READING ACCURACY IN BILINGUAL DYSLEXIC STUDENTS OF BRAZILIAN PORTUGUESE (L1) AND ENGLISH (L2): A COLLECTIVE CASE STUDY

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Abstract

This collective case study investigates how dyslexia affects reading ability in the first and second language among six Brazilian students with dyslexia and a control group without dyslexia in grades 3 to 5 at a bilingual primary school. Two reading-aloud tests, one with real words and one with pseudowords, were administered in English (L2) and Brazilian Portuguese (L1). Dyslexic students made more errors than their typically developing peers across all conditions of language, word frequency, word length, error type, and syllabic position. Some error types decreased with age among dyslexics, suggesting improvement over time. Both groups encountered greater difficulty with pseudowords, especially in Brazilian Portuguese (BP). In BP, dyslexics showed more rhyme and multisyllabic errors, which further illustrates how error patterns differed between languages.

Keywords: dyslexia; bilingualism; accuracy; reading.

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1.0 Introduction

Dyslexia[1] is a neurobiologically based disorder recognized for its significant impact on learning to read (Shaywitz, 2006). Dyslexic individuals present challenges in associating phonemes with graphemes, which results in increased cognitive effort in reading tasks (Dehaene, 2012; Łodej, 2016). Dyslexia is characterized as a learning condition that disrupts reading ability by impeding the decoding of orthographic symbols. Commonly associated with dyslexia are conditions such as depression, anxiety, dyscalculia, and ADHD[2], which can also be characterized as having a genetic-neurological basis (Łodej, 2016). Bilingualism, defined by the use of two languages with varying proficiency levels in daily life (Grosjean & Li, 2013), is suggested to have potential benefits on dyslexics' reading performance and overall cognitive functioning (Vender et al., 2021). In Vender et al (2018), bilingual individuals with dyslexia appear to show more advanced morphological and metalinguistic skills than monolingual dyslexic peers, and in certain contexts, they even outperform monolingual children without reading difficulties. Bruin et al. (2020) explored how bilingualism, phonological awareness, and dyslexia interact in both dyslexic and typically developing children. Their results suggest that bilingualism may provide a protective advantage against dyslexia, particularly by strengthening phonological awareness in the second language.

This research delves into the intersection of dyslexia and bilingualism, aiming to investigate factors that influence the reading performance of bilingual dyslexics in a Brazilian primary school that offers immersive English instruction. It seeks to compare reading abilities in English (L2[3]) and Brazilian Portuguese (L1) by employing reading tests in both languages.

In the realm of language learning, challenges in reading the first language (L1) and second language (L2) can be influenced by differences in orthographic systems. Although both English and Brazilian Portuguese utilize the alphabetic writing system, there are several distinctions. English is considered a relatively opaque and unpredictable script (Wydell & Kondo, 2003) due to its variable granularity in orthographic representation (Butterworth, 1980; 1992), resulting in irregularity in grapheme-phoneme mapping. For example, <g> can represent the sound [g], as in "gap", but in combination with <gh> it sounds out [f], as in <tough>, and in combination with <ough> as in <though>, it can even represent [o]. In contrast, BP is deemed transparent, fine-grained (i.e., there is a predominantly one-to-one grapheme-phoneme mapping), and mostly regular (Soto et al., 2018). These distinctions may affect dyslexic students' reading and writing performance differently compared to their typically developing peers.

It has been observed that the underlying cognitive mechanisms engaged by dyslexic readers may differ due to the characteristics of the given orthography and dyslexia subtype. The dual-route reading model (Ellis, 1995), for example, proposes two distinct routes for reading processing: the phonological route and the lexical route. The phonological route involves breaking down words into orthographic units, aligning them with sublexical phonological segments

to create phonological words, and then mapping them to lexical entries. The sublexical route is generally more suited for transparent orthographies, whereas more opaque orthographic systems tend to favor the lexical route, which involves a direct mapping of orthographic input onto the whole-word phonological form of the word, which subsequently activates the lexical entry. The lexical route, often referred to as the direct route, involves sublexical orthographic information making direct contact with whole-word orthographic representations, which in turn provide access to whole-word phonology on the one hand, and to higher-level semantic information on the other (Coltheart, et al, 2001). Dyslexic learners may, irrespective of language transparency, tend to rely on the lexical route due to intrinsic challenges in recognizing and applying grapheme–phoneme correspondences. Snowling, Hulme, and Nation (2020) argue that focused instruction in phoneme–grapheme correspondence can significantly enhance the reading skills of children with dyslexia. Similarly, Lallier and Carreiras (2017) support the notion of cross-linguistic transfer, particularly from more transparent orthographies to less consistent ones—such as from Portuguese to English. Additionally, a potential contributor to the bilingual advantage in dyslexia is the bilingual individual's regular engagement with linguistic and orthographic systems in both languages. This continuous interaction may promote bidirectional knowledge transfer, thereby supporting reading and writing development in the second language (Kovelman, Bisconti, & Hoeft, 2016).

Furthermore, Azevedo et al (2023) conducted a study with teenagers whose mean age was 14.8 with the objective to validate the hypothesis that learning a second language (L2) since childhood could bring benefits to individuals with dyslexia by investigating reading performance in Portuguese-English and the brain activation associated with reading words by bilingual and monolingual dyslexic readers, as well as typical bilinguals as controls. In the word reading task in Brazilian Portuguese (BP), dyslexic bilinguals have similar accuracy to controls on the task, just taking longer to respond, whereas dyslexic monolinguals are the slowest of all. In the same study, in the English reading tasks, bilingual children with dyslexia showed performance comparable to that of the control group, with their scores generally close to, though seldom exceeding, those of typically developing peers. Regarding the Portuguese tests, dyslexic bilinguals outperformed monolingual dyslexic children but still lagged behind the control group across all tasks. On average, the bilingual dyslexic group made five more errors than the control group in the English tasks—a smaller gap than the one observed between the same groups in the Portuguese tasks.

In Reina et al (2023), a study done with dyslexics and non-dyslexics bilinguals from 3rd to 5th grades, dyslexics showed poorer performance on reading pseudowords, but less impairment for frequent words and better performance in English than in BP, with near similar scores compared to controls for sentence reading.

There are several studies on dyslexia in the context of written Portuguese, specially in European Portuguese (Da Fontoura & Siegel, 1995; Moura et al., 2015;

Oliveira et al., 2021; Pacheco et al., 2014); however, it is important to distinguish between European Portuguese (EP) and Brazilian Portuguese (BP). Although most orthographic conventions overlap between these varieties of Portuguese, there are also linguistic and orthographic differences to consider. For example, there are variants that exist in one variety, but not in the other. In PE, both written forms <facto> and <fato> are allowed reflecting the variant pronunciation of the consonant cluster [kt] ~ [t]; whereas in BP, only <fato> and /ˈfato/ exist. In BP, a tendency to pronounce certain diphthongs as monophthongs (ex. [e] vs. [eI]) may cause spelling mistakes in words such as <primeiro>; in PE (Baronas; Lini, 2011), the same graphemes <ei> map a different pronunciation ([ɐi]) (Cruz-Ferreira, 1995). Thus, due to the context specific influences of oral use and convention rules on spelling performance, we may expect differences between Brazilian and Portuguese dyslexics, not only in their Portuguese spelling, but also in their spelling of English, which is expected to be affected by the bilingual context in which it is acquired. This study aims to extend existing research by investigating Brazilian Portuguese in particular.

2.0 Research Aims and Rationale

Reading in bilingual learners with dyslexia presents a unique intersection of cognitive, linguistic, and educational challenges, especially when the two languages differ significantly in orthographic transparency, as is the case with transparent Brazilian Portuguese and opaque English. As noted above, despite the difference between European and Brazilian Portuguese language systems, the majority of current research on dyslexia in Portuguese-speaking populations has focused on European Portuguese, with limited exploration of Brazilian Portuguese in bilingual contexts. This underrepresentation may limit our understanding of how dyslexia manifests in students exposed to two orthographically distinct languages, one of which is a variety of Brazilian Portuguese, and how these learners navigate reading tasks across their language pair.

Therefore, the study addresses this gap by examining the reading strategies of six young bilingual students with and without dyslexia. It investigates the influence of bilingualism on reading performance by comparing the reading accuracy of these students in BP and EN. Reading tasks include aloud reading of frequent, infrequent, and pseudowords in both languages. Performance is compared to that of typically developing bilingual peers matched for age and gender. The central aim of this research is to identify the linguistic and cognitive factors that contribute to reading accuracy in bilingual learners with dyslexia. Specifically, to explore how orthographic transparency, word frequency, syllabic structure, and error type affect decoding success, and whether these factors interact differently in each language. It also seeks to examine the nature and frequency of errors, and whether dyslexic readers display distinct processing strategies in BP and EN.

To guide the investigation, the following hypotheses were proposed:

Hypothesis 1: Dyslexic bilingual learners will produce different types of reading errors in BP and EN, due to the languages' differing orthographic depth.

More guessing-type errors are expected in English, likely resulting from exposure to sight-word-based instruction and the opaque nature of the English spelling system.

Hypothesis 2: Bilingual readers with dyslexia will show a stronger reliance on the lexical route in both languages, with greater success in English due to this strategy being more compatible with the irregularity of the English orthographic system. It is hypothesized that this reliance will result in better performance in English than in Brazilian Portuguese, where decoding through the phonological route is more essential due to its transparency.

Hypothesis 3: Dyslexic readers will demonstrate poorer performance on infrequent words and pseudowords in both languages, as these forms rely more heavily on sublexical decoding strategies. In contrast, typically developing bilingual peers are expected to perform better on these items due to more efficient use of phonological mapping.

Hypothesis 4: Dyslexic readers will make more errors in Brazilian Portuguese on syllables in rhyme positions of multisyllabic words. This is attributed to both the cognitive demands of decoding longer words and the greater need for phonological processing in a transparent orthography, which may contribute to cognitive overload. This pattern is interpreted in light of Broadbent's (1958) bottleneck theory, which suggests that dyslexic individuals may abandon processing when cognitive demands exceed their capacity.

In doing so, this study aims to fill a gap in the current literature by contributing empirical evidence on bilingual dyslexic readers whose first language is Brazilian Portuguese. The findings are expected to enhance understanding of how orthographic transparency and language exposure shape decoding strategies and inform more effective instructional approaches tailored to bilingual learners with dyslexia.

3.0 Method

This study employed a qualitative collective case study design with a quantitative approach to data collection, aiming to explore reading strategies among bilingual learners with and without dyslexia. Participants were selected using purposive sampling to ensure a focused and comparative analysis. The sample consisted of six bilingual students attending an American primary school in Brazil. Three students had been formally diagnosed with dyslexia, while the remaining three, matched for age and gender, constituted a control group of typically developing bilingual readers. This design facilitated an in-depth examination of individual reading behaviors, and error patterns across two orthographically distinct languages.

3.1. Participants

The participants were recruited from a private international bilingual school in Rio de Janeiro, Brazil. The sample consisted of six children between the ages of

8 and 11, all of whom were enrolled in an American primary school and had been attending the school for a minimum of three years. All participants were native speakers of Brazilian Portuguese and were regularly exposed to and used English in their school and social environments, reflecting a context of daily bilingual language use. The sample included two groups: three children with formal diagnoses of both dyslexia and ADHD, and three typically developing peers who served as the control group. Control participants were selected from the same school and were matched with the dyslexic participants based on age, gender, school year, and non-verbal intelligence, the latter assessed using the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 2011). This matching ensured the creation of a balanced comparison group.

Although the dyslexic participants had been previously diagnosed by external specialists, a speech therapist from the research team conducted a comprehensive anamnesis to confirm the diagnoses and to compile individual language and developmental profiles. Informed consent was obtained from all parents through signed documentation, and verbal assent was given by all participants prior to data collection. The study received ethical approval from the Research Ethics Committee of the Federal University of Rio de Janeiro (UFRJ), under protocol number 55071622.8.0000.5286.

3.2 Research Instruments

Two reading assessment instruments were employed in this study—one designed for Brazilian Portuguese (BP) and the other for English (EN). Both tools were adapted for use with bilingual learners, and cognates were excluded to minimize cross-linguistic interference. To assess reading in BP, the instrument developed by Rodrigues et al. (2015) was used. Originally designed for proficient readers of BP, typically around the age of ten, this task required participants to read aloud a set of words and pseudowords. The original version of the instrument included 72 stimuli, consisting of 48 real words selected based on criteria such as concreteness, length, frequency, and regularity, as well as 24 pseudowords. These pseudowords were derived from real words through modifications such as letter or syllable inversions, substitutions, or omissions. Despite being non-existent in the lexicon, they maintained the structural properties of real BP words. For the purposes of the present study, words that were cognates or false cognates with English were removed to control for cross-language effects. After this adaptation, the final set included 63 items: 20 frequent words, 18 infrequent words, and 25 pseudowords. In terms of length, 31 of the items were short (two syllables), and 32 were long (three or more syllables).

Whereas, reading in English was assessed using an instrument designed by Siqueira (2018), tailored specifically for native speakers of BP who had acquired English as a second language. These participants were successive bilinguals with varying levels of proficiency. The English reading task included 64 items to be read aloud: 20 frequent words, 20 infrequent words, and 24 pseudowords.

The distribution of word length was similar to the BP instrument, with 31 short items (two syllables) and 33 long items (three or more syllables). Although the original instrument was designed for adults between the ages of 18 and 50, it was adapted for use with school-aged children in the current study by removing items outside of the expected vocabulary range and ensuring structural comparability with the BP test.

3.3 Study Design and Procedure

Reading tasks were administered using PsychoPy version 2 (Peirce et al., 2019), a software platform used for stimulus presentation and response time recording. Words were displayed individually in random order, and participants were instructed to read each word aloud and press the spacebar to proceed to the next item. The reading tests in English and Brazilian Portuguese were conducted in separate sessions, each lasting approximately 15 minutes, and held in a quiet room at the school to ensure a consistent testing environment.

The primary outcome measure was reading accuracy, based on the number of correct and incorrect responses. A range of linguistic and cognitive factors was considered in relation to this dependent variable. These included types of errors made, errors categorized by syllabic constituents (onset, rhyme, coda, or multiple positions), and by sonority. Additional variables included orthographic depth, word frequency, target language (BP or English), number of syllables, number of letters, word length, syntactic category, regularity, orthographic neighborhood, response time, animacy, and degree of abstraction. These were examined in conjunction with the experimental factor of target language (BP vs. EN), as well as participant variables such as dyslexic status (dyslexic or non-dyslexic), gender, age group, and educational level.

Error types were further classified based on their location within the word and the nature of the disruption. Errors were categorized according to ten distinct types: letter inversion, substitution, omission, addition, refusals (when the participant paused and was unable to attempt the word), mispronunciation (incorrect articulation or stress), guessing (for instance, reading the pseudoword <bunding" as <building> or <smill> as <smile>), scaffolding errors (where the initial and final phonemes of the word were preserved but the vowel digraphs in the middle were mispronounced), combined omission and inversion, and multiple occurrences, where two or more error types appeared simultaneously. This detailed classification scheme provided a nuanced framework for analyzing the reading profiles of bilingual learners with and without dyslexia across two orthographically distinct languages. Due to the small sample size, no statistical significance testing was conducted. Instead, descriptive analyses and data visualizations were carried out using the RStudio platform (R Core Team, 2023).

4.0 Results

A consistent pattern emerged across all participants, indicating that reading accuracy in English (EN) generally surpassed performance in Brazilian Portuguese (BP), regardless of dyslexia status. To facilitate reference throughout the results, participants were labeled as follows: C1, C2, and C3 for the three control group participants in 3rd, 4th, and 5th grades respectively; and D1, D2, and D3 for the three dyslexic participants in the corresponding grade levels. When examining reading accuracy by word frequency (see Table 1), performance on frequent words was comparable between languages for most participants. C1, C2, and D3 achieved identical scores of 100% in both English and Portuguese. D2 scored 95% in BP and 94.7% in EN, while D1 and C3 performed slightly better in BP than EN (D1: 75% in BP vs. 70% in EN; C3: 100% in BP vs. 94.7% in EN).

In contrast, low frequency words revealed more variability across languages. Among the dyslexic group, results generally reflected those observed for high frequency words, with either similar or slightly higher scores in English. D2 scored 90% in EN and 88.9% in BP, while D3 achieved 95% in EN and 88.9% in BP. The control group participants in 4th and 5th grades demonstrated a similar pattern, with C2 scoring 100% in both languages, and C1 and C3 scoring higher in EN (C1: 100% in EN vs. 94.4% in BP; C3: 100% in EN vs. 94.4% in BP). Even D1, who had the lowest overall scores, performed better in EN (40%) than in BP (27.8%), possibly due to earlier exposure to or more structured reading instruction in English (see Table 1).

Results for pseudowords followed a similar trend, particularly among the control group. Their performance was either better in English or roughly equivalent across both languages. Specifically, C1 scored 88% in BP and 100% in EN, C2 achieved 96% in BP and 100% in EN, and C3 scored 84% in BP and 91.7% in EN. These results suggest that control participants may have developed stronger internal representations of grapheme-to-phoneme correspondences in English, likely supported by explicit phonics-based instruction and familiarity with recurring orthographic patterns. In contrast, the dyslexic group showed overall lower scores, particularly for pseudowords, with more variability in performance across languages. Notably, D1 scored higher in BP (52%) than in EN (45.8%), which deviated from the general trend. However, D2 and D3 continued to demonstrate stronger performance in English than in BP (D2: 72% in BP vs. 79.2% in EN; D3: 78.3% in BP vs. 68% in EN). These results might suggest that while dyslexic participants also benefited from English reading instruction, they did not seem to internalize grapheme–phoneme mapping strategies as effectively as their typically developing peers.

In summary, participants across both groups generally performed better in English than in Brazilian Portuguese, with the lowest scores observed for pseudowords in the dyslexic group in both languages. This highlights the potential difficulty of decoding unfamiliar or novel items for learners with dyslexia, particularly in the context of transparent and opaque orthographies.

Table 1 - Participants' scores per word frequency

| Reading words and pseudowords aloud BP x EN score per frequency (in %)					
		BP		EN	
Frequency	Participant	*Dyslexics*	*Controls*	*Dyslexics*	*Controls*
High frequency	1	75	100	70	100
	2	95	100	94.7	100
	3	100	100	100	94.7
Low frequency	1	27.8	94.4	40	100
	2	88.9	100	90	100
	3	88.9	94.4	95	100
Pseudowords	1	52	88	45.8	100
	2	72	96	79.2	100
	3	68	84	78.3	91.7

Plotting the data from Table 1 as error rates in Graph 1 offers a clearer visual representation of general performance trends. Overall, dyslexic participants (D group) consistently demonstrated higher error rates than their non-dyslexic peers (C group), with the most pronounced differences observed for low frequency words and pseudowords. The dyslexic student in the 3rd grade (D1) exhibited the highest error rates of all participants for pseudowords in both English and Brazilian Portuguese, with 54.5% and 48% error rates, respectively. This participant also recorded elevated error rates for low frequency words—60% in English and 72.2% in Brazilian Portuguese—while errors on high frequency words were considerably lower, at 30% for English and 25% for Brazilian Portuguese. In contrast, the non-dyslexic 3rd grade student (C1) showed markedly better performance, with an error rate of 12% for pseudowords and 5.6% for low frequency words in BP, and no errors in any word category in English.

Error rates decreased noticeably among 4th and 5th graders in both groups, although non-dyslexic participants showed a more consistent reduction across all word types. Interestingly, unlike the 3rd-grade dyslexic participant, the 4th- and 5th-grade dyslexic students struggled more with pseudowords than with low frequency words, indicating ongoing difficulties with phonological decoding. This pattern may reflect a developmental shift in reading strategies, where a growing vocabulary supports recognition of low frequency real words but does not aid in decoding unfamiliar pseudowords. This trend was evident in both languages. In English, the 5th-grade dyslexic student (D3) made 21.7% errors on pseudowords compared to just 5% on low frequency words. In Brazilian Portuguese, the same student made 32% errors on pseudowords versus 11.1% on low frequency words. Meanwhile, the non-dyslexic participants in the 4th and 5th grades demonstrated minimal error rates across all word types, reinforcing the widening gap in reading performance between the two groups as grade level increases.

Although dyslexic participants clearly presented relatively more difficulty for pseudowords than control participants, both groups showed proportionally

higher error rates in Brazilian Portuguese than in English for pseudowords, with the exception of the 3rd-grade dyslexic participant. Subtracting English from Brazilian Portuguese scores, for pseudowords, we see differences of 7.2 and 10% for D2 and D3, respectively, and 12.4 and 7.7% for C1, C2 and C3, respectively. This tendency may be attributed to the greater transparency of BP, which perhaps encourages reliance on phonological decoding strategies. Both participant groups seem less successful in these strategies, but for dyslexic students they appear to be even less effective, resulting in higher error rates. In contrast, the use of the lexical route in English—a language with more opaque orthography—may have supported greater accuracy, particularly among non-dyslexic participants and, to a lesser extent, among dyslexic readers. This was reflected in the fact that two of the non-dyslexic participants made no errors in English at all, while dyslexic students also demonstrated fewer errors in English than in Brazilian Portuguese when decoding pseudowords. However, given the small scale of the sample, further research is needed to confirm this hypothesis more robustly.

Graph 1 - Error Performance x Word Frequency x Grade x Language x Dyslexic (D) or Non-Dyslexic (C) (the absence of bars indicates zero errors)
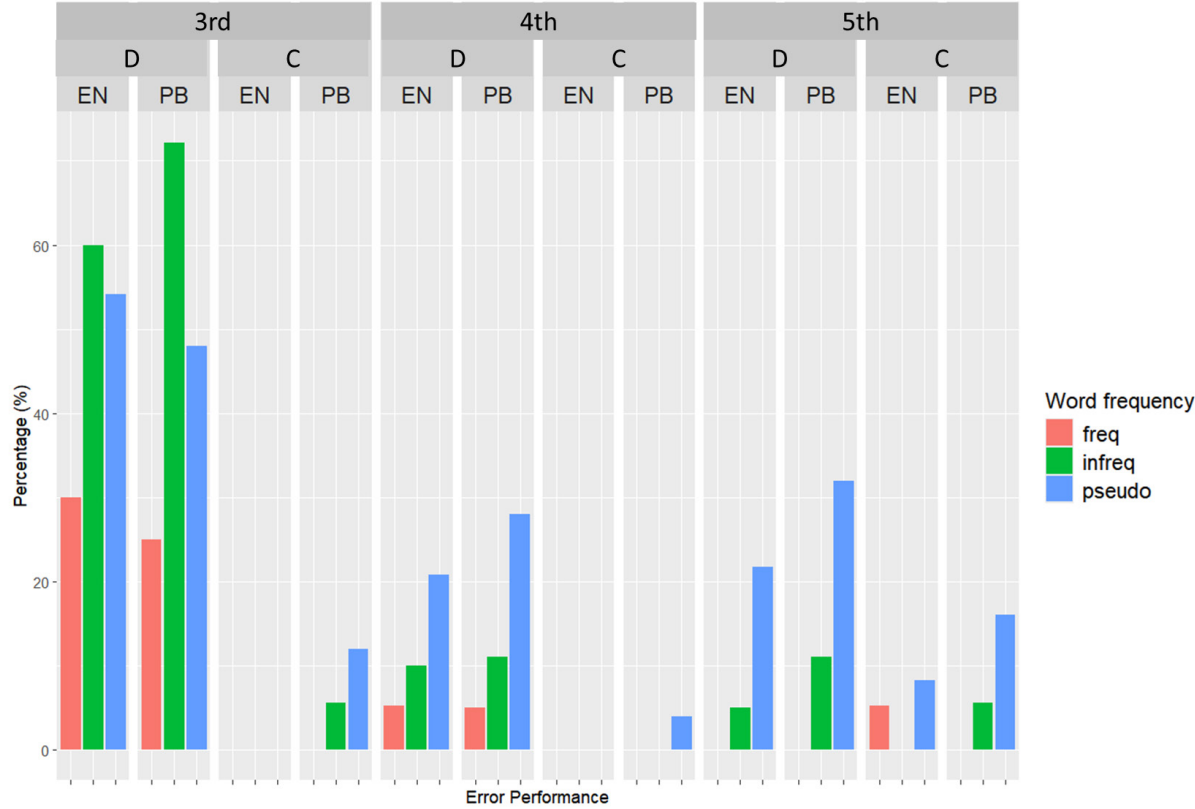
In terms of error performance per syllabic constituents, Graph 2 illustrates the percentage of error performance among dyslexic students across three different school grades (3rd, 4th, and 5th), in two languages—English (EN) and Brazilian Portuguese (BP). These patterns are further detailed in Table 2, which presents a breakdown by syllabic constituents, grade, and language, focusing exclusively on dyslexic participants. The data are categorized based on four syllabic constituents:

coda, multi, onset, and rhyme. An example of an error in the onset position is <criança> → [si'rãnsə] in BP (D1) and <slatter> → ['saʷtəɹ] in EN (D2). An example of an error in the coda position is <felino> → [fe'li] in BP (D1) and <butterfly> → [bə'təɹf] in EN (D1). An example of an error in the rhyme position is <rorola> → [xo'xɔlə] in BP (D3) and <amude> → [a'mad] in EN (D1). An example of an error in multiple positions is <machucado> → [maʃi'kudə] in BP (D1) and <secretary> → <security> in EN (D2).

Graph 2 - Error Performance x Syllabic Constituents x Grade x Language x Only Dyslexics (D)
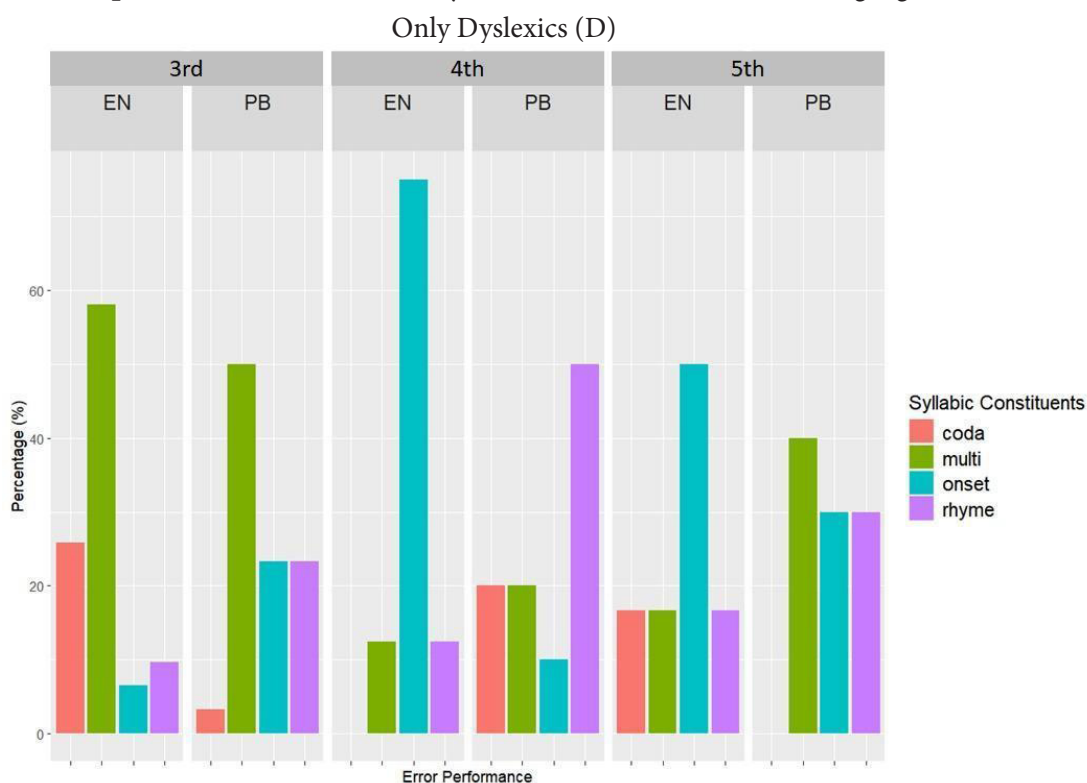

For the dyslexic student in the 3rd grade, English exhibits the highest error rate overall, as shown in Graph 2. These errors are also of the most complex type, with multiple position errors reaching 58.1%, followed by coda errors at 25.8%. In BP, multiple position errors are also the most frequent in the 3rd grade (50%), while onset and rhyme errors are both at 23.3%, and coda errors are minimal (3.3%). The 4th grader shows a shift in error patterns in English, with onset errors being the most common (75%), and all other types remaining under 13%. BP in the 4th grade is marked by a predominance of rhyme errors (50%), while other errors remain relatively low. For the 5th grader, error percentages drop compared to the other students across both languages, but in English, onset errors still lead (50%) as the main source, while BP displays a more balanced distribution between multiple positions (40%), onset (30%), and rhyme errors (30%).

Table 2 - Error Performance x Syllabic Constituents x Grade x Language x Only Dyslexics (D)

grade:	Syllabic Constituents	EN		BP	
		Number of errors (total)	errors (%)	Number of errors (total)	errors (%)
3rd	coda	8 (31)	25,8	1 (30)	3,3
	multi	18 (31)	58,1	15 (30)	50
	onset	2 (31)	6,5	7 (30)	23,3
	rhyme	3 (31)	9,7	7 (30)	23,3
4th	coda	-	-	2 (10)	20
	multi	1 (8)	12,5	2 (10)	20
	onset	6 (8)	75	1 (10)	10
	rhyme	1 (8)	12,5	5 (10)	50
5th	coda	1 (6)	16,7	-	-
	multi	1 (6)	16,7	4 (10)	40
	onset	3 (6)	50	3 (10)	30
	rhyme	1 (6)	16,7	3 (10)	30

Graph 3 and Table 3 illustrate the distribution of error types among dyslexic students in the 3rd, 4th, and 5th grades for both English (EN) and Brazilian Portuguese (BP), with percentages representing the frequency of each error category. These visual and tabular representations provide a comprehensive overview of how specific error types vary by language and grade level.

Graph 3 - Error Performance x Error Type x Language x Grade x Only Dyslexics (D)
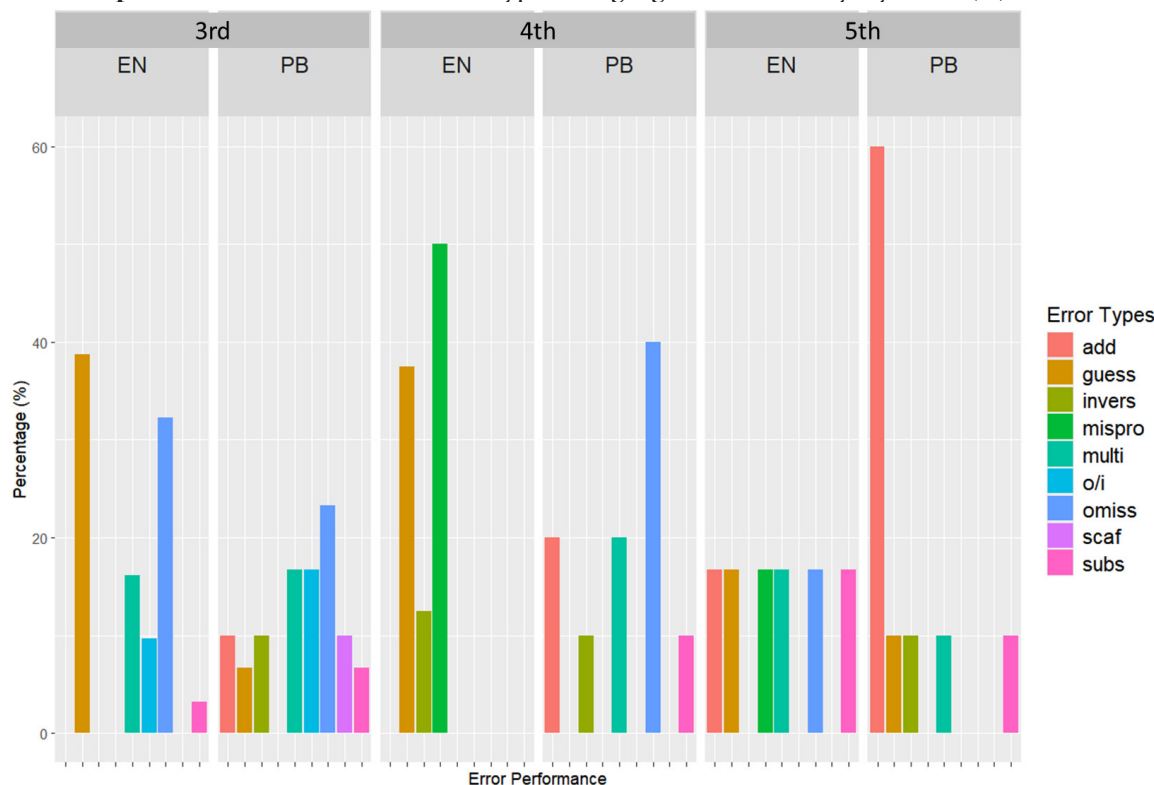
In the 3rd grade for English, guessing errors (for example: <smill> → [smaⰖl]) are the most prevalent, accounting for 38.7% of errors. These are followed by omissions, such as <butterfly> → [bə'təɹf], at 32.2%, and multiple errors, exemplified by <chonile> → [ʃaˈloni], at 16.1%. Other error types, including omission/inversion (e.g., <slatter> → [ˈsaʷtəɹ]) and substitutions (e.g., <basin> → [ˈbeɪsɪk]), occur with moderate frequency. By the 4th and 5th grades, a reduction is observed across most error types in English, although guessing and mispronunciation errors (e.g., <taxímetro> → [tɐʃiˈmɛtʊ]) continue to appear in the 4th grade at lower rates. In the 5th grade, no single error type dominates in English, in contrast to BP, where additional errors clearly stand out.

In BP, the 3rd-grade error profile differs significantly. Omission errors are the most common (23.3%), followed by multiple errors (16.7%) and omission/ inversion errors (16.7%). Guessing and substitution errors are also present but occur with less frequency. In the 4th grade, the overall error rate in BP decreases slightly, though omission remains the most frequent category at 40%. By the 5th grade, addition errors become notably more prominent, reaching 60%, with other categories showing minimal presence. This shift indicates a developmental trend in BP where certain error types, such as addition, become more frequent with grade level, possibly due to increased lexical exposure and phonological processing demands. Further examples help to contextualize these patterns. Scaffolding errors, which preserve the initial and final boundary phonemes while distorting vowel digraphs in the medial position, are exemplified by <zarronte> → [ˈzaʁtʃi] (D1). Inversion errors are also observed, such as <tabaco> → [taˈkabʊ] (D1), indicating challenges in maintaining correct phoneme sequencing.

Table 3 - Error Performance x Error Type x Language x Grade x Only Dyslexics (D)

Grade	Error Type	EN		BP	
		Number of errors (total)	Error %	Number of errors (total)	Error %
3rd	*addition*	-	-	3 (30)	10
	guessing	12 (31)	38,7	2 (30)	6,7
	inversion	-	-	3 (30)	10
	mispro	-	-	-	-
	multiple	5 (31)	16,1	5 (30)	16,7
	o/i	3 (31)	9,7	5 (30)	16,7
	omission	10 (31)	32,3	7 (30)	23,3
	scaffolding	-	-	3 (30)	10
	substitution	1 (31)	3,2	2 (30)	6,7

4th	*addition*	-	-	2 (10)	20
	guessing	3 (8)	37,5	-	-
	inversion	1 (8)	12,5	1 (10)	10
	mispro	4 (8)	50	-	-
	multiple	-	-	2 (10)	20
	o/i	-	-	-	-
	omission	-	-	4 (10)	40
	scaffolding	-	-	-	-
	substitution	-	-	1 (10)	10
5th	*addition*	1 (6)	16,7	6 (10)	60
	guessing	1 (6)	16,7	1 (10)	10
	inversion	-	-	1 (10)	10
	mispro	1 (6)	16,7	-	-
	multiple	1 (6)	16,7	1 (10)	10
	o/i	-	-	-	-
	omission	1 (6)	16,7	-	-
	scaffolding	-	-	-	-
	substitution	1 (6)	16,7	1 (10)	10

Overall, the data suggest distinct developmental trajectories in error type distribution between English and Brazilian Portuguese. In English, dyslexic students tend to make more guessing and omission errors in earlier grades, with these decreasing as reading skills develop. In contrast, BP shows a more varied error profile, with certain error types such as addition increasing in frequency in later grades. After thorough analysis, syllabic constituents and error types have been identified as significant properties that characterize performance, revealing specific error patterns in relation to each language. The interplay of language, grade, and word frequency also manifests in the specific types of errors observed. These patterns underscore the role of orthographic transparency and phonological complexity in shaping the reading difficulties experienced by bilingual dyslexic learners.

5.0 Discussion and Conclusion

This section provides a critical evaluation of the study's findings with respect to the four guiding hypotheses. By integrating the results with existing literature, it aims to deepen our understanding of how orthographic transparency, reading strategy, and cognitive load interact in bilingual dyslexic reading performance. Hypothesis 1 proposed that dyslexic bilingual learners would produce different types of reading errors in Brazilian Portuguese (BP) and English (EN), with a higher incidence of guessing-type errors anticipated in English due to its orthographic complexity and the influence of sight-word instruction. The findings support this

hypothesis. Dyslexic participants demonstrated distinct error patterns in each language. As predicted, guessing errors were more frequent in English, particularly among 3rd-grade students, while omission and addition errors predominated in BP. This pattern corresponds with the expected influence of orthographic depth and instructional practices associated with English literacy acquisition. As shown in Graph 3 and Table 3, overall error rates were slightly higher in BP than in EN, which may reflect differences in the reading strategies applied to each language. Given BP's more phonologically transparent orthography, learners are more likely to engage in phoneme-level decoding, which may increase the likelihood of omission, addition, and inversion errors. In contrast, English readers appear to rely more on whole-word recognition strategies, possibly compensating for the inconsistent grapheme–phoneme correspondences characteristic of English orthography. Consequently, errors in English were more commonly associated with onset syllables and guessing, rather than with phonological manipulation.

The predominance of guessing errors in English, as confirmed by Graph 3 and Table 3, further underscores the reliance on the lexical route in second language English reading, where sight-word strategies are emphasized. Conversely, the frequent omission and addition errors observed in BP appear to reflect phonological regularities specific to the language. For example, vowel epenthesis—a common phonological process in BP involving the insertion of a vowel between two non-liquid consonants—is well documented (Gomes, 2016; Parlato-Oliveira, 2005) and may partially explain the occurrence of addition errors in BP reading. Notably, mispronunciation errors were absent in BP but occurred in EN, again reflecting the differing phonological demands of each language. Inversion errors were also more frequent in BP than in EN, possibly due to the more active role of phonological decoding required by BP's transparent orthography. Taken together, these results indicate that the types of reading errors made by dyslexic bilingual learners vary systematically depending on the language being read. This provides strong support for Hypothesis 1, confirming that orthographic and phonological characteristics of BP and EN interact with dyslexia in distinct ways. These patterns are consistent with Bruin et al. (2020) and Lallier and Carreiras (2017), who argue that orthographic depth interacts with phonological processing, shaping the error profiles of bilingual dyslexics. Additionally, Reina et al. (2023) confirmed that error types vary systematically across languages, reinforcing the impact of orthographic transparency on decoding strategies.

Having established that dyslexic readers make different types of errors depending on the language, Hypothesis 2 further investigated whether these patterns reflect differences in reading strategy use. Hypothesis 2 proposed that bilingual readers with dyslexia would demonstrate a stronger reliance on the lexical route in both languages, with greater success in English due to this strategy being more compatible with the irregularity of the English orthographic system. It was further hypothesized that this reliance would result in better performance in English than in Brazilian Portuguese (BP), where decoding through the

phonological route is more essential due to its transparency. This hypothesis was partially supported. One of the underlying assumptions was that the lexical route may be beneficial for dyslexic readers (Ellis, 1995), and this appears to be supported by the overall better performance in English compared to BP across both participant groups.

Dyslexic individuals may have relied more heavily on the phonological route in BP and the lexical route in English, reflecting the influence of orthographic transparency on reading strategy. This partially aligns with the hypothesis that the lexical route would be more effective in English due to the language's irregular grapheme–phoneme correspondences. However, potential methodological factors must also be considered in interpreting these results. The greater transparency of BP may have made errors more easily identifiable, potentially inflating the observed error rate. In contrast, English's orthographic complexity may have introduced greater ambiguity in accuracy judgments—multiple pronunciations might have been accepted as correct, inadvertently lowering the apparent error rate. Such factors may reflect a methodological bias. Future studies should consider refining assessment procedures to better account for cross-linguistic differences in orthographic structure and pronunciation variability. This interpretation is echoed by Vender et al. (2018), who highlight that bilingual dyslexics often display advanced metalinguistic and morphological awareness that may support whole-word recognition. Likewise, Azevedo et al. (2023) observed that bilingual dyslexics performed comparably to controls in English reading tasks, while still underperforming in Portuguese. However, Snowling, Hulme, and Nation (2020) caution that overreliance on the lexical route may not suffice; structured instruction in grapheme–phoneme correspondence remains essential, especially in transparent orthographies such as BP. Thus, while reliance on the lexical route appears to offer some compensatory benefits, it should be complemented by phonological instruction tailored to language-specific orthographic demands.

While Hypothesis 2 focused on processing preferences, Hypothesis 3 turned to item-specific reading challenges, particularly the role of lexical familiarity and decoding demands. Hypothesis 3 proposed that dyslexic readers would demonstrate poorer performance on low frequency words and pseudowords in both languages, as these item types rely more heavily on sublexical decoding strategies. In contrast, typically developing bilingual peers were expected to perform better on these items, given their more efficient use of phonological mapping. The results support this hypothesis. As illustrated in Graph 1 and Table 1, dyslexic readers consistently made more errors than their typically developing peers across all conditions, including both English (EN) and Brazilian Portuguese (BP), and across word types (high frequency, low frequency, and pseudowords). These findings align with well-documented challenges dyslexic individuals face in phonological processing and sublexical decoding. Although both groups showed increased error rates for pseudowords in comparison to real words, the effect was substantially more pronounced among dyslexic participants,

indicating a specific vulnerability in tasks requiring phoneme-level analysis of unfamiliar lexical items.

Interestingly, participants tended to perform slightly worse in BP across most conditions, particularly on pseudowords, despite BP being a more transparent orthography. This unexpected pattern may be attributable to contextual factors such as differential exposure to the languages, variation in instructional methods, or differences in familiarity with the testing format. These findings suggest that while orthographic transparency may facilitate decoding in theory, its practical advantages may be moderated by learners' language experience and the cognitive demands of the task. This trend is supported by Azevedo et al. (2023), who found that bilingual dyslexic adolescents outperformed monolingual dyslexics in both languages but still lagged behind controls, particularly in tasks requiring phonological decoding. Similarly, Reina et al. (2023) noted marked difficulties with pseudowords among dyslexic children, confirming their specific vulnerability to sublexical demands.

Following this analysis of performance by word type, Hypothesis 4 narrows the focus to the specific phonological components most affected in dyslexic reading, particularly in relation to syllabic structure and word length. Hypothesis 4 proposed that dyslexic readers would produce more errors in Brazilian Portuguese (BP) in the rhyme positions of multisyllabic words. This was attributed to the combined cognitive demands of decoding longer words and the increased need for phonological processing in a transparent orthography, which may lead to cognitive overload. This pattern is interpreted in light of Broadbent's (1958) bottleneck theory. The data provide supporting evidence for this hypothesis. Within the dyslexic group, errors related to syllabic constituents—particularly in multiple and rhyme positions—were more frequent in BP than in English (EN), as illustrated in Graph 2 and Table 2. This suggests that participants were generally able to initiate word reading with some accuracy but encountered greater difficulty in completing the pronunciation, particularly toward the end of the word. This observation aligns with Broadbent's theory, which posits that cognitive overload may lead dyslexic individuals to abandon processing when cognitive demands exceed their capacity. The elevated error rate in rhyme positions, where phonological demands intensify, reinforces the idea that orthographic transparency can increase processing load for dyslexic readers, particularly with longer and more complex words. This finding is consistent with Broadbent's (1958) bottleneck theory and is reinforced by Reina et al. (2023), who observed similar patterns of syllabic difficulty in BP. Although Azevedo et al. (2023) did not directly examine syllabic positions, their results also point to greater difficulty in Portuguese among monolingual dyslexics, suggesting an increased phonological burden in that context.

Due to the small sample size, generalizations regarding age effects should be made with caution. However, a tentative trend suggests that the influence of orthographic transparency and opacity may diminish with age. Analysis across age groups revealed that guessing errors in EN decreased over time, whereas addition

errors in BP increased. Omission errors in BP, by contrast, varied across age groups without a clear developmental pattern. Similarly, the multiple occurrence error type in BP also showed age-related variation. These observations suggest that while some error types may decrease as students mature and their lexical knowledge expands, inconsistencies—likely related to difficulties in internalizing spelling-to-sound correspondences—remain a persistent characteristic of dyslexic reading profiles.

The findings of this study carry important pedagogical and methodological implications for supporting bilingual learners with dyslexia of Brazilian Portuguese (L1) and English (L2). The differential error patterns observed across languages underscore the need for language-specific instructional strategies that account for orthographic transparency and the cognitive demands associated with phonological processing. In particular, the prominence of guessing errors in English and rhyme-based errors in Brazilian Portuguese suggests that dyslexic readers may benefit from targeted interventions that strengthen both lexical and sublexical reading routes. From a methodological perspective, the results highlight the importance of designing assessment tools that are sensitive to cross-linguistic variation in orthographic structure and pronunciation norms. The potential for misclassification of errors in opaque orthographies such as English underscores the need for refined scoring criteria and clearer benchmarks for acceptable pronunciation variants. Moreover, recognizing the influence of orthographic transparency on error visibility and phonological variability reinforces the importance of distinguishing reliably between permissible variants and genuine decoding errors. These methodological considerations are essential not only for enhancing the validity of research findings but also for informing the development of pedagogical resources that are attuned to the linguistic and cognitive profiles of bilingual learners with dyslexia.

Despite the study's limited participant pool, this research aims to enhance the broader understanding of dyslexia-induced reading challenges in bilingual learners of transparent L1 and non-transparent L2. The study provides insights into the types of errors that are characteristic of dyslexic students, particularly their sensitivity to linguistic features such as syllabic constituents and language-specific reading strategies. This enhanced awareness sheds light on the complex relationship between bilingualism and dyslexia. We recommend that future research include larger samples and longitudinal designs to validate and expand upon the present findings. Longitudinal designs may offer valuable insight into how reading strategies and error patterns develop over time, while the inclusion of neurocognitive measures could further deepen our understanding of the underlying processing mechanisms. Such future directions would not only strengthen the empirical foundations of bilingual dyslexia research but also support the development of more targeted, evidence-informed pedagogical interventions.

DATA AVAILABILITY STATEMENT: Datasets related to this article will be available upon request to the corresponding author.

Notes

1. The DMS-5 (Diagnostic and Statistical Manual of Mental Disorders) includes dyslexia as a specific learning disorder, characterized by impairment in reading, in the speed of word recognition and in the decoding process, which may or may not be related to comprehension difficulties.

2. According to the American Psychiatric Association (2013), Attention Deficit Hyperactivity Disorder (ADHD) is the most common neuropsychiatric disorder in childhood and is included among the most prevalent chronic diseases among school children. ADHD is a condition that affects people's behavior. Symptoms include inattention and hyperactivity. People with ADHD can seem restless, may have trouble concentrating and may act on impulse.

3. Within the scope of this article, we are referring to L2 as the additional language learned in a formal learning context.

References

Azevedo, A. F. (2016). *Cérebro, leitura e dislexia: Um estudo experimental sobre a leitura e as bases neurais da dislexia em monolíngues e aprendizes de inglês como L2, com o uso de ressonância magnética funcional* (Doctoral dissertation, Pontifícia Universidade Católica do Rio Grande do Sul – PUC-RS).

Azevedo, A., Esper, N., Silva, A., Portuguez, M., & Buchweitz, A. (2023). Dyslexia and the perks of being bilingual: A study on the neurobiology of reading with fMRI. *Ilha do Desterro: A Journal of English Language, Literatures in English and Cultural Studies, 76*(3), 279–299.

Baronas, J. E. A., & Lini, V. (2011). Quando a oralidade se faz presente na escrita: Dados diacrônicos e sincrônicos [When orality is present in writing: Diachronic and synchronic data]. *Estudos Linguísticos, 40*(2), 1073–1083.

Broadbent, D. (1958). *Perception and communication*. London, UK: Pergamon Press.

Bruin, A., Treccani, B., & Della Sala, S. (2020). Cognitive advantage in bilingualism: An example of publication bias? *Psychological Science, 26*(1), 99–107.

Butterworth, B. (1980). Evidence from linguistic analysis for cognitive modularity. In M. P. Friedman, J. P. Das, & N. O'Connor (Eds.), *Intelligence and learning* (pp. 83–107). New York, NY: Plenum Press.

Butterworth, B. (1992). *The mathematical brain*. London, UK: Macmillan.

Cardoso-Martins, C. (2006). *Beginning reading acquisition in Brazilian Portuguese*. In J. R. Malatesha & P. G. Aaron (Eds.), *Handbook of orthography and literacy*. Mahwah, NJ: Lawrence Erlbaum.

Coltheart, M., Rastle, K., Perry, C., Langdon, R., & Ziegler, J. (2001). DRC: A dual route cascaded model of visual word recognition and reading aloud. *Psychological Review, 108*(1), 204.

Cruz-Ferreira, M. (1995). European Portuguese. *Journal of the International Phonetic Association, 25*(2), 90–94. https://doi.org/10.1017/S0025100300005223

Da Fontoura, H. A., & Siegel, L. S. (1995). Reading, syntactic, and working memory skills of bilingual Portuguese-English Canadian children. *Reading and Writing, 7*, 139–153. https://doi.org/10.1007/BF01026951

Dehaene, S. (2012). *Os neurônios da leitura: Como a ciência explica a nossa capacidade de ler*. Porto Alegre: Penso.

Ellis, A. W. (1995). *Leitura, escrita e dislexia: Uma análise cognitiva* (2.ª ed., tradução de Dayse Batista). Porto Alegre: Artes Médicas.

Gomes, E. (2016). A função da vogal epentética na construção da sílaba CV. *Margens, 8*(10), 307–318. https://doi.org/10.18542/rmi.v8i10.2740

Grosjean, F., & Li, P. (2013). *The psycholinguistics of bilingualism*. Chichester, UK: Wiley-Blackwell.

Hedman, C. (2012). Profiling dyslexia in bilingual adolescents. *International Journal of Speech-Language Pathology, 14*(6), 529–542. https://doi.org/10.3109/17549507.2012.693201

Ho, C. S.-H., & Fong, K.-M. (2005). Do Chinese dyslexic children have difficulties learning English as a second language? *Journal of Psycholinguistic Research, 34*(6), 603–618. https://doi.org/10.1007/s10936-005-9166-1

Kovelman, L., Bisconti, S., & Hoeft, L. (2016). *Literacy & dyslexia revealed through bilingual brain development*. International Dyslexia Association. Retrieved May 1, 2025, from https://dyslexiaida.org/literacy-dyslexia-revealed-through-bilingual-brain-development/

Lallier, M., Thierry, G., Barr, P., Carreiras, M., & Tainturier, M.-J. (2018). Learning to read bilingually modulates the manifestations of dyslexia in adults. *Scientific Studies of Reading, 22*(4), 335–349. https://doi.org/10.1080/10888438.2018.1447942

Łodej, M. (2016). *Dyslexia in first and foreign language learning: A cross-linguistic approach*. Newcastle upon Tyne: Cambridge Scholars Publishing.

Moura, O., Moreno, J., Pereira, M., & Simões, M. R. (2015). ***Developmental dyslexia and phonological processing in European Portuguese orthography.*** *Dyslexia, 21*(1), 60–79. https://doi.org/10.1002/dys.1489

Oliveira, C. M., Vale, A. P., & Thomson, J. M. (2021). The relationship between developmental language disorder and dyslexia in European Portuguese school-aged children. *Journal of Clinical and Experimental Neuropsychology, 43*(1), 46–65. https://doi.org/10.1080/13803395.2020.1870101

Pacheco, A., Reis, A., Araújo, S., Petersson, K. M., & Faísca, L. (2014). Dyslexia heterogeneity: Cognitive profiling of Portuguese children with dyslexia. *Reading and Writing, 27*, 1529–1545. https://doi.org/10.1007/s11145-014-9504-5

Parlato-Oliveira, E. (2009). Análise acústica da vogal epentética da língua portuguesa brasileira. In D. Hora (Ed.), *Vogais: no ponto mais oriental das Américas,* 107–122. João Pessoa: Ideia.

Peirce, J. W., Gray, J. R., Simpson, S., MacAskill, M. R., Hochenberger, R., Sogo, H., Kostmann, E., & Lindelov, J. (2019). PsychoPy2: Experiments in behavior made easy. *Behavior Research Methods*. https://doi.org/10.3758/s13428-018-01193-y

R Core Team (2023). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. https://www.R-project.org/

Reina, R., Soto, M., Marques, J., & Reina, M. (2023). Dyslexia, bilingualism and education: Influence on reading processing in L1 and L2. *Ilha do Desterro, 76*(3), 251–278. https://doi.org/10.5007/2175-8026.2023.e94534

Rodrigues, J. C., Nobre, A. P., Gauer, G., & Salles, J. F. (2015). Construção da tarefa de leitura de palavras e pseudopalavras (TLPP) e desempenho de leitores proficientes. *Temas em Psicologia, 23*(2), 413–429. http://dx.doi.org/10.9788/TP2015.2-13

Shaywitz, S. (2006). *Entendendo a dislexia: Um novo e completo programa para todos os níveis de problemas de leitura* (trad. Vinícius Figueira). Porto Alegre: Artmed.

Siqueira, E. C. G. (2018). O uso das rotas de leitura no bilinguismo e sua relação com a profundidade ortográfica e a proficiência nas línguas. *Revista do GELNE, 20*(1), 27–45.

Snowling, M. J., Hulme, C., & Nation, K. (2020). Defining and understanding dyslexia: Past, present and future. *Oxford Review of Education, 46*(4), 501–513.

Soto, M., Gomes, J. N., França, A. I., & Manhães, A. G. (2018). Neurophysiology of

grapheme decoding: The N170 as a predictive and descriptive tool. *Revista da Abralin, 17*(1), 402–433.

Van Setten, E. R. H., Tops, W., Hakvoort, B. E., van der Leij, A., Maurits, N. M., & Maassen, B. A. M. (2017). L1 and L2 reading skills in Dutch adolescents with a familial risk of dyslexia. *PeerJ, 5*, e3895. https://doi.org/10.7717/peerj.3895

Vender, M., et al. (2018). Inflectional morphology: Evidence for an advantage of bilingualism in dyslexia. *International Journal of Bilingual Education and Bilingualism*, 1–18.

Vender, M., Krivochen, D. G., Phillips, B., Saddy, D., & Delfitto, D. (2019). Implicit learning, bilingualism, and dyslexia: Insights from a study assessing AGL with a modified Simon task. *Frontiers in Psychology, 10*, 1-16.https://www.frontiersin.org/articles/10.3389/fpsyg.2019.01647

Vender, M., Delfitto, D., & Melloni, C. (2020). How do bilingual dyslexic and typically developing children perform in nonword repetition? Evidence from a study on Italian L2 children. *Bilingualism: Language and Cognition, 23*(4), 884–896. https://doi.org/10.1017/S1366728919000828

Vender, M., Vernice, M., & Sorace, A. (2021). Supporting bilingualism in vulnerable populations. *Sustainability, 13*(24), 13830. https://doi.org/10.3390/su132413830

Wechsler, D. (2011). *Wechsler Abbreviated Scale of Intelligence–Second Edition (WASI-II)*. San Antonio, TX: NCS Pearson.

Wydell, T. N., & Kondo, T. (2003). Phonological deficit and the reliance on orthographic approximation for reading: A follow-up study on an English-Japanese bilingual with monolingual dyslexia. *Journal of Research in Reading, 26*(1), 33–48.