transcription training effects on students' motivation in writing.

### 1.2. Writing motivation

Among the long-term memory resources proposed in the WWC model, Graham (2018a, 2018b) argued that motivational factors are particularly important in writing, given that motivational beliefs influence whether one engages in writing, how much effort is committed, what actions the writer takes, and how he or she interacts with others (e.g., teacher or other students). These motivational beliefs include self-efficacy and motives to write, which are assumed to influence writers and their written products.

In the writing domain, self-efficacy can be broadly defined as students' self-judgments about their ability to write (cf. Bandura, 1997). These self-judgments can be very specific as they may vary across genres, writing processes, and task features (Pajares, 2003). For example, writers may feel more capable to produce a narrative than an argumentative text; they may express more confidence in forming neat letters than generating catchy openings; and they may be more self-efficacious for producing free writing at home than time-limited writing in a school test. Given the assumed genre-based nature of self-efficacy, several studies assessed writers' general confidence to produce spontaneous writing according to different genres (e.g., Limpo & Alves, 2013a; Pajares & Valiante, 1997). Consistently at different school-

levels, self-efficacy was found to positively predict the quality of students' writing (Pajares, 2003).

Acknowledging the limitations of approaching writing self-efficacy as a general construct, which ignored the premise that writers may feel more or less self-efficacious to achieve specific characteristics of writing, recent studies adopted multidimensional approaches to self-efficacy. For example, Bruning, Dempsey, Kauffman, McKim, and Zumbrunn (2013) found support for a model identifying three independent and specific dimensions of writing self-efficacy (viz., self-efficacy for conventions, ideation, and self-regulation; see also Limpo & Alves, 2017a; Sanders-Reio, Alexander, Reio, & Newman, 2014). Notwithstanding the importance of these multidimensional approaches, they failed to address the specificity of transcription skills as well as schemas used to guide particular kinds of writing (e.g., story grammar schema). Though spelling is covered by Bruning's self-efficacy scale under the conventions factor (Bruning et al., 2013), only recently was a scale developed to assess students' self-perceptions about their abilities to produce fast handwriting (Limpo, Filipe, Magalhães, Cordeiro, Veloso, Castro, & Graham, 2020). This study found that third graders' self-efficacy for handwriting was associated with handwriting fluency ( $r = 0.27$ ) as well as with story length ( $r = 0.15$ ) and quality ( $r = 0.33$ ). In that study, Limpo and colleagues also developed a self-efficacy scale for story writing. Given the unique characteristics and constraints of text genres (Berman & Nir-Sagiv, 2007), assessing students' confidence to follow specific schematic structures can provide relevant information. To date, no study examined whether the benefits of transcription training on transcription and composing skills is attended by a parallel increase in self-efficacy. Such assumption relies on a previous study showing that transcription was a strong predictor of students' self-efficacy beliefs (Limpo & Alves, 2013a).

Another set of beliefs that writers bring to bear when writing involves the reasons why they engaged in that activity. Though writers' motivations to produce a text can vary according to specific, localized factors (e.g., text topic, health conditions, writing purpose), the WWC model assumes that writers may feel more or less motivated to write in general (Graham, 2018a, 2018b). This paper adopts this latter assumption of writing motivation and it focuses on the usual motivational incentives for engaging in writing. Grounded on past work in the reading domain (Schiefele & Schaffner, 2016; Schiefele, Schaffner, Möller, & Wigfield, 2012), Graham, Aitken, Harbaugh, Wilson, Wdowin, Ng, and Harris (2019) proposed a multidimensional conceptualization of writers' reasons for writing. Assuming that motivation is influenced by multiple incentives (Deci & Ryan, 2000), motives to write were grouped into seven categories: (a) *curiosity*, that is, writing because of an interest in knowing more about the composition topic (e.g., new and personally-interesting topics may require writers to gather information from different sources; also, writers can generate new knowledge through text production itself, which is commonly described by novel authors as the process of discovery), (b) *involvement*, that is, to experience positive feelings during the activity of writing, either due to the text content (e.g., when writers compose about good things that happened to them) or due to the fully immersion in the act of writing (e.g., when they experience a flow state of mind, that is, when writers are totally absorbed while producing an interesting and engaging storyline); (c) *grades*, that is, to raise school grades (e.g., when writers are motivated to write as part of classroom assignments that will be evaluated), (d) *competition*, that is, to surpass peers at school (e.g., writers may feel motivated to be engaged in writing activities as a means to show that they are better than their classmates); (e) *social recognition*, that is, to see good writing performance recognized (e.g., writers may be committed to write a text to be praised or receive prizes from others); (f) *emotional regulation*, that is, to overcome negative emotions (e.g., producing a story or a poem can be used as a means to surpass feelings of annoyance or unhappiness; also, writing about traumatic experiences can help writers to cope with the negative feelings associated to them), and (g) *relief from boredom*, that is, to deal

with tediousness (e.g., when more interesting activities are unavailable, writers may decide to engage in writing as a leisure activity and fill in their spare time).

Through the lens of the Self-Determination Theory, these seven motives to write can be organized into two main categories of motivational incentives (Deci & Ryan, 1985). The dimensions of curiosity, involvement, emotional regulation, and relief from boredom are deemed components of intrinsic motivation. This means that writers may be willing to engage in writing for its own sake, for example, for the pleasure they took from the writing experience. The dimensions of grades, competition, and social recognition are considered to be components of extrinsic motivation. This means that writers may be willing to engage in writing for what it brings, for example, for the positive consequences brought by the activity of producing a text.

The 7-factor structure of students' motives to write was confirmed in primary and middle grades (Camping, Graham, Ng, Wilson, & Wdowin, 2019; Graham et al., 2019; Limpo & Graham, 2019; Rocha, Filipe, Magalhães, Graham, & Limpo, 2019). It was found that the strongest writing motivations in American and Portuguese students in middle grades related to curiosity and grades (Camping, Graham, Ng, Wilson, & Wdowin, 2019; Rocha et al., 2019), which were also found to be correlated with better stories in another study with Portuguese third graders (Limpo et al., 2020). Using regression analyses, Rocha et al. (2019) found that curiosity and social recognition were significant predictors of writing quality, above and beyond attitudes toward writing and self-efficacy beliefs. These are pioneering findings in regard to students' motives to write, which we aimed to extend in the present study. There are no prior studies examining whether – and if yes, to what extent – transcription training may change students' motivations for writing. Given the key role of transcription in primary grades, it seems plausible that changes in such a fundamental skill may reflect on changes in motives to write. For example, a slow writer with poor penmanship may only be motivated to write by extrinsic incentives (e.g., to complete mandatory school assignments and perform well at school). On the contrary, facilitating the process of putting words into paper may reduce obstacles to writing and prompt writers to write also for intrinsic reasons (e.g., leisure activity).

## 2. Present study

The main goal of this research was to test the effectiveness of a 10-week transcription program with or without a composing homework assignment in Portuguese students in Grade 3. Portuguese is an orthography of intermediate depth with some complex and inconsistent patterns (Seymour, Aro, & Erskine, 2003), which make spelling acquisition challenging as reflected in the amount of misspellings produced by primary school writers (Mesquita, Carvalhais, Limpo, & Castro, 2020). Spelling as well as handwriting skills of Portuguese third graders are far from being automatic: There is evidence showing that transcription skills not only continue to improve after Grade 3 (Alves & Limpo, 2015), but also constrain writing production well beyond primary grades (Limpo & Alves, 2013a). Therefore, the importance of acquiring automatic transcription along with the lack of such automaticity in Portuguese primary students support the overall purpose of the present study to test the effects of transcription training in Portuguese third graders.

Here, we used an evidence-based transcription intervention developed by Limpo and Alves (2018). This program provided explicit instruction and systematic practice in writing cursive letters, words, and sentences in a fluent and accurate way. The cursive style was chosen because this is the one introduced in Grade 1 and practiced throughout primary years in Portuguese schools. All activities were composed of target words that contained alternations (i.e., different ways to represent a single phoneme), thereby contributing to increase students' knowledge about the Portuguese spelling system. Based on this program, we developed a drawing intervention with the same structure,

which was implemented in another group of students (active control). This group provided a stringent test to the transcription intervention as it was composed of exercises targeting visuo-motor skills (which are also involved in transcription), but it lacked the orthography-related component. Thus, a superiority of transcription over drawing students could not be attributed to visuo-motor training only. Regardless of the intervention, all students were given a homework assignment every two weeks, which could be either composing or drawing a story. Before and after the programs' implementation, we assessed students' writing skills and motivation.

### 2.1. Effects on writing skills

We anticipated that students in the transcription intervention would show greater handwriting and spelling than their counterparts in the drawing intervention. The program provided explicit handwriting instruction, which has been shown to improve students' handwriting legibility and fluency (Santangelo & Graham, 2016). It was also designed to improve students' spelling using implicit instructional methods, which have also been shown to enhance students' spelling skills (Graham, 2000; Graham, Harris, & Adkins, 2018).

We further predicted that students' writing would improve, as measured by the ability to write stories. This hypothesis was aligned with meta-analyses' findings (Graham & Santangelo, 2014; Santangelo & Graham, 2016), showing that transcription instruction results in improved writing. As discussed before, enhanced transcription may free up attentional resources for higher order processes. Based on this claim, transcription training was expected to improve students' composing skills. The corroboration of this hypothesis would provide further support to the link between transcription and composing. We were particularly interested in examining a moderating role of homework assignment in this link. Three mutually exclusive hypotheses were advanced. (1) Story writing would improve only for transcription students receiving the composing homework assignment, meaning that *composing opportunities are essential* for transcription training to improve story writing. (2) Story writing would improve for all transcription students, but larger improvements would occur for those receiving the composing homework assignment, suggesting that *composing opportunities facilitate* the benefits of transcription training on story writing. (3) Story writing would improve for all transcription students, regardless of the homework assignment, indicating that *composing opportunities are needless* for transcription training to improve story writing.

### 2.2. Effects on writing motivation

Concerning self-efficacy, we expected that students in the transcription intervention would report more confidence in their handwriting and story writing abilities than their peers. A key source of self-efficacy is the interpretation that students make about their own performance (Bandura, 1997). Thus, the anticipated growth in handwriting fluency and story writing was expected to raise their ability estimates. Concerning motives to write, we predicted that transcription training would increase components related to intrinsic motivation (curiosity, involvement, emotional regulation, and relief from boredom). This hypothesis was grounded on key features of the transcription program, assumed to facilitate intrinsic motivation in academic domains (Ames, 1992): combination of goal setting with self-monitoring, focus on students' progress, and emphasis on the link between effort and performance.

## 3. Methods

### 3.1. Participants and research design

This study included 178 Portuguese native speakers without special education needs in third grade. Twelve students who did not attend one

**Table 1**  
Participants' Characteristics by Intervention Group and Homework Assignment.

	Handwriting		Drawing	
	Composing	Drawing	Composing	Drawing
Age (in years)				
<i>M</i>	8.68	8.67	8.73	8.79
<i>SD</i>	0.30	0.35	0.45	0.47
Mother educational level ( <i>n</i> )				
Grade 4	0	0	1	2
Grade 9	9	8	16	18
Highschool	17	16	16	12
College	12	11	12	10
Post-graduation	0	2	0	0
Unknown	2	0	2	0
Portuguese marks (1–5)				
<i>M</i>	3.63	3.51	3.66	3.62
<i>SD</i>	0.87	0.73	0.70	0.79
Mathematics marks (1–5)				
<i>M</i>	3.88	3.92	4.09	3.83
<i>SD</i>	0.97	0.80	0.88	0.96

*Note.* There were differences neither in terms of age, Portuguese marks, and Mathematics marks,  $F_s(1, 162) > 1.69$ ,  $p_s > 0.20$ ; nor in terms of socioeconomic status,  $\chi^2(12) = 16.23$ ,  $p = .18$ .

or more testing sessions were dropped from data analysis. All analyses were based on the data from 166 students ( $M = 8.7$  years,  $SD = 0.4$ ; 87 girls). The study involved a pretest–posttest quasi-experimental design. Eight classes were randomly assigned to one of two intervention groups, with four classes per group: transcription vs. drawing. Within each class, half of the students were randomly assigned to one of two types of homework assignments: composing vs. drawing. This research design resulted in four groups: (a) transcription intervention with composing homework assignment ( $n = 40$ , 29 girls), (b) transcription intervention with drawing homework assignment ( $n = 37$ , 19 girls), (c) drawing intervention with composing homework assignment ( $n = 47$ , 23 girls), and (d) drawing intervention with drawing homework assignment ( $n = 42$ , 16 girls). Table 1 provides information on the students in each of these groups. They were equivalent in terms of age, mothers' educational level, and school achievement.

### 3.2. Transcription and drawing programs

Both programs were delivered during 10 weekly units. Each unit involved three 20-min daily lessons, delivered by students' regular teachers during class time.

#### 3.2.1. Transcription program

This program was designed with the main goal of explicitly promoting automaticity in handwriting. Moreover, it was also designed to provide implicit practice in spelling words, in order to facilitate students' access to correct word spellings. Implicit spelling instruction was provided while students wrote and copied words as part of their handwriting instruction. Teachers never explicitly taught spelling or drew students' attention to spelling.

The structure of three lessons in each unit was similar and organized into two parts: alphabet warm-up plus words/sentences copying. Alphabet and copying activities are recognized as some of the best practices to facilitate the learning of transcription skills (Alves, Limpo, Salas, & Joshi, 2018; Graham, 2009; Limpo & Graham, 2019). All lessons were implemented in the classroom. This represents a slight difference from the original transcription program, in which the second weekly lesson was performed at home (Limpo & Alves, 2018).

The goal of the alphabet warm-up activity was twofold: to promote fast access to letter forms representations in an ordered set, and to automatize the retrieval and the written production of these forms. There was a different activity in each of the three lessons. In the first

unit lesson, students were asked to write the alphabet starting from different letters. In the second one, they had to write the letter coming before and/or after other letters. In the third lesson, they were given 60 s to write the lowercase alphabet. Afterwards, they were taught to self-monitor their performance by counting and registering the number of letters correctly written.

The goal of the copying activities was to improve handwriting accuracy and speed. As before, there were different activities for each lesson within the unit. In the first lesson, students were asked to organize a set of 20 words into two groups in line with a superficial criterion. For example, the activity presented 10 words written in blue ink mixed with 10 words written in red ink. Students were then asked to write the "blue ink words" in a column with blue background and the "red ink words" in a column with red background. Similar activities were designed using other sorting criteria, such as words written in manuscript vs. print, or words in bold vs. italic. In the next lesson, they had 10 incomplete sentences and a list of missing words (one per sentence). They were asked to fill in the blank and then to copy the full sentence. In the third unit lesson, students had to copy 10 sentences as fast as possible (60 s per sentence). Afterwards, they self-monitored their performance, by counting and registering the number of words correctly copied in the last sentence.

The inclusion of carefully selected words into the copying activities allowed us to combine explicit handwriting with implicit spelling practice. Throughout the three lessons of each unit, children encountered and copied a set of 20 words including alternations (i.e., different forms to represent one phoneme) that pose a challenge for Portuguese children (see Limpo & Alves, 2018 for further details). In Lesson 1, even though students were asked to organize the words in line with a superficial feature, they were in fact organizing them according to the two forms of representing a phoneme (e.g., the phoneme /r/ can be represented by the grapheme *R* in *rato* [mouse] /r'a.tu/ or by the grapheme *RR* in *carro* [car] /k'a.ru). In Lesson 2, the 10 words that were missing were half of the 20 words selected for that unit. In the last lesson of the unit, the 10 sentences to copy included the other half of the 20 target words (one word per sentence). The activities of weeks 5 and 10 gave students further practice on the words included in the previous four weeks. Importantly, spelling was only trained through the copying activities and in the absence of any form of explicit instruction. Teachers never directed students' attention to word spelling and eventual spelling mistakes were signaled as copying mistakes.

**3.2.1.1. Treatment fidelity.** Four procedures were used to guarantee that the transcription program was implemented as planned. First, teachers took part in a 2-h pre-intervention workshop aimed at introducing the theoretical and empirical bases of the program, presenting the instructional manual, and discussing lessons. Teachers also had regular meetings with the second author, where they practiced the next lesson and discussed the preceding one. There were sporadic divergences from instructional plans that typically involved missed steps. These were completed in the subsequent lesson with minimal interference in the planned lessons' duration. Third, teachers received a checklist per lesson with the main steps to implement and were asked to check them off when completed. The four teachers reported they completed all steps. Fourth, a pair of trained research assistants observed one third of the lessons and filled out the teachers' checklist. Research assistants reported that teachers completed an average of 97% of the planned steps (interrater agreement was 100% for all observed lessons).

#### 3.2.2. Drawing program

This program had the same structure as the transcription program. The structure of the three lessons was similar and included two parts: warm-up (5 min) plus drawing activity (15 min). The warm-up included a different activity in each lesson of a unit. In the first lesson, students were asked to color a picture. In the second lesson, they connected a set

of numbered dots to uncover a picture to be colored. In the last lesson, they were given half of a picture and were asked to complete it. After the warm-up, there was a different drawing activity in each lesson. In the first lesson, students were asked to produce drawings representing words. In the second lesson, they solved a maze by drawing a path. In the third lesson, students were given a set of geometric shapes to copy. Afterwards, students did a self-monitoring activity, in which they counted the number of geometric shapes correctly copied.

**3.2.2.1. Treatment fidelity.** Three procedures guaranteed that the drawing program was implemented as intended. First, teachers took part in a 2-h pre-intervention workshop. During this, they got to know the program and lessons' procedures and received the implementation manuals. At week 5, the second author met with all teachers to assure the program was being implemented as expected and to discuss eventual adjustments. Teachers were told to contact the second author to clarify any question emerging during implementation. Second, teachers were given a checklist with main lessons' steps and they were asked to check them off when completed. The four teachers reported they completed all proposed steps. Finally, students' workbooks were checked for completion. In general, this examination confirmed that all activities were performed as expected.

### 3.2.3. Homework assignment

During the implementation of the program, students were given a homework assignment every two weeks (a total of five assignments). All students received the same prompt (Alves et al., 2016; e.g., "Tell a story about a child who found an injured animal."). Randomly within each class, half of the students was asked to "compose a story", whereas the other half was asked to "make a drawing". Regardless of the intervention program, all teachers received notifications to give the homework to students, which was collected in the next week. None of the students received feedback about the homework. The story writing homework was designed to test whether including composing opportunities into transcription training would be necessary or not for this type of training to improve story writing.

### 3.3. Standard writing instruction

It should be noted that, in addition to the intervention provided by this study, all students received the standard writing curriculum delivered by their teachers. In Grade 3, writing instruction focuses on explicit instruction in spelling, punctuation, and text production (Buesco, Morais, Rocha, & Magalhães, 2015). The teaching of spelling involves explicit instruction of orthographic rules, trained through dictation and error-finding activities. Regarding text production, students learn the characteristics of different text types (e.g., narrative, expository, invitations) and practice key writing processes, namely, planning, translating and revising, with a focus on calligraphy, spelling, and vocabulary. Importantly, standard writing instruction does not include fast-paced handwriting exercises or implicit training of spelling as here implemented.

### 3.4. Testing sessions

All students were evaluated one week before and after instruction following the same procedure. The evaluation lasted about 60 min and was carried out in classroom groups. The testing session started with the experimenter presenting the story topic ("Tell a story about a child who broke his/her brother's toy.", "Tell a story about a child who lost his/her pet.", for pretest and posttest, respectively). Students were then given 10 min to compose the story. Afterwards, they completed a copy task during 90 s, that is, they copied as quickly and legibly as possible a sentence that included all alphabet letters (*O rouxinol azul fugiu do jardim porque chovia bastante. [The blue nightingale ran away from the garden because it was raining a lot.]*). Then, students spelled 16

dictated words. Finally, they filled in the self-efficacy and motives to write scales. For both questionnaires, the procedures were explained, and students were told there were no correct/incorrect answers. The experimenter read aloud all items to the students, who completed items simultaneously and one item at a time.

### 3.5. Measures

#### 3.5.1. Handwriting fluency

Handwriting fluency was assessed as the total number of words written on the copy task. A second judge rescored 120 protocols (60 from each testing time) and inter-rater reliability was high (ICC = 0.99, at both testing times).

#### 3.5.2. Spelling

We used students' performance on a dictation task that included 16 words that were targeted in the transcription program. There were eight orthographically consistent and eight orthographically inconsistent words. The correct spelling of consistent words could be determined by applying phoneme-to-grapheme correspondences and orthographic rules, whereas that of inconsistent words required rote learning. For both word sets, we counted the number of words correctly spelled. A second judge rescored 120 protocols (60 from each testing time) and inter-rater reliability was high (consistent set: ICC<sub>pretest</sub> = 0.95, ICC<sub>posttest</sub> = 0.92; inconsistent set: ICC<sub>pretest</sub> = 0.95, ICC<sub>posttest</sub> = 0.97).

#### 3.5.3. Story writing

Two measures were extracted from students' stories: text length and text quality. Text length was calculated with the word count function of Microsoft Word. Text quality of all stories was double rated by two research assistants, blind to study purposes. They used a 7-point scale from 1 (*low quality*) to 7 (*high quality*) to evaluate the stories by giving a single value accounting for four factors ascribed the same weight: creativity (i.e., uniqueness and significance of the ideas), coherence (i.e., clarity and organization of the text), syntax (i.e., grammar and diversity of the sentences), and vocabulary (i.e., variety and adequate use of the words). Based on Cooper (1977), this holistic scale provides an overall measure of writing quality widely used in the field. Numerous studies demonstrated its validity to appraise the quality of written texts of varying genres as well as the scale's sensitivity to change of primary and middle-grade students' overall writing performance (e.g., Graham et al., 2000, 2005; Limpo & Alves, 2013a, 2018). To remove transcription biases from quality evaluations (Graham, Harris, & Hebert, 2011), the texts were typed and the spelling errors were corrected. The final score was the average across judges (ICC<sub>pretest</sub> = 0.91; ICC<sub>posttest</sub> = 0.93).

#### 3.5.4. Self-efficacy

We assessed students' self-efficacy for handwriting and story writing using a two-factor scale developed by Limpo et al. (2020). The scale includes three items targeting handwriting fluency (e.g., "My handwriting is fast") and four items related to the story grammar (e.g., "I can write a story that tells several things that happened during the story"). Students were asked to say the extent to which each statement was true for them, using a scale ranging from 1 (*always true*) to 5 (*never true*). For convenience of interpretation, the responses were reverse-coded. Thus, higher scores indicate higher levels of self-efficacy. In this study, internal consistency measured with the ordinal omega was adequate for the two subscales both at pretest ( $\omega_{\text{fluency}} = 0.62$ ;  $\omega_{\text{story}} = 0.81$ ) and at posttest ( $\omega_{\text{fluency}} = 0.83$ ;  $\omega_{\text{story}} = 0.79$ ).

#### 3.5.5. Motives to write

Students' motives to write were measured with the Writing Motivation Questionnaire (Graham et al., 2019). The Portuguese version was developed by Limpo et al. (2020) and it is composed of 21

items organized into seven dimensions: curiosity (e.g., “I write because I can write about topics important to me.”), involvement (e.g., “I write because I like to create a character that I can identify with.”), grades (e.g., “I write in order to get better grades at school.”), competition (e.g., “I write because it is important for me to know more than other students.”), social recognition, (e.g., “I write because one gets praise for writing well.”), emotional regulation (e.g., “I write because it helps me calm down.”), and relief from boredom (e.g., “I write because it helps me pass the time.”). Students were given sentences illustrating possible motives for them to write and asked to indicate the extent to which each reason was true for them. As before, the answers were given on scale ranging from 1 (*always true*) to 5 (*never true*). For convenience of interpretation, the responses were reverse-coded. Thus, higher scores indicate higher levels of motivation. In this study, internal consistency measured with the ordinal omega was adequate for all subscales both at pretest ( $\omega_{\text{competition}} = 0.79$ ;  $\omega_{\text{curiosity}} = 0.80$ ;  $\omega_{\text{regulation}} = 0.79$ ;  $\omega_{\text{grades}} = 0.80$ ;  $\omega_{\text{involvement}} = 0.65$ ;  $\omega_{\text{relief}} = 0.75$ ;  $\omega_{\text{recognition}} = 0.68$ ) and at posttest ( $\omega_{\text{competition}} = 0.89$ ;  $\omega_{\text{curiosity}} = 0.80$ ;  $\omega_{\text{regulation}} = 0.87$ ;  $\omega_{\text{grades}} = 0.79$ ;  $\omega_{\text{involvement}} = 0.75$ ;  $\omega_{\text{relief}} = 0.83$ ;  $\omega_{\text{recognition}} = 0.79$ ).

**4. Results**

As a first step, we checked if the data followed a normal distribution. Values of skewness and kurtosis of all variables at pretest and posttest showed no evidence of distributional problems, as their absolute values were below 3.0 and 10.0, respectively (Kline, 2005). For handwriting fluency, text length, and text quality, we conducted  $2 \times 2 \times 2$  (Intervention [transcription, drawing]  $\times$  Homework Assignment [composing, drawing]  $\times$  Testing Time [pretest, posttest]) Analyses of Variance (ANOVAs) with repeated measures on the last factor. For the other variables, a fourth repeated factor was added in line with the respective variable: Spelling (consistent words, inconsistent words), Self-Efficacy (handwriting fluency, story writing), Motives to Write (competition, curiosity, emotional regulation, grades, involvement, relief from boredom, and social recognition). Because the group receiving transcription training with composing homework assignment had considerably more girls than boys, we reran all the analyses with gender as a between-group factor. Since there were no interactions of gender with condition or/and homework assignment this variable is not further discussed. Table 2 provides means and standard deviations for all variables. Significant interactions were examined by

means of tests of simple main effects. As students were nested within classrooms, *t* statistics for between-groups comparisons were corrected for clustering following the guidelines of McCoach and Adelson (2010). This correction is indicated with a subscript (*t<sub>c</sub>*). For all pairwise comparisons we computed Cohen’s *d* (Cohen, 1988), which was corrected for the correlation in repeated measures comparisons (Wolf, 1986).

**4.1. Effects on writing skills**

**4.1.1. Handwriting fluency**

We found three significant effects: a main effect of testing time,  $F(1, 160) = 120.42, p < .001, \eta_p^2 = 0.43$ , indicating an increase from pretest to posttest; a main effect of intervention,  $F(1, 160) = 13.75, p < .001, \eta_p^2 = 0.08$ , with transcription students surpassing drawing students; and an Intervention  $\times$  Testing Time interaction,  $F(1, 160) = 20.25, p = .002, \eta_p^2 = 0.06$ . Follow-up analysis revealed an increase in handwriting fluency for the transcription ( $t = 9.64, p < .001, d = 1.61$ ) and drawing ( $t = 5.74, p < .001, d = 0.90$ ) interventions. Moreover, transcription children surpassed drawing children at pretest ( $t_c = 2.11, p = .04, d = 0.34$ ) and posttest ( $t_c = 2.59, p = .01, d = 0.70$ ). Due to the pretest difference between intervention groups, we conducted an Analysis of Covariance introducing pretest scores as a covariate. After controlling for pretest differences, transcription students displayed higher handwriting fluency than drawing students,  $F(1, 159) = 15.31, p < .001, \eta_p^2 = 0.09$  ( $t_c = 2.28, p = .02, d = 0.47$ ;  $M_{\text{adj}} = 24.61$  vs.  $M_{\text{adj}} = 22.07$ ).

**4.1.2. Spelling**

Results showed three significant effects: a main effect of spelling,  $F(3, 160) = 92.78, p < .001, \eta_p^2 = 0.37$ , with higher accuracy in spelling consistent than inconsistent words; a main effect of testing time,  $F(1, 160) = 43.78, p < .001, \eta_p^2 = 0.22$ , indicating an increase in spelling from pretest to posttest; and a significant interaction between intervention and testing time,  $F(1, 160) = 8.87, p = .003, \eta_p^2 = 0.05$ . Follow-up analysis showed that students in the transcription ( $t = 6.14, p < .001, d = 1.04$ ) and drawing ( $t = 2.31, p = .02, d = 0.39$ ) interventions increased spelling performance over time. At posttest, students in the transcription intervention surpassed those in the drawing intervention ( $t_c = 2.22, p = .03, d = 0.49$ ). There were no differences at pretest.

**Table 2**  
Descriptive Statistics for all Variables across Intervention Group (Transcription vs. Drawing) and Testing Time (Pretest vs. Posttest).

	Pretest				Posttest			
	Transcription		Drawing		Transcription		Drawing	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Handwriting fluency ( <i>N</i> = 164)	20.57	5.21	18.92	4.32	25.28	4.95	21.53	5.73
Spelling accuracy ( <i>N</i> = 164)								
Consistent words	6.99	1.26	7.01	1.33	7.55	0.81	7.17	1.11
Inconsistent words	6.11	1.62	6.04	1.96	6.92	1.14	6.26	1.71
Writing performance ( <i>N</i> = 166)								
Text length	89.19	25.88	80.92	27.85	103.10	26.42	85.58	27.81
Text quality	3.68	0.96	3.55	0.96	4.19	1.13	3.70	1.06
Self-efficacy ( <i>N</i> = 147)								
Handwriting fluency	3.57	0.92	3.70	0.77	3.64	0.98	3.86	1.01
Story writing	3.71	0.95	3.82	0.87	3.69	0.95	3.94	0.75
Motives to write ( <i>N</i> = 132)								
Competition	3.76	1.03	3.87	1.14	3.62	1.37	3.49	1.46
Curiosity	3.93	0.97	4.16	0.89	3.54	1.11	4.13	0.83
Emotional regulation	3.45	1.05	3.63	0.95	2.89	1.30	3.45	1.19
Grades	4.42	0.83	4.60	0.60	4.29	0.92	4.55	0.67
Involvement	3.77	0.95	3.97	0.82	3.35	1.11	3.95	0.91
Relief from boredom	3.39	1.06	3.90	0.88	3.07	1.25	3.56	1.10
Social recognition	3.83	1.01	4.02	0.89	3.46	1.18	3.91	1.14

Note. Sample size below 166 for some variables is related to missing values.

**Table 3**  
Pairwise Comparisons between Motives to Write for Intervention Groups (Transcription vs. Drawing) and Testing Times (Pretest vs. Posttest).

Pairwise comparisons		Transcription				Drawing			
		Pretest		Posttest		Pretest		Posttest	
		<i>t</i>	<i>p</i>	<i>t</i>	<i>p</i>	<i>t</i>	<i>p</i>	<i>t</i>	<i>p</i>
Competition vs.	Curiosity	-1.16	.25	0.43	.67	-1.98	.05	-4.06	< .001
	Emotional regulation	1.70	.09	3.71	< .001	1.45	.15	0.17	.86
	Grades	-4.83	< .001	-4.55	< .001	-5.45	< .001	-7.55	< .001
	Involvement	-0.14	.89	1.49	.14	-0.58	.56	-2.81	.01
	Relief from boredom	2.09	.04	2.94	.004	-0.16	.87	-0.47	.64
Curiosity vs.	Social recognition	-0.57	.57	1.10	.27	-1.19	.24	-3.14	.002
	Emotional regulation	3.58	< .001	4.98	< .001	4.20	< .001	5.42	< .001
	Grades	-5.16	< .001	-7.16	< .001	-4.76	< .001	-4.20	< .001
	Involvement	1.41	.16	1.86	.06	1.91	.06	1.86	.07
	Relief from boredom	4.11	< .001	3.81	< .001	2.12	.04	4.76	< .001
Emotional regulation vs.	Social recognition	0.89	.38	0.58	.56	1.28	.20	1.53	.13
	Grades	-7.94	< .001	-9.27	< .001	-8.28	< .001	-7.62	< .001
	Involvement	-2.54	.01	-3.62	< .001	-2.76	.01	-4.07	< .001
	Relief from boredom	0.50	.62	-1.48	.14	-2.17	.03	-0.99	.32
Grades vs.	Social recognition	-2.49	.01	-3.41	< .001	-2.72	.01	-2.91	.004
	Involvement	6.04	< .001	7.97	< .001	6.19	< .001	5.34	< .001
	Relief from boredom	8.21	< .001	8.69	< .001	5.85	< .001	7.34	< .001
	Social recognition	5.21	< .001	6.55	< .001	5.29	< .001	5.24	< .001
Involvement vs.	Relief from boredom	2.91	.004	2.64	.01	0.50	.62	3.74	< .001
	Social recognition	-0.38	.71	-0.70	.49	-0.43	.67	0.27	.78
Relief from boredom	Social recognition	-3.12	.002	-2.56	.01	-0.88	.38	-2.40	.02

4.1.3. Text length

We observed a main effect of intervention,  $F(1, 162) = 12.11$ ,  $p = .001$ ,  $\eta_p^2 = 0.07$ , with transcription students writing longer texts than drawing students; and a main effect of testing time,  $F(1, 162) = 21.71$ ,  $p < .001$ ,  $\eta_p^2 = 0.12$ , indicating an increase in text length from pretest to posttest. Moreover, we found a significant Intervention  $\times$  Testing Time interaction,  $F(1, 162) = 5.67$ ,  $p = .02$ ,  $\eta_p^2 = 0.03$ . Follow-up analyses revealed that text length was higher at posttest than pretest for the transcription intervention only ( $t = 4.81$ ,  $p < .001$ ,  $d = 0.74$ ), and that at posttest transcription students surpassed drawing students ( $t = 2.71$ ,  $p = .01$ ,  $d = 0.65$ ). There were no pretest differences. Results additionally showed a three-way interaction between intervention, homework assignment, and testing time  $F(1, 162) = 4.23$ ,  $p = .04$ ,  $\eta_p^2 = 0.03$ . There was an increase in text length from pretest to posttest only for transcription students receiving the drawing homework assignment ( $t = 4.98$ ,  $p < .001$ ,  $d = 1.10$ ; pretest:  $M = 86.57$ ,  $SD = 23.41$  vs. posttest:  $M = 107.73$ ,  $SD = 25.05$ ).

4.1.4. Text quality

Results revealed a main effect of intervention,  $F(1, 162) = 5.38$ ,  $p = .02$ ,  $\eta_p^2 = 0.03$ , with better texts in the transcription than drawing intervention; a main effect of testing time,  $F(1, 162) = 15.37$ ,  $p < .001$ ,  $\eta_p^2 = 0.09$ , suggesting an increase in text quality from pretest to posttest; and a significant interaction between intervention and testing time,  $F(1, 162) = 4.49$ ,  $p = .04$ ,  $\eta_p^2 = 0.03$ . Tests of simple main effects showed that the quality of transcription students' texts increased from pretest to posttest ( $t = 2.32$ ,  $p = .004$ ,  $d = 0.59$ ); and that, at posttest, students in the transcription intervention wrote better stories than those in the drawing intervention ( $t_c = 1.94$ ,  $p = .05$ ,  $d = 0.45$ ). There were no differences at pretest.

4.2. Effects on writing motivation

4.2.1. Self-efficacy

We found a significant interaction between testing time and homework assignment,  $F(1, 143) = 5.21$ ,  $p = .02$ ,  $\eta_p^2 = 0.04$ . Follow-up analyses showed that there was an increase in self-efficacy from pretest to posttest among students receiving the composing homework assignment ( $t = 2.73$ ,  $p = .01$ ,  $d = 0.46$ ; pretest:  $M = 3.62$ ,  $SD = 0.79$

vs. posttest:  $M = 3.82$ ,  $SD = 0.73$ ). However, despite this increase, self-efficacy of students receiving the composing homework assignment was not statistically different from that of students receiving the drawing homework assignment both at pretest and at posttest.

4.2.2. Motives to write

Results showed significant main effects of testing time  $F(1, 128) = 13.46$ ,  $p < .001$ ,  $\eta_p^2 = 0.10$ , intervention,  $F(1, 128) = 7.50$ ,  $p = .01$ ,  $\eta_p^2 = 0.06$ , and motives to write,  $F(6, 768) = 41.29$ ,  $p < .001$ ,  $\eta_p^2 = 0.24$ , which were modulated by a three-way interaction between intervention, testing time, and motives to write,  $F(6, 768) = 2.57$ ,  $p = .02$ ,  $\eta_p^2 = 0.02$ . Findings decomposing this interaction are described below.

4.2.2.1. Differences between intervention groups. At posttest, transcription students achieved lower scores than drawing students for curiosity ( $t_c = 2.21$ ,  $p = .03$ ,  $d = 0.60$ ) and involvement ( $t_c = 2.07$ ,  $p = .04$ ,  $d = 0.59$ ). There were no pretest differences.

4.2.2.2. Differences between testing time. In the drawing intervention group, there was a decrease from pretest to posttest in motives associated with competition ( $t = 2.31$ ,  $p = .01$ ,  $d = 0.45$ ) and relief from boredom ( $t = 2.48$ ,  $p = .01$ ,  $d = 0.48$ ). In the transcription intervention group, there was a decrease from pretest to posttest in motives related to curiosity ( $t = 2.99$ ,  $p = .003$ ,  $d = 0.65$ ), emotional regulation ( $t = 3.28$ ,  $p = .001$ ,  $d = 0.83$ ), involvement ( $t = 3.34$ ,  $p = .001$ ,  $d = 0.90$ ), relief from boredom ( $t = 2.18$ ,  $p = .03$ ,  $d = 0.91$ ), and social recognition ( $t = 2.55$ ,  $p = .01$ ,  $d = 0.77$ ).

4.2.2.3. Differences among motives to write. Consistently across intervention groups and testing times, there were higher scores in grades compared to all other motives, and there were higher scores in curiosity than emotional regulation. Excepting drawing students at pretest, we found that curiosity scores were higher than those of relief from boredom. Finally, the following differences were observed at posttest: drawing students reported more curiosity than competition, and more involvement than emotional regulation and relief from boredom; and transcription students reported more competition than regulation, and more involvement and social recognition than

emotional regulation. Given the number of comparisons in this set of analyses (total of 84), we used an alpha level of 0.001. See Table 3 for all pairwise comparisons results.

## 5. Discussion

This research analysed the effects of a transcription intervention in Grade 3. Students receiving transcription training were compared with students receiving drawing training. Within both groups, half of the students was given a composing homework assignment, whereas the other half was given a drawing homework assignment. Intervention effects were examined for students' transcription skills, composing skills, and motivation. Overall, findings suggested that transcription training increased transcription and composing skills and decreased intrinsic motivation. Type of homework assignment had virtually no impact on writing and motivation.

### 5.1. Effects on writing skills

As anticipated, transcription training improved handwriting fluency. Students in the transcription intervention were able to copy more words than their peers in the drawing intervention. This increase, which was related to the extensive practice in writing letters, words, and sentences provided by the program, replicated prior studies showing that such instruction enhances young students' handwriting skills (Alves et al., 2016; Berninger et al., 1997; Graham et al., 2018; Graham et al., 2000; Limpo & Alves, 2018; for a meta-analysis, see Santangelo & Graham, 2016).

Transcription training also improved spelling. Following the transcription intervention, students correctly spelled more words than their peers. This is an important finding because spelling training involved just copying words without explicit instruction. This result demonstrated that copying activities can be used to teach spelling skills through a thoughtful selection of words and without overloading students' attention. This is not to say, however, that these exercises should replace explicit spelling instruction (cf. Graham & Santangelo, 2014). It means that rather than asking students to do meaningless copying exercises, the words and sentences selected can be used to expose students to key features of good writing.

The effects of transcription training on handwriting and spelling skills replicated Limpo and Alves (2018) investigation with younger Grade 2 students. Effect sizes were however slightly smaller, which can be explained by the older participants (Grade 3 vs. Grade 2) and the more stringent control group (drawing vs. standard instruction) of the present study. Importantly, given the drawing condition here used, we extended Limpo and Alves (2018) findings by showing that transcription improvements were not due to visuo-motor practice. This is the second published study showing that a transcription program including explicit handwriting and implicit spelling instruction improves students' handwriting fluency and spelling accuracy; and the first one demonstrating that transcription improvements cannot be exclusively attributed to the fine-motor training inherent in transcription programs.

In line with our hypotheses, the transcription intervention also benefited story writing. Students receiving transcription training produced longer and better stories than their counterparts receiving drawing training. This finding is consistent with past research showing that transcription instruction improved not only the skills directly targeted (handwriting and spelling) but also the amount and quality of students' writing (Alves et al., 2016; Berninger et al., 1997; Graham & Santangelo, 2014; Limpo & Alves, 2018; Santangelo & Graham, 2016). These findings empirically supported the proposition that transcription and composing skills are causally related, as assumed by the WWC model (Graham, 2018b). Theoretically, lessening the demands of transcription in beginning writers should reduce cognitive overload and enable the enactment of other writing processes, essential for composing good texts, such as generating ideas or putting these into

sentences (McCutchen, 1996, 2006). This claim was supported by previous research showing that transcription training improved students' ability to generate ideas (Limpo & Alves, 2018) and to build well-formed sentences with complex vocabulary (Graham et al., 2018). This research suggests that, in the current study, transcription training may have redirected students' attention from transcription to idea- and sentence-related writing processes, which reflected in longer and better texts.

### 5.2. Role of composing opportunities

Results showed that homework assignment did not moderate the effects of transcription training on story quality. This finding corroborated the hypothesis that story writing would improve for all transcription students, regardless of the homework assignment. This result revealed that composing opportunities are not essential to facilitating the positive effects of transcription training to story quality, and that transcription training is enough to improve story writing, at least in this study's sample. These findings should be interpreted with some caution as the composing activities were performed at home. We neither controlled the conditions under which these activities were implemented (e.g., duration, extra help) nor examined the characteristics of the output (e.g., text quality or length). Though homework was generally carried out as planned, there might have been some variability among students that could explain the lack of a moderating effect of homework. Moreover, given the random allocation of students to the homework assignment within each class, teachers gave general instructions to all students simultaneously. For example, they did not explicitly ask students to apply the handwriting skills being trained to the homework assignment nor aimed for establishing a functional relationship between school and home activities. Additional tests are therefore needed about the role of imbedding composing opportunities into transcription training, particularly in the classroom setting. For example, Berninger et al. (1997) included 3 min of composing practice at the end of every instructional lesson, and Alves et al. (2016) included a single lesson comprising 10 min every three lessons. In either case, children were asked to write as much as possible about motivating topics without quality concerns. Allowing for composing opportunities seems a key ingredient of any writing intervention. Meta-analytic findings have shown that extra writing can result in better text quality (Graham et al., 2012).

### 5.3. Effects on writing motivation

Despite the key role of self-efficacy in shaping cognitive processes in writing, as claimed by the WWC model (Graham, 2018b), transcription training did not influence students' self-efficacy for writing. In other words, the observed growth in handwriting and story writing skills was not paralleled by an increase in writing self-efficacy. Moreover, despite the slight increase in self-efficacy among students receiving the composing homework assignment, at posttest, the level of self-efficacy of these students was statistically similar to that of their peers with the drawing homework assignment. As discussed before, the homework assignment did not influence transcription and composing skills. Thus, this increase in self-efficacy did not follow a similar increase in performance. The mismatch between self-efficacy and performance was observed in prior intervention studies with young writers (Graham, Harris, & Mason, 2005; Limpo & Alves, 2013b), who may struggle to produce accurate estimates of their ability (Klassen, 2002).

Results involving motives to write did not support our predictions. In fact, they mostly ran counter to them. From pretest to posttest, there was a decrease in curiosity, involvement, emotional regulation, and social recognition for the students in the transcription condition. At posttest, students in the transcription condition reported lower curiosity and involvement than drawing students. These results suggest that transcription training, as implemented here, reduced students' intrinsic



motivation for writing. We envision at least two reasons for this unexpected finding, namely, the characteristics of the transcription exercises combined with participants' age. The role of task characteristics on learners' motivation is well-known (Ames, 1992). On the one hand, given the highly predictable structure of the program (i.e., three sets of lessons repeated throughout 10 weeks), at some point, students might have found it unappealing and monotonous. Such lack of diversity among exercises could have therefore contributed to decrease children's motivation. Indeed, anecdotal evidence provided by teachers suggested students found the program repetitive. On the other hand, the over-emphasis of the intervention on increasing fluency may have inadvertently put external pressure on the children. For example, the third lesson of each weekly module included a set of timed activities, in which students were explicitly encouraged to write as fast as possible and surpass their previous achievements. Additionally, even though research supported that there is room for improvement concerning the handwriting skills of Portuguese third graders (Alves & Limpo, 2015; for similar results in the US and UK see, respectively, Graham, Weintraub, Berninger, & Schafer, 1998; and Connelly, Gee, & Walsh, 2007), the alphabet and copying exercises may have been remarkably straightforward for third graders. The mechanical training of handwriting might have posed little cognitive challenge, leading to students' demotivation.

Though the decline in intrinsic motivation does not put into question the well-established benefits of transcription training (Santangelo & Graham, 2016), it certainly is a wake-up call for researchers and educators, who should not overlook motivational aspects in the teaching of writing. As proposed by the WWC model (Graham, 2018b), writers' motivation is shaped by aspects of the context, such as the type of writing instruction and teaching practices enacted. Transcription training should be (re)designed to maintain students' motivation, for example, by allowing differentiated instruction (Frédéric, Roy, & Valois, 2017), or promoting students' autonomy (Ames, 1992). It may also be a good idea to ensure that other components of the larger writing program be designed to increase writing motivation in general.

Given the positive links between intrinsic motivation and school achievement (e.g., Lepper, Corpus, & Iyengar, 2005), no intervention program should harm intrinsic motivation, at the expense of compromising future learning. Additional research should examine whether the observed decrease in intrinsic motivation is replicable, and, if so, what are its main sources. For a comprehensive analyses of transcription training effects, it would be useful to tap other motivational dimensions included in the WWC model (Graham, 2018b), such as independent mastery and challenge towards tasks (Harter, 1981), as well as other motivation-related factors, such as attitudes (Graham, Berninger, & Fan, 2007), achievement goals (Limpo & Alves, 2017a), or implicit theories (Limpo & Alves, 2014). Structural models could also be tested to examine the mechanisms transmitting the effects of transcription training on intrinsic motivation (for an example, see Brunstein & Glaser, 2011). As claimed by intervention researchers (e.g., Hopwood, 2007), it is critical to isolate the components through which an intervention produces specific effects and the mediating processes that explain how these effects take place.

Another result from the current study that should be given consideration in the future was that, both at pretest and posttest, all students identified grades as the strongest motivational incentive to be engaged in writing. Similar findings were reported for older, middle-grade writers (Camping et al., 2019; Rocha et al., 2019). It seems that students' willingness to initiate writing activities is largely dependent upon external rewards that may result from the task, in particular, the achievement of better grades at school. This may reflect a perception of writing as a routine for acquiring and displaying school-based knowledge with manifest evaluative purposes, rather than a creative activity for communication and personal growth (Boscolo, 2009). Such assumption raises two important questions for future enquiry: Why are grades a key force in motivating students to write? How does this focus

on grades influence students' writing approach and outcomes?

#### 5.4. Limitations and indications for future research

Current findings should be considered in the light of at least four limitations. First, despite our quasi-experimental design, we examined intervention effects at the student-level, and not at the group-level. Ignoring the nested nature of the data violates the assumption of independence of ANOVAs. This may result in bias standard error estimates and in increases in Type I error rate (McCoach & Adelson, 2010). To minimize this limitation, we computed clustering-corrected estimates. In spite of that, additional studies with larger sample sizes are warranted, as these may allow the use of powerful statistical techniques, which adjust for and model nested data.

Second, the composing component of the program was implemented as a homework assignment. Our goal was to test whether having composing opportunities was essential to the previously reported benefits of transcription training on story writing. However, practical constraints associated with the school curricula did not allow us to implement this component in the classroom. Consequently, we were not able to control the conditions under which it was carried out. Future research is needed to provide additional evidence on the role of composing opportunities during transcription training. This can be achieved by including extra writing sessions.

Third, the procedures used to assess treatment fidelity in the drawing group were not as extensive as those applied with the transcription group. Despite the pre- and middle-intervention meetings between the second author and the teachers as well as her availability to clarify any question arising during implementation, it is important that future research implement similarly robust procedures in both the treatment and control conditions. Even so, given teachers' self-report and students' workbooks examination, we have no reasons to believe that the program was not delivered as intended.

Fourth, text quality was assessed with a holistic scale. Despite its extensive use in writing research and proved validity, this measure provided an overall indicator of writing quality that could not inform on the specific text features that benefited from training. In the future, writing researchers may consider using more fine-grained measures of text quality to inspect transcription interventions' effects. Still, it is worth mentioning that the factors within such analytic scales tend to be highly correlated, often leading researchers to combine individual factor and end up with composite measures of writing quality equivalent to holistic scales (e.g., Alves & Limpo, 2015; Glaser & Brunstein, 2007).

In conclusion, despite the stated limitations, the present study has relevant theoretical and practical implications. On the one hand, the findings were consistent with a small, but growing body of research showing the importance of transcription skills to producing good texts. On the other hand, it provided evidence that we need to take into consideration how such programs influence students' motivation to write.

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