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Implementing an online peer tutoring intervention to promote reading skills of elementary students: Effects on fluency and accuracy

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The global COVID-19 pandemic disrupted face-to-face teaching, having a significant impact on the teaching-learning process. As a result, many students spent less time reading (and learning to read) than they did during face-to-face instruction, requiring the use of alternative approaches of instruction. A combined online and peer tutoring intervention was designed to improve reading skills such as fluency and accuracy. Following a quasi-experimental design, this study sought to evaluated the impact of implementing an online peer tutoring intervention on the development of reading fluency and accuracy in a sample of 91 2nd and 4th graders (49.6% female). Children were aged 6–10 years old (M = 7.81, SD = 1.10) and were enrolled in five classrooms (A, B, C, D, and E) from three schools in the Portuguese district of Porto, between January and May 2021. A set of 10 texts were chosen from official textbooks to assess reading fluency and accuracy. Classes were evaluated in three moments: initial (pre-intervention), intermediate (after 10 sessions) and final (post-test, after other 10 sessions). In order to examine the effects of the intervention, there was a 8-week lag between the start of the intervention in classes A, B, and C (experimental group) and classes D and E (control group). Moreover, classes D and E started intervention with a gap of 5 weeks between them. Students in the experimental group registered significant higher improvements in reading accuracy and fluency than in the control group. Interaction effects revealed that students with an initial lower performance (i.e., at the frustration level) showed higher increases in reading accuracy. Furthermore, 2nd graders showed higher increases throughout the intervention while the 4th graders stablished their progress after the first 10 sessions of intervention. Despite the

study's limitations, the findings support the positive impact that online peer tutoring can have on promoting students' reading skills, adding to the ongoing discussion—which has gained a special emphasis with the COVID-19 pandemic—about the development of effective strategies to promote reading abilities in the first years of school.

KEYWORDS

reading, peer tutoring, online learning, intervention, fluency, accuracy

Introduction

Reading is an essential human skill (Ritchie and Bates, 2013) and a fundamental goal for elementary students. The ability to read is a critical for opening knowledge spaces, in such a way that public authorities around the world have focused on promoting reading practices and skills starting in early childhood education [see the Program for International Student Assessment (PISA), and the Progress in International Reading Literacy Study (PIRLS); Mullis and Martin, 2015; Organisation for Economic Co-operation and Development, OECD, 2019; Rosa et al., 2020].

However, the worldwide COVID-19 pandemic challenged educational practices, having a significant impact on the teaching-learning process (Reimer et al., 2021). Face-to-face instruction was abruptly halted, and many schools were forced to provide emergency remote learning (Flores et al., 2022). In Portugal, this scenario occurred with two successive lockdowns, the first between March-September 2020, and the second between January and March 2021. Teachers and parents struggled to balance formal and informal education during these periods (Daniel, 2020; Hodges et al., 2020; Reich et al., 2020), and family houses were converted into schooling environments. The disruptions prompted by the COVID-19 pandemic in educational settings, specifically with the adoption of distance/online learning, changes in teaching practices, and increased stress (Meinck et al., 2022), intensified challenges associated with the process of learning to read. Empirical data suggest that lockdowns had a significant impact on students' reading skills in their early years (Wyse et al., 2020). One reason for this is that many students spent less time engaged in formal learning during school shutdowns than they did during face-to-face instruction, which means they spent less time reading—and learning to read (Huber and Helm, 2020; König et al., 2020). In the Portuguese case, such challenges may have been especially difficult for primary school children, particularly those in the early grades, because children learn to read in the first grade, consolidate their reading skills in the following one and are expected to have achieved reading competency by the 4th grade. Thus, being actively engaged with reading (in and outside school) is critical. To meet these challenges teachers had to develop alternative modes of teaching instruction to encourage students reading abilities. Lin et al. (2017) found that using digital tools (such as app's, software programs, smartphones, and tablets) can boost learning motivation by keeping students' attention and focus on their learning process even when faced with difficult situations. Students' motivation and focus are especially important when we consider that, unlike oral language, learning to read is a process that does not occur naturally as a result of exposure to written material or information or words (Sim-Sim, 2009). It assumes the adoption of strategies through explicit, consistent, and systematized teaching practices, demanding the use of specific methodologies and allowing adequate time for learning and training. The first years of school are deemed pivotal in the process of learning to read, and they are frequently marked by families and teacher's high expectations regarding children's success (Stern, 2006; Cruz et al., 2022). It is also during the first years of formal education that learning difficulties associated with reading emerge, highlighting the relevance of early assessment and intervention so that students have a better chance of overcoming them. Reading difficulties can have a negative impact on children's learning and development trajectories, such that children who struggle with reading in primary school are more likely to struggle through high school (Roberts et al., 2022), putting them at higher risk of dropping out (Hernandez, 2011). A growing body of research indicates that early interventions are effective in preventing these negative outcomes, emphasizing the importance of developing early intervention programs that systematically promote and assess reading abilities in the classroom (Lyytinen and Erskine, 2016; Hall and Burns, 2018; Raspin et al., 2019). Primary school grades (such as the 2nd and 4th grades) provide a unique developmental window in which children are more sensitive to the effects of reading interventions, particularly when delivered earlier (Al Otaiba et al., 2009; Lovett et al., 2017; Wanzek et al., 2018).

In parallel, research has also highlighted the role played by individual differences in reading difficulties. One of the most debated dimensions has been children's gender. Literature has consistently described girls as having better reading ability than boys (McKenna et al., 1995; Logan and Johnston, 2009; Below and Sorrell, 2010; Sochacka, 2014). This gender difference

has been found in different countries and cultures (van Hek et al., 2019). In PISA and PIRLS reports on reading in students (Rosa et al., 2020), girls are consistently reported as having a significant advantage over boys in terms of reading performance across all OECD countries (van Hek et al., 2019). However, when considering reading fluency and accuracy in primary school years the results appear to be inconsistent. While Abd Ghani et al. (2020) reported no statistically significant gender differences when analyzing reading fluency in 2nd grade children, Sochacka (2014) and Solheim et al. (2021) found significant gender differences in first graders' reading fluency and accuracy, favoring girls. This ambiguity of findings supports the need for additional research into potential gender differences in reading fluency and accuracy, particularly in primary education level.

Reading entails both decoding written words and comprehending their meaning (Suggate, 2016). Such a complex process highlights the task's difficulty as well as the importance of encouraging the automation of the deciphering process in order to free the child to comprehend what he or she is reading (Schwanenflugel et al., 2006). With automatic word and sentence recognition, more cognitive resources are available to engage in higher-level thinking processes, which are frequently critical for reading comprehension (Zimmerman et al., 2019). Thus, reading comprehension is dependent on the ability to combine fluency of reading (the number of words read per minute in a text) with accuracy (the absence of errors) and prosody (cadence, intonation, and rhythm) (Zimmerman et al., 2019). Given the focus of the current study, we will now explore further the fluency and accuracy reading dimensions or skills.

Fluency is linked with reading comprehension and can be defined as the ability to read a text quickly, accurately and expressively (Gersten et al., 2020). Fluent readers can identify words accurately and automatically, allowing them to focus their attention on reading comprehension and in the connections between the ideas presented in a text and their prior knowledge (National Institute of Child Health and Human Development, 2000). Less fluent readers, on the other hand, must focus their attention on word recognition, resulting in less attention devoted to reading comprehension. As a result, while the ability to read words accurately is required in the process of learning to read, the fluency with which this process is carried out is critical for children's reading comprehension (Gersten et al., 2020). Rasinski et al. (2011) suggest that fluent readers tend to have more positive attitudes toward reading, as well as a more positive perception of themselves as readers. As a result, fluent readers are more likely to read more, learn more, and further improve their reading skills. In addition, fluent readers can serve as good reading models and assist other learners in the process of learning to read. Fluency assessment is also an important indicator of general reading competence in the school context, and it is directly related to reading comprehension (Zimmerman et al., 2019; Sucena et al., 2022). The recognition of a list of related words and a text reading are two strategies commonly used to assess reading fluency (Meeks et al., 2014; Martens et al., 2019). Following Martins and Capellini (2021), fluency performance can be analyzed calculating the reading percentile, with results above the 55th percentile considered average. Strategies such as reading aloud, repeated reading of a small excerpt of a text, and peer-tutoring have all been shown to be effective in improving reading fluency (National Institute of Child Health and Human Development, 2000; Oddo et al., 2010). In fact, research suggests that to promote the development of reading fluency, teachers should provide students with numerous opportunities for reading practice, preferably with guidance from more fluent readers (e.g., teachers, peers, or parents) who comment on the readings and help them to become aware of their mistakes and correct them (Beach and Traga Philippakos, 2021; Zimmermann et al., 2021). Hence, systematic and deliberate practice of activities that promote mastery of the alphabetic principle, as well as holistic activities that allow students to anticipate and comprehend meaningful messages, are good practices for developing reading fluency (Sim-Sim, 2009; Carvalho, 2011). In terms of written material, reading a text is thought to be a more accurate predictor of fluency (Wanzek et al., 2016). There have been few studies that analyze reading fluency in European Portuguese primary school children (Fernandes et al., 2017; Cruz et al., 2022). Key findings highlight the influence of word recognition skills in the development of reading fluency, as well as the intrinsic relationship between the latter and vocabulary acquisition, particularly in the early grades (Fernandes et al., 2017). At the same time, Serrano et al. (2011) emphasize the 2nd grade as critical for establishing a more abstract representation of the spelling system in Portuguese children, underscoring the potential impact that early reading fluency interventions may have on subsequent reading competency development.

The reader's precision in orally representing words from their orthographic forms, on the other hand, is referred to as accuracy (National Institute of Child Health and Human Development, 2000; Zimmerman et al., 2019). However, reading fluency cannot be achieved solely through reading accuracy. The speed and ease of word recognition (i.e., automaticity) emerge later as the learner's instant recognition repertoire becomes embedded. Reading accuracy then refers to the reader's ability to "produce an accurate oral representation of words in text from their orthographic forms" (Zimmerman et al., 2019, p. 73), i.e., to correctly recognize or decode words. According to Hudson et al. (2005), a strong understanding of the alphabetic principle, the dexterity to combine different sounds, and knowledge of a large number of words are at the heart of reading accuracy. Low word recognition accuracy has a negative impact on reading fluency, potentially leading to text misinterpretation. Thus, accurate word decoding is required for fluency (Lopes et al., 2014; Borges and Viana, 2020). The percentage of correct words read by the reader is deemed as a good indicator of reading

accuracy (Carvalho, 2011; Rasinski et al., 2011). In this regard, Rasinski (2004) identified three levels of accuracy performance: independence level (97–100% of accuracy; i.e., the student can read the assessment text autonomously, without assistance); instruction level (90–96% of accuracy; i.e., the student can read the text, but still requires some assistance, as some errors are not noticed); and the frustration level (below 90% of accuracy; i.e., even with assistance, the student finds reading the text or another material of similar difficulty very challenging, and cannot track most decoding errors, often needing several attempts before decoding certain words). Contrary to what is observed in reading fluency studies, very few research has focused on gender differences in reading accuracy, particularly in the early school years. Research on the development of reading accuracy in European Portuguese readers is also scant (Seymour et al., 2003; Cadime et al., 2021; Cruz et al., 2022). Findings suggest that Portuguese first grade readers have lower reading accuracy levels than other European readers, with levels significantly lower than 90% (Seymour et al., 2003). Thus, research exploring changes in reading accuracy across subsequent grades level is especially important for determining whether reading accuracy is still developing or if a real difficulty is already emerging so early on.

Recent meta-analyses show that a plethora of variables influence the efficacy of the strategies and interventions used for reading fluency and accuracy (Gersten et al., 2020; Kim et al., 2020; Zimmermann et al., 2021). These include the duration of the intervention, the number of sessions, the session length, and the size of the group. Scripted, short interventions (i.e., between 10 and 100 sessions), that take 10–60 min and happen 3 or 5 times a week in small groups of students (i.e., two to five students) with similar academic needs, have consistently emerged as effective in promoting reading competency (Wanzek et al., 2016; Gersten et al., 2020; Kim et al., 2020).

Among these interventions, peer tutoring has proven to be effective in improving students' reading fluency and accuracy (Blanch et al., 2012; Topping et al., 2016; Alzahrani and Leko, 2018; Duran et al., 2019). Peer tutoring is a system whereby learners help each other and learn by teaching. It is a process in which more advanced learners, not necessarily teachers, helpless advanced learners in an interactive, systematic and meaningful way, often used on a one-to-one basis, that is, between peers (Topping et al., 2016). In comparison to formal education, peer tutoring allows more opportunities for practice while also providing guidance, personalized feedback, and assistance in resolving misinterpretations (Casanova, 2012; Sytsma et al., 2019; Lee and Szczerbinski, 2021). It can also encourage more reflection on the learning process, leading to high levels of self-regulation and agency over one's learning process. It can promote the development of study skills, foster learning autonomy, and nurture the "learning to learn" capacity in the cognitive development scope. Furthermore, it can promote the ability to deal with uncertainty in a less anxious manner, significantly contributing to higher levels of emotional self-regulation and, ultimately, to the overall learning process (Forbes-Riley et al., 2008).

Casanova (2012) implemented a peer tutoring intervention by pairing children of similar ages and educational levels. Even though the participants are in an asymmetrical relationship, they share similar characteristics and a common goal. The peer tutoring process has been shown to benefit both the tutor and the tutored because it can improve the former's self-esteem, self-confidence, perspective-taking, and metacognitive abilities, to name a few (Casanova, 2012). Moreover, peer tutoring can have both a preventive and a remedial effect, anticipating developmental obstacles (and encouraging a proactive attitude toward them) while also assisting in their resolution. Jones et al. (2017) studied the effects of a peer-tutoring reading intervention in early primary grades and found positive and significant effects on children's reading fluency. Moreover, Fuchs et al. (2000) obtained positive and significant effects on first grade children's reading accuracy involved in peer-tutoring reading intervention.

To ensure the quality and success of peer tutoring, however, it is critical to clearly define the procedures, schedules, and spaces to be used during tutoring, as well as to clarify the peer tutoring process to the peer-tutor and the peer-tutored, teaching them general mentoring skills. It is also critical to monitor the quality of the peer relationship, provide peer role rotation, and ensure continuous process evaluation (Sanches Ferreira and Santos, 1994; Topping et al., 2016).

With the challenges imposed by the COVID-19 pandemic (Reimer et al., 2021), a new variable has been introduced into the traditional reading skills interventions: online learning methods and tools, which have risen to the forefront of educational systems worldwide. However, research on how the pandemic may have influenced children's reading performance is still limited, both in typical and struggling readers, with only a few studies examining the effects of online education and interventions (Alves and Romig, 2021; Beach and Traga Philippakos, 2021), implying that more research is needed to investigate the efficacy of online reading interventions. Furthermore, given the importance of reading in shaping students' learning and developmental paths, providing teachers with strategies that promote reading within favorable learning educational contexts should be one of education's primary concerns. In this regard, the purpose of this study is to assess the impact of implementing an online peer tutoring intervention on the development of fluency and accuracy reading skills in primary school students. Given that Portuguese children begin learning to read in first grade, consolidate their abilities in 2nd and complete their learning to read cycle in 4th grade, we chose to include only 2nd and 4th graders (with and without the need for universal and selective measures to support learning and

inclusion)[1] because it would allow us to better understand and differentiate gains in the reading development process.

The study aims to answer the following three research questions: (1) What is the effect of the online peer-tutoring intervention on students' reading fluency and accuracy? (2) To what extent do students' reading fluency and accuracy change during the intervention period? (3) To what extent can the intervention effects be attributed to grade level (G2, G4), gender and pre-intervention reading performance level (i.e., frustration level or not)?

Materials and methods

Participants

Ninety-one students (49.6% female), aged 6–10 years old (M = 7.81, SD = 1.10), enrolled in five classes (A, B, C, D, and E) from three schools of a school cluster in the district of Porto participated in this study. Teachers from 2nd and 4th grades were invited to participate in the study. Out of 10 possible classes, five teachers agreed to participate. Students from classes A and D were in the 2nd grade and students from classes C and E were in the 4th grade. Class B included students from the 2nd and the 4th grades. Overall, 43 students were in the 2nd grade and 48 in the 4th grade (**Table 1**).

Teachers ranged in age from 39 to 58 years old (M = 48.40, SD = 6.18), had between 17 and 36 years of service experience (M = 24.80, SD = 4.40) and they were all working at the school cluster that took part in the study.

Study design

The effects of the online peer tutoring intervention were evaluated through a quasi-experimental design, with a lagged introduction of the intervention across the different five participating classrooms. **Figure 1** displays the study design detailing the different moments/phases of the study—the moment in which each class was evaluated and involved in the intervention.

Intervention

The online peer tutoring intervention took place between January and May 2021. This period coincided with the third wave of the COVID-19 pandemic and, consequently, with a period of lockdown, in which all students had to stay at home. Peer tutoring sessions occurred in dyads or triads, most at the beginning of the day, in parallel rooms created by teachers in the Zoom platform. Teachers were in proximity with all participating dyads/triads providing instructions to the class before each session and monitoring each session conclusion with them.

First, in whole-group, the teacher in each classroom demonstrated what was expected from the peer tutoring sessions. He/she gave each student a text and a score sheet and explained how to use the stopwatch. Then she read the text aloud during 3 min and asked students to note the errors he/she made and the number of words read using the Goodman's Taxonomy of Errors (Goodman, 1973, 1982; **Table 2**). After discussing with students the procedure and clarifying all doubts, the students went two parallel sessions according to the formed pairs/triads. The tutee had 3 min to read the text and the tutor registered the reading errors on the score sheet and the location where the student was reading at the end of the given time. After the tutee finished reading without interruptions, the tutor assisted the tutee in correcting the reading errors noted on the score sheet. Then, the roles were reversed. Finally, the errors were counted, and if time allowed, the students could repeat the reading, without taking notes. Reading moments in peer tutoring lasted 10 minutes and occurred every school day for twenty sessions, preferably at the start of the teaching activities. For children reading in triads, the teacher explained the procedure and gave them three more minutes to complete the reading.

As detailed in **Figure 1**, all classes were evaluated in three moments—initial (pre-intervention), intermediate (after 10 peer tutoring sessions) and final (after 10 peer tutoring sessions). Classes A (2nd), B (2nd and 4th) and C (4th) were intervened between January and March and classes D (2nd) and E (4th) between March and May. Therefore, there was a 8-week lag between the start of the intervention in classes A, B, and C and classes D and E. Furthermore, classes D and E also started the intervention with a period lag of 6 weeks. Prior to the intervention, these two classes received additional assessments, which served as a control for the effects of the intervention in classes A, B, and C. All evaluations were audio-recorded. Additionally, because children's performance before the intervention was compared to their performance during and after the intervention, each participant served as their own control.

Considering the specificities of the sample, ethical concerns were considered before collecting data. In harmony with the principles of The Declaration of Helsinki, we gathered, *a priori*, written informed consents from the school principal, teachers, and children's legal guardians, as well as an oral agreement from students.

1 In Portugal, support learning and inclusion measures are organized in three intervention levels: universal support (comprising practices or services made available for the purpose of promoting learning and success for all students, and thus not depending on the identification of special intervention needs); selective support (including practices or services aimed at students at higher risk of school failure or that show a need for complementary support), and additional support (refers to more frequent and intensive interventions, designed according the needs and potential of each student, implemented individually or in small groups, and usually longer).

TABLE 1 Sample characterization.

Grade	2nd grade		2nd and 4th grade	4th grade	
Number of students per class	A	B	C	D	E
	21	13	20	19	18
Gender N (%)					
Male	8 (44.4%)	6 (46.2%)	10 (50%)	11 (57.9%)	14 (77.8%)
Female	10 (55.6%)	7 (53.8%)	10 (50%)	8 (42.1%)	4 (22.2%)
Age M (SD)	6.86 (0.36)	6.77 (0.44)	7.90 (1.33)	8.68 (0.48)	8.67 (0.49)
Support measures N (%)					
No support	21 (100%)	13 (100%)	10 (50%)	19 (100%)	18 (100%)
Universal support	0 (0%)	0 (0%)	8 (40%)	0 (0%)	0 (0%)
Selective support	0 (0%)	0 (0%)	2 (10%)	0 (0%)	0 (0%)

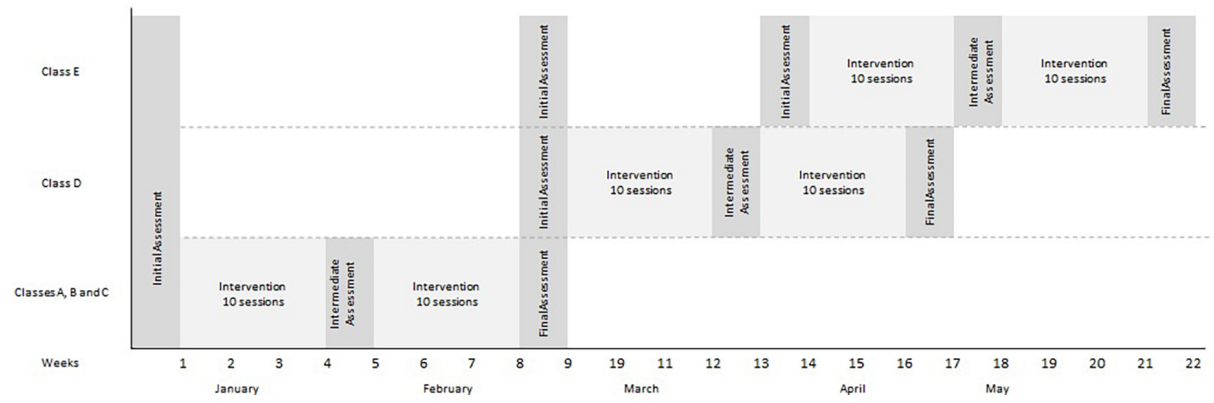

FIGURE 1
Study design.

Materials and procedures

Instructional and progress monitoring of students' reading was conducted through a curriculum-based assessment procedure that consists of a set of 10 texts drawn from 2nd and 4th grade official textbooks and chosen for their difficulty, specifically in terms of text complexity, reading cases, and the number of difficult words per grade. The texts included in this study were not part of the official textbooks used by the school cluster that took part in this study, so none of the students were familiar with or had the opportunity to practice reading these texts previously. The texts are listed in Table 3 (five texts were used in the group of children in the 2nd grade and five texts were used in the group of children in the 4th grade). Students were provided with a score sheet to record the peer's reading errors.

Based on the accuracy and fluency results of the initial assessment moment conducted by teachers in the classroom, but in a 1:1 relation (see Table 4), two pairing lists of the participating students in the class were prepared. The dyads/triads were formed by pairing the student with the best performance with the student with the worst performance, with the first serving as a tutor to the latter. Changes in the dyads/triads were allowed to teachers, depending on the individual characteristics of each student. In case of an odd number class, the teacher formed one triad, that is there were five triads with fifteen students. The teacher of each class then informed the students about the dyads/triads and which students would take on the peer-tutored role first and explained in what will consist the peer tutoring. The students who formed the dyads/triads were the same throughout the intervention.

TABLE 2 Goodman's reading errors taxonomy.

Type of error	Description
Insertion	Words or letters that are added to the text.
Omission	Words or letters that are omitted.
Substitution	Words or letters that are replaced by other words or letters.
Inversion	Words or letters whose order is changed.
Regression	Repetition of words or parts of the text.

Measurement

To assess reading development and examine intervention effects, reading accuracy and fluency were recorded at three different moments: initial (pre-test), intermediate (after 10 tutoring sessions) and final (post-test, after other 10 sessions). Students were individually assessed by the regular teacher, using a text appropriate to their grade and different from the texts that had previously been used in the classroom. To measure the reading accuracy and fluency, each student was given a time limit of 3 min (controlled by a stopwatch), to read aloud. The number of errors and reading time were noted on the score sheet. The location where the child was reading was marked on the text after 3 min. If the text reading was finished sooner than the time limit, the stopwatch was stopped, and the time spent reading was recorded. Reading was not interrupted, except when the student was experiencing difficulties in reading a word. In this case, the word was read to him/her after 5 s. To avoid potential scoring errors, the researcher listened to the students' recordings again at the end of the assessment and confirmed the data. Previously, an external 2nd/4th grade teacher reviewed more than 30% of the ratings from the initial assessment (January) and compared with the researcher rates to increase the reliability of the findings (30 observations).

Dependent variables

Reading accuracy was operationally defined as the number of corrected words read in a text and fluency corresponds to the number of words per minute read in a text. On the score sheet, the following variables were noted: (a) the amount of time the child spent reading the text (RT); (b) the number of words read (WR); and (c) the number of errors (NE). The formula

TABLE 3 Texts included in the "Informal Assessment of Fluency and Accuracy in Reading".

2nd grade			4th grade		
Text title	**Author**	**Number of words**	**Text title**	**Author**	**Number of words**
"A girafa que comia estrelas" *The giraffe that ate stars*	José Eduardo Agualusa	213	"O caçador de palavras" *The word hunter*	José Jorge Letria	228
"Uma história com palavras" *A story with words*	José Fanha	166	"A maior flor do mundo" *The biggest flower in the world*	José Saramago	306
"Táxi" *Taxi*	Jorge Listopad	183	"O rei vai nu" *The King Goes Naked*	Hans Christian Andersen (adapted version)	280
"A história da princesa do garfo" *The Story of the Fork Princess*	José Jorge Letria	227	"O mar" *The sea*	Mia Couto	262
"Também as pequenas histórias merecem grandes livros" *Little stories deserve great books*	António Torrado	207	"Os desenhos no teto do meu quarto" *The drawings on my bedroom ceiling*	José Peixoto	493

TABLE 4 Fluency and accuracy performance levels per grade and gender, before the intervention.

Fluency performance levels	**Grade**			
	2nd		**4th**	
	Male	**Female**	**Male**	**Female**
Above the 90th percentile (N)	0	0	6 (12.5%)	5 (10.4%)
Between the 55th and the 90th percentile (N)	8 (18.6%)	4 (9.3%)	19 (39.6%)	10 (20.8%)
Below the 55th percentile (N)	14 (32.6%)	17 (39.5%)	5 (10.4%)	3 (6.3%)
Fluency (N)	22 (51.2%)	21 (48.8%)	30 (62.5%)	18 (37.5%)
Accuracy performance levels				
Independence level (97–100% accuracy) (N)	2 (4.8%)	0	5 (14.9%)	1 (2.1%)
Instruction level (90–96% accuracy) (N)	7 (11.9%)	8 (19.1%)	17 (31.9%)	10 (21.3%)
Frustration level (below 90% of accuracy) (N)	13 (33.3%)	13 (31%)	8 (14.9%)	7 (14.9%)
Accuracy (N)	22 (50%)	21 (50%)	30 (61.7%)	18 (38.3%)
Total (N)	43 (100%)		48 (100%)	

WRD = WR-NE was used to calculate the number of words read correctly (WRC). The accuracy index (A) was calculated using the formula A = (WRC/WR) × 100, and the fluency index (F) was calculated using the formula F = (WRC/RT) × 60.

Data analysis

For data analysis, the SPSS statistics for Windows, version 27 was used. First, we conducted a descriptive analysis using measures of central tendency (the mean and standard deviation) of the absolute variables of reading accuracy and fluency, distinguishing the three assessment moments (initial, intermediate, and final) as well as the five classes examined (A, B, C, D, E). After confirming the assumptions of normality of the distribution (via asymmetry and kurtosis scores) and sphericity (based on the Mauchly test), ANCOVA was used to compare changes in accuracy and fluency in the two study groups (intervention: classes A, B and C; control: classes D and E), with the online peer tutoring intervention as the main factor and pre-test scores of each outcome variable as a covariate. In these analyses, post-test scores for classes D and E were the ones registered on the third measurement moment (between 8 and 9 weeks). Then, to evaluate the extent to which changes were due to the intervention or time/teacher instruction, classes with a lagged introduction of the intervention—classes D and E—were compared in terms of changes in reading scores before the online peer tutoring intervention. We controlled for pre-test scores (weeks 1–2), when analyzing "no intervention" effects, using ANCOVA with pre-test scores as covariates for each corresponding "last pre-test" (i.e., measurement moment immediately before the start of the intervention; Class D—between 8 and 9 weeks; Class E—between 13 and 14 weeks).

To analyze the differences on students' levels of accuracy and reading fluency according to children's gender, grade and measurement moments (initial—intermediate—final), a repeated measures ANCOVA was performed comparing fluency and accuracy scores at the three main measurement points. In these analysis, pre-test scores for classes D and E were the ones at the measurement occurred immediately before the beginning of the intervention (i.e., Class D—8–9 weeks; Class E—13–14 weeks). Students' gender, grade, and level of performance in accuracy and fluency were inserted analyses as within-subject factors and the students' class as covariate.

Results

Intervention effects—Experimental group and control group

ANCOVA comparing experimental and control groups (8–9 weeks, post-test moment for the experimental group and pre-intervention for control group) indicated significant intervention effects on accuracy and fluency scores (Table 5). Results demonstrate that the covariate, pre-test score, was significantly related to the students' improvements in accuracy, $F(1, 88) = 38.331$, $p < 0.001$, $\eta^2_p = 0.303$. There was also a significant effect of the online peer tutoring intervention on levels of accuracy after controlling for the effect of pre-test scores, $F(1, 88) = 6.709$, $p = 0.011$, $\eta^2_p = 0.071$. Results related to the dependent outcome reading fluency were similar. The covariate, pre-test score, was significantly related to the students' improvements in fluency, $F(1, 88) = 321.610$, $p < 0.001$, $\eta^2_p = 0.785$. There was also a significant effect of the online peer tutoring intervention on levels of fluency after controlling for the effect of pre-test scores, $F(1, 88) = 45.919$, $p < 0.001$, $\eta^2_p = 0.343$. For both dependent variables, effect sizes were higher for pre-test scores than for intervention effect and larger for fluency than for accuracy.

"No intervention" effect—Class D and Class E

ANCOVA comparing groups throughout "no intervention" period for classes D and E did not revealed a significant change neither in accuracy nor fluency scores, after controlling for the effect of pre-test scores (Table 6). However, results demonstrate that the covariate, pre-test score (1–2 weeks) was significantly related to the students' improvements in accuracy, $F(1, 88) = 38.331$, $p < 0.001$, $\eta^2_p = 0.303$ and fluency, $F(1, 88) = 38.331$, $p < 0.001$, $\eta^2_p = 0.303$.

Variables influencing gains in reading accuracy and fluency

Table 7 displays repeated measures ANCOVA, considering the accuracy and fluency scores obtained by students in the three main moments of measurement—pre-test, intermediate and post-test. For each class, pre-test scores considered the moment immediately before the start of the online peer tutoring intervention. In that sense, pre-test scores for classes D and E took place in March and April, respectively (Figure 1). Independent variables, such as gender, grade, and performance level were submitted in the model as between-subjects factors, and the belonging class as covariate variable. Interaction effects between these independent variables and intervention effects were introduced in the model generated per outcome. Only the significant effects are reported (Table 7).

Results demonstrate a progressive significant increase in accuracy scores throughout the intervention, that is, across pre-test, intermediate and post-test measurement moments. This difference had large effect between all three intervention moments, $F(2, 162) = 6.963$; $p = 0.004$, $\eta p^2 = 0.079$. Contrasts revealed that pre-test accuracy rates were significantly lower

than intermediate, $F(1, 81) = 18.424$, $p < 0.001$,$\eta p^2 = 0.185$ and post-test rates, $F(1, 81) = 8.166$, $p = 0.005$,$\eta p^2 = 0.092$.

A similar result was found for fluency scores with a significant increase across the three main measurement moments, $F(2, 130) = 16.507$; $p < 0.001$, $\eta p^2 = 0.203$. Contrasts revealed that pre-test fluency rates were significantly lower than intermediate, $F(1, 65) = 34.912$, $p < 0.001$,$\eta p^2 = 0.349$ and pos-test rates, $F(1, 65) = 17.934$, $p < 0.001$, $\eta p^2 = 0.216$.

The scrutiny of interaction effects revealed that for accuracy in reading, there was a significant interaction effect between the online peer tutoring intervention and the level of performance students demonstrated before the intervention, $F(2, 162) = 15.418$, $p \leq 0.001$, $\eta p^2 = 0.160$. This indicates that accuracy scores across pre-test, intermediate and post-test assessments significantly differ between students in the frustration level (<90%) and students in instructional and independence level (≥90%). To break down this interaction, contrasts were performed comparing accuracy scores in each moment of assessment across students with low and higher performance in reading accuracy before the intervention. These revealed significant interactions when comparing students with low and high performance scores in the pre-test to post-test measurement point, $F(1, 81) = 17.481$; $p < 0.001$, $\eta p^2 = 0.181$. Looking at the interaction graph (Figure 2), this suggest although the reading accuracy scores increases between pre-test and pos-test in both high- and low-accuracy-performance students, this increase is greater in students that showed low-performance in reading accuracy before the intervention.

Concerning fluency in reading, there was a significant interaction effect between the online peer tutoring intervention and the educational level of the participants, $F(2, 130) = 7.816$; $p = 0.001$, $\eta p^2 = 0.107$. This indicates that fluency scores across pre-test, intermediate and post-test assessments significantly differ in 2nd and 4th grades students. To break down this interaction, contrasts were performed comparing fluency scores in each moment of assessment across 2nd and 4th graders. These revealed significant interactions when comparing 2nd and 4th graders scores in the pre-test to intermediate scores,

TABLE 5 Intervention outcomes.

		Control ($n = 31$)	Intervention ($n = 60$)	ANCOVA	p	Partial eta squared
Accuracy	Pre-test	88.92 (6.12)	83.74 (17.21)	6.709	0.011	0.071
	Pos-test (8–9 week)	90.13 (5.13)	93.44 (13.49)			
Fluency	Pre-test	60.47 (29.73)	55.72 (27.56)	45.919	<0.001	0.343
	Pos-test (8–9 week)	59.14 (23.52)	74.93 (30.83)			

Main analyses use ANCOVA with pre-test score as covariate.

TABLE 6 "No intervention" outcomes.

		Class D ($n = 13$)	Class E ($n = 18$)	ANCOVA	p	Partial eta squared
Accuracy	Pre-test (1–2 week)	86.52 (7.59)	90.66 (4.21)	2.913	0.099	0.094
	Pre-test (8–9 week)	91.66 (5.07)	91.84 (4.66)			
Fluency	Pre-test (1–2 week)	38.26 (16.49)	76.50 (26.80)	0.332	0.569	0.012
	Pos-test (13–14 week)	44.22 (15.70)	86.30 (30.33)			

Main analyses use ANCOVA with pre-test score as covariate.

TABLE 7 Accuracy and fluency scores per evaluation moment.

		Pre-test		Intermediate		Pos-test		Repeated measures test		
		M	SD	M	SD	M	SD	F	P	ηp^2
Accuracy										
Online peer tutoring intervention	91	86.48	14.71	91.19	9.31	93.85	11.08	6.963	0.004	0.079
Online peer tutoring intervention × Performance level								15.418	<0.001	0.160
<90% of accuracy	37	75.11	18.12	85.85	12.38	89.64	10.29			
≥90% accuracy	54	93.99	2.28	94.75	3.50	96.66	10.89			
Fluency										
Online peer tutoring intervention	91	60.12	29.85	73.12	35.44	77.33	30.65	16.507	<0.001	0.203
Online peer tutoring intervention × Educational grade								7.816	0.001	0.107
2nd grade	41	40.16	18.45	47.63	18.65	57.20	21.09			
4th grade	48	78.03	26.89	94.98	31.57	94.67	27.48			

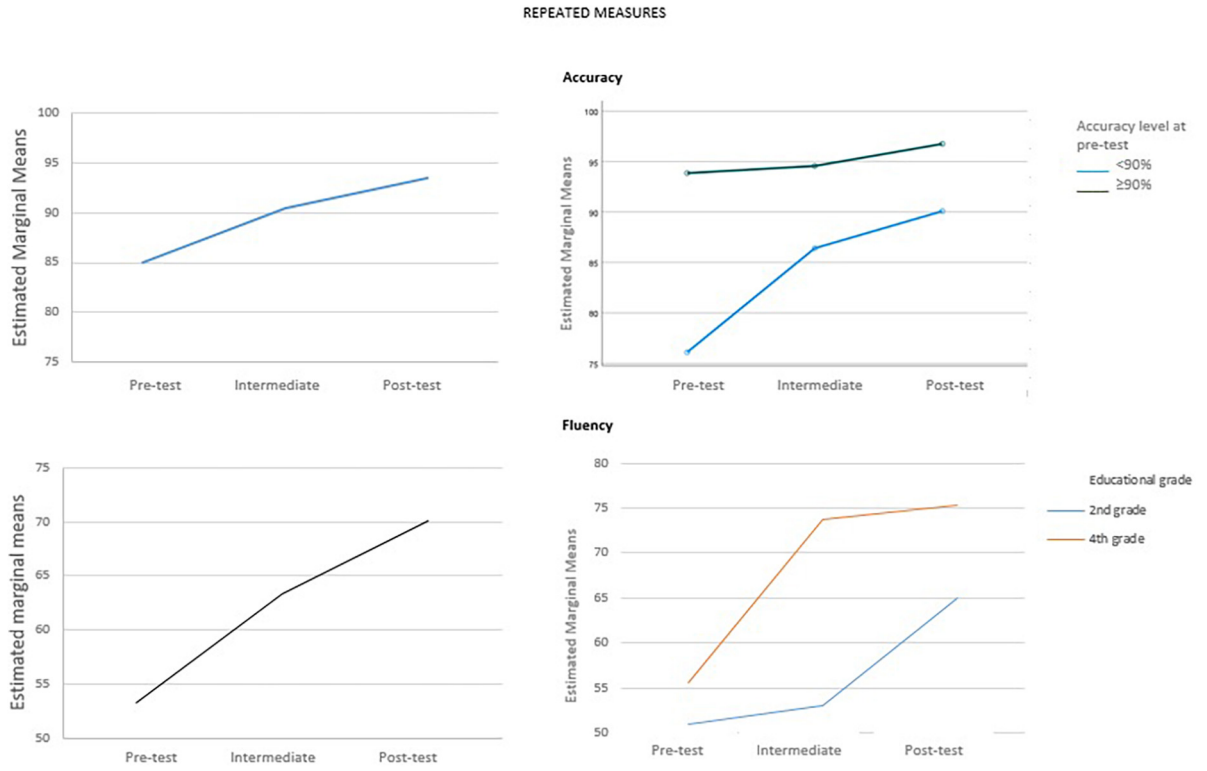

FIGURE 2
Contrasts graphs for repeated measures.

$F(1, 65) = 22.039$, $p < 0.001$, $\eta p^2 = 0.253$ and in the intermediate to post-test measurement point, $F(1, 65) = 7.019$, $p = 0.010$, $\eta p^2 = 0.097$. This indicates that the increase in fluency scores between pre-test and intermediate scores is significantly greater for 4th grade than for 2nd grade students. On the other hand, the increase between intermediate and post-test scores is significantly higher for 2nd grade than for 4th grade students (**Figure 2**).

In turn, gender was not significant in the interaction between intervention and gender in both fluency and accuracy scores.

Discussion

This study aimed at assessing the impact of an online peer tutoring intervention on the development of fluency and accuracy reading skills of elementary school students (2nd and 4th graders). In line with previous findings (Blanch et al., 2012; Topping et al., 2016), our study showed that the combined intervention significantly contributed to the students' progress in their reading abilities, that is he intervention was effective for three classrooms, when the two other classrooms functioned as the control group. To corroborate these findings no significant effects of "no intervention" were found, when controlling for pre-test scores, that is Class E, that started the intervention in week 13–14 and therefore was more time in the waiting list did not registered a higher improvement in reading skills than class D. Despite having no statistical significance, slight improvements were verified in these two classes on accuracy and reading fluency before starting the intervention. This indicates that getting instruction by teachers is important to support students in improving their reading, but implementing interventions, such as online peer tutoring can maximize what students get in school curriculum. Reading in pairs constitutes an opportunity to increase the time for reading practice with an audience, which is a common challenge for elementary teachers in a typical day in the classroom (Alzahrani and Leko, 2018; Sytsma et al., 2019). This challenge became particular evident during the successive lockdowns during the COVID-19 pandemic, which demanded alternative ways to assure teaching learning processes (Chetty et al., 2020; Kuhfeld et al., 2020; Flores et al., 2021). Therefore, the relationship between the use of digital tools and the teaching-learning process has become increasingly important (Jamshidifarsani et al., 2019; Dúo-Terrón et al., 2022) justifying additional research.

Results revealed a statistically significant, large effect difference between the three measurement moments in terms of reading fluency and accuracy. Accuracy gains between pre and post-test were significant higher for students that

were in the frustration level (low performance) in reading accuracy before the intervention. The use of three-measurement point procedure allowed the analysis of the stability of the development of reading accuracy and fluency, suggesting that for accuracy, having a peer aside is a more proficient peer is important to support children in identifying mistakes and correct them. In particular, peer tutoring intervention seems to be a particular relevant intervention for children who need extra support to decode words.

On regard to fluency gains, differences were not found between pre and post-test measurement points. Instead, the increase in fluency scores between pre-test and intermediate scores were significantly greater for 4th grade than for 2nd grade students and the increase between intermediate and post-test scores was significantly higher for 2nd grade than for 4th grade students. These results suggest that older students demonstrated effects of the intervention soon after its initiation, but these tended to stabilize, while younger students took longer to demonstrate results, but the growth was greater from the middle of the intervention. These findings seem to reveal that 4th graders are at other phase, they are more mature, so they seem to reach their potential earlier in the intervention, while 2nd graders are just developing their fluency skills.

Therefore, it seems relevant that the implementation of the reading promoting intervention through peer tutoring has contributed to an effective increase in children's accuracy and fluency indices. Results also indicates that these type of intervention can be beneficial for all students, but mainly for students with lower performance in reading and therefore with additional needs of supports. Those who read better, read more, increasing the probability of developing the competence to extract and construct meaning in the interaction with texts, as well as of expanding lexical development, which broadens world-knowledge, and diversifies cognitive and metacognitive strategies (Stern, 2006; Cruz et al., 2022). Furthermore, the fluency gains in 2nd graders found in this study reinforce the importance of placing emphasis on additional interventions in the early years of learning, such as online peer tutoring, that reinforce the pedagogical strategies used by teachers in the classroom. It should be noted that this intervention was implemented with all students and can be used as a universal educational measure, requiring no special and overly demanding adjustments.

Interestingly, analyses in this study demonstrate no significant mean differences for gender. This finding suggest that the gains of boys and girls in reading skills, such as fluency and accuracy, throughout the online peer tutoring intervention are comparable. Despite the results of other studies documenting that girls tend to present higher reading skills (Sochacka, 2014; van Hek et al., 2019; Solheim et al., 2021), these data demonstrate that the interventions have similar benefits for both groups.

However, there are limitations to this study that must be considered and ideally overcome in future studies. Due to the sample size, the results cannot be generalized to the general population. In fact, it is necessary to replicate this study with a representative sample to overcome this limitation. It is also advisable to use a sample that includes a representative number of students identified with additional support needs. Students in the waitlist-control group had more experience with the test format than children in the intervention groups. Another limiting aspect concerns the time limitation for data collection and the lack of a follow-up to further explore the effects of the intervention. Finally, it is important to note that despite parents were asked not to interfere in the peer tutoring activity, this fact cannot be completed assured.

Despite the study's limitations, the findings support the positive impact that online peer tutoring can have on the promotion of students' reading abilities. Overall, given the online peer tutoring format, the current study may pose a relevant contribution to the ongoing discussion about the development of effective strategies to promote reading abilities in the first years of school.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors upon reasonable request.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

MS-F: conceptualization, study design, data analysis, and article editing and review. HM: conceptualization, data collection, and article editing. AV: data analysis and article writing. SA: study design, data analysis, and article writing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

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References

Abd Ghani, A., Muslim, N. H., and Zakaria, M. N. (2020). 'The effects of gender and academic achievement on reading fluency among year 2 Malaysian school children'. *Int. J. Pediatr. Otorhinolaryngol.* 132:109907. doi: 10.1016/j.ijporl.2020.109907

Al Otaiba, S., McDonald Connor, C., Foorman, B., Schatschneider, C., Greulich, L., and Sidler, J. F. (2009). 'Identifying and intervening with beginning readers who are at-risk for dyslexia: Advances in individualized classroom instruction'. *Perspect. Lang. Lit.* 35, 13–19.

Alves, K. D., and Romig, J. E. (2021). 'Virtual reading lessons for upper elementary students with learning disabilities'. *Interv. Sch. Clin.* 57, 95–102. doi: 10.1177/10534512211001865

Alzahrani, T., and Leko, M. (2018). 'The effects of peer tutoring on the reading comprehension performance of secondary students with disabilities: A systematic review'. *Read. Writ. Q.* 34, 1–17.

Beach, K. D., and Traga Philippakos, Z. A. (2021). 'Effects of a summer reading intervention on the reading performance of elementary grade students from low-income families'. *Read. Writ. Q.* 37, 169–189. doi: 10.1080/10573569.2020.1760154

Below, J. L., and Sorrell, C. (2010). 'Gender differences in early literacy: Analysis of kindergarten through fifth-grade dynamic indicators of basic early literacy skills probes'. *Sch. Psychol. Rev.* 39, 240–257.

Blanch, S., Duran, D., Flores, M., and Valdebenito, V. (2012). 'The effects of a peer tutoring programme to improve the reading comprehension competence involving primary students at school and their families at home'. *Proc. Soc. Behav. Sci.* 46, 1684–1688. doi: 10.1016/j.sbspro.2012.05.361

Borges, M., and Viana, F. L. (2020). *Ouvintes sortudos. Um programa de promoção da fluência em leitura - 2o ano.* Lisboa: ME/PNPSE.

Cadime, I., Chaves-Sousa, S., Viana, F. L., Santos, S., Maia, J., and Ribeiro, I. (2021). 'Growth, stability and predictors of word reading accuracy in European Portuguese: A longitudinal study from Grade 1 to Grade 4'. *Curr. Psychol.* 40, 5185–5197. doi: 10.1007/s12144-019-00473-w

Carvalho, A. F. (2011). *Aprendizagem da leitura (learning to read).* Viseu: Psicosoma.

Casanova, M. P. (2012). "O Papel da tutoria ao serviço do desenvolvimento curricular [paper presentation]," in *Proceedings of the XIX congresso da AFIRSE "revisitar os estudos curriculares: Onde estamos e para onde vamos?".* (Lisboa: EDUCA/Secção Portuguesa da AFIRSE).

Chetty, R., Friedman, J. N., Hendren, N., Stepner, M., and The Opportunity Insights Team. (2020). *The economic impacts of COVID-19: Evidence from a new public database built using private sector data.* (NBER Working Paper No. 27431). Cambridge, MA: National Bureau of Economic Research, 1–109. doi: 10.3386/w27431

Cruz, J., Mendes, S., Marques, S., Alves, D. R., and Cadime, I. (2022). 'Face-to-face versus remote: Effects of an intervention in reading fluency during COVID-19 pandemic'. *Front. Educ.* 6:817711. doi: 10.3389/feduc.2021.817711

Daniel, S. J. (2020). 'Education and the COVID-19 pandemic'. *Prospects* 49, 91–96. doi: 10.1007/s11125-020-09464-3

Dúo-Terrón, P., Moreno-Guerrero, A.-J., and Marín-Marín, J.-A. (2022). 'ICT motivation in sixth-grade students in pandemic times—the influence of gender and age'. *Educ. Sci.* 12:183. doi: 10.3390/educsci12030183

Duran, D., Oller, M., Ramírez, M., and Flores Coll, M. (2019). 'Reading in Pairs, description and results of a peer tutoring program for English as a foreign language'. *Innov. Lang. Learn. Teach.* 13, 303–317.

Goodman, K. (1973). *Miscue analysis: Applications to reading instruction.* Bhubaneswar: NCTE-ERIC.

Goodman, K. (1982). "A linguistic study of cues and miscues in reading," in *Language and literacy: The selected writings of kenneth goodman,* Vol. 1, ed. F. V. Gollasch (Boston, MA: Routledge & Kegan Paul, Ltd).

Fernandes, S., Querido, L., Verhaeghe, A., Marques, C., and Araújo, L. (2017). 'Reading development in European Portuguese: Relationships between oral reading fluency, vocabulary and reading comprehension'. *Read. Writ.* 30, 1987–2007. doi: 10.1007/s11145-017-9763-z

Flores, M. A., Barros, A., Simão, A. M. V., Pereira, D., Flores, P., Fernandes, E., et al. (2022). 'Portuguese higher education students' adaptation to online teaching and learning in times of the COVID-19 pandemic: Personal and contextual factors'. *High. Educ.* 83, 1389–1408. doi: 10.1007/s10734-021-00748-x

Flores, M. A., Machado, P. E. A., Alves, P., and Vieira, D. A. (2021). 'Teaching in times of COVID-19: A study of portuguese elementary and secondary school teachers'. *Rev. Port. Educ.* 34, 5–27. doi: 10.21814/rpe.21108

Forbes-Riley, K., Litman, D., and Rotaru, M. (2008). "Responding to student uncertainty during computer tutoring: An experimental evaluation," in *Intelligent tutoring systems. ITS 2008. Lecture notes in computer science, vol 5091*, eds B. P. Woolf, E. Aïmeur, R. Nkambou, and S. Lajoie (Berlin: Springer), 60–69. doi: 10.1007/978-3-540-69132-7_11

Fuchs, D., Fuchs, L. S., and Burish, P. (2000). 'Peer-assisted learning strategies: An evidence-based practice to promote reading achievement'. *Learn. Disabil. Res. Pract.* 15, 85–91. doi: 10.1207/SLDRP1502_4

Gersten, R., Kelly, H., Rebecca, N. G., Joseph, D., and Madhavi, J. (2020). 'Meta-analysis of the impact of reading interventions for students in the primary grades'. *J. Res. Educ. Eff.* 13, 401–427. doi: 10.1080/19345747.2019.1689591

Hall, M. S., and Burns, M. K. (2018). 'Meta-analysis of targeted small-group reading interventions'. *J. Sch. Psychol.* 66, 54–66. doi: 10.1016/j.jsp.2017.11.002

Hernandez, D. J. (2011). *Double jeopardy: How third-grade reading skills and poverty influence high school graduation*. Baltimore, MD: Annie E. Casey Foundation.

Hodges, C., Moore, S., Lockee, B. B., Trust, T., and Bond, M. A. (2020). *'The difference between emergency remote teaching and online learning*'. Available online at: https://er.educause.edu/articles/2020/3/the-difference-betweenemergency-remote-teaching-and-online-learning (accessed June 8, 2022).

Huber, S. G., and Helm, C. (2020). 'COVID-19 and schooling: Evaluation, assessment and accountability in times of crises—reacting quickly to explore key issues for policy, practice and research with the school barometer'. *Educ. Assess. Eval. Account.* 32, 237–270. doi: 10.1007/s11092-020-09322-y

Hudson, R., Lane, H., and Pullen, P. (2005). 'Reading fluency assessment and instruction: What, why, and how?'. *Read. Teach.* 58, 702–714. doi: 10.1017/S1355617710000135

Jamshidifarsani, H., Garbaya, S., Lim, T., Blazevic, P., and Ritchie, J. (2019). Technology-based reading intervention programs for elementar grades: An analytical review. *Comput. Educ.* 128, 427–451. doi: 10.1016/j.compedu.2018.10.003

Jones, G., Ostojic, D., Menard, J., Picard, E., and Miller, C. J. (2017). 'Primary prevention of reading failure: Effect of universal peer tutoring in the early grades'. *J. Educ. Res.* 110, 171–176. doi: 10.1080/00220671.2015.1060929

Kim, D., An, Y., Shin, H. G., Lee, J., and Park, S. (2020). 'A meta-analysis of single-subject reading intervention studies for struggling readers: Using Improvement Rate Difference (IRD)'. *Heliyon* 6:e05024. doi: 10.1016/j.heliyon.2020.e05024

König, J., Jäger-Biela, D. J., and Glutsch, N. (2020). 'Adapting to online teaching during COVID-19 school closure: Teacher education and teacher competence effects among early career teachers in Germany'. *Eur. J. Teach. Educ.* 43, 608–622. doi: 10.1080/02619768.2020.1809650

Kuhfeld, M., Soland, J., Tarasawa, B., Johnson, A., Ruzek, E., and Liu, J. (2020). Projecting the potential impact of COVID-19 school closures on academic achievement. *Educ. Res.* 49, 549–565. doi: 10.3102/0013189X20965918

Lee, L., and Szczerbinski, M. (2021). 'Paired Reading as a method of reading intervention in Irish primary schools: An evaluation'. *Irish Educ. Stud.* 40, 589–610. doi: 10.1080/03323315.2021.1927797

Lin, M.-H., Chen, H., and Liu, K. S. (2017). 'A study of the effects of digital learning on learning motivation and learning outcome'. *EURASIA J. Math. Sci. Technol. Educ.* 13, 3553–3564. doi: 10.12973/eurasia.2017.00744a

Logan, S., and Johnston, R. (2009). 'Gender differences in reading ability and attitudes: Examining where these differences lie'. *J. Res. Read.* 32, 199–214. doi: 10.1111/j.1467-9817.2008.01389.x

Lopes, J., Spear-Swerling, L., Oliveira, C. R. G., Velasquez, M. G., Almeida, L. S., and Araújo, L. (2014). *Ensino da leitura no 1. ° ciclo do ensino básico: Crenças, conhecimentos e formação dos professores.* Lisboa: Fundação Francisco Manuel dos Santos.

Lovett, M. W., Frijters, J. C., Wolf, M., Steinbach, K. A., Sevcik, R. A., and Morris, R. D. (2017). 'Early intervention for children at risk for reading disabilities: The impact of grade at intervention and individual differences on intervention outcomes.'. *J. Educ. Psychol.* 109, 889–914. doi: 10.1037/edu0000181

Lyytinen, H., and Erskine, J. (2016). "Early identification and prevention of reading problems," in *Encyclopedia on early childhood development,* eds R. E. Tremblay, M. Boivin, and R. D. Peters (CEDJE). Available online at: https://www.child-encyclopedia.com/learning-disabilities/according-experts/early-identification-and-prevention-reading-problems

Martens, B. K., Young, N. D., Mullane, M. P., Baxter, E. L., Sallade, S. J., Kellen, D., et al. (2019). 'Effects of word overlap on generalized gains from a repeated readings intervention'. *J. Sch. Psychol.* 74, 1–9. doi: 10.1016/j.jsp.2019.05.002

Martins, M. A., and Capellini, S. A. (2021). 'Identification of struggling readers or at risk of reading difficulties with one-minute fluency measures'. *Psicol. Reflex. Crit.* 34:10. doi: 10.1186/s41155-021-00174-z

McKenna, M. C., Kear, D. J., and Ellsworth, R. A. (1995). 'Children's attitudes toward reading: A national survey'. *Read. Res. Q.* 30, 934–956.

Meeks, B. T., Martinez, J., and Pienta, R. S. (2014). 'Effect of edmark program on reading fluency in third-grade students with disabilities'. *Int. J. Inst.* 7, 103–118.

Meinck, S., Fraillon, J., and Strietholt, R. (2022). *The impact of the COVID-19 pandemic on education: International evidence from the responses to educational disruption survey (REDS).* Paris: UNESCO.

Mullis, I. V. S., and Martin, M. O. (eds) (2015). *PIRLS 2016 assessment framework*, 2nd Edn. Paris: IEA.

National Institute of Child Health and Human Development (2000). *Report of the national reading panel teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction. (NIH Publication No. 00-4769).* Washington, D.C: National Institute of Child Health and Human Development.

Oddo, M., Barnett, D. W., Hawkins, R. O., and Musti-Rao, S. (2010). 'Reciprocal peer tutoring and repeated reading: Increasing practicality using student groups: RR in groups'. *Psychol. Sch.* 47, 842–858. doi: 10.1002/pits.20508

OECD (2019). *PISA 2018 assessment and analytical framework*. Paris: OECD. doi: 10.1787/b25efab8-en

Rasinski, T. (2004). *Assessing reading fluency*. Honolulu, HI: Pacific Resources for Education and Learning.

Rasinski, T. V., Reutzel, C. R., Chard, D., and Linan-Thompson, S. (2011). "Reading fluency," in *Handbook of reading research,* Vol. IV, eds M. L. Kamil, P. D. Pearson, B. Moje, and P. E. Afflerbach (New York, NY: Routledge), 286–319.

Raspin, S., Ruth, S., Sarah, H., and Lauren, B. (2019). 'Exploring the use of the ARROW literacy intervention for looked after children in a UK local authority'. *Educ. Psychol. Pract.* 35, 411–423. doi: 10.1080/02667363.2019.1632172

Reich, J., Buttimer, C. J., Fang, A., Hillaire, G., Hirsch, K., and Larke, L. R. (2020). '*Remote learning guidance from state education agencies during the COVID-19 pandemic: A first look*'. Available online at: https://edarxiv.org/437e2 (accessed June 5, 2022).

Reimer, D., Smith, E., Andersen, I. G., and Sortkær, B. (2021). 'What happens when schools shut down? Investigating inequality in students' reading behavior during Covid-19 in Denmark'. *Res. Soc. Stratif. Mobil.* 71:100568. doi: 10.1016/j.rssm.2020.100568

Ritchie, S. J., and Bates, T. C. (2013). 'Enduring links from childhood mathematics and reading achievement to adult socioeconomic status'. *Psychol. Sci.* 24, 1301–1308. doi: 10.1177/0956797612466268

Roberts, G. J., Hall, C., Cho, E., Coté, B., Lee, J., and Qi, B. (2022). 'The State of current reading intervention research for English learners in grades K–2: A best-evidence synthesis'. *Educ. Psychol. Rev.* 34, 335–361. doi: 10.1007/s10648-021-09629-2

Rosa, V. A., João Sampaio, M., Daniela, M., and António, T. (2020). 'PISA, TIMSS e PIRLS em Portugal: Uma análise comparativa: PISA, TIMSS and PIRLS in Portugal: A comparative analysis'. *Rev. Port. Educ.* 33, 94–120. doi: 10.21814/rpe.18380

Sanches Ferreira, M., and Santos, M. (1994). *Aprender a aprender.* Porto: Afrontamento.

Schwanenflugel, P. J., Meisinger, E. B., Wisenbaker, J. M., Kuhn, M. R., Strauss, G. P., and Morris, R. D. (2006). 'Becoming a fluent and automatic reader in the early elementary school years'. *Read. Res. Q.* 41, 496–522. doi: 10.1598/RRQ.41.4.4

Serrano, F., Genard, N., Sucena, A., Defior, S., Alegria, J., and Mousty, P. (2011). 'Variations in reading and spelling acquisition in Portuguese, French and Spanish: A cross-linguistic comparison'. *J. Port. Linguist.* 10:183. doi: 10.5334/jpl.106

Seymour, P. H. K., Aro, M., and Erskine, J. M. (2003). 'Foundation literacy acquisition in European orthographies'. *Br. J. Psychol.* 94, 143–174. doi: 10.1348/000712603321661859

Sim-Sim, I. (2009). *O ensino da leitura: a decifração.* Lisboa: Ministério da Educação Direcção-Geral de Inovação e de Desenvolvimento Curricular.

Sochacka, K. (2014). 'The stability of gender-related differences in early reading development in Polish children'. *L1 Educ. Stud. Lang. Lit.* 14, 1–18. doi: 10.17239/L1ESLL-2013.01.11

Solheim, O., Torppa, M., Uppstad, P. H., and Lerkkanen, M. (2021). 'Screening for slow reading acquisition in Norway and Finland – a quest for context specific predictors'. *Scand. J. Educ. Res.* 65, pp. 584–600. doi: 10.1080/00313831.2020.1739130

Stern, H. (2006). *Parents' academic expectations, children's perceptions, and the reading achievement of children at varying risk.* Chapel Hill, NC: The University of North Carolina.

Sucena, A., Silva, A. F., and Marques, C. (2022). 'Reading skills intervention during the Covid-19 pandemic. *Humanit. Soc. Sci. Commun.* 9:45. doi: 10.1057/s41599-022-01059-x

Suggate, S. P. (2016). 'A meta-analysis of the long-term effects of phonemic awareness, phonics, fluency, and reading comprehension interventions'. *J. Learn. Disabil.* 49, 77–96. doi: 10.1177/0022219414528540

Sytsma, M., Panahon, C., and Houlihan, D. D. (2019). 'Peer tutoring as a model for language and reading skills development for students who are English language learners' *J. Appl. Sch. Psychol.* 35, 357–379.

Topping, K. J., Duran, D., and Van Keer, H. (2016). *Using peer tutoring to improve reading skills: A practical guide for teachers.* New York, NY: Routledge.

van Hek, M., Buchmann, C., and Kraaykamp, G. (2019). 'Educational systems and gender differences in reading: A comparative multilevel analysis'. *Eur. Sociol. Rev.* 35, 169–186. doi: 10.1093/esr/jcy054

Wanzek, J., Stevens, EA., Williams, KJ., Scammacca, N., Vaughn, S., Sargent, K. (2018). 'Current evidence on the effects of intensive early reading interventions'. *J. Learn. Disabil.* 51, 612–624. doi: 10.1177/0022219418775110

Wanzek, J., Vaughn, S., Scammacca, N., Gatlin, B., Walker, MA., Capin, P. (2016). 'Meta-analyses of the effects of tier 2 type reading interventions in grades K-3'. *Educ. Psychol. Rev.* 28, 551–576. doi: 10.1007/s10648-015-9321-7

Wyse, A. E., Stickney, E. M., Butz, D., Beckler, A., Close., C. N. (2020). 'The potential impact of COVID-19 on student learning and how schools can respond'. *Educ. Measure. Issues Pract.* 39, 60–64. doi: 10.1111/emip.12357

Zimmerman, B. S., Rasinski, T., Was, C. A., Rawson, K. A., Dunlosky, J., Kruse, S. D et al. (2019). 'Enhancing outcomes for struggling readers: Empirical analysis of the fluency development lesson'. *Read. Psychol.* 40, 70–94. doi: 10.1080/02702711.2018.1555365

Zimmermann, L.M., Reed, D.K. and Aloe, A.M. (2021). 'A meta-analysis of non-repetitive reading fluency interventions for students with reading difficulties'. *Remed. Special Educ.* 42, 78–93. doi: 10.1177/0741932519855058