Considerations on phonological development and assessment of phonological disorders in Brazilian children in bilingual education: an exploratory literature review

Considerações sobre o desenvolvimento e a avaliação de distúrbios fonológicos de crianças brasileiras na educação bilíngue: uma revisão exploratória da literatura

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Abstract: Despite the increase in the number of Portuguese/English bilingual schools in Brazil, regulatory policies on the number of hours of instruction in each language are still non-existent. However, considering that children may be introduced to this environment prior to developing complete phonological awareness of the sounds of their first language, it is of relevance to analyse the consequences of bilingual education for phonologically atypical children, and whether it negatively affects the clinical assessment of typically developing children in terms of over-identification. This exploratory literature review aimed to analyse the extent to which research on the phonological development in children attending Portuguese/English bilingual schools in Brazil has advanced, and whether it addresses the issue of (mis)diagnosis. Six publications, retrieved from the *Periódicos Capes* portal, were deemed (relatively) relevant to this objective. The findings indicate that studies on bilingual education in Brazil are mainly concerned with the analysis of phonological awareness and processing in order to assess reading and writing skills. Methodological aspects, e.g. the exclusion of atypically developing children, show that research on bilingualism in the Brazilian context has not advanced to the same extent as in international studies.
Keywords: Bilingual education; phonological development; phonological impairment

Resumo: Apesar do crescimento no número de escolas bilíngues português/inglês no Brasil, ainda não há políticas regulamentadoras quanto ao número de horas para a instrução em cada língua nessas instituições. Todavia, considerando que as crianças podem ser introduzidas nesse contexto antes de adquirir consciência fonológica dos sons da sua primeira língua, seria de interesse investigar as consequências do ensino bilingue em crianças fonologicamente atípicas, e se este impactaria negativamente a avaliação clínica daquelas que demonstram desenvolvimento típico, em termos de uma identificação excessiva de desvios fonológicos. Esta revisão exploratória da literatura objetivou verificar em que medida as pesquisas sobre o desenvolvimento fonológico de crianças brasileiras na educação bilíngue têm progredido e se problemas de diagnóstico são abordados. Seis publicações, extraídas do portal *Periódicos Capes*, mostraram-se (relativamente) relevantes diante desse objetivo. Conclui-se que os estudos sobre educação bilíngue no Brasil focalizam, sobretudo, na análise da consciência fonológica e do processamento fonológico a fim de avaliar habilidades de leitura e escrita. Aspectos metodológicos, como a exclusão de crianças com desenvolvimento atípico, evidenciam que as pesquisas sobre bilinguismo no contexto brasileiro não avançaram na mesma proporção que as pesquisas internacionais.
Palavras-chave: Educação bilíngue; desenvolvimento fonológico; desenvolvimento fonológico atípico.

Introduction

In recent years, the number of schools adopting a Portuguese/English bilingual approach in Brazil has increased significantly (Oliveira; Höfling, 2021), although official policies have not been issued to regulate these institutions.

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Currently, only a proposal for curricular guidelines, issued in 2020, exists. Many shortcomings have been identified in the document by Oliveira and Höfling (2021), including a lack of guidelines for the allocation of instruction hours to each language. Consequently, schools establish their own curricular norms, and practices may differ between institutions. For instance, some schools use English as the medium of instruction for all or part of the curriculum, whereas others determine a specific ratio of hours to dedicate to each language (e.g. a fifty-fifty per cent approach). Additionally, it is not uncommon for schools to identify themselves as bilingual despite offering only extracurricular English classes and not focusing on the development of bilingual skills (Oliveira; Höfling, 2021).

Bilingualism is a complex construct that goes beyond linguistic aspects. According to Butler (2013), bilingualism is multidimensional, contextual, non-static and heterogeneous. Its multidimensionality includes: the degree of proficiency in two languages (*balanced* and *dominant* bilinguals); the age of acquisition: *simultaneous* bilinguals (who have contact with both languages from birth), *sequential* bilinguals (L2 acquisition during childhood) and *late* bilinguals (L2 acquisition in adulthood); cultural identity (*bicultural* and *monocultural* bilinguals) (Butler, 2013). The following example illustrates a context-dependent aspect that shapes bilingualism: a child born to Brazilian parents in England may use Portuguese at home and English at school. The amount of use of each language may change over the course of time; as this child grows up in England, the L2 may become dominant as he/she develops social and professional relations, which consequently affects his/her L1 proficiency. Thus, proficiency is not static and is subject to changes according to the degree of language practice. The dimensions of bilingualism should be considered and adapted to the bilingual education context.

Considering that genuine contexts of bilingual education are those where two languages are used as a means of instruction through constant and meaningful practices (Garcia, 2009 *apud* Brentano and Finger, 2020), it is of great importance to examine the impact of bilingual education on children's speech development, as they may be introduced to this environment before having fully acquired the phonological system of their L1. Of particular interest are the implications for children who are prone to phonological impairments.

The purpose of this article is to conduct an exploratory literature review of the current state of research on phonological development (PD) in children attending

Portuguese/English bilingual schools (PEBS) in Brazil, focusing on the extent to which this issue is addressed considering children with speech development issues.

In light of this introductory section, the remainder of this article is structured as follows: in the next section, I present an overview of international studies that investigate PD issues in bilingual children with and without speech impairments; subsequently, the objectives and methods are presented; the following section is dedicated to a review of the literature on PD in children attending PEBS in Brazil; and the last part of the article consists of a discussion and recommendations for future studies.

Phonology and bilingualism in (a)typically developing children: an overview

From the mid to late twentieth century, studies of PD carried out with bilingual children were usually characterised as individual case studies (Vihman, 2014). Therefore, their findings were difficult to generalise. Their focus was on perception and phonological processing rather than on specific aspects of oral production. A review of ten studies conducted between 1975 and 2004 can be found in Vihman (2014).

Recently, there has been an increase in the number of large-scale studies that address the PD of bilinguals by comparing their oral performances to those of monolinguals. For example, the studies by Marecka *et al.* (2020) and Sieg, Fabiano and Barlow (2023) are methodologically and theoretically similar. PRIMIR (*Processing Rich Information from Multidimensional Interactive Representations*) (Curtin; Byers-Heinlein; Werker, 2011) is a framework that underpins the interpretation of their findings.

PRIMIR explains the relation between early speech perception and lexical development in bilinguals by describing how information from input is processed and stored into phonetic/phonological spaces. The PD addressed by this framework is exclusively in the domain of phonemes (i.e. it does not address prosodic aspects).

In early infancy, children automatically capture certain auditory input and establish specific linguistic categories. As infants' knowledge of the language(s) being acquired improves, they develop mechanisms to direct intake into appropriate *Representational Spaces* and to manage stored information. These spaces are multidimensional and interactive, and include: (i) The *General Perceptual Space*, which stores phonetic (articulatory and acoustic cues) and indexical (visual aspects and voice quality) information. This is not a phonetic category yet, since at this stage phonemes do not have

contrastive properties; (ii) *Word Form Space*, which stores patterns of sound sequences. Initially, it implies in simple associations between words and objects, but conceptual meaning develops over time; and (iii) *Phoneme Space*, which emerges as associations of word-form meanings increase. Phonemic representations emerge from generalizations of information stored within the General Perceptual Space, and phonemes are categorised according to context-sensitive criteria (i.e. separate representations are created for word-initial /t/ and word-final /t/) (Curtin; Byers-Heinlein; Werker, 2011). These spaces do not necessarily mature sequentially or hierarchically, and can develop in an interactive way (Curtin; Byers-Heinlein; Werker, 2011). According to the PRIMIR principles, the establishment of phonological representational spaces in simultaneous and early sequential bilingual children is subject to between-language interaction.

As stated in Marecka *et al.* (2020), bilingual children's phonology can be characterised by *transfer* (incorporating an element from one language into another), *acceleration* (acquiring certain elements earlier than monolinguals), or *deceleration* (acquiring a certain element later than a monolingual). The authors argue that there are two reasons why PRIMIR explains deceleration: increased processing demands limiting access to phonological representations, and underdeveloped phoneme representations.

Clinical assessment of PD in bilingual children is based on quantitative data extracted from narrow phonetic transcription, in order to analyse phonological processes (substitutions, deletions or misarticulations of sounds) (Marecka *et al*, 2020; Rose, 2020).

The study by Marecka *et al.* (2020) describes deceleration and transfer in 30 bilingual Polish/English children without impairments born to Polish migrants in England, aged 4;7–7 (years; months). Their oral production performances were compared to those of a group of monolinguals raised in Poland. The findings were discussed within the PRIMIR framework. The results show no statistically significant difference between the bilinguals and the monolinguals, and the speech of bilinguals was characterised by transfer, but not by deceleration. This suggests that while deceleration ceases in children above the age of 4;7, transfer continues to occur.

According to Marecka *et al.* (2020) and Paradis (2022), the speech of bilingual children differs from that of their monolingual peers and might resemble the speech of atypically developing monolingual children. This may lead to misdiagnosis, as bilinguals may be assessed by speech therapists as unintelligible.

Sieg, Fabiano and Barlow (2023) collected data on bilingual Latin children (Spanish/English) living in the USA, aiming to contribute to clinical assessment. Participants (n=70) were aged between 3;11–6;7, seven of whom had speech impairments. Data was analysed according to the PRIMIR framework. The results reveal that certain sounds were used as substitutes on the basis of their relatively uncomplexity and commonality between languages. This finding is consistent with the PRIMIR framework: the avoidance of unshared sounds suggests that there is less interaction between the representational spaces when acquisition is at its beginning. The typically developing bilinguals produced a lower rate of substitutions in English than their atypically developing peers. However, there was no difference between the groups in the Spanish productions. The children with impairments used more early developing sounds as substitutes and showed more variability in their substitution patterns. Sieg, Fabiano and Barlow (2023) recommend that clinical assessment should be based on both quantitative and descriptive analyses. However, no direction for intervention is given.

Goldstein and Neumann (2015) note that there is little research on clinical intervention for bilingual children with speech impairments, and no consensus on effective intervention approaches. They support dual language intervention, as these children will manifest speech disorders in both languages, and advise that treatment goals are chosen according to specific needs (e.g. reducing syllabic error patterns, increasing phonetic inventory, etc.). In instances where multiple goals are identified, they recommend focusing on one at a time. Another important consideration is how to create a therapy design that effectively achieves dual language goals (i.e. treating both languages in one session vs. alternating between the languages across sessions).

There are two trends of clinical practice for bilingual children with phonological disorders, as reported by Paradis (2022): one that encourages parents to use one language, and another that supports dual language use at home.

Accordingly, research on PD in bilingual children needs to work towards improving the reliability of tests used to assess phonological (under)development, as well as establishing effective clinical practice.

Objective and methods

The purpose of this article is to investigate the extent to which research on PD in Brazilian children attending PEBSs has advanced, and whether it addresses the issue of (mis)diagnosis.

This qualitative study is exploratory in nature (Creswell, 2007), as the topic is believed to be under-researched in the Brazilian context. Thus, a general overview of emerging studies is provided, along with the identification of key research gaps.

Firstly, an exploratory literature review was carried out on *Periódicos CAPES* portal (https://www-periodicos-capes-gov-br) between May and June 2024. Successive attempts with various combinations of keywords, such as "bilingual children AND pathology" and "bilingual AND impairment", yielded no results. A total of seven results were obtained for the combination “bilingual AND pathology”, but they were considered irrelevant for the purpose of the present study since they focused on bilingual children with hearing impairments who are users of LIBRAS (“Brazilian Portuguese Sign Language”). As a consequence, the more general term “bilingual children” was entered in the subject search field, with filters set to “Portuguese” and “English” and to open-access files. The total number of items retrieved was 217 (202 articles, eight dissertations, and seven book chapters), produced between 2002 and 2024.

The initial selection process consisted of reading the titles and, where necessary, part of the abstracts. As a result, 16 files were selected. Given that the majority of these studies are concerned with bilingual literacy (i.e., the development of reading and writing skills), I considered them important to analyse since they could potentially provide data on phonological processing and phonological awareness (PA) that could potentially be considered from the perspective of oral production. Thus, the 16 selected files (15 articles and one dissertation) were read in their entirety. This process led to the exclusion of ten papers. The main reason for excluding these ten publications was that most of them were literature reviews which aimed to reflect on the (dis)advantages of bilingual education for the development of either cognitive or literacy skills, without addressing PD, phonological processing, PA, or procedures to assess these skills. Moreover, among the papers that were discarded, there were studies on pedagogical practices for the development of literacy skills in PEBSs and on the oral production of bilingual Brazilian children whose L2 was not English. In addition, it was found that one research study was duplicate, i.e. it had been published by two different journals. Finally, six papers (five articles and one

dissertation), which are presented in the next section, were considered relevant for the purposes of this article. This process is outlined in chat 1 below.

Chart 1: Steps of the exploratory literature review carried out on *Periódicos Capes* portal

Step	Procedure	Outcome
1	Keywords: "bilingual children AND pathology"; "bilingual AND impairment"; "bilingual education AND phonological development"	No results.
2	Keywords: "bilingual AND pathology"	Children who are users of LIBRAS
3	Keyword: "bilingual children" Filters: "Portuguese" and "English"; open access; 2002-2024	217 (202 articles + 8 dissertations + 7 book chapters)
4	Reading of the 217 titles and part of the abstracts	16 files selected
5	16 publications were fully read	10 papers excluded: literature reviews, pedagogical practices, oral production of bilinguals whose L2 was not English, a research study that has been published twice.
6	6 papers were selected (5 articles and 1 dissertation)	4 papers on the assessment of PA, phonological processing and access to the mental lexicon with a focus on literacy; 2 papers on qualitative accounts of oral production.

Source: Elaborated by the author.

The second part of this study consisted of a search for research groups in Brazil in the fields of linguistics and speech therapy that investigate PD in children with impairments, conducted in July 2024. The aim was to find out whether they conduct this type of research on Portuguese/English bilingualism. Unfortunately, no information was found on this specific topic. A list of the research groups found and their topics of interest are presented on chart 2 below.

Chart 2: Research groups in Brazil studying bilingualism and PD in children with and without speech-language disorders

Research Group	Institution	Topics
Grupo de Estudos de Psicolinguística e Desenvolvimento Fonológico **Coordinator:** Profa. Dra. Maria de Fátima de Almeida Baía	*Universidade Estadual do Sudoeste da Bahia*	Phonological development and musicality, typical development of writing abilities and acquisition of specific sounds in (Portuguese-Armenian) bilingual children, the emergence of templates during the PD of (a)typical monolingual children, speech development of monolingual children with Down Syndrome, PD in monolingual twins, prosodic development in monolingual children with autism spectrum disorder (ASD).
Estruturas Gramaticais e de Aquisição da Linguagem **Coordinator:** Profa. Dra. Adriana Stella Cardoso Lessa de Oliveira	*Universidade Estadual do Sudoeste da Bahia*	Oral and written language acquisition by monolingual children with auditory impairments.

Núcleo Interdisciplinar em Desenvolvimento Infantil (NIDI) **Coordinator:** Profa. Dra. Ana Paula Ramos de Souza	*Universidade Federal de Santa Maria*	The relation between language acquisition delay and psychic suffering in monolingual children, infant L1 acquisition, linguistic development in monolingual children with Down Syndrome and ASD, syllabic and phonemic awareness in typical and atypical developing monolingual children.
NALingua **Coordinator:** Profa. Dra. Alessandra Del Ré	*Universidade Estadual Paulista "Júlio de Mesquita Filho"*	Dysfluency and stuttering in monolingual children aged 2-5 years, bilingualism/multilingualism in migrant children in Brazil, L1 acquisition.
Grupo de Pesquisa Estudos sobre a Linguagem (GPEL) **Coordinator:** Prof. Dr. Lourenço Chacon Jurado Filho	*Universidade Estadual Paulista "Júlio de Mesquita Filho"*	Prosodic perception and production in typical and atypical monolingual children (Profa. Dra. Geovana Carina Neris Soncin). Perception and production of segmental aspects in monolingual children with phonological impairments, substitution errors and articulation gestures in monolingual children with phonological disorders analysed by ultrasonographic technology, speech therapy assessment and intervention in monolingual children with disorders in a phonetic perspective (Profa. Dra. Larissa Cristina Berti). Non-conventional segmentations (hypo- and hyper-segmentations) of words in orthographic productions of monolingual children, the relation between prosodic constituents to orthographic (mis)segmentations. (Prof. Dr. Lourenço Chacon Jurado Filho).
Linguagem, Aprendizagem, Escolaridade **Coordinator:** Profa. Dra. Simone Aparecida Capellini	*Universidade Estadual Paulista "Júlio de Mesquita Filho"*	Writing and orthographic abilities of monolingual children with dyslexia and learning delay, reading performance of children with stuttering.

Source: Elaborated by the author.

An exploratory literature review: phonological issues and bilingualism in Brazil

In this section, six publications selected from an exploratory literature review that was carried out on the *Periódicos CAPES* portal are presented. This review aimed to investigate the extent to which research on PD in Brazilian children attending PEBSs has progressed, and whether the issue of (mis)diagnosis is considered.

As previously stated, the majority of studies retrieved from this literature review focus on the development of reading and writing skills in bilingual children attending PEBSs. Nevertheless, they are included in this analysis because their methodological aspects or results may provide data on phonological processing and PA, which can possibly be considered from the perspective of oral production.

Chart 3 presents a summary of the studies reviewed. Explanations and comments on each study are subsequently provided.

Chart 3: Summary of the publications selected for this exploratory literature review

Publication	Goal	Participants	Methods	Results
Title: *Desenvolvimento do processamento fonológico em crianças inseridas no ensino bilíngue* ("The development of the phonological processing in children in bilingual education") **Author:** Lia Netto Vaz Faiad **Type/year:** Dissertation/2021	To assess the performance of children enrolled in a PEBS on tests of phonological processing abilities, and to investigate the influence of these skills on the development of writing.	72 children (first grade of elementary school): 38 (PEBS) and 34 (monolingual education). **Exclusion criteria:** learning difficulties, visual and hearing impairments, and neurological disorders.	**Experimental tests**: *Phonological Working Memory Test*; *Sequential Assessment Instrument*; *Rapid Automatised Naming* (RAN); and assessment of written performance (dictation task). **Data analysis**: Mann-Whitney's test.	- *Phonological Working Memory Test:* superior performance of bilinguals on digits (p=0,028). - *Sequential Assessment Instrument*: superior PA of bilinguals (p=0,015), mainly phonemic (p=0,022). No statistical significance on the subtests. - *RAN*: superior performance of the bilinguals in the tasks of letters (p=0,016) and numbers (p=0,005). No statistical significance on objects and colours. - *Written task*: superior performance (p=0.035) of the bilingual group (92.1% of bilinguals had a satisfactory writing level x 73.5% of monolinguals).
Title: Bilingualism and Rapid Automatized Naming: effects of language switching on lexical access and reading speed **Authors:** Esther Simonato, Anne Taffin d'Heursel Baldisseri, Clara Regina Brandão de Ávila **Type/year:** Article/2020	To assess: whether bilingualism, regarding language switching, is associated with higher or lower accuracy in naming objects; and whether the speed of access to the mental lexicon is related to reading speed.	97 Brazilian children, aged 7-9: 50 (PEBS with 30 hours a week of L2 exposure for at least three years) and 47 (monolingual school). **Exclusion criteria:** indications/diagnoses related to sensorial, auditorial, cognitive, neurological, psychiatric, learning or communication impairments.	**Experimental test**: *Rapid Automatised Naming* (RAN) and reading task. **Data analysis**: - Variables: substitution, omission, intrusion, hesitation, repetition and self-correction; - RAN: total time spent; - Reading: number of words; - Descriptive statistics; - Inferential statistics.	- Bilinguals produced more hesitations (p=0.003). No differences for the other variables. - No correlations between the number of errors and the number of words read per minute for either group. - Significant (negative) correlation (p=0.001) between the time spent on rapid naming and the number of words read per minute for the bilingual group in the English test. No significant correlation (p=0.633) for the Portuguese analysis.
Title: *A hesitação em aulas de língua inglesa* ("Hesitation	To analyse hesitation marks in the	Nine children (aged 2-3)	**Material**: four extracts (ranging from 23 to 40	Learning a new language is interwoven with all sorts of

in English language classes") **Authors:** Natália Borges Carlos, Josimayre Novelli, Cristiane Carneiro Capristano **Type/year:** Article/2020	oral performance of children attending a bilingual school in order to investigate the influence of hesitations on the learning of the L2.	enrolled in a PEBS.	seconds) from a recorded lesson depicting student-teacher interactions. **Method**: transcription and classification of pauses (Marcuschi, 1999). **Data analysis:** qualitative (linguistic-discursive view); body language, contextual and verbal aspects.	experiences that children carry with them. Hesitation marks represent not only the process of acquiring a new linguistic system, but also the formation of a child's identity.
Title: Desenvolvimento da fala infantil: neurolinguística e aquisição da linguagem em crianças bilíngues (*"Development of child speech: neurolinguistics and language acquisition in bilingual children"*) **Authors:** Mariana Gonçalves Vargas, Glória Alice Wanka, Mariana Aparecida Vicentini, Fabiana Boos Vásquez. **Type/year:** Article/2023	To better understand, from a neurolinguistic perspective, the development of oral abilities in children attending a public school in order to contribute to clinical and educational fields.	Six children (aged 2-6) enrolled in a public school: - two Haitian refugees (L1 reported as French); - two Brazilian monolinguals with ASD; - two Brazilian monolinguals with reported speech development delay.	**Type of study:** Longitudinal observation (2 years). **Data collection and analysis**: no information is given.	- The Haitian children learned Portuguese in just one month. - The children with ASD exhibited a notable aptitude for oral comprehension and production in English. - No results are reported for the Brazilian monolinguals with speech development delay.
Title: Profile of phonological awareness in bilingual and monolingual children **Authors:** Lourdes Bernadete Rocha de Souza, Aline Gisele Conceição Leite **Type/year:** Article/2014	To compare the PA performance of Brazilian children enrolled in a PEBS with that of children in monolingual education.	17 third-year students, aged 7-8;11, enrolled in a PEBS (n=9) and in a monolingual school (n=8). **Exclusion criteria:** auditory impairments and learning difficulties; less than two years in PEBS.	**Experimental test:** *Phonological Awareness Profile Test*: rhyme (reception and sequence); syllable/phoneme addition, subtraction, substitution; sentence/word segmentation; syllabic reversal; articulation image.	- Bilingual children obtained superior overall scores (p=0.027), as well as on sequential rhyming (p=0.041). - On articulation image skills, bilinguals scored near the threshold considered statistically significant (p=0.050). - Monolingual children obtained marginally superior scores, though not statistically significant, on word segmentation and syllabic reversal.

			Data analysis: Mann-Whitney's test.	
Title: Processamento fonológico em crianças com dificuldade de aprendizagem em escolas bilíngues português-inglês: relatos de casos ("*Phonological processing and reading in children with learning difficulties in Portuguese/English bilingual schools: case reports"*). **Authors:** Thayane Amanda de Lima Rocha, Ana Carolina Dantas de Medeiros, Bárbara Louise Cista Messias, Anna Irenne de Lima Azevedo, Cíntia Alves Salgado-Azoni. **Type/year:** Article/2021	To characterise the performance of Brazilian children with learning difficulties attending a PEBS in phonological processing and reading skills.	Three Brazilian students (aged 8;2-8;7) attending PEBSs (half the curriculums per language) for a minimum of 5 years. *Child 1* (female): born in France to Brazilian parents and relocated to Brazil at the age of two. Attended a French school prior the PEBS. Written production issue: substitution of letters. *Child 2* (male) and *Child 3* (female): no previous contact with a foreign language. Written production issues: hypo-segmentation of words.	**Experimental tests:** PA skills on syllabic and phonemic level (synthesis, alliteration, segmentation, rhyme, identification and transposition); *Phonological Working Memory Test;* Access to the mental lexicon (*Rapid Automatised Naming* – RAN and *Automatic Naming* – TENA); reading aloud task; and reading comprehension task.	- Child 1: PA and phonological working memory scores below the average for her age; unsatisfactory score on access to the lexicon; reading was paused and slow; failed to understand the main ideas of the text. - Child 2: satisfactory scores on the PA test and access to the lexicon; average score for phonological working memory; reading was paused and slow; managed to partially understand the main ideas of the text. - Child 3: satisfactory PA scores; results on phonological working memory test were unsatisfactory for non-words, but average for digits; satisfactory access to the lexicon; average reading speed; managed to partially understand the main ideas of the text.

Source: Elaborated by the author.

The research conducted by Faiad (2021) aimed to assess the performance of 38 children enrolled in a private PEBS on three phonological processing skills (phonological memory, PA, and access to the lexicon) in order to verify their influence on the development of writing skills. Thirty-four children who received a monolingual education were used as a comparison group. Both the bilingual and monolingual participants were in the first year of elementary education and had been enrolled in their respective schools for an average of 2.9 years. Children with reported delays in learning, hearing difficulties, and neurological impairments were excluded from the corpus.

The following tests were administered by Faiad (2021): (i) *Phonological Working Memory Test* (Hage; Grivol, 2009), to verify the number of elements from a list of non-words and a set of digits (presented in a direct and inverse order) that a child could retrieve

from immediate memory by repeating each item immediately after hearing it; (ii) *Sequential Assessment Instrument* (Moojen *et al*., 2015), composed by a set of tasks designed to measure PA skills on syllable and phoneme level: segmentation, synthesis and identification of sounds (initial, medial and final positions), rhyme identification and production, production of words with a given syllable, exclusion and transposition; (iii) *Rapid Automatised Naming* (RAN) *Task* (Wolf; Denkla, 2005), to assess the speed with which a child names stimuli (colours, numbers and objects) that are presented visually and alternatively. It is unclear whether the two latter tests and the writing task were administered to the bilingual group in both languages or only in Portuguese.

The results obtained by Faiad (2021) show an advantage among the bilinguals in terms of access to the lexicon, the storage of phonological information, and written performance. The author posits that there is no delay in the development of literacy skills and phonological processing in children in PEBSs. Consequently, she advocates for the introduction of children to PEBSs as early as possible (at or before the literacy stage), in order to positively influence their metalinguistic abilities during the literacy development stage.

A prospective avenue for further research would be to examine the suitability of the *Sequential Assessment Instrument* (Moojen *et al*., 2015) for the context of oral production. For instance, a comparison of the performance of children in bilingual and monolingual education on the production subtests of this instrument could contribute to verifying whether PD is decelerated in children attending PEBSs. The inclusion of children suspected of having phonological impairments in such a study would prove beneficial for the development of a reliable clinical assessment tool.

The RAN test was also used by Simonato, Baldisseri and Avila (2020) in a language switching experiment that aimed to assess the effect of bilingualism on the level of accuracy in naming objects, in addition to analyse whether the speed of accessing the mental lexicon is related to reading speed. The performance of 50 Brazilian children attending a PEBS was compared with that of 47 children receiving a monolingual education in Portuguese. The participants were aged between seven and nine years. Children with learning difficulties and impairments were excluded from the corpus. The monolingual children were given the RAN test in Portuguese, while the bilingual children were given the same version of the test in both languages. The data were analysed

according to the criteria of substitution, omission, intrusion, hesitation, repetition and self-correction.

The results demonstrate that language switching negatively affected the performance of the bilingual group in terms of speed and accuracy, and that their performance was characterised by a significant prevalence of hesitations. To explain this, the authors argue that the RAN task demands not only executive functions but also considerable verbal skills. Also, they hypothesise that the hesitations can be attributed to difficulties in lexical access among the bilinguals. Therefore, adapting this methodology in light of the PRIMIR framework would be useful for assessing the PD in Brazilian children attending bilingual schools, at both the phonemic and prosodic levels.

Carlos, Noveli and Capristano (2020) analysed hesitation marks in spontaneous speech of 2–3-year-old children (n=9) attending a PEBS. Pauses were observed in recorded lessons where children were interacting with teachers while learning the names of colours in English. The results were interpreted from a linguistic-discursive perspective. The authors conclude that the occurrence of hesitations should be seen not only as a sign of contact with a new language, but also as a way of constituting a child's identity. The acquisition of a foreign language is therefore complex, since it involves an immersion in a linguistic-discursive system that is intertwined with all the (school and non-school) experiences that the children carry with them (Carlos, Noveli and Capristano, 2020). Although prosodic disorders are not addressed in this study, we can conclude that an integrated approach combining speech and psychological therapies may prove beneficial for children experiencing such issues.

Vargas *et al.* (2023) carried out a longitudinal study in which the oral performance of six children (aged 2-6 years) attending a public municipal school in the southern region of Brazil was observed for a two-year period. The purpose of the study was to understand the development of oral abilities among these children from a neurolinguistic perspective, contributing to both clinical and educational fields. The participants were grouped as follows: (i) two Haitian refugees, whose L1 was reported as French; (ii) two Brazilian monolinguals with ASD; and (iii) two Brazilian monolinguals with suspected speech development delay.

The authors reported that the Haitians demonstrated rapid adaptation to Portuguese, having learned the new language in one month, although no details about this process are provided. Furthermore, the terms "language learning" and "language

adaptation" are not defined by the authors and seem to be used in this context in a non-technical manner. With regard to the group of children with ASD, it is reported that they demonstrated considerable dexterity with oral comprehension and production in English. The authors argue that children with ASD are more likely to retain cerebral plasticity than their typically developing peers, although they do not refer to any theory to support this claim. In addition, it is unclear from the text whether children with ASD were receiving instruction in English at the school where the research was conducted. Findings for the third group are not presented. Overall, Vargas *et al.*'s (2023) results are not specified, and phonological aspects are not addressed. Furthermore, the authors do not describe the methodology they used to collect and analyse the data, and the neurolinguistic perspective that should underpin their findings is only superficially presented. It can therefore be concluded that the findings of this study lack reliability due to the absence of empirical analysis and the lack of clarity regarding the methodology employed.

The objective of Souza and Leite's (2014) descriptive cross-sectional research study was to compare the performance of Brazilian children attending bilingual and monolingual educational programmes on a PA test. Drawing on contributions from other authors, the researchers define PA ability as the capacity to reflect on and to manipulate the structural sound components of words, which is essential for learning how to read and write. The participants were 17 third-year students aged between 7;00-8;11 who were attending two private schools (one PEBS and a school with a monolingual curriculum) in the north-western region of Brazil. Students with auditory impairments and learning difficulties were excluded from the study. The *Phonological Awareness Profile Test* was administered to the participants. This test, which is similar to the one administered by Faiad (2021), comprised nine subtests, including: syllable and phoneme subtraction, rhyme perception, syllabic reversal, sentence and word segmentation, and articulation image. It is not clear whether the test was administered to the bilingual group in both languages or only in Portuguese.

According to the overall results, 64.7% of the participants performed within expectations for their age, while 35.3% performed above expectations. Of these, 83.3% were bilingual. The authors found that monolingual children exhibited superior performance on two tests: word segmentation and syllabic reversal. They hypothesize that this phenomenon may be justified by the fact that Brazilian Portuguese is a syllabic language, which may enable children to recognise phonological units more easily.

Conversely, the bilinguals obtained better results on the phonemic awareness subtest, a skill that is considered more complex than syllabic awareness. It may be attributed, according to the authors, to the richer linguistic environment these children are immersed, which allows the development of skills pertinent to phoneme discrimination. According to Souza and Leite's (2014), this hypothesis is convergent with studies that claim that bilingual children tend to pay more attention to phonetic rather than to semantic aspects. Additionally, bilingual children demonstrated superior performance on the skill of sequential rhyming, as well as statistically significant superior results compared to the monolingual group on the articulation image test. The researchers conclude that exposure to two languages makes children more sensitive to the perception of sounds.

The investigation conducted by Rocha *et al.* (2022) aimed to characterise the phonological processing abilities underlying the reading performance of Brazilian children with learning difficulties enrolled in PEBSs. The study comprised three case studies of individual children who had been referred for clinical assessment following parental observation of reading and writing difficulties. Participants were two females and one male, aged between 8;2-8;7, who had been attending PEBSs for at least five years. *Child 1* was born in France to Brazilian parents, having moved to Brazil at the age of two, where she initially attended a French school before moving to a PEBS. *Child 2* and *Child 3* had no previous exposure to foreign languages prior to attending PEBSs.

Similarly to Faiad (2021) and Souza and Leite (2014), Rocha *et al.* (2022) administered the *Phonological Working Memory Test,* two mental lexicon access tests (RAN and TENA – *Automatic Naming Test*), and a test to assess PA skills (e.g. segmentation and syllable identification). Additionally, tasks were employed to assess reading aloud performance and reading comprehension. It is unclear whether the tests were administered in both languages or solely in Portuguese.

Child 1 did not achieve the expected score for her age on the PA test, indicating a lack of phonemic awareness. Nonetheless, the syllabic awareness abilities demonstrated by *Child 1* are within the expected range for her age. According to the results of the mental lexicon access test, *Child 1* and *Child 2* exhibited slower processing of phonological information than would be expected for their age. The results concerning the PA abilities obtained by *Child 2* and *Child 3*, especially at the phoneme level, are consistent with previous studies that detected better performance of bilinguals in certain PA tests in comparison to their monolingual peers. *Child 1* was the participant who obtained the

lowest scores in the majority of the tests. This suggests that the cognitive delay affecting her reading abilities may be due to her early exposure to three languages.

It is believed that the methodology employed by Rocha *et al*. (2022) for assessing oral performance would be useful to analyse the impact of bilingualism on PD in children with a background similar to that of Child 1, as well as to contribute to the implementation of reliable clinical practices.

In conclusion, while international studies on PD in bilingual children have advanced from perception to production, research with Brazilian children in PEBSs has focused primarily on perception and phonological processing, emphasising literacy and methods similar to those that were used in international studies in the twentieth century (as previously reported). The tendency to exclude participants with impairments is also indicative of the limited advancement of studies on bilingualism in the Brazilian context. Another caveat identified in this exploratory literature review is the lack of explicitness, in the majority of studies, about the languages in which the tests were administered to the bilingual participants.

It is nevertheless important to emphasise that the studies reviewed in this section make a significant contribution to the field of bilingual education in the Brazilian context. The assessment of PA with a focus on reading and writing is of great significance, as literacy is a direct reflection of a child's cognitive and linguistic abilities. However, with the advent of PEBSs in Brazil, it is important that the focus be directed towards oral production skills, and that they be assessed in both languages.

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Discussion and conclusion

The aim of this article was to investigate how research on PD in Brazilian children in PEBSs has advanced and whether it addresses (mis)diagnosis.

Firstly, I presented a brief historical overview of international studies on PD in bilingual children, as well as the findings of two investigations (Marecka *et al.*, 2020; Sieg, Fabiano and Barlow, 2023), accompanied by the explanation of the PRIMIR framework (Curtin; Byers-Heinlein; Werker, 2011). Subsequently, I presented the results of an exploratory literature review, which indicated that research conducted with Brazilian children attending PEBSs is predominantly focused on literacy skills rather than on PD. It can therefore be concluded that the PD in children attending PEBSs in Brazil is a relatively understudied area.

However, the fact that this literature review was based only on open access files from a single database may be considered a limitation.

As a direction for future research, it is recommended that the tests used in the aforementioned studies be administered concurrently with tests designed to assess oral production skills. The results could be interpreted in the light of the PRIMIR framework (Curtin; Byers-Heinlein; Werker, 2011), as this theory can serve as a foundation for understanding the relationship between phonological processing, PA and oral production specificities. The inclusion of children with impairments would potentially contribute to the advancement of this field of research by offering a more comprehensive view of bilingualism in Brazilian education, as well as contributing to the development of reliable clinical protocols for the assessment of PD among children attending these institutions. To avoid concerns about validity, it is important that this type of research be conducted without a monolingual bias. According to Buttler (2013), it is necessary to question the validity of studies that assess the proficiency of bilinguals through a comparison to the proficiency of monolinguals, since the abilities of these two groups are qualitatively distinct. In other words, bilinguals should not be seen as a simple combination of two monolinguals, and their skills should be considered in their own right.

The study of PD in children enrolled in PEBSs would also be relevant for helping teachers understand their pupils' developmental processes and, consequently, make their practice more inclusive. Moreover, equipping teachers in PEBSs with psycholinguistic and phonetic/phonological knowledge would lead to less initial overidentification of phonological delays and, as a consequence, fewer unnecessary referrals for therapy.

Finally, future regulatory policies for PEBSs in Brazil should not only specify the number of hours for the instruction of each language, but also consider the feasibility of the presence of speech therapists in these institutions.

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