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Development and validation of instruments to measure Portuguese third graders' reasons to write and self-efficacy

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Abstract

There is a growing body of research showing that writers are influenced by motivation-related aspects. This study documents the translation process of the Portuguese version of the Writing Motivation Questionnaire and the construction of two scales to measure self-efficacy for handwriting and story writing. The psychometric properties of these instruments were then explored. Firstly, we examined the factorial structure of these instruments and tested measurement invariance across two independent samples of 202 and 193 third graders. Secondly, we evaluated the reliability of the scales and their convergent/discriminant validity by testing the relationship among them and with external correlates (viz., handwriting fluency and story length and quality). Thirdly, we tested instruments' predictive validity by regressing story length and quality on motives to write, and on self-efficacy for handwriting and story writing. Findings confirmed the multidimensional nature of motivations to write and supported the validity and reliability of the scales developed. Regression analyses showed that competition- and grades-related had, respectively, a negative and positive contribution on story quality. Moreover, self-efficacy for story writing and handwriting contributed, respectively, to story length and quality, above and beyond handwriting fluency. This study provided evidence on the validity and reliability of the instruments under analysis, showing their usefulness to assess motivational dimensions in students as young as 8 years old. Findings join to current research emphasizing the importance of having valid and reliable tools to explore the role of motivation in young children's writing.

Keywords Handwriting · Motives to write · Self-efficacy · Story writing · Writing motivation

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Introduction

In the nineties, John Hayes proposed a theoretical model of writing that included motivation as a main component, side by side to cognitive processes (Hayes, 1996). Since then, efforts have been made to shed light into the motivational processes involved in writing (Boscolo & Hidi, 2007; Bruning & Horn, 2000), even though these latter continue to receive less research attention than cognitive ones. The key role of motivation in writing was recently highlighted in the Writer(s)-Within-Community (WWC) model proposed by Graham (2018a, b). This model proposes a theoretical account of writing that merges sociocultural and cognitive perspectives prevalent in the field. There are two main components in the WWC model: the writing community where writing takes place; and the cognitive resources and capabilities of its members. Writing communities are potentially permeable and flexible structures, which share a set of interrelated characteristics: writing purposes, members, writing tools, actions to achieve writing purposes, written products, physical and social environments, collective history, and macrolevel forces (viz., social, cultural, political, institutional, and historical influences). The members of the writing community apply control mechanisms (viz., attention, working memory, and executive control) to regulate the mental and physical operations used to produce text (viz., conceptualization, ideation, translation, transcription – i.e., spelling and handwriting –, and reconceptualization), which draw on long-term memory resources, including knowledge and motivation.

The development of expertise in writing – which can be characterized by the effective use of control and production couple with rich long-term memory resources – is a long and demanding journey. Writers' capabilities, as proposed by the WWC model, are far from being fully operational in child writers. In primary grades (6–10 years of age), spelling and handwriting skills represent the strongest constraint to writing, indicating that they are not completely automatic (Graham, Berninger, Abbott, Abbott, & Whitaker, 1997; Limpo & Alves, 2013). For beginning and developing writers, the act of putting words onto paper imposes heavy demands on the limited capacity of working memory, thereby depleting available attentional resources and preventing the activation of other production processes (Bourdin & Fayol, 1994; Kellogg, 1996; McCutchen, 1996). For example, when young children have to concentrate on drawing letters, they cannot devote much attention to monitor and evaluate what is being written. As proposed by Bereiter and Scardamalia (1987), children cope with the demanding nature of writing by engaging in a knowledge telling composing process: They compose text by retrieving content that is immediately written down. Their writing lacks the activation of control mechanisms and it is mostly driven by what they know about the topic and how this can be fitted within genre constraints (Olive & Kellogg, 2002).

Contrasting with the substantial amount of research showing the above-described cognitive profile of children's text production, little is known about the motivational characteristics of beginning writers. Motivational factors are particularly important in the acquisition and development of writing, as they

influence whether children engage in writing, how much effort is committed, what actions they take, and how children interact with other community members (e.g., teacher or classmates). The WWC model proposes that writers and their written products are influenced by different motivational beliefs, such as motives to write and self-efficacy, which are addressed in the current paper. Specifically, we examine the psychometric properties of three instruments measuring motives to write, self-efficacy for handwriting, and self-efficacy for story writing in Portuguese primary-grade beginning writers attending Grade 3 (8–9-year-olds).

Motives to write

Another set of beliefs that writers bring to bear when writing involves the motivational incentives for engaging in that activity. The WWC model assumes that writers may feel more or less motivated to write in general (Graham, 2018a, b). Through the lens of the Self-Determination Theory (SDT; Deci & Ryan, 1985; Deci & Ryan, 2000; Ryan & Deci, 2000), these incentives can be organized into two main categories: intrinsic motivation, when writers may be willing to engage in writing for its own sake, for example, for the inner pleasure they took from the writing experience per se; and extrinsic motivation, when 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. As proposed by SDT, extrinsic motivation can be further characterized according to the degree to which motives are self-determined, falling along a continuum anchored by controlled and autonomous. In the most controlled form of extrinsic motivation, engagement in writing results from others' administration of contingencies (e.g., when children write to be praised by the teacher), whereas in the most autonomous form of extrinsic motivation, actions are fully volitional, but instrumental (e.g., when children write to achieve a self-relevant outcome, such as good grades). Though self-determined, autonomous motivation differs from intrinsic motivation, which fosters engagement in writing for the behavior itself rather than for its outcomes, even if self-determined.

Recently, De Smedt and colleagues examined the relationship between controlled and autonomous motivation in writing among fifth and sixth graders from Flanders. De Smedt et al. (2016) showed that autonomy-oriented students wrote qualitatively better narrative and informative texts, while control-oriented students performed significantly lower on the narrative text. In a subsequent study, De Smedt, et al. (2017) reported a positive association between autonomous motivation and students' writing performance. In line with findings from health and educational settings (Deci & Ryan, 2000), these studies were important by showing the benefits of behaviors to be self-determined rather than externally regulated. However, De Smedt's studies are limited in two ways: they relied on a 2-factor approach of motivational incentives for engaging in writing and did not focus on the role of intrinsic motivation.

Stemming from the SDT proposition that motivation is influenced by multiple intrinsic and extrinsic incentives with varying degrees of external regulation (Deci & Ryan, 2000; Ryan & Deci, 2000) and grounded on past work in the reading domain (Schiefele & Schaffner, 2016; Schiefele, Schaffner, Möller, & Wigfield,

2012), Graham et al. (2020) proposed a multidimensional conceptualization of writers' reasons for writing, which provides a more fine-grained analysis to writing motivational incentives than the autonomous vs. controlled dichotomic approach. Using confirmatory factor analyses, Graham and colleagues found supporting evidence for a model composed of seven reasons to write: (a) *curiosity*, that is, writing because of an interest in knowing more about the composition topic, (b) *involvement*, that is, to experience positive feelings, such as getting lost in a story or experiencing imaginative actions; (c) *grades*, that is, to raise one's grades in school, (d) *competition*, that is, surpass one's classmates in school; (e) *social recognition*, that is, to see good writing performance recognized; (f) *emotional regulation*, that is, to overcome negative emotions, such as anger or sadness, and (g) *relief from boredom*, that is, to deal with tediousness and fill in time. According to the SDT framework, the motives of curiosity, involvement, emotional regulation, and relief from boredom represent intrinsic motives, whereas the motives of grades, competition, and social recognition represent extrinsic motives, in descending order of self-determination levels.

To date, only three studies tested the validity of this 7-factor model of students' motives to write: Graham et al. (2020) provided the first validation of this model in American fourth and fifth graders; Camping, Graham, Ng, Wilson, and Wdowin (2020) replicated this model in American sixth and eighth graders with English as the first language as well as former and current English language learners; and Rocha, Filipe, Magalhães, Graham, and Limpo (2019) replicated this model in Portuguese sixth graders, using the instrument validated here. In addition to the validation and cross-validation of the motives to write, two findings from these studies are noteworthy. First, the strongest motivations held by students related to curiosity and grades (Camping et al., 2020; Rocha et al., 2019). At least in middle grades, writing seemed to be simultaneously driven by intrinsic and self-determined extrinsic incentives. Second, curiosity and social recognition had a positive and negative contribution to sixth graders' writing, respectively (Rocha et al., 2019). This finding seems aligned with SDT (Deci & Ryan, 2000; Ryan & Deci, 2000), claiming that intrinsic and autonomous motives tend to result in positive outcomes, whereas controlled, non-self-determined incentives (such as writing for others to praise oneself) may have the opposite effect.

Writing self-efficacy

Students' perceptions about their writing ability are considered one of the strongest motivational predictors of writing throughout schooling (Pajares, 2003). Previous research showed that students with greater confidence in their writing abilities produced better writing both in primary (Graham, Kiuhara, Harris, & Fishman, 2017; Pajares, Miller, & Johnson, 1999) and middle grades (Graham et al., 2019; Pajares & Valiante, 1999). For example, Graham et al. (2017) reported that self-efficacy (together with attitude toward writing) made a unique and significant contribution to the amount and quality of personal narratives written by fourth graders, above and beyond gender and self-reported strategic writing behaviors. It seems that self-efficacy is a powerful predictor of writing performance because those beliefs can

influence children's choices, the efforts they make to accomplish the goals, the persistence and perseverance they exert when they find obstacles, and the thinking patterns and emotional reactions they experience (Pajares, Valiante, & Cheong, 2007).

However, the majority of past studies portrayed self-efficacy as a unitary construct, ignoring the premise that writers may fell more or less self-efficacious to achieve specific characteristics of writing. A child may feel more capable to produce a story than an opinion essay, or they may express more confidence in forming neat letters than spelling words correctly. Recognizing the limitations of approaching writing self-efficacy as a general construct, recent studies developed multidimensional measures tapping self-efficacy to accomplish specific writing processes (Bruning, Dempsey, Kauffman, McKim, & Zumbrunn, 2013; Limpo & Alves, 2017; Sanders-Reio, Alexander, Reio, & Newman, 2014). Bruning et al. (2013) found empirical support for a model with three factors comprising self-efficacy for conventions (i.e., translating ideas into linguistic forms and transcribing them into writing), ideation (i.e., generating good ideas for writing and ordering them), and self-regulation (i.e., managing the cognitive, emotional, and behavioral aspects of writing). This multidimensional approach to self-efficacy is advantageous as it may provide fine-grained information about writers' self-perceived and actual competence. For example, in late primary students, it was found that higher self-efficacy for ideation was associated with better quality in stories (De Smedt, Van Keer, & Merchie (2016), whereas higher self-efficacy for self-regulation was associated with more strategic writing behaviors (De Smedt, Merchie, Barendse, Rosseel, Van Keer, & De Naeghel, 2017). Notwithstanding the merits of multidimensional scales of self-efficacy, available instruments left out two writing dimensions particularly important to target in primary school, namely, handwriting and text genre.

Handwriting involves the execution of fine-motor movements required by a writing tool to produce orthographic symbols (Abbott & Berninger, 1993). This skill is a building block of writing that needs to be acquired from early on (Limpo & Graham, 2019). Research showed that primary-grade children with faster handwriting produced better texts (Alves & Limpo, 2015; Limpo & Alves, 2013) and that systematic handwriting instruction improved writing performance (for a meta-analysis, see Santangelo & Graham, 2016). However, despite the central role of handwriting in writing acquisition, no research targeted children's self-perceptions about their capabilities to produce fast and neat handwriting. To gauge these beliefs in primary school seems important because they may be a key factor in children's performance and their approach to learning activities (Bandura, 1997). Indeed, those who see themselves as slow writers may feel anxious during writing tasks, develop negative attitudes about writing, and avoid composing opportunities. Particularly in the early stages of learning to write, this is a harmful mindset that may compromise future development.

The unique characteristics of text genres and the different constraints they impose on writers is well established (Berman & Nir-Sagiv, 2007). Text genre assumes a key role in beginning writers as their composing process is typically guided by topic and genre cures with little influence of control mechanisms (Olive, Favart, Beauvais, & Beauvais, 2009). Indeed, writing interventions including text structure as an instructional component are very effective in improving primary graders writing

performance (for a meta-analysis, see Graham, McKeown, Kiuhara, & Harris, 2012). However, the majority of writing self-efficacy scales does not tap genres' structural features. For example, the ideation factor of Bruning's scale (Bruning et al., 2013) includes general items, such as "*I can think of many ideas for my writing*", which disregard the schematic structure of a particular genre (e.g., students' confidence to think of ideas to describe characters or create suspense). Since stories are among the most familiar and used genres to teach and evaluate writing in children, it seems relevant to examine how confident they feel in their abilities to produce well-structured stories. Nevertheless, there is no instrument available to that purpose.

Overall, in addition to being able to produce writing quickly, in compliance with genre schematic structures, primary graders should develop a strong sense of efficacy to do it. Given the lack of measures to assess self-efficacy in these key domains of early writing, this study developed and validated self-efficacy scales targeting handwriting and story writing.

Present study

This study aimed to report on the Portuguese adaptation process of the Writing Motivation Questionnaire (WMQ) developed by Graham et al. (2020), and on the creation process of two self-efficacy scales to measure students' self-efficacy for handwriting and story writing. Moreover, we examine the psychometric properties of these instruments in three ways. First, we tested the construct validity of the scales by examining their factorial structure and testing measurement invariance across two independent samples. Second, we examined the reliability of the motivational and self-efficacy dimensions assessed and tested their convergent/discriminant validity by examining the relationship among them and with external correlates, namely, handwriting fluency and writing performance (measured via story length and quality). Because both scales measure related but independent constructs, we expected weak to moderate correlations among motives to write and self-efficacy dimensions. Furthermore, we anticipated handwriting for self-efficacy to be associated with handwriting skills, and motives to writing and story writing self-efficacy associated with story writing skills.

Finally, we conducted two sets of regression models to examine the predictive validity of the motives to write and self-efficacy scales. The first regression model tested the contribution of motivational incentives for engaging in writing to performance in writing. Based on SDT supporting the benefits of intrinsic and autonomous forms of extrinsic motivation (Deci & Ryan, 2000), we expected that intrinsic (curiosity, involvement, emotional regulation, and relief from boredom) and extrinsic autonomous motives (grades) would be more likely to contribute to better writing performance; whereas extrinsic controlled motives (competition and social recognition) could affect writing negatively. The previously reported findings from Rocha et al. (2019) already provided partial support to these predictions. Still, comparisons between that study and this one should be made carefully, because the different age of participants (Grade 3 vs. 6) encompasses different cognitive and motivational profiles.

The second regression model tested the contribution of self-efficacy to writing performance, above and beyond handwriting fluency. Given the key role of handwriting in children's writing (Limpo & Graham, 2019; Santangelo & Graham, 2016), we anticipated that handwriting fluency would be a strong predictor of writing performance. Moreover, we hypothesized that students' beliefs about their abilities to produce fast and neat handwriting, as well as to generate ideas according to the story grammar would be associated with longer and better texts. These predictions relied on research showing that writing performance is influenced not only by children's handwriting and genre-based ideation skills (e.g., Limpo & Alves, 2018), but also by their beliefs about being able to enact them effectively (Bandura, 1997; Pajares, 2003).

Study contributions

This is the first study presenting the development and validation process of three instruments to measure motivation-related aspects in Portuguese primary graders. We documented how the Portuguese WMQ (Graham et al., 2020) used in Rocha et al. (2019) was achieved and scrutinized its psychometric properties. Our research differs and extends findings from Rocha et al. (2019) in at least three ways. First, by examining WMQ construct validity with a single confirmatory factor analysis, Rocha et al. did not provide compelling evidence on the psychometric properties of the Portuguese WMQ. Here, we tested its construct validity with a cross-validation design and examined measurement invariance across two independent samples of about 200 students each (Kline, 2005). Moreover, we inspected convergent and discriminant validity of WMQ with self-efficacy measures and external correlates (handwriting and writing skills). We also detailed the translation and data-analytic strategies that resulted in the elimination of 7 items from the original version (Graham et al., 2020) and consequent attainment of the 21-item version used by Rocha and co-workers.

Second, Rocha et al. tested the association of motives to write with attitudes and self-efficacy for conventions, ideation, and self-regulation (Bruning et al., 2013), as well as the contribution of these variables to opinion essay writing. None of these variables were collected in the current study. We did focus on self-efficacy, but using different (and new) instruments, more appropriate to third graders' writing challenges (Graham et al., 1997; Limpo & Alves, 2013). As noted, Bruning's scale neglects central aspects in primary-grade writing, such as handwriting and text genre. Here, we created and validated two scales to measure self-efficacy for handwriting and story writing. Also, we focused on stories – a largely taught genre in primary grades – rather than on opinion essays – a more demanding genre introduced later in school (Buesco, Morais, Rocha, & Magalhães, 2015; Olive et al., 2009). Differences between genres are well established (Berman & Nir-Sagiv, 2007). Assuming that motives to write would relate similarly with opinion and story writing would be an overgeneralization.

Third, another key difference between this study and Rocha et al.'s study concerns participants' age. Rocha and co-workers focused on sixth graders (11–12 years)

whereas we focused on third graders (8–9). As noted, the cognitive and motivational profile of these age groups is different (Graham et al., 1997; Limpo & Alves, 2013; Pajares et al., 2007), and it would be reckless to assume the WMQ would behave similarly across grades (actually, the involvement dimension was removed from the model tested in Grade 6, which was not the case here, where the seven dimensions worked perfectly). This study's focus on Grade 3 is also relevant to the field of writing motivation, typically targeting higher grades (Bruning & Horn, 2000; Pajares et al., 2007), likely due to a concern with young children's ability to provide accurate self-perceptions. Therefore, showing that such instruments are valid to measure motivational aspects in 8–9-year-olds is of the utmost relevance to move the field forward.

Overall, this study contributes to writing research by providing new evidence on the psychometric properties of a set of motivation-related instruments, which will allow and foster the fine-grained analysis of motivation in writing in students as young as 8 years old. Such analysis is important not only to deepen our knowledge about the processes involved in early writing, but also to provide additional strategies to promote writing in primary grades. Motivational beliefs are considered as catalysts for learning in a given domain (Alexander, 1998). By assessing students' motivation in writing and implementing strategies to booster it, teachers can increase students' interest to participate in writing activities and make them more eager to learn how to write. An enhanced interest for writing by learners can be a strong allied in teaching them to develop and use key cognitive writing processes in a goal-directed, conscious, and sustained way.

Methods

Participants

This study included two samples of Portuguese-speaking students in Grade 3, from four clusters of schools located in the North of Portugal. Sample A included 202 students with an average age of 8.15 years ($SD = 0.49$, 104 girls), and Sample B included 193 students with an average age of 8.73 years ($SD = 0.40$, 98 girls).

Instructional setting

Writing is a central component of the Portuguese language school curriculum for primary school years (Buesco et al., 2015). In Grades 1–2, the teaching of writing is mainly aimed to develop students' handwriting and spelling skills. Handwriting instruction focuses on fine motor skills, letter drawing, and capitalization rules, trained through letter writing and text copying with "careful handwriting." Spelling instruction aims to development basic phonological and orthographic skills through different activities (e.g., phoneme deletion, syllable counting, dictation). In Grades 3–4, teaching of writing becomes focused on complex, text-level skills. Children contact with different genres (e.g., narratives, poetry, invitations) and learn

to analyze and replicate their schematic structure. Despite focusing on skills that research showed to be fundamental for writing acquisition (handwriting and spelling), the Portuguese language curriculum neglects motivational components.

Measures development

Writing motivation questionnaire (WMQ)

As described before, this questionnaire measures students' motivation to write (Graham et al., 2020). Its original version, which was used as the starting point in the present study, is composed of 28 items organized into seven dimensions (four items per dimension): curiosity, involvement, grades, competition, social recognition, emotional regulation, and relief from boredom. Respondents are asked to read a set of sentences illustrating possible reasons for them to write in free time and to indicate the extent to which each reason is true for them. All items are answered on a 5-point Likert-type scale ranging from 1 (*always true*) to 5 (*never true*). Lower scores indicated higher level of motivation. The Portuguese version of WMQ was developed using a 4-step procedure: (a) items translation to Portuguese by the first two authors, who are Portuguese native speakers fluent in English, (b) discussion of differences between the two versions to achieve a single version, (c) administration of the questionnaire to six third graders (not involved in the main study) followed by discussion with them, and (d) back-translation into English to assure semantic equivalence between Portuguese and English items. At each step, items phrasing was fine-tuned, until we achieved the final version that was used in the study.

Self-efficacy

Items to measure self-efficacy for handwriting and story writing were developed by the first and last authors. For handwriting, we created seven items targeting the two main dimensions of this skill, namely, fluency (e.g., "*My handwriting is fast*") and legibility (e.g., "*My handwriting is neat*"). Regarding story writing, we created six items related to the schematic structure of a story (e.g., "*I can write a story that tells several things that happened during the story*"). Items were initially created in English and then translated to Portuguese using the exact same 4-step procedure used for WMQ. Respondents are asked to say the extent to which each statement was true for them, using a 5-point Likert-type scale ranging from 1 (*always true*) to 5 (*never true*). Lower scores indicated stronger self-efficacy beliefs.

Because the items were created by the authors, we conducted an Exploratory Factor Analysis (EFA) on Sample A data to determine the factor structure of the scale and, eventually, to drop some items. We conducted principal component analysis with Varimax rotation, and the following stringent criteria were used to remove items based on each EFA results: (a) communalities below .45, (b) cross-loadings above .40, and (c) factors with less than three items (based on Brown, 2006; Tabachnick & Fidell, 2007). In all EFAs, the Kaiser–Meyer–Olkin index was above .84 and the Bartlett's Test of Sphericity was significant, $p < .001$. The first EFA showed

that the communality value of items 5 and 6 was low (respectively, .26 and .42), so these items were removed (all other values were above .53). The remaining 11 items were subject to a second EFA, that showed communalities above .58. The analysis revealed three factors explaining 65% of the variance. The following problems were identified: one factor with only two items (item 2 and item 12), and cross-loadings above .40 for item 2 and items 8. Therefore, these three items were dropped, and a final EFA for the remaining eight items was conducted. Results revealed two factors composed of four items with factor loadings above .70, which explained 64% of the total variance. After an examination of items content, the first factor was labeled "self-efficacy for handwriting fluency" and the second factor was labeled "self-efficacy for story writing". Because all items regarding handwriting legibility were dropped, this dimension was no longer examined. The final 8-item self-efficacy scale was used in the subsequent analyses.

Procedure

All students were asked to fill in the WMQ and self-efficacy scales in classroom groups of about 20–25 students. Whereas Sample A students fill in the full scales, Sample B students fill in the reduced version of the scales, changed in line with results from Sample A. For both scales, the experimenter indicated that there were no right or wrong answers and explained the overall procedure. Items were read aloud to students, who completed the instruments simultaneously and one item at a time. Additionally, students in Sample B were asked to complete two writing measures. First, they wrote a story to the prompt "*Tell a story about a child that broke his/her brother's favorite toy*", during 10 min. Then, they were asked to copy a sentence during 90 s as many times as possible, fast and accurately.

Writing measures

We extracted one measure of handwriting fluency from the copy task and two measures of composing skills from the story writing task (viz., length and quality).

Handwriting fluency

We counted the total number of legible words copied in the sentence-copying task during 90 s.

Story length

After transcribing all texts to Microsoft Word, we used the word-counting option to compute the total number of words written per story.

Story quality

Two pairs of research assistants, blind to study purposes, assessed the quality of children's stories with a holistic scale based on Cooper (1997). All judges were asked to evaluate each text with a single score ranging from 1 (*low quality*) to 7 (*high quality*). This score should consider to the same extent the following factors: creativity (i.e., originality and relevance of the ideas), coherence (i.e., clarity and organization of the text), syntax (i.e., syntactic correctness and diversity of the sentences), and vocabulary (i.e., diversity, interest, and proper word usage). To avoid transcription biases on quality assessments, all texts were typed and corrected for spelling errors (Berninger & Swanson, 1994). Several prior studies showed the validity of this procedure to assess text quality across different genres and grade levels (e.g., Harris, Graham, & Mason, 2006; Limpo & Alves, 2018). As the inter-judge agreement was high (ICC for average measures = .92), the final score was the average across judges.

Results

To examine the factorial structure of the WMQ and self-efficacy scales we conducted a set of Confirmatory Factor Analyses (CFA) using the R system for statistical computing (R Development Core Team, 2005). Since data collection occurred in classroom groups, analyses were conducted using the lavaan.survey package, which allows structural equation modeling analyses of clustered data (Oberski, 2014). The method of estimation was maximum-likelihood with robust standard errors, which takes into account the non-independence of the observations and any effects of non-normality. Latent variables were scaled by imposing unit of loading identification constraints. Specifically, the variance of all latent factors was constrained to equal 1.0, so that all factor loadings could be freely estimated. To evaluate model fit we used the Chi square statistic (χ^2), the confirmatory fit index (CFI), the root-mean-square error of approximation (RMSEA), and the standardized root mean residual (SRMR). CFI values > .95 and .90, RMSEA values < .06 and .10, and SRMR values < .06 and .09 are considered good and adequate fits, respectively (Hu & Bentler, 1999). Multiple-group structural equation modeling was then used to test for invariance of the models across the two samples. After testing a configural model with factor loadings free to vary across samples, we tested a model with factor loadings constrained to be equal across both samples. Following the guidelines of Chen (2007), evidence of non-invariance was claimed if the difference between the configural and constrained model was ≤ .010 in CFI, supplemented by a change of ≤ .015 in RMSEA or a change of ≤ .030 in SRMR. For the purpose of providing further empirical support to the validity of the WMQ and self-efficacy scales, after establishing measurement invariance, we examined the pattern of correlations between these scales and writing measures, followed by an analysis of their predictive value (only for Sample B).

Writing motivation questionnaire

After examining the descriptive statistics of each item (see Table 1), item 4 from the Grades subscale was removed as the values of skewness and kurtosis were 2.99 and 10.47, respectively, indicating a strong deviation from the normal distribution (Kline, 2005). We therefore tested the fit of a model with 27 items (Model 1; goodness-of-fit statistics are displayed in Table 2). Results revealed an unacceptable fit of the model to the data (CFI = .895, RMSEA = .051). An examination of parameter estimates revealed low loadings of item 1 (.29) and item 27 (.38). These two items also correlated poorly with the remaining items of the respective subscale ($rs < .20$). The inspection of Modification Indices (MI) additionally showed an error covariance between items 3 and 16 (MI = 29.02). This covariance can be explained by the similarity between the items content (item 3: *I write because it is important for me to know more than other students*; item 16: *I write because it is important to me to write better than other students*). Based on these results, item 1 from the Curiosity subscale, item 27 from the Emotional Regulation subscale, and item 3 from the Competition subscale were removed. We then tested a second model (Model 2 in Table 2) with 24 items, with all factors having three or four indicators. This model achieved an acceptable fit (CFI = .907, RMSEA = .053), and was then cross-validated on Sample B.

Model 2 failed to converge on Sample B due to the achievement of a non-positive defined matrix. An inspection of the covariance matrix revealed a problem in the Involvement sub-scale. Item 11, which showed the weakest inter-item correlations within the factor ($rs < .18$), was removed and a model with 23 items was tested (Model 3 in Table 2). Results showed an acceptable model fit (CFI = .921, RMSEA = .048). Still, an examination of inter-item correlations within 4-item factors suggested the additional removal of two items due to low correlations ($rs < .20$). Based on this, we removed item 9 from the Social Recognition subscale and item 19 from the Relief from Boredom subscale. We thus tested a model with 21 items with three items per factor (Model 4 in Table 2). This model showed a similar model fit to Model 3 (CFI = .921, RMSEA = .051), but it was preferred due to parsimony. Then, we tested its adjustment to Sample A data, and results showed a good fit (CFI = .927, RMSEA = .049).

Multiple-group structural equation modeling was used to test for invariance of the 21-item model across the two samples. The 7-factor configural model (Model 6 in Table 2) fitted the data well (CFI = .915, RMSEA = .055), as well as the constrained model (Model 7) with factor loadings fixed across groups (CFI = .906, RMSEA = .053). These results showed no decrement in model fit (ΔCFI = .009, ΔRMSEA = .013, ΔSRMR = .014), thus indicating metric invariance across both samples. Hereafter, we refer to this questionnaire as WMQ-21.

Factor loadings, item-total correlations, and reliability estimates of the WMQ-21 are presented in Table 3, separately by sample. Factor loadings were above .37 in Sample A and .47 in Sample B, and item-total correlations were above .28 in Sample A and .34 in Sample B. Based on the limitations of the Cronbach's alpha (Peters, 2014), we additionally computed the ordinal omega coefficient for

Table 1 Factor Loadings, Item-Total Correlations, and Reliability Estimates (ω) for Handwriting and Story Writing Self-Efficacy

Items	Sample A ($n=202$)				Sample B ($n=193$)			
	M	*SD*	*Sk*	*Ku*	*M*	*SD*	*Sk*	*Ku*
1. I write because I can learn about things that interest me.	1.63	1.03	1.79	2.69				
2. I write in order to get better grades at school.	1.47	0.93	2.14	4.01	1.30	0.70	2.74	7.79
3. I write because it is important for me to know more than other students.	2.60	1.64	0.47	−1.44				
4. I write because it helps me get better in school.	1.30	0.71	2.99	10.47	1.21	0.56	2.95	8.72
5. I write in order to avoid being bored.	3.11	1.54	−0.04	−1.45	2.60	1.46	0.51	−1.05
6. I write because I like to think about particular topics.	1.90	1.11	1.03	0.06	2.05	1.21	0.91	−0.26
7. I write because I like to create a character that I can identify with.	2.43	1.41	0.46	−1.17	2.08	1.25	0.95	−0.17
8. I write because it cheers me up when I am in a bad mood.	2.77	1.50	0.20	−1.36	2.54	1.25	0.35	−0.81
9. I write because my parents think it is important that I write well.	1.62	1.05	1.83	2.75	1.37	0.84	2.54	6.24
10. I write because it helps me pass the time.	2.50	1.36	0.53	−0.88	2.29	1.20	0.71	−0.31
11. I write because it allows me to imagine everything so well.	1.75	1.05	1.40	1.26	1.81	1.00	1.22	0.94
12. I write because it helps me perform well in school.	1.50	0.86	1.84	3.02	1.51	0.87	1.82	2.94
13. I write because it helps me calm down.	2.71	1.33	0.23	−1.01	2.57	1.25	0.41	−0.73
14. I write because I know that my friends write a lot.	2.71	1.68	0.32	−1.58	2.21	1.40	0.80	−0.71
15. I write in order to have something to do.	2.32	1.36	0.61	−0.90	2.36	1.26	0.63	−0.55
16. I write because it is important to me to write better than other students.	2.91	1.66	0.10	−1.63	2.44	1.52	0.63	−1.08
17. I write because it is important to me to be among the best students.	1.91	1.23	1.28	0.61	1.65	1.12	1.77	2.24
18. I write because it makes me feel better.	2.31	1.41	0.70	−0.86	2.26	1.13	0.51	−0.75
19. I write if there is nothing better to do.	2.48	1.36	0.39	−1.05	2.19	1.28	0.77	−0.53
20. I write because I can write about topics interesting to me.	2.20	1.27	0.79	−0.47	2.04	1.12	0.68	−0.63
21. I write because it helps me forget everything around me.	2.84	1.46	0.08	−1.35	2.45	1.30	0.51	−0.79
22. I write because it helps me perform better in school than my classmates.	2.41	1.47	0.62	−1.06	2.25	1.31	0.72	−0.66
23. I write because I can write about topics important to me.	2.04	1.19	0.91	−0.23	1.83	1.02	1.05	0.27

Table 1 (continued)

Items	Sample A ($n=202$)				Sample B ($n=193$)			
	M	*SD*	*Sk*	*Ku*	*M*	*SD*	*Sk*	*Ku*
24. I write because one gets praise for writing well.	2.05	1.32	1.02	−0.20	1.81	1.01	1.07	0.34
25. I write because I can create and experience adventures in my mind.	2.04	1.24	1.05	0.08	1.70	0.96	1.12	0.03
26. I write because I like it when other people think I am a good writer.	2.29	1.37	0.69	−0.77	2.11	1.23	0.84	−0.30
27. I write so that I can think about something that is bothering me.	3.17	1.49	−0.09	−1.39				
28. I write because it is important to how well I do at school.	1.98	1.23	0.98	−0.20	1.60	0.99	1.66	2.03

Higher scores indicate lower motivation

Table 2 Goodness-of-Fit Statistics for WMQ Models

Models	χ^2	*df*	CFI	RMSEA	RMSEA 90% CI	SRMR
Model 1 (27 items), single group analysis with Sample A	435.63	303	.895	.051	[.040; .062]	.067
Model 2 (24 items), single group analysis with Sample A	342.49	231	.907	.053	[.041; .064]	.062
Model 3 (23 items), single group analysis with Sample B	291.45	209	.921	.048	[.034; .061]	.061
Model 4 (21 items), single group analysis with Sample B	308.58	168	.921	.051	[.042; .060]	.051
Model 5 (21 items), single-group analysis with Sample A	237.19	168	.927	.049	[.034; .063]	.061
Model 6 (21 items), multiple-group analysis without constraints	517.63	336	.915	.055	[.045; .064]	.061
Model 7 (21 items), multiple-group analysis with factor loadings constrained	557.90	357	.906	.053	[.047; .065]	.075

χ^2 Chi square statistic, *df* degrees of freedom, *CFI* confirmatory fit index, *RMSEA* root-mean-square error of approximation, *CI* confidence interval, *SRMR* standardized root mean residual

Table 3 Factor Loadings, Item-Total Correlations, and Reliability Estimates (ω) for WMQ Subscales

	Sample A ($n=202$)		Sample B ($n=193$)	
	Factor loadings	Item-total correlations	Factor loadings	Item-total correlations
Competition	ω = .77		ω = .79	
Item 16	.65	.50	.67	.59
Item 17	.59	.46	.56	.37
Item 22	.77	.60	.79	.64
Curiosity	ω = .69		ω = .80	
Item 6	.40	.28	.55	.58
Item 20	.56	.46	.60	.58
Item 23	.80	.48	.77	.60
Emotional regulation	ω = .77		ω = .74	
Item 8	.52	.43	.58	.52
Item 13	.77	.59	.71	.56
Item 18	.77	.58	.73	.49
Grades	ω = .71		ω = .81	
Item 2	.37	.28	.47	.52
Item 12	.56	.43	.61	.58
Item 28	.68	.36	.69	.50
Involvement	ω = .71		ω = .64	
Item 7	.57	.54	.54	.29
Item 21	.77	.47	.67	.34
Item 25	.50	.41	.56	.38
Relief from boredom	ω = .70		ω = .73	
Item 5	.45	.37	.52	.45
Item 10	.71	.45	.71	.54
Item 15	.65	.49	.63	.45
Social recognition	ω = .70		ω = .72	
Item 14	.58	.39	.59	.40
Item 24	.56	.39	.58	.43
Item 26	.66	.49	.66	.53

each subscale of WMQ-21 (Dunn, Baguley, & Brunsden, 2014; Revelle & Zinbarg, 2009). Results showed that each subscale had acceptable levels of reliability and internal consistency both in Sample A ($.70 < \omega < .77$) and in Sample B ($.64 < \omega < .81$). Table 4 displays the pattern of correlations between the WMQ-21 subscales for each sample. For Sample A, correlations ranged between .24 for Competition with Emotional Regulation to .58 for Competition with Social Recognition. For Sample B, correlations ranged between .17 for Competition with both Emotional Regulation and Involvement to .55 for Curiosity with both Grades and Involvement (cf. Table 4).

Table 4 Descriptive Statistics and Correlations between WMQ-21 Subscales, Handwriting Fluency Self-efficacy, and Story Writing Self-Efficacy for Sample A ($n = 202$, above the diagonal), and Sample B ($n = 193$, below the diagonal)

	1	2	3	4	5	6	7	8	9	*M*	*SD*
1. Competition		.37***	.24***	.48***	.43***	.36***	.58***	.35***	.19**	2.41	1.15
2. Curiosity	.32***		.42***	.47***	.38***	.31***	.35***	.19**	.40***	2.05	0.89
3. Emotional Regulation	.17*	.46***		.31***	.49***	.56***	.41***	.19**	.17*	2.60	1.12
4. Grades	.34***	.55***	.34***		.39***	.31***	.47***	.21**	.32***	1.65	0.73
5. Involvement	.17*	.55***	.42***	.37***		.48***	.49***	.26***	.39***	2.44	1.06
6. Relief from Boredom	.23***	.39***	.37***	.31***	.38***		.45***	.25***	.23***	2.64	1.08
7. Social Recognition	.53***	.42***	.26***	.39***	.32***	.38***		.24***	.19*	2.35	1.10
8. Handwriting Fluency Self-Efficacy	.15*	.32***	.30***	.35***	.26***	.32***	.37***		.46***	2.68	1.09
9. Story Writing Self-Efficacy	.23**	.45***	.19**	.32***	.31***	.25***	.28***	.37***		2.25	0.92
M	2.11	1.98	2.46	1.47	2.08	2.42	2.04	2.39	2.28		
SD	1.05	0.92	0.96	0.68	0.84	1.01	0.93	0.92	0.90		

*$p < .05$. **$p < .01$. ***$p < .001$

Self-efficacy scales

Descriptive statistics for the items of the self-efficacy handwriting fluency and story writing scales are displayed in Table 5. An examination of the values of skewness and kurtosis of self-efficacy items revealed no severe deviations from the normal distribution. CFA was then conducted to test the fit of a model with eight items in Sample A and B (Model 1 and 2, respectively; goodness-of-fit statistics are displayed in Table 6). Results revealed a very good fit of the model to the data in both samples (CFI > .998, RMSEA < .015). We then conducted multiple-group structural equation modeling to test for invariance of this model across the two samples. The 2-factor configural model (Model 3) fitted the data extremely well (CFI = .992, RMSEA = .031). However, when factor loadings were constrained (Model 4 in Table 6) there was a decrement in fit (CFI = .976, RMSEA = .050; ΔCFI = .016, ΔRMSEA = .019, ΔSRMR = .038), which suggested lack of metric invariance across both samples. To locate the source of variance we implemented a stepwise procedure, by releasing one item at a time. We were able to identify item 3 from the Handwriting Self-Efficacy scale as the non-invariant item. After removing it, we re-ran the single- and multiple-group analyses. The single-group analyses for Sample A and B (Models 5 and 6, respectively; cf. Table 6) showed again a very good fit to the data (CFI > .996, RMSEA < .026).The multiple-group analyses also showed a very good fit of the configural model (CFI = .992, RMSEA = .031) as well as of the model with factor loadings constrained (CFI = .993, RMSEA = .033). Difference tests provided evidence of non-invariance across both sample (ΔCFI = .009, ΔRMSEA = .012, ΔSRMR = .024).

As displayed in Table 7, factor loadings and item-total correlations for the self-efficacy scales were, respectively, above .60 and .57 in Sample A, and above .67 and .52 in Sample B. We also found high levels of reliability and internal consistency both (.76 < ω < .82). Handwriting and story writing self-efficacy were found to be moderately correlated with each other (r = .46 and r = .37 for Sample A and B, respectively).

Relationship with external correlates

Table 8 reports the association of WMQ-21 and Self-Efficacy scales with the writing measures of handwriting fluency, story length, and story quality (with higher scores in motives to write and self-efficacy indicating lower motivation and self-efficacy, respectively). Regarding motives to write, results showed that longer and better stories were associated with stronger curiosity-related motives (|rs| = .16) and better stories were associated with stronger grade-related motives (|r| = .20). There were no other significant correlations, including between handwriting fluency and WMQ-21 subscales. Concerning self-efficacy, results showed that higher handwriting fluency was associated with stronger handwriting self-efficacy

Table 5 Descriptive Statistics for Handwriting and Story Writing Self-Efficacy Items

Items	Sample A ($n=202$)				Sample B ($n=193$)			
	M	*SD*	*Sk*	*Ku*	*M*	*SD*	*Sk*	*Ku*
1. I can write letters and words quickly.	2.49	1.28	0.45	−0.72	2.26	1.15	0.60	−0.46
2. My handwriting is fast.	2.69	1.37	0.26	−1.11	2.31	1.17	0.60	−0.48
3. I can write fast without making handwriting mistakes.	3.50	1.36	−0.36	−1.16	2.82	1.15	0.41	−0.52
4. I can write all letters quickly and correctly.	2.87	1.29	0.22	−0.96	2.60	1.17	0.26	−0.78
5. I can write a story that describes where and when the story takes place.	2.39	1.15	0.39	−0.75	2.23	1.18	0.58	−0.72
6. I can write a story that tells several things that happened during the story.	2.33	1.17	0.52	−0.68	2.51	1.15	0.37	−0.71
7. I can write a story that tells several things that happened to the main character.	2.17	1.12	0.68	−0.37	2.49	1.17	0.32	−0.85
8. I can write that includes everything I want to say.	2.11	1.16	0.70	−0.58	1.91	1.08	1.00	0.04

Higher scores indicate lower self-efficacy

Table 6 Goodness-of-Fit Statistics for Self-Efficacy Models

Models	χ^2	*df*	CFI	RMSEA	RMSEA 90% CI	SRMR
Model 1 (8 items), single group analysis with Sample A	19.70	19	.998	.015	[.000; .069]	.034
Model 2 (8 items), single group analysis with Sample B	19.69	19	.999	.014	[.000; .069]	.034
Model 3 (8 items), multiple-group analysis without constraints	44.39	38	.992	.031	[.000; .064]	.042
Model 4 (8 items), multiple-group analysis with factor loadings constrained	67.26	46	.976	.050	[.020; .074]	.080
Model 5 (7 items), single group analysis with Sample A	16.33	13	.996	.026	[.000; .059]	.031
Model 6 (7 items), single group analysis with Sample B	13.36	13	.999	.012	[.000; .072]	.030
Model 7 (7 items), multiple-group analysis without constraints	31.67	26	.993	.033	[.000; .068]	.040
Model 8 (7 items), multiple-group analysis with factor loadings constrained	47.25	33	.984	.045	[.000; .072]	.064

χ^2 Chi square statistic, *df* degrees of freedom, *CFI* confirmatory fit index, *RMSEA* root-mean-square error of approximation, *CI* confidence interval, *SRMR* standardized root mean residual

Table 7 Factor Loadings, Item-Total Correlations, and Reliability Estimates (ω) for Handwriting and Story Writing Self-Efficacy

	Sample A ($n = 202$)			Sample B ($n = 193$)	
	Factor loadings (EFA)	Factor loadings (CFA)	Item-total correlation	Factor loadings (CFA)	Item-total correlation
Handwriting self-efficacy	ω = .81			ω = .76	
Item 1	.80	.77	.62	.72	.64
Item 2	.79	.76	.63	.79	.55
Item 4	.71	.60	.57	.67	.39
Story writing self-efficacy	ω = .82			ω = .81	
Item 5	.80	.68	.61	.69	.60
Item 6	.77	.76	.65	.75	.65
Item 7	.77	.72	.63	.73	.63
Item 8	.75	.64	.61	.69	.52

EFA exploratory factor analyses, *CFA* confirmatory factor analyses

Table 8 Association of WMQ-21 Subscales, Handwriting Self-efficacy, and Story Self-Efficacy with Writing Measures (Sample B, N = 193)

	Handwriting fluency		Story length		Story quality	
	r	*p*	*r*	*p*	*r*	*p*
Competition	.06	.38	.04	.60	.06	.43
Curiosity	− .09	.21	− .16	.03	− .16	.03
Emotional Regulation	− .09	.22	− .12	.09	− .13	.07
Grades	− .11	.15	− .004	.95	− .20	.01
Involvement	.07	.31	− .05	.47	− .03	.69
Relief from Boredom	− .02	.83	.04	.63	− .07	.31
Social Recognition	− .03	.66	− .01	.86	− .04	.56
Handwriting Fluency Self-Efficacy	− .27	< .001	− .15	.04	− .33	< .001
Story Writing Self-Efficacy	− .12	.09	− .20	.01	− .23	< .001
M	19.48		87.07		3.51	
SD	4.47		25.59		1.00	

Higher scores in motives to write and self-efficacy indicate lower motivation and self-efficacy, respectively

beliefs ($|r| = .27$), and that longer and better stories were associated with stronger self-efficacy beliefs for both self-efficacy ($|r| = .15$ and $|r| = .20$, respectively) and story writing ($|r| = .33$ and $|r| = .23$, respectively).

Predictive value of motives to write and self-efficacy

To examine the predictive value of motives to write and self-efficacy scales on children's writing we conducted a set of two regression analyses (full results appear on Table 9). The first set of regressions showed that motives to write contributed to the quality, but not to the amount, of writing produced by third graders ($R^2 = .08$, $p = .04$ vs. $R^2 = .06$, $p = .15$). Together, the seven motivational incentives explained 8% of the variability in story quality, but only competition and grades made significant and unique contributions to it. Specifically, children with weaker competition-related motives ($|b| = .17$, $p = .05$) and stronger grades-related motives wrote better texts ($|b| = .19$, $p = .03$).

After controlling for handwriting fluency (Step 1), the second set of regressions examined the effects of self-efficacy on writing skills (Step 2). Step 1 of the analyses proved significant both for story length and quality (respectively, $R^2 = .25$, $p < .001$ and $R^2 = .19$, $p < .001$). The inclusion of self-efficacy variables significantly increased the amount of variance explained in story length and quality (respectively, $R^2_{change} = .02$, $p = .05$ and $R^2_{change} = .06$, $p = .001$). Story length was uniquely predicted by self-efficacy for story writing (($|b| = .17$, $p = .02$), whereas story quality was uniquely predicted by self-efficacy for handwriting fluency ($|b| = .18$, $p = .01$).

Table 9 Regression Models Predicting Story Length and Quality from Motives to Write (Regression 1) and Self-Efficacy (Regression 2)

Regression models and predictors	Story length				Story quality			
	B	*b*	*t*	*p*	*B*	*b*	*t*	*p*
Regression 1	$R^2 = .06$, $F(7, 182) = 1.55$, $p = .15$				$R^2 = .08$, $F(7, 182) = 2.19$, $p = .04$			
Competition	1.88	.08	0.89	.37	0.16	.17	1.96	.05
Curiosity	−6.71	−.24	−2.38	.02	−0.15	−.14	−1.36	.18
Emotional regulation	−3.06	−.12	−1.36	.18	−0.09	−.08	−0.99	.32
Grades	3.51	.09	1.05	.29	−0.28	−.19	−2.15	.03
Involvement	1.35	.04	0.49	.63	0.16	.14	1.52	.13
Relief from boredom	2.88	.12	1.37	.17	−0.01	−.01	−0.17	.86
Social recognition	−0.39	−.01	−0.16	.88	−0.02	−.02	−0.19	.85
Regression 2, Step 1	$R^2 = .25$, $F(1, 188) = 64.47$, $p < .001$				$R^2 = .19$, $F(1, 188) = 45.01$, $p < .001$			
Handwriting fluency	3.90	.51	8.03	< .001	0.10	.44	6.71	< .001
Regression 2, Step 2 (change statistics)	$R^2 = .02$, $F(2, 186) = 3.09$, $p = .05$				$R^2 = .06$, $F(2, 186) = 7.69$, $p = .001$			
Handwriting fluency	2.86	.50	7.73	< .001	0.09	.38	5.78	< .001
Handwriting fluency self-efficacy	1.08	.04	0.57	.57	−0.20	−.18	−2.62	.01
Story writing self-efficacy	−4.73	−.17	−2.47	.02	−0.14	−.12	−1.82	.07

Higher scores in motives to write and self-efficacy indicate lower motivation and self-efficacy, respectively

Discussion

This study presents the development process of the Portuguese version of the WMQ (Graham et al., 2020) and the creation of two self-efficacy scales to measure students' self-efficacy for handwriting and story writing. To explore the psychometric properties of these instruments, the scales were administered to two independent samples of third graders. After a systematic data-analytic procedure, we achieved the WMQ-21 and Self-Efficacy for Handwriting Fluency and Story Writing scales.

Motives to write

Replicating previous findings, results provided support for the conceptualization of motivation as a 7-factor multidimensional construct adopted in the WMQ (Camping et al., 2020; Graham et al., 2020; Rocha et al., 2019). Though the analyses conducted led us to drop one item for each scale – resulting in a 21-item instrument with three items per factor – we found the expected seven dimensions of motivation. Each dimension represents a different incentive to write, namely, to think and write about interesting topics (i.e., curiosity), to experience positive states of feeling or imaginative actions through writing (i.e., involvement), to improve one's grades in school (i.e., grades), to reach higher levels of school achievement than other students (i.e., competition), to get praise for good writing performance (i.e., social recognition), to deal with negative emotions (i.e., emotional regulation), and to fill in time when more preferred activities are unavailable (i.e., relief from boredom). This 7-factor model of writing motivation fitted the data from Sample A very well and was also successfully cross-validated in an independent sample (Sample B). Moreover, across both samples, interitem and item-total correlations, factor loadings, and scale reliability were all adequate. These findings provided preliminary evidence on the validity and reliability of the Portuguese WMQ-21 and extended those from De Smedt et al. (2016, 2017), showing that, even though motives to write can be conceptualized dichotomically in terms of autonomous vs. controlled motivation, a more fine-grained 7-dimension approach to motivational incentives in writing is also valid, including in Grade 3.

As expected, there were weak-to-moderate correlations among motives to writing and self-efficacy for handwriting and story writing. These findings are aligned with the claim of the WWC (Graham 2018a, b) that motives to writing and self-efficacy constitute independent beliefs within a common motivational component. Importantly, it seems that third graders can already differentiate between different motives to write as well as between these and perceptions of self-efficacy to enact specific activities (write fluently vs. create stories). Supporting WMQ-21 convergent/discriminant validity, we found that motives to write were not related with handwriting skill, but at least some of them were related with writing

ability, measured through the amount and quality of story writing. Specifically, the more students reported to write for having the opportunity to think and write about interesting and important topics (curiosity motive), the longer and better their texts; and the more students reported to write for having better grades and achievement in school (grades motive), the better their stories.

To further examine the correlational findings and test the predictive validity of the WMQ-21, we regressed story length and quality on motives to write. Two findings are worth mentioning. First, as a whole, the WMQ-21 was found to be a significant predictor of third graders' writing performance. However, motives to write only explained 8% of variability in story quality. This low percentage of explained variance is similar to that found in studies examining autonomous vs. controlled motives to write (De Smedt et al., 2016, 2017) and to other studies measuring writing motivation. For example, Limpo and Alves (2017) found that implicit theories of writing, achievement goals, and self-efficacy together only explained 10% of the variability in middle graders' writing performance. These findings are however not surprising. As claimed by the WWC model (Graham 2018a, b), motivation is only one writing dimension, alongside many others (e.g., idea generation, language formulation, reviewing, knowledge). The low percentage of explained variance shows that writing well is not only about being motivated. Instead, it is about being motivated and having the ability to use motivation and many other skills in the benefit of writing. Indeed, a model predicting writing performance from self-efficacy together with key writing skills (viz., handwriting, spelling, planning, and revising) was found to explain 76% and 82% of the variability in Grades 4–6 and 7–9 (Limpo & Alves, 2013). In any case, despite low, the independent contribution of motivation to writing performance is being supported by empirical evidence and theoretical claims (e.g., Bruning & Horn, 2000). Motivation should not be neglected by researchers or practitioners, as it can be vehicle to improve the many other writing skills.

Second, writing to surpass others was associated with poorer stories, whereas writing to improve own grades was related to better stories. Being both competition- and grade-related motives extrinsically regulated, these differential findings can be explained by the varying levels of self-determination involved (Deci & Ryan, 2000; Ryan & Deci, 2000). Reasons associated with surpassing others are more externally regulated and therefore a form of controlled motivation, whereas reasons related to grades' self-improvement represent a more internalized form of motivation (i.e., to achieve better grades is a self-relevant outcome valued by students themselves). These findings are particularly interesting considering our third-grade sample. They join to CFA results showing that children as young as 8 years old can discriminate between seven motives of varying levels of self-determination, extending past findings on motives to write with older writers (Camping et al., 2020; Graham et al., 2020; Rocha et al., 2019). Additionally, these findings indicate that some of those motives already play a role in influencing students' writing quality in the early stages of learning to write. The most salient cognitive processes for producing good writing may vary across development (e.g., handwriting and spelling are more critical in early stages, and reviewing in later phases; Limpo & Alves, 2013). Still, motivational aspects, seem to be a catalyic force for writing quality in very young writers as similarly found in older students. Indeed, the positive and

negative outcomes of endorsing, respectively, autonomous and controlled motives have already been found in later Grade levels (De Smedt et al., 2017). Using the WMQ without the involvement dimension, Rocha et al. (2019) also found the positive and negative effect of, respectively, intrinsic motives (curiosity) and extrinsic controlled motives (social recognition) on opinion essay quality. In addition to the different Grade levels targeted (Grade 3 vs. 6), other differences between this and Rocha et al.'s study are the outcome variable (story vs. opinion essay quality) and the inclusion of control variables (none here vs. attitudes and self-efficacy for conventions, ideation, and self-regulation). Thus, we cannot determine the source of the differential impact of motives to write, which can be associated with participants age and variables under analysis. Given the current reduced amount of studies examining the role of motives to write, more research seems needed to ascertain the exact nature of the link between reasons to write and ability to write, and how this may vary across writers' age.

Writing self-efficacy

As noted earlier, self-efficacy is one of the strongest motivation predictors of writing achievement (Pajares, 2003). However, notwithstanding the recently developed self-efficacy measures grounded on multidimensional conceptualizations of self-efficacy (Bruning et al., 2013; Limpo & Alves, 2017; Sanders-Reio et al., 2014), the field lacked valid and reliable instruments to measure self-efficacy for handwriting and for story writing, which are key writing dimensions in the initial years of learning to write. This study aimed to fill in this gap.

We developed a set of items tapping self-efficacy for handwriting fluency and story writing. After a set of exploratory and confirmatory analyses, we achieved a two-factor instrument with three (handwriting) and four items (story writing). This model fitted the data extremely well, both for Sample A and for Sample B. Measurement invariance across the two samples was also observed. Results concerning interitem and item-total correlations, factor loadings, and scale reliability were all adequate. The relationship between the two self-efficacy scales and external correlates was also in the expected direction. Concerning handwriting fluency, we found that performance in the copy task was associated with students' beliefs in their ability to write fast, but not to their confidence to write stories. Regarding story writing, we found that both the amount and quality of students' writing was related to their self-efficacy beliefs for handwriting fluency and for story writing.

To deepen these findings, we regressed story length and quality on self-efficacy for handwriting and story writing, after controlling for handwriting fluency. Consistently with past studies (Abbott & Berninger, 1993; Alves & Limpo, 2015; Graham et al., 1997; Limpo & Alves, 2013), we found that handwriting fluency was a key predictor of early writing, explaining 25% and 19% of the variability in story length and quality, respectively. These findings join to a substantial body of research showing the importance of handwriting fluency for writing acquisition (Limpo & Graham, 2019; Santangelo & Graham, 2016). Moreover, we showed that self-efficacy contributed to story writing above and beyond children's handwriting skill.

However, as already noted and discussed for motives to write, the independent contribution of self-efficacy beliefs was reduced (2% for story length, and 6% for story quality). These findings confirm that besides being capable of taking an action or achieving a goal, children ought to feel competent in doing so (Bandura, 1997; Pajares, 2003; Pajares et al., 2007).

Specifically, we found that the more children felt self-efficacious about having ideas for each story part, the longer their stories. It seems that if they perceive themselves as capable of generating many ideas to characterize characters, settings, and events, they are more likely to produce longer stories, presumably with more ideas. Research already showed that improving primary-grade students' abilities to generate ideas according to the story grammar increases the amount of their writing (Limpo & Alves, 2018). This is however the first study showing that the extent to which they believe to have those skills also plays a role in text length. Furthermore, we found that the more children felt self-efficacious about producing fast handwriting, the better their stories. This finding extends previous results on the well-established link between handwriting and writing performance (Limpo & Graham, 2019; Santangelo & Graham, 2016). Regardless of children's handwriting skill, their beliefs about it play a role in qualitative aspects of writing, and as shown here in children as young as 8 years old. From a practical viewpoint, it seems that primary teachers should aim to increase the skill of handwriting as well as students' self-perceptions about it. This is the first time that beginning writers' self-efficacy for handwriting is related to their writing skills. Until now, there were no valid instruments to measure self-efficacy for handwriting. Moreover, the study of self-efficacy in such young populations has been controversial. A lack of relationship is sometimes found (e.g., Limpo & Alves, 2013) and interpreted as a calibration problem, that is, young children may not be able to report their self-efficacy beliefs accurately, alike struggling writers (Klassen, 2002). This study challenges that interpretation and hints at the possibility that the lack of relationship reported by past studies can be related to the use of self-efficacy instruments targeting more abstract skills (e.g., self-efficacy for self-regulation) and consequently more difficult for young writers to gauge them with accuracy.

Taken together, these findings also provide preliminary evidence on the validity, reliability, and usefulness of the self-efficacy scales here developed. Given the lack of similar instruments to measure the specific, albeit fundamental, skills of writing fast and in compliance with genres' schematic structure, this a major contribution of the current study. These short scales can be easily added to available instruments adopting a multidimensional perspective of self-efficacy, such as the one developed by Bruning et al. (2013). The self-efficacy scales proposed in the current research can be of particular utility in intervention research. In regard to handwriting fluency, there is a growing body of evidence showing the effectiveness of systematic handwriting training to promote handwriting fluency (Santangelo & Graham, 2016). The handwriting scale here provided will be a valuable tool to complement these findings, by enabling the examination of handwriting interventions' effects on self-efficacy.

It is worth remembering that our original handwriting self-efficacy scale included a set of items tapping handwriting legibility, which were dropped during

the EFA-based procedure. Still, though fluency seems to impose more constraints on writing performance, legibility is another component of handwriting that should not be overlooked (Santangelo & Graham, 2016). Reduced legibility may negatively affect readers by complicating their task of deciphering what is written and fully understanding the message. Readers may either be forced to re-read passages and stop frequently to decode the message or simply decide to disregard the least legible portions of the text. Furthermore, grounded on the idea that poor penmanship is typically assumed to result in poor writing (Graham, Harris, & Hebert, 2011), readers may also develop biased perceptions about the writing ability of the writer. Considering the importance of handwriting legibility to convey a message through writing, it would be important to implement further efforts to develop a measure to assess students' self-perceptions about their ability to correctly draw letters and produce neat handwriting.

Limitations and indications for future research

At least three limitations in the present study need to be considered, along with possible ways to provide further evidence on the validity of the instruments developed and explore the role of motivation in writing. First, WMQ and self-efficacy scales were only administered once, precluding us to test temporal stability. Future research should administer both instruments over different time intervals not only to provide further information on their psychometric properties, but also to answer questions about the development of motivation and self-efficacy throughout schooling. Considering that our study only focused on Portuguese children in Grade 3, additional tests across varying age or developmental groups, different levels of writing competence, and different socioeconomic statuses would be worthwhile as well.

Second, the relationship between motivation constructs and writing ability was examined at a single time point with concurrent data collections. Thus, no developmental conclusions or causal inferences can be made based on our findings. It would be particularly insightful to conduct longitudinal studies aimed at examining development of motives to write and self-efficacy throughout schooling as well as how their development may influence the process of learning to write. Such longitudinal results would also allow for a deeper understanding of the motivational mechanisms underlying writing development and provide useful hints to design interventions aimed to promote motivation in writing.

Third, our examination of the relationship between motives to write and other motivation variables was limited to self-efficacy. Future research should aim to examine how WMQ is related to other motivation constructs. It would be particularly relevant to examine the discriminant validity between motives to write and achievement goals, which refer to students' purposes or desired outcomes for engaging in academic activities and it is crucial to motivation (Pintrich, 2000). There is general agreement on a trichotomous model of achievement goals, including three major types of goal: mastery goals which reflect an orientation towards learning, understanding, and mastering tasks for increasing competence; performance-approach goals which represent a concern with surpassing others for

demonstrating competence; and performance-avoidance goals which are associated with a focus on concealing failure for avoiding displaying lack of competence. Previous research already showed the benefits of holding mastery goals to produce good writing (Limpo & Alves, 2017; Yilmaz Soylu et al., 2017). Further research is needed to shed light on motives to write and achievement goals are related to each other and may interact to influence writer's performance.

Educational implications

Though the validation of the scales presented in this research is a work in progress, available evidence supported the validity and reliability of the instruments to measure students' motives and self-efficacy in the writing domain. This study joins to an increasing body of research arguing that, given the key role of motivation-related processes in writing, these aspects cannot be overlooked in the teaching of this skill. Such claims have been receiving more and more theoretical and empirical support (Boscolo & Hidi, 2007; Bruning & Horn, 2000; Graham, 2018a, 2018b). As teachers manage the learning context, decide on writing assignments, and react to students' behaviors and feelings, teachers are in a privileged position to sow the seeds of adaptive motivational beliefs and nurture them right through the learning process. There is now considerable evidence showing that teachers can enhance students' motivation by proposing challenging and meaningful assignments, providing frequent opportunities for success, emphasizing the process of learning, stressing self-improvement over social comparisons, giving regular progress feedback, praising for effort rather than for ability, and promoting students' sense of autonomy (Ames, 1992; Mueller & Dweck, 1998; Urdan & Schoenfelder, 2006).

Specifically, in the writing domain, these instructional features were already acknowledged as catalysts for success within the Self-Regulated Strategy Development model (SRSD; Harris & Graham, 2009), which is one of the most effective instructional approach for teaching writing (Graham et al., 2012; Graham & Perin, 2007). A core feature of this model is the joint focus on students' cognitive skill and motivational will as key ingredients for effective teaching and learning of writing. Recently, in alignment with the WWC model described in the introduction (Graham, 2018a, 2018b), Graham and Harris (2018) specified a set of design principles, focuses of instruction, and instructional activities for, among other goals, enhancing teachers and students' capabilities and motivations for teaching and learning writing via SRSD. A set of different instructional activities are presented to advance students' competence, knowledge, and motivations to write better texts. However, despite current efforts in including motivation as a core target of writing instruction, there is a dearth of intervention studies testing the added value of introducing instructional activities aimed at fostering students' motivation in writing. This article is expected to contribute to fill in that gap by providing researchers and educators with valid and reliable tools to measure motivation in writing and take steps to strengthen it in the classroom.

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