

Review articles

Are dyslexia and developmental language disorder isolated or comorbid conditions? An integrative review

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ABSTRACT

Purpose: to gather scientific evidence on the linguistic skill profile in developmental dyslexia and developmental language disorder to better understand possible comorbid or isolated conditions.

Methods: an integrative review of the literature. The search was conducted in SciELO, ERIC, LILACS, and PubMed. The inclusion criteria were as follows: 1) studies published and available in open-access national and international journals in full text; 2) addressing the topic in the last 10 years; 3) in English and/or Portuguese.

Literature Review: the search retrieved 654 articles, the final sample comprising 10, 5 of which agreed with the hypothesis that dyslexia and developmental language disorder can be comorbid disorders, impairing reading, writing, and phonological awareness. The other studies described broader language deficits in children with developmental language disorder alone, affecting language decoding and comprehension, whereas deficits in dyslexia are more associated with phonological processing.

Conclusion: there is no consensus on whether dyslexia and developmental language disorders occur simultaneously in children. However, both pose risks to reading comprehension and school performance.

Keywords: Dyslexia; Specific Language Disorder; Reading; Child

INTRODUCTION

Learning to read and write depends on the development of certain linguistic and cognitive skills, such as phonological awareness, attention, and information manipulation, storage, and reflection¹.

Individuals with neurodevelopmental disorders may have various levels of impairment affecting language, memory, attention, executive functions, motor-perceptual skills, and so forth².

Dyslexia is a specific learning disorder among other neurodevelopmental ones, which specifically impairs precise word reading, velocity or fluency, and comprehension³. These difficulties manifest in the early school years when children learn academic skills. Their manifestations are not due to intellectual development deficiencies, sensory deficiencies (sight or hearing), neurological or motor deficiencies, lack of access to education, lack of language proficiency, lack of academic instruction, or psychosocial adversities⁴.

Risk factors for dyslexia can be early identified in preschoolers regarding phonological awareness difficulties, especially in rhymes, word pronunciation, and difficulties learning and naming letters⁵, which culminate in inefficient reading and writing over time. Most people with this diagnosis have phonological deficits, characterized by a dysfunction in some aspects of speech sound emission or processing, which involves difficulties in phonological awareness skills, phonological working memory, and slow access to the phonological lexicon⁶⁻⁸.

Developmental language disorder (DLD)⁹ is characterized by language expression or comprehension difficulties, interfering with children's and adults' daily lives¹⁰. It is a considerable impairment in the capacity to comprehend and emit spoken language, independent from the supposedly typical development¹⁰. It is also known as Specific Language Disorder (SLD), in which "specific" refers to limited deficits, as such children do not have sensory, neurological, socioemotional, or cognitive deficiencies that would justify their language difficulties¹¹.

The term DLD was proposed by a group of researchers¹². However, the use of this terminology and the criteria for its diagnosis are still being discussed, especially by the American Speech-Language-Hearing Association (ASHA)¹³. Therefore, the term DLD is not clearly described in the classificatory systems of DSM-5³ or ICD 11⁴, but it was used in this study because it has been widely approached in the current literature worldwide.

Children with DLD have uncommon and diverging language competency development and impaired linguistic processing¹⁴. A more recent study indicates that children with DLD may have other expressions superposing the linguistic deficits, with changes in attention, speech motor processing, intellect, and differentiation between verbal and nonverbal skills. Hence, children whose nonverbal IQ is below average but above 70 should be screened for DLD¹⁰.

Therefore, early diagnosis, by 18 to 24 months old, is important, as long as parents/guardians are attentive to their children's linguistic development – the earlier the diagnosis and intervention, the better these patients' prognoses¹⁵. To confirm the DLD diagnosis, individuals must not have other developmental disorders or hearing loss, which are excluding factors¹⁶. Nevertheless, children with DLD have reading and writing difficulties when they start going to school, like those with dyslexia.

Diagnosing these children is a tough task because it is difficult to find instruments that analyze cognitive-intellectual skills as early as preschool and that can be applied by speech-language-hearing therapists^{17,18}.

Thus, this article aimed at gathering scientific evidence on the linguistic skill profile in developmental dyslexia and DLD to better understand possible comorbid or isolated conditions, considering that some studies address DLD and dyslexia as different disorders, but with possible comorbidities¹⁹⁻²¹.

METHODS

This is an integrative review of the literature, guided by the following research question: "What are the linguistic skill profiles in cases of dyslexia and DLD that can be identified as comorbidities or isolated conditions?".

This study was constructed through the following stages: establishing the research question, defining the keywords and inclusion and exclusion criteria, selecting studies, and analyzing and interpreting data.

Articles were selected through a search in national and international databases, namely: SciELO, MEDLINE, ERIC, LILACS, as well as PubMed search engine, using the following combined Portuguese terms regarding the topic of interest: ("Dislexia") AND ("Transtorno específico de linguagem" OR "Prejuízo específico de linguagem") AND ("Diagnóstico"), ("Dislexia") AND ("Transtorno específico de linguagem" OR "Prejuízo específico de linguagem") AND ("Criança"), ("Dislexia") AND ("Transtorno

específico de linguagem” OR “Prejuízo específico de linguagem”) AND (“Leitura”), (“Dislexia”) AND (“Transtorno específico de linguagem” OR “Prejuízo específico de linguagem”) AND (“Avaliação”). Combined English terms were also used: (“Dyslexia”) AND (“Specific language impairment” OR “Specific Language Disorder”) AND (“Diagnosis”), (“Dyslexia”) AND (“Specific language impairment” OR “Specific Language Disorder”) AND (“Children”), (“Dyslexia”) AND (“Specific language impairment” OR “Specific Language Disorder”) AND (“Reading”), (“Dyslexia”) AND (“Specific language impairment” OR “Specific Language Disorder”) AND (“Assessment”).

The article inclusion criteria for the review were as follows: 1) studies published in open-access national and international journals in full text and available in the selected databases; 2) addressing this topic in the

last 10 years; 3) in English and/or Portuguese. The sample was selected by title reading, abstract reading, and then full-text reading. The exclusion criteria were opinion articles, reviews or communications, congress studies, reviews, and duplicates.

The analysis was made with an Excel spreadsheet with the following data: year of publication, name of the authors, country of publication, study objective, sample, method, main results, and conclusion.

The flowchart (Figure 1) shows that only articles with the terms (“Dislexia”) AND (“Transtorno específico de linguagem” OR “Prejuízo específico de linguagem”) AND (“Leitura”) e (“Dislexia”) AND (“Transtorno específico de linguagem” OR “Prejuízo específico de linguagem”) AND (“Avaliação”) were found in LILACS. In PubMed, SciELO, and ERIC, in their turn, only articles with English descriptors were found.

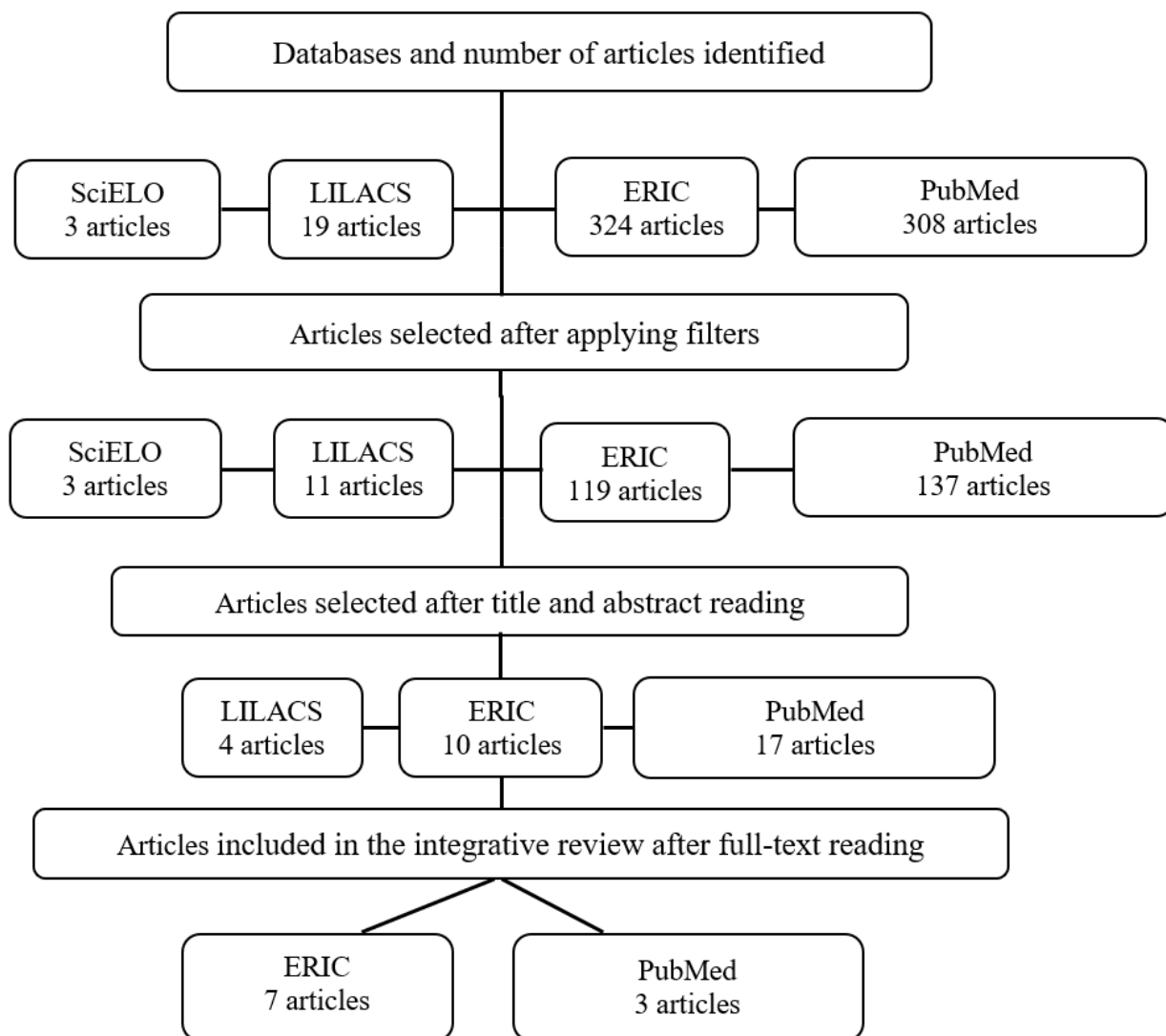


Figure 1. Flowchart of the search in the integrative review

LITERATURE REVIEW

The initial search identified 654 articles from January 2012 to June 2021. It was decided to use articles indexed in these databases in the last 10 years because of the growing discussion about both conditions in Brazil and the world. Also, the greater variety in the sampling process increases the potential for more in-depth and broad results in this review²².

In subsequent stages, 644 articles were excluded for not meeting the eligibility criteria. Hence, 10 studies were selected from PubMed and ERIC.

Five studies in the review agreed with the hypothesis that dyslexia and DLD can be comorbid disorders (i.e., they can coexist in an individual)^{21,23,25,26,31}. The studies obtained this result by assessing their language – e.g., phonological awareness^{21,26,31}, word and pseudoword reading^{21,23,25,31}, vocabulary^{21,24,25,31}, working memory^{21,24,26,28}, mental lexicon access^{24,25}, reading comprehension^{21,24,26}, and writing^{23,24}.

Language measures and other cognitive skills were also assessed in preschoolers. For instance, three studies assessed working memory^{21,26,27}, three assessed short-term memory^{21,26-30}, one assessed superior linguistic skills²⁶, two assessed psychomotor skills²¹⁻²⁶, and one assessed academic performance and cognitive variables in verbal comprehension²⁷.

A 2019 study conducted in England compared three groups: children with both DLD and dyslexia, children with only DLD or dyslexia, and a control group whose children had no deficits. Phonological impairments were more severe in the comorbid cases²⁵. Another study presented similar results regarding the hypothesis of dyslexia and DLD as comorbid disorders. However, children with dyslexia alone had more indications of deficient phonological connections than those with DLD alone and dyslexia and DLD combined²³.

A study conducted in the United States³¹ on word learning skills compared children with DLD alone, dyslexia alone, and combined DLD/dyslexia with a group of children with no deficits. Its results indicated that children with dyslexia alone and DLD/dyslexia combined had significantly impaired performance in tasks that assess semantic and phonological aspects in word learning.

Contrarily, studies conducted in China and the United States^{27,28} concluded that children with dyslexia

performed worse than their peers with DLD alone or comorbid DLD in language skills involving phonological processing. Consequently, they had further impaired reading and writing, due to the etiological factor of the phonological deficit.

Other researchers^{29,30} diverged from these and found better performance in children with dyslexia. Those diagnosed with DLD had more evidence of deficits in phonological skills than their peers. Nonetheless, a study from the University of Cyprus²⁴ observed that children with dyslexia and DLD have similarly impaired phonological processing, though with different manifestations.

Phonological processing impairments are directly related to the children's potential to learn to read and write because they are predictors that allow future reading decoding and comprehension²⁷. Therefore, children with these two conditions start learning to read and write with such a developmental gap – which makes it essential that teachers be familiar with these disorders.

Phonological deficits observed in dyslexia may contribute to a different impairment profile from that of children with DLD regarding reading and spelling processing²⁴. Moreover, short-term verbal memory impairments map more severe problems in word reading and spelling processing in the dyslexia group than in the DLD group.

Additionally, children diagnosed with dyslexia performed worse than their peers with DLD in reading comprehension. They had greater difficulty in phonological awareness, working memory, and mental lexicon access tasks, which are relevantly predictive skills of reading acquisition²¹⁻²⁹.

Concerning writing skills, participants in a study from England diagnosed with comorbid dyslexia and DLD had greater spelling difficulties than children diagnosed with DLD alone. These difficulties were mainly characterized by misspellings and phonological and semantic errors²⁵.

Furthermore, children with DLD, with or without dyslexia, had a wider range of deficiencies, including significant problems with executive and motor tasks and primary cognitive deficits, which pose a risk of reading difficulties²⁶.

Chart 1. Synthesis of articles selected for the review

Authors and year	Country	Objectives	Methodologies	Results
Talli et al. (2016) ³⁰	Greece	To investigate whether specific language disorders and dyslexia are different disorders or whether reading deficiencies are always present in DLD.	Cross-sectional study. The sample comprised 15 preschoolers with language disorders diagnosed with DLD by speech-language-hearing therapists, and 15 children diagnosed with dyslexia in 2nd and 3rd grades with an interdisciplinary assessment in Greek hospitals. The control group had 30 children in elementary school. Decoding, phonological awareness, and reading comprehension skills were assessed.	This study did not consider DLD and dyslexia as comorbid disorders, as the group comparison revealed more evidence of phonological skill deficits in the DLD group than in the dyslexia group. The reading comprehension performance of 8 out of the 30 children in the two clinical groups was within normative standards (3 in the DLD group and 5 in the dyslexia group). 80% of children with DLD had phonological deficits, in contrast with only 47% in the dyslexia group.
Ramus et al. (2013) ²¹	England	To compare children with DLD and dyslexia, with DLD alone, and with dyslexia alone to verify their phonological and cognitive skills.	Cross-sectional study. The sample initially comprised 129 children: 30 with DLD and dyslexia, 13 with DLD alone, 21 with dyslexia alone, and 65 children in the control group. The following skills were assessed: phonological awareness, morphosyntax, prosody, nonword reading, vocabulary, phonological working memory, and reading comprehension.	The language skills assessed in the study revealed that children with DLD do not always have phonological deficits and reading impairments. While DLD and dyslexia may often coexist, there is DLD alone and dyslexia alone. Children with dyslexia alone are characterized by phonological skill impairments, just below average in vocabulary, not in grammar skills. Children with comorbid DLD and dyslexia were characterized by deficits in the three language dimensions studied, and these deficits were generally more severe than in children with DLD or dyslexia alone. Children with DLD alone are similarly impaired in expression and phonological skills.
Lauterbach et al. (2017) ²⁸	United States of America	To explore the performance of cognitive and language variables in predicting reading skills in children with dyslexia and DLD and analyze which variables are more predictive to distinguish the two groups.	Cross-sectional study. The sample comprised 44 participants with dyslexia and 19 with DLD. The following skills were assessed: phonological awareness, nonword reading, reading comprehension, cognitive variables, and working memory.	The group of participants with dyslexia performed better in overall intellectual skills, reading, and verbal and oral comprehension. However, they had lower scores in phonemic awareness skills than the DLD group. Working memory was the main predictor of pseudoword reading in the DLD group; in the dyslexia group, it was phonological awareness. It was observed that verbal comprehension, phonological awareness, and reading decoding efficiency can be used to distinguish both groups.
McCarthy (2014) ²³	United States of America	To investigate how oral language and word reading relate to spelling skills in children with DLD, dyslexia, and both, in comparison with peers with typical development.	Case-control. The sample comprised 43 children with DLD, 21 with dyslexia, and 18 with both. Word reading and spelling performance were assessed.	Children with dyslexia and DLD/dyslexia had low spelling precision, and additional support to the theory that dyslexia and DLD are comorbid, characterized by phonological, spelling, and semantic errors.
Farquharson et al. (2014) ²⁹	United States of America	To examine the influence of phonological and lexical characteristics on phonological awareness in children with dyslexia and/or DLD.	Cross-sectional study. The sample comprised 33 children with typical development, 13 with DLD, and 18 with dyslexia, studying in 2nd grade. Phonological awareness and word decoding skills were assessed. Each child completed a battery of assessments encompassing language, word decoding, nonverbal intelligence, and phonological awareness. Measures included both standardized assessments and experimental tasks.	Children with dyslexia had greater difficulties characterized by phonological deficits than their peers with DLD and typical development.

Authors and year	Country	Objectives	Methodologies	Results
Spanoudis et al.(2019) ²⁴	Cyprus	To investigate the possible co-occurrence of DLD and dyslexia and the nature of such a co-occurrence in linguistical and cognitive terms in an orthographically consistent language.	Cross-sectional study. The sample comprised 140 2nd- and 4th-grade Greek Cypriot children, divided into 4 groups: comorbid group, dyslexia group, DLD group, and control group with no deficits. The following skills were assessed: reading, grammar, receptive vocabulary, mental lexicon access, phonological working memory, semantics, and spelling.	In cognitive measures, the DLD group had a worse result in memory figures, digits, phonological memory, and naming speed. In language, they had comparable deficits in semantics and reading comprehension, without related impairments in phonological awareness. Children with DLD and dyslexia have characteristics in common, with impaired semantics, reading comprehension, short-term verbal memory, and word spelling identification. However, they manifest different symptoms. The control group performed significantly better, with fewer cognitive and language impairments.
Snowling et al. (2019) ²⁵	England	To screen the progress reading problems from initial developmental stages.	Longitudinal study. The sample comprised 260 children, divided into children with risk factors for language changes, at family risk, and with typical development. The following skills were assessed: reading, receptive and expressive grammar, rapid automatic naming, phonological awareness, vocabulary, comprehension, and executive functions.	Phonological deficits are risk factors present in both dyslexia and DLD. Those with comorbid DLD and dyslexia have more severe impairments in reading and phonological awareness than children with either disorder alone.
Schuchardt et al.(2013) ²⁷	Germany	To investigate whether children with learning disorders have working memory deficits like children with DLD.	Cross-sectional study. The sample comprised 113 children divided into 5 groups: 30 children with dyslexia; 16 with dyslexia that receive special education; 19 with combined school skill difficulties; 18 with combined school skill difficulties that receive special education; and 30 in a control group. Working memory, executive functions, and visuospatial skills were assessed.	Deficits were found in the phonological loop and executive functions in children with dyslexia and with DLD. Phonological functioning deficits were broader and deeper in children with DLD.
Wong et al. (2017) ²⁶	China	To examine whether working memory and superior language skills were responsible for individual differences between Chinese children in reading comprehension and whether children with DLD or dyslexia had deficits in these skills.	Cross-sectional study. The sample comprised 82 Cantonese-speaking Chinese children aged 7 and 8 years, with typical development, dyslexia, DLD, and both. Working memory and reading comprehension skills were assessed.	Children with DLD alone and dyslexia alone had different deficit profiles. The comorbid DLD-D group was worse in reading comprehension than the DLD alone group, but not the D alone group. The comorbid DLD-D group did not perform worse than either group with a disorder alone in superior language skills associated with reading comprehension.
Adlof et al.(2021) ³¹	United States of America	To examine group differences in word learning overall measures in children with DLD alone and dyslexia alone, comparing with one another, with peers with both DLD and dyslexia, and with peers with typical development.	Cross-sectional study. The sample comprised children (N = 244) aged 7 years and 10 months to 9 years and 4 months. Language, reading fluency, phonological memory, nonverbal cognitive, and semantic skills (naming and recalling) were assessed.	Children with dyslexia alone performed significantly better in existing vocabulary measures than their peers with DLD alone. In experimental word learning measures, children in dyslexia alone and DLD+dyslexia groups performed significantly worse than children with typical development in all word learning tasks. Children with DLD alone significantly differed from the typical development group in a single word learning task assessing verbal semantic recalling.

Captions: DLD: developmental language disorder; D: Dyslexia; DLD-D: developmental language disorder – dyslexia; N = sample size.

Given the above, there is no consensus in the literature about the nature of these disorders, whether they are comorbid or not, and what linguistic characteristics may distinguish dyslexia from DLD.

Important findings pointed to phonological skills, explaining the similarities and differences in dyslexia and DLD, with a broad basis of linguistic skills especially involved in learning to read and write.

Even though the studies described aspects of cognitive-linguistic functioning in these conditions, understanding methodological evidence that ensures differential diagnoses between them contributes to scientific advancements. Hence, the role of professionals in interdisciplinary teams – particularly speech-language-hearing therapists and psychologists/neuropsychologists – helps to identify clinical characteristics that can still be misdiagnosed.

Regardless of characteristics manifested differently or in common, in either developmental dyslexia or DLD, scientific evidence also indicates that cognitive functioning impairments, especially in language and its reading and writing specificities, hinder these schoolchildren's academic performance^{17,18}. Therefore, interdisciplinary assessment, especially involving psychologists and speech-language-hearing therapists, is necessary for more precise diagnosis and therapeutic procedures established according to each person's profile.

CONCLUSION

There is no consensus yet about whether developmental dyslexia and DLD occur simultaneously. Nevertheless, phonological skills importantly explained the reading difficulties in the two disorders, particularly impaired in dyslexia. These findings support the principle that both dyslexia and DLD need comprehensive diagnostic assessments by interdisciplinary teams to characterize the linguistic skill profiles and better define the therapeutic practice. Moreover, when children begin to learn to read and write, teachers must pay careful attention to signs suggestive of difficulties inherent to these conditions.

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