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SPECIFIC LEARNING DISORDERS AND READING

PERTURBAÇÕES ESPECÍFICAS DA APRENDIZAGEM E LEITURA

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Abstract

Children with Specific Learning Disorders, particularly those with reading deficits (Dyslexia), exhibit difficulties in acquiring this complex skill. Currently, reading acquisition is considered an indispensable requirement for communication and social inclusion. This article aims to address the topic of Specific Learning Disorders, recognizing that they affect many school-age children. The main objective of this work is to analyse specific learning disorders, particularly reading deficits, by referring to the main explanatory theories. The theoretical analysis included the prevalence of this learning disorder, possible causes, the diagnostic process, including diagnostic criteria and assessment instruments. Finally, the functioning of the brain during reading in children with a Specific Learning Disorder was addressed. The consequences and warning signs of this disorder for children from an early age were also investigated.

Keywords: learning, reading, disorder, dyslexia

Resumo

As crianças com Perturbações Específicas de Aprendizagem, particularmente as que apresentam défices de leitura (Dislexia), apresentam dificuldades na aquisição desta competência complexa. Atualmente, a aquisição da leitura é considerada um requisito indispensável para a comunicação e inclusão social. Este artigo pretende abordar a temática das Perturbações Específicas da Aprendizagem, reconhecendo que estas afetam muitas crianças em idade escolar. O principal objetivo deste trabalho é analisar as perturbações específicas de aprendizagem, nomeadamente os défices de leitura, referindo as principais teorias explicativas. A

análise teórica incluiu a prevalência desta perturbação de aprendizagem, as possíveis causas, o processo de diagnóstico, incluindo os critérios de diagnóstico e os instrumentos de avaliação. Por fim, foi abordado o funcionamento do cérebro durante a leitura em crianças com uma Perturbação Específica da Aprendizagem. As consequências e os sinais de alerta desta perturbação para as crianças desde tenra idade também foram investigados.

Palavras-chave: aprendizagem, leitura, perturbação, dislexia

Introduction

Dyslexia is a learning difficulty that affects the skills involved in accurate and fluent word reading and spelling. The author, Rose (2009) clarify that characteristic features of Dyslexia are difficulties in phonological awareness, verbal memory and verbal processing speed, occurring across the range of intellectual abilities.

Children with Specific Learning Disorders, especially with reading deficits (Dyslexia), experience difficulties in learning to read. Reading acquisition is a complex skill that highlights linguistic and cognitive abilities (Ferraz, 2020).

One of the factors' influencing learning is parental involvement. In fact, a good relationship between family and school brings parents and children closer, enhances trust between parents and teachers, boosts children's motivation, prevents indiscipline, and contributes to academic success (Estanqueiro, 2013).

Given that reading acquisition is considered an indispensable requirement for communication and social inclusion, this work arises to gain a deeper understanding of Specific Learning Disorders, particularly reading deficits (Dyslexia).

The term "Dyslexia" has undergone several changes over time, and currently, the most appropriate term to define this neurodevelopmental disorder is Specific Learning Disorder with a reading deficit, according to the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2014). However, in this work, we will refer back to the term "Dyslexia" as this concept is still widely used and accepted by the scientific community.

This disorder affects many school-age children. The concept of Specific Learning Disorders was analysed, with a special emphasis on Specific Learning Disorder with a reading deficit. This concept and its evolution were explored through a review of studies and assessment instruments. Finally, an analysis was made of the relationship between the brain and the learning process of reading, highlighting some warning signs and the consequences of this learning disorder.

Specific Learning Disorders

Specific Learning Disorders, previously referred to as Specific Learning Difficulties, are generic terms that refer to a heterogeneous group of disorders. These are manifested by significant difficulties in acquiring and using listening, speaking, reading and reasoning skills (Kirk & Gallagher, 2002).

Specific Learning Difficulties are the disorders within the field of Special Educational Needs that have sparked the most multidisciplinary research and debates (Kirk et al., 2005).

The most common developmental disorders are specific learning difficulties in reading, writing, and arithmetic. These disorders are called "specific" because the difficulty in learning is not generalized (Antunes, 2009). Many researchers consider them mysterious and complex (Citoler, 1996; Correia, 2008; Lerner & Kline, 2005, Rose, 2009) because Dyslexia often co-occurs with other disorders although these are not themselves markers of this disturbance.

In Portugal, the term "Learning Difficulties" translating the original "Learning Disabilities" was introduced by Vítor da Fonseca in 1984 in his book "An Introduction to Learning Difficulties". This book marked the first scientific publication concerning Learning Difficulties in Portugal.

In agreement with Fonseca (1984, 2009), Specific Learning Difficulties are a heterogeneous set of disorders, disturbances, disabilities, manifesting significant and specific difficulties in the verbal learning process. These difficulties are evident in the acquisition, integration, and expression of one or more of the following symbolic skills: auditory comprehension, speech, reading, writing, and arithmetic. Fonseca adds that specific learning difficulties manifest in the way the student processes information, interfering with academic achievement.

As specified by Cruz (2011), the term Specific Learning Disorder is generalized and is used by official entities like the Ministry of Education and the National Education Council, as well as by non-official entities, including the media, professionals, and even parents.

However, Martins (2006) notes that the concept underlying the term Specific Learning Difficulties is not understood uniformly by all who use it, suggesting that this term is synonymous and polysemous. He points out that this term is often used inappropriately to refer to different populations on the one hand, and on the other, different terminologies are used to describe the same group of people.

Other authors (Correia, 2008; Correia & Martins, 1999) suggest that in Portugal, the term Learning Difficulties has been used to refer to completely disparate concepts. These concepts range from intrinsic learning problems, such as intellectual and developmental difficulties, to extrinsic learning problems, such as inadequate teaching.

Today, Snowling and Hulme (2024) bring to reflection that the definition of Dyslexia as a dimensional disorder sometimes causes concern. They compare this

disorder with hypertension (high blood pressure), adding that, if there is no universally accepted cut-off does this make the disorder less real.

The Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2014) by the American Psychiatric Association states that Specific Learning Disorders fall under neurodevelopmental disorders and have a biological origin.

The biological origin includes an interaction of genetic, epigenetic and environmental factors that influence the brain's ability to perceive or process verbal or non-verbal information efficiently and accurately (American Psychiatric Association, 2014). As specified by this manual, children with this disorder have difficulty learning or using specific academic skills, such as reading, writing or arithmetic.

The American Psychiatric Association (2014), Specific Learning Disorders are organized according to three specifiers (p. 67):

i) 315.0 (F81.0) With reading deficit (Dyslexia): Word reading accuracy; Reading speed or fluency; Reading comprehension.

ii) 315.2 (F81.81) With written expression deficit: Spelling accuracy; Grammar and punctuation accuracy; Clarity or organization of written expression.

iii) 315.1 (F81.2) With mathematics deficit (Dyscalculia): Number sense; Memorization of arithmetic facts; Accuracy or fluency of calculation; Accuracy in mathematical reasoning.

In this work, we will discuss in more detail Specific Learning Disorder with a reading deficit (Dyslexia), because we pretend to assist educators, parents, and professionals in better identifying and addressing the disorder.

Specific Learning Disorder with a Reading Deficit (Dyslexia)

The main objective of this work is to analyze Specific Learning Disorders, particularly reading deficits, by referring to the main explanatory theories. This is a theoretical analysis about Dyslexia and those characteristics. For comprehend this disturb we need to analyze the evolution of this concept abound time.

Historically, Dyslexia was described in 1877 by Kussmaul, who used the term “word-blindness” to refer to an adult patient with severe difficulty in reading after a brain injury (Moura, 2014).

The term Dyslexia was introduced by the German ophthalmologist Rudolf Berlin (1887) to describe poor reading ability in adults with normal vision after suffering a specific brain injury. In 1896, Pringle Morgan referred to “congenital word-blindness” when describing a clinical case of a 14-year-old boy who was very intelligent but unable to learn to read and write (Moura, 2014).

Since then, Dyslexia has received various denominations: "congenital word-blindness", "congenital Dyslexia", "strephosymbolia", "developmental alexia", "constitutional Dyslexia" and part of the continuum of language disorders characterized by a deficit in verbal sound processing (Teles, 2004). Chiland (1973) notes that in the 1960s, under the influence of psychodynamic currents, the biological aspects of Dyslexia were minimized, and reading difficulties were attributed to emotional or affective problems and even "immaturity". However, during the 1970s and 1980s, several researchers demonstrated that the etiological cause of Dyslexia did not reside in visual perception deficits but in specific neurolinguistic deficits (Teles, 2004).

According to various authors (Antunes, 2009; Moura, 2014; Teles, 2004), Dyslexia can be defined as a specific learning disability of neurobiological origin. Etymologically, the word "Dyslexia" comes from "dys" meaning difficulty/disorder and "lexia" meaning reading (Latin) and language (Greek). Dyslexia is understood as a Specific Learning Disorder characterized by difficulty in reading accuracy, fluency, and comprehension, with deficits in phonological decoding, word recognition, and poor spelling skills. The difficulties associated with Dyslexia result from a deficit in the phonological component of language, which is unexpected in relation to other cognitive abilities (Snowling, 2001).

For a long time, the cause of Dyslexia was unknown. As specified by Teles (2004) the studies conducted presented converging results regarding its origin and the underlying cognitive processes. In conformity with this author, several theories emerged about the cognitive processes responsible for these difficulties.

It is consensual, the strong relationship between phonological skills and reading and the role of phonological deficits in Dyslexia (Melby-Lervåg, Lyster & Hulme, 2012). There is also evidence that phonological deficits are observed in children who go on to be dyslexic prior to reading instruction (Snowling et al., 2019). The phonological skills predict individual differences in reading fluency across alphabetic orthographies (Caravolas et al., 2013).

The definition of Dyslexia is included in the American Psychiatric Association (2014) specifically under Specific Learning Disorder with a reading deficit, characterized as a significant impairment in the development of word recognition and reading comprehension skills (p. 66). The difficulties arise during the school years, and academic abilities are significantly below what is expected for the chronological age. This manual adds that this disorder significantly interferes with school performance or daily activities that require reading skills.

Today, Snowling and Hulme (2024) clarify the definition of Dyslexia. In accordance with these authors Dyslexia is a difficulty in learning to decode or encode print. This disturbance is associated with phonological problems and may occur at different levels of ability. They add that Dyslexia is a dimensional disorder, where we set a cut-off for identification that is to some extent arbitrary.

Explanatory Theories

Over time, several explanatory theories about Dyslexia have emerged. These include neurobiological-based cognitive theories, genetic and hereditary theories and theories that rely on environmental factors. The most recent research (Snowling & Melby-Lervåg, 2016; Snowling & Hulme, 2024) indicates that the neurobiological perspective is the most relevant; however, psycholinguistic and visual-perceptual-motor perspectives continue to be referenced by researchers, indicating the lack of consensus (Cruz, 2009).

Several researchers support the neurobiological and multifactorial origin, with various genetic and environmental factors (Doust et al., 2022; Hulme & Snowling, 2016; Sousa & Martins, 2015). This disorder has a heritability between 40% and 60% (Fletcher et al., 2007) and genes involved in the onset of Dyslexia have even been identified.

Hulme and Snowling (2016) mention that, despite the importance of genetic factors, parental literacy, environment and the quality of teaching influence reading development. They add that genes act through the environment and that passive and active gene-environment correlations can affect literacy outcomes. Parents with Dyslexia not only share genes with their children but may also provide a literacy environment different from that found in families where parents do not experience such difficulties.

The automatization deficit theory was advocated by Fawcett and Nicolson (1992), characterizing Dyslexia as a generalized deficit in automatization capacity. In accordance with this theory, dyslexics manifest difficulties in automating word decoding, performing fluent, correct and comprehensive reading.

The magnocellular theory generated some controversy and attributed Dyslexia to a specific deficit in the transfer of sensory information from the eyes to the primary areas of the cortex (Teles, 2004). In agreement with this theory, people with Dyslexia have low sensitivity to stimuli with low contrast, low spatial frequencies or high temporal frequencies.

Conforming to Teles (2004), most researchers agree with the phonological deficit theory, which argues that Dyslexia is caused by a deficit in the phonological processing system due to a "disruption" in the brain's neurological system, at the level of phonological processing (Shaywitz, 2003; Zeffiro & Eden, 2000). In line with these authors, the phonological deficit hampers the discrimination and processing of language sounds, as well as the awareness that language is made up of words, that words consist of syllables and that syllables are made up of phonemes.

Regarding types of Dyslexia, Torres and Fernandez (2001) classified it into two types: auditory and visual. In accordance with to these authors, children with auditory Dyslexia have difficulties in differentiating, analyzing, and naming speech sounds, and they struggle with naming sequences and rhymes. Fonseca (2004) adds that auditory Dyslexia affects the cognitive process that allows relating phonemes (sounds) to graphemes (letters), leading to difficulties in interpreting, memorizing,

and differentiating words, confusion in word configuration, and frequent reversals, omissions, and substitutions, i.e., they have trouble relating spoken language to written language.

In agreement with Torres and Fernandez (2001), children with visual Dyslexia struggle with visual perception and discrimination tasks, exhibit orientation errors, have difficulties distinguishing sizes and shapes, confuse groups of letters and face challenges in transforming letters into sounds. Fonseca (2004) adds that in visual Dyslexia, letters are not recognized as letters due to a discrimination problem, which affects the visual encoding of graphemes and word formation.

More recently, Moura (2014) and Coelho (2014) argue that Dyslexia can be acquired or developmental. Acquired Dyslexia refers to the existence of brain injury, while developmental Dyslexia shows specific alterations in certain neurocognitive functions and a broad range of difficulties in reading and writing. The latter is currently characterized by difficulty in word reading accuracy and/or fluency, along with poor spelling ability. Reading difficulties result from a deficit in the phonological component of language, which is unexpected given the individual's other cognitive abilities and the educational conditions provided (Fletcher, 2009; Lyon, Shaywitz, & Shaywitz, 2003).

From a neuropsychological perspective, Specific Learning Disorder with reading impairment (Dyslexia) occurs in school-aged children (Ritzen & Debray, 1981). Cancela (2014) argue that it is a disorder with multiple causes. Some studies (Doust et al., 2022) indicate that some people are born with a genetic code that allows them to use the part of the brain that alters and creates perceptions. Being born with this genetic code does not cause the disorder, but it allows its development (Davis & Braun, 2010).

In the field of Genetics, some researchers argue that Specific Learning Disorder is hereditary, as children with this issue often have at least one close family member with difficulties in reading and writing (American Psychiatric Association, 2014). Moreover, some researchers believe that this disorder may be due to mutations in specific chromosomes, particularly chromosomes 6 and 15 and more recently, chromosome 2 (Lona, 2014).

From a psycholinguistic point of view, this disorder is related to language processing, which derives from brain function. Research using brain imaging suggests that information is processed differently by these individuals. Psycholinguistics points to phonological issues as the cause of many reading difficulties, revealing a broad set of language deficits among poor readers (Lona, 2014). Since learning to read results from the functioning of systems integrating various brain areas or units (Serra & Estrela, 2007), damage to even one part of the functional system can impair learning.

New research confirms that Specific Learning Disorder with reading impairment (Dyslexia) belongs to the field of Neuropsychology (Pépio & Maia,

2018), if we understand that reading, writing, and speech are elements of language, and language is one of the brain's higher mental functions (Ritzen & Debray, 1981).

Various cognitive components are involved in the learning process, which results from the reception and exchange of information between the environment and different nervous centers. The neuropsychological model applied to learning disorders assumes these disorders represent a dysfunction in the natural learning acquisition process, i.e., in stimulus selection, processing, and information storage. From this perspective, neuropsychological research allows for understanding the internal structure of psychological processes and the internal connection that links them (Paula et al., 2006).

After analyzing the explanatory theories of Dyslexia, it makes perfect sense to examine the prevalence of this disorder to better understand its occurrence.

Prevalence of Dyslexia

Regarding the prevalence of Dyslexia, it is observed in 5% to 10% of school-age children (Vellutino et al., 2004), although some studies present prevalence estimates between 6% and 17%, depending on the reading severity criteria used (Fletcher et al., 2007).

Yang, et al. (2022) analyzed the studies carried out between 1950 and 2021 about Dyslexia. These authors conclude that the prevalence of Dyslexia in school-age children is 7.10%.

The American Psychiatric Association, through the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2014), estimates that 5% to 15% of school-age children present a Specific Learning Disorder. Some studies report significant differences in the prevalence of this disorder between females and males, being higher in males (Cruz, 2009; Hulme & Snowling, 2016; Vale et al., 2011). Yang, et al. (2022) conclude that the prevalence in boys was significantly higher than in girls (boys: 9.22%; girls: 4.66%; $p < 0.001$).

In Portugal, there is no recent data on the prevalence of Dyslexia. However, a study conducted by Vale, Sucena, and Viana (2011) indicates that the prevalence of Dyslexia in Portuguese children attending the first cycle is between 5.4% and 8.6%, with about 28% of children in their sample presenting reading difficulties.

It is also common to observe a comorbidity relationship between Dyslexia and Attention Deficit Hyperactivity Disorder (ADHD) in 15% to 40% of children (Willcutt et al., 2005) and Dyscalculia in 15% to 70% of children (Willcutt et al., 2013).

Having established the prevalence rates of this disorder, it is essential to explore the underlying causes of Dyslexia.

Possible Causes

Regarding possible causes of Specific Learning Disorder with a reading deficit (Dyslexia), the American Psychiatric Association (2014) points out different causes (p. 72).

One of the causes cited in this manual is related to the environment, namely prematurity, very low birth weight and prenatal exposure to nicotine.

Another cause is genetic and physiological, which means that first-degree relatives of individuals with these learning difficulties and a family history of reading difficulties predict literacy problems, indicating the combined role of genetic and environmental factors.

Course modifiers are also considered causes of Dyslexia. Marked problems with inattentive behavior in the preschool years predict later reading difficulties. Delayed or disordered speech or language, or impaired cognitive processing in the preschool years predict specific disorders of later learning in reading and written expression.

Considering the possible causes of Dyslexia, it makes sense to analyze how the diagnosis is made and the criteria used to better understand this disorder.

Diagnosis

Due to the empirical evidence of recent decades on the neurobiological and neurocognitive nature of Dyslexia, the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2014) included Dyslexia in the group of Neurodevelopmental Disorders. As specified by this manual, Specific Learning Disorder with a reading deficit (Dyslexia) is a neurobiological disorder underlying the cognitive changes observed in reading and writing (American Psychiatric Association, 2014).

In addition to this new classification, some changes were made to the diagnostic criteria. Thus, the American Psychiatric Association (2014) establishes the necessity for a performance in reading fluency, accuracy, and/or comprehension that is substantially below expectations for chronological age, interfering with academic performance or daily life activities significantly. Performance should be confirmed through standardized reference tests, individually administered, a comprehensive clinical assessment that includes collecting medical, developmental and school information, symptom manifestations and a psychological/cognitive evaluation (American Psychiatric Association, 2014).

The same manual highlights that reading decoding difficulties should not result from intellectual difficulties, global developmental delay, sensory alterations or neurological or motor disorders. In other words, besides significant reading difficulties, children with Dyslexia tend to show specific deficits in some neurocognitive functions, such as phonological processing, executive functions, and working memory (Moura, 2014). In agreement with Fonseca (2009), Dyslexia has

been considered a reading and language disorder, an unexpected learning difficulty since the individual shows average or above-average intelligence. The Intelligence Quotient (IQ), considered a selective criterion, should be equal to or greater than 80. Therefore, based on this data, it is easy to deduce that Dyslexia is not synonymous with a low IQ.

The same author adds that Dyslexia is not related to a lack of motivation to learn to read, nor to unfavourable socioeconomic and deviant conditions. It can manifest in an individual throughout life, regardless of adequate learning opportunities.

Fonseca (2009) also notes that Dyslexia can be addressed through multi-therapeutic re-education. Many signs can be identified in preschool education, but it is with the learning of reading those problems related to sound awareness, letter recognition, verbal expression, and copying begin to emerge.

Cruz (2009) mentions that Dyslexia can be diagnosed in the presence of specific deficits in perception or information processing abilities in individuals who, despite having "normal" intelligence and adequate physical, mental, sensory, emotional, and pedagogical conditions, achieve results significantly below what is expected for their chronological age in specific learning areas. Oral reading in individuals with Dyslexia is characterized by omissions, distortions, and word substitutions, as well as slow, inaccurate, and effortful reading.

According to the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2014), the diagnosis involves observing the following criteria (pp. 68-69): Persistent difficulties in learning key academic skills that begin with formal schooling (Criterion A). The individual's performance in the affected academic skills is below the average for their age (Criterion B). Learning difficulties become readily apparent during the early school years for most individuals (Criterion C). Learning difficulties are considered "specific" because they are not attributable to intellectual disabilities, global developmental delays, hearing or vision impairments, or neurological or motor problems (Criterion D).

Specific Learning Disorder with a reading deficit (Dyslexia) can only be diagnosed after the start of formal education, at any time. The learning difficulties are persistent and not transitory, and progress in learning is very limited over at least six months, despite additional help being provided at home and/or school.

It can be diagnosed in children, adolescents, and adults, as long as there is evidence of onset during formal schooling years. The diagnosis is clinical, based on a synthesis of the individual's medical, developmental, educational, and family history.

The evaluation process is complex and involves multiple components, including clinical interviews to gather detailed personal history, school reports to assess academic performance, work portfolios that showcase a student's progress, rating scales completed by teachers or parents to provide additional insights, and

educational or psychological assessments that offer standardized measures of cognitive and emotional functioning.

On this subject, Ribeiro and Baptista (2006) mention four types of assessment to be carried out in the diagnosis of a Specific Learning Disorder with reading deficit (Dyslexia). They suggest a Neuropsychological Assessment, focusing on perception, motor skills, cognitive functioning, psychomotricity, psycholinguistic functioning, language and emotional development.

These authors consider that Psycholinguistic Assessment is crucial to determine the mechanisms responsible for this disorder. In psycholinguistic assessment, it is important to evaluate vocalization, lexical decision, semantic decision and visual processing. Another assessment that they consider crucial for diagnosis is Psychological Assessment, which aims to assess language, reading, spatial references, level of intelligence, attention and immediate memory.

The Comprehensive assessment, suggested by these authors, aims to evaluate language (comprehensive and expressive), psychomotricity (body scheme, laterality, spatial and temporal orientation), perception (visual and auditory), motor skills (gross/fine) and academic areas (reading, writing and arithmetic).

To diagnose Specific Learning Disorders, it is crucial to use the appropriate instruments and for this reason we analyse the most suitable instruments to make a correct diagnosis of Dyslexia.

Assessment Instruments

When evaluating a child or adolescent with suspected Specific Learning Disorder, it is important to consider some aspects, as Viana (2005) points out. Firstly, it is important to understand the child's development process and the problem, starting by knowing the child's life story and analyzing the educational materials used, such as notebooks and tests. It is equally crucial to understand the implications that this problem has on the individual's life, that is, to analyze the difficulties revealed that have consequences that extend to all contexts. It is also important to understand how the problem is perceived by the student and the people around them. Unfortunately, what has been observed is that psychological assessment is generally developed for remediation and not prevention. Finally, difficulties must be identified, to do this it is necessary to evaluate reading, identify letters and words, read groups of words and identify the main idea of a sentence.

For the evaluation or diagnosis of Specific Learning Disorder with reading deficits, various instruments can be applied, such as:

a) Assessment of Cognitive Functioning through Intelligence Scales: WISC-IV: Wechsler Intelligence Scale for Children (Wechsler, 2005); Wechsler Preschool and Primary Scale of Intelligence (Wechsler, 2005); WAIS-III: Wechsler Adult Intelligence Scale (Wechsler, 1997).

b) Assessment of Reading through Tests: TIL: Test of Reading Age (Sucena & Castro, 2008); ALEPE: Battery for Assessment of Reading in European Portuguese (Sucena & Castro, 2011); PRP: Word Recognition Test (Viana & Ribeiro, 2010).

c) Assessment of Expressive Language (Lexical knowledge; morphosyntactic knowledge; auditory memory for verbal material; capacity to reflect on oral language): TICL: Test of Identification of Linguistic Competencies (Viana, 2004).

d) Assessment of Phonological Processes through Tests: Oral Language Assessment Test (Sim-Sim, 1997); Phonological Test Battery (Silva, 2002).

e) Assessment of Perceptual-Motor Organization, Attention and Immediate Visual Memory through the Test: REY: Rey Complex Figure Test (Rey, 1942); TPD: Test of Perception of Differences (Thursthone & Yela, 1985).

f) Assessment of Perceptual-Auditory Acquisitions through the Test: DAPA: Diagnostic of Perceptual-Auditory Acquisitions (Fonseca, 1979).

g) Tests for Screening Phonological or Orthographic Disorders: PADD: Dyslexia Analysis and Screening Test (Carreteiro, 2005). PEDE: Exploratory Test of Specific Dyslexia (Condemarin & Blomquist, 1989).

h) Assessment of Perceptual-Motor Areas through: PDDA: Screening Project for Difficulties and Learning (Fonseca, 1978).

In the report of an evaluation of a Specific Learning Disorder with reading deficits, it should include not only the diagnosis but also the definition of the child's strengths and weaknesses in different areas, as well as the presentation of intervention objectives (Antunes, 2018). The diagnosis and assessment of Dyslexia should not serve to label a child or young person but should aim to define the most suitable intervention strategies to contribute to their academic success (Cruz, 2009).

The evaluation of a Specific Learning Disorder should be conducted by accredited professionals, and the evaluation process is complex, requiring a clinical interview, school reports, and work portfolios. Rating scales should be applied, and educational or psychological assessments should be conducted (American Psychiatric Association, 2014).

How the Brain Functions During Reading

It is necessary to understand how the brain functions to better understand the origin of a Specific Learning Disorder with reading deficits. Gray matter is composed of various areas with different functions. Learning is a brain function that involves information processing through sensory (reception), neurological (decoding, translation, retention and encoding) and psychological (perception, imagery, symbolism, and conceptualization) means (Serra & Estrela, 2007).

It is known that for human learning to occur naturally, a set of requirements, which Fonseca (2004) termed "neuropsychological functional completeness" must be met; otherwise, a brain dysfunction is likely to exist.

In accordance with Serra and Estrela (2007), to perform tasks such as reading, writing or counting, our brain activates each process of a complex and extensive functional system. It seems evident that if a part of this functional system is impaired, learning will be affected. Various studies in this area (Moura, 2014) have shown changes in the brains of children with Specific Learning Disorders.

There is a prevalence of the left hemisphere for linguistic processing in individuals with a Specific Learning Disorder compared to normal readers (Sousa & Martins, 2015). These individuals show a lower processing rate and deficient functioning of the right hemisphere. Studies have demonstrated involvement of the temporal lobe in the left cerebral hemisphere and adjacent parts of the parietal and occipital lobes (posterior language area), disrupting language, reading, and writing functions (Ritzen & Debray, 1981). The brains of individuals with this disorder are perfectly normal, although they process information in a different area, resulting in failures in brain connections (Lona, 2014).

Learning to read and write is a fundamental aspect of academic success; however, this is a heterogeneous and individual process that requires children to apply and integrate various cognitive and perceptual-linguistic skills, with some individuals experiencing difficulties in this process (Cruz, 2009).

Shaywitz and collaborators (1998) used functional magnetic resonance imaging (fMRI) to study brain function during reading tasks. They identified three brain areas: the inferior frontal region, the parietal-temporal area and the occipital-temporal area. The inferior frontal region is responsible for oral language (Shaywitz et al., 1998). It is where vocalization and articulation of words are processed and where phoneme analysis begins. This area is particularly active in beginning readers and individuals with dyslexia. The parietal-temporal region is where word analysis occurs (Shaywitz et al., 1998). This area handles visual processing of letter shapes, the correspondence between graphemes and phonemes, syllabic and phonemic segmentation and fusion. It performs analytical reading that occurs slowly and is utilized by both beginning readers and individuals with dyslexia. The occipital-temporal region processes visual word recognition, enabling fast and automatic reading (Shaywitz et al., 1998). All information from different sensory systems converges here, where relevant information about each word is stored and orthography is integrated. Most children learn to read without difficulties; however, dyslexic children do not learn to read at the appropriate or expected time, regardless of their normal intelligence and satisfactory teaching conditions. Therefore, reading acquisition in dyslexic children is slow and requires significant emotional investment (Fonseca, 2009).

In accordance with Sousa and Martins (2015), research conducted using functional resonance imaging has concluded that in individuals with dyslexia, the posterior areas (parietal-temporal, responsible for phonological processing and grapheme-phoneme conversion; and occipital-temporal, responsible for reading automation, word recognition and its components) show lower activation. In dyslexics, the inferior frontal gyrus (responsible for motor programming of word

articulation) is more activated. These authors suggest that these dysfunctions seem to justify phonological difficulties, accuracy, fluency and decoding capacity. Similarly, lower activation of the occipital-temporal area is associated with difficulties in automatic recognition of words and reading.

Thus, modern brain research procedures have identified three distinct subareas (Shaywitz, 2003): one that processes phonemes: vocalization and articulation of words (inferior frontal region); another that analyzes words: related to grapheme-phoneme (parietal-temporal region); and the last that recognizes words and enables fast and automatic reading (occipital-temporal region). Analysis of these examinations revealed that individuals with a Specific Learning Disorder have difficulties in activating the posterior brain areas responsible for word analysis and reading automation, relying more on Broca's area (left inferior frontal area) and other areas on the right side of the brain that use visual cues (Oliveira, 2017). These individuals exhibit deficiencies in phonological processing, showing confusions with letters, syllables, and words that resemble each other graphically.

In conformity with Fonseca (2009) it is now possible to assert that the left side of the brain is directly related to language, with its different areas responsible for processing phonemes, analyzing and recognizing words, which allows humans to learn to read and write.

When a child learns to read, reading is initially processed by the phonological route and later, with the acquisition of new skills, shifts to the lexical route. As the child refines reading skills, the brain becomes more proficient in the process, requiring less effort. However, the brains of individuals with this disorder do not function this way; they only use the area of the brain that processes phonemes while the area that analyzes words remains inactive, preventing proficient recognition and reading, even of words they have already read or studied (Polese, Costa, & Miechuanski, 2011). As specified by Cancela (2014) a deficit in cerebellar activity is suggested as an explanatory hypothesis for this disorder.

After understanding how the brain works in a Specific Learning Disorder, we need to clarify the warning signs to identify this disorder as early as possible.

Warning Signs

Today it is known that it is possible to identify a Specific Learning Disorder with a reading deficit when the child starts learning to read; however, this diagnosis should only be made by properly qualified professionals. Early intervention is considered by various authors (Teles, 2004) to be the most important factor in the recovery of dyslexic readers.

In accordance with Shaywitz (2003) and Teles (2004), there are some warning signs that can be observed before the start of reading learning. The first signs that may indicate potential difficulties in writing appear at the level of oral language:

- Delay in language acquisition

- Difficulty pronouncing complex words correctly (omission or inversion of sounds in words)

- Use of short sentences with poorly pronounced words and omissions or substitutions of syllables or phonemes

- Difficulty learning names of objects, colors, places, people

- Difficulty memorizing songs, nursery rhymes, rhymes

- Difficulty acquiring basic concepts: temporal and spatial

- Difficulty understanding that sentences made up of words can be segmented into syllables

To diagnose a Specific Learning Disorder with a reading deficit, children must demonstrate performance in reading fluency, accuracy, and/or comprehension significantly below what is expected for chronological age, interfering substantially with academic performance and daily life activities (American Psychiatric Association, 2014).

Thus, some authors (Shaywitz, 2003; Teles, 2004) identify several warning signs:

- Does not recognize the letters of their own name

- Difficulty learning and memorizing letter names and sounds

- Difficulty associating letters with their sounds

- Difficulty reading monosyllables and spelling simple words

- Frequent reading errors due to ignorance of grapheme-phoneme correspondence rules

- Refusal or delay in reading and writing tasks

- Reluctance, slowness, and need for parental support in completing homework

- Family history of reading and writing difficulties

- Very slow progress in acquiring reading and spelling

- Omission of phonemes and syllables in the middle of words

- Substitution of words with others of the same meaning

- Tendency to guess words, relying on pictures and context

- Greater ease in reading words in context than isolated words

- Difficulty finishing tests within the allotted time

- Frequent spelling errors

- Lack of pleasure in reading, avoiding books

- Disjointed speech with pauses and hesitations

- Incorrect pronunciation of long, unfamiliar, or complex words
- Difficulty finding the correct word, recalling verbal information
- Short-term memory problems, recalling dates, names, phone numbers
- Difficulty giving quick oral responses
- Difficulty recognizing words they have read or heard
- Preference for books with few words and many blank spaces
- Avoids reading to others
- Expressive vocabulary lower than receptive vocabulary
- Avoids using words they fear mispronouncing

If difficulties are not diagnosed early, they can persist and lead children to academic failure and the development of emotional and social integration problems. Consequently, frequent early school dropout (Antunes, 2018) and the choice of less demanding educational paths can be observed.

In addition to these difficulties, some authors argue that a late diagnosis can imply societal problems (Hulme & Snowling, 2016) and even affect the child's integration into school (Nash et al., 2013), potentially leading to more difficulties and academic failure.

Consequences of Dyslexia

If this disorder is not diagnosed early, it can have negative functional consequences throughout the individual's life. According to American Psychiatric Association (2014), one of the consequences of Dyslexia is related to low academic performance, which is reflected in higher rates of school dropout. People with this disorder experience high levels of psychological distress and, consequently, poorer mental health. These individuals have a propensity to attempt suicide whether as children, adolescents or adults. People with Dyslexia have high unemployment rates and, commonly, receive lower wages.

In accordance with Piedade, Marcelo, Porto and Martins (2020), when a child starts school, they begin a process of competition, being compared, evaluated and tested against their peers for the first time. In fact, it is easy to understand that a child facing difficulties may start to doubt their abilities.

Antunes (2018) also notes that early school dropout is more frequent among children with learning disorders, who tend to choose less demanding educational paths. This author adds that the child may eventually seek other options that might include acting out or taking risks. Typically, these children tend to do anything to be noticed or admired, even negatively.

Individuals with a learning disorder often experience psychological distress that can be analysed at the personality and educational levels (Piedade et al., 2020).

At the personality level, they tend to exhibit lack of attention due to the intellectual effort required to address their difficulties. Antunes (2018) notes that the child also demonstrates fatigue, which can result in a delay in vocabulary development and general academic knowledge.

The child with this disorder often shows disinterest in studying due to demotivation and a lack of educational or family stimuli. They may also exhibit personal maladjustment or even emotional issues such as emotional tension, aggressiveness, shyness, insecurity, and indiscipline (Hulme & Snowling, 2016).

At the educational level, children with this disorder typically enter a cycle of failure that may extend into adulthood. They generally have a more limited vocabulary and, as a result, struggle with self-expression. Dyslexic individuals frequently face barriers, which often leads to school dropout (Antunes, 2018).

In addition to these difficulties, the consequences can lead to social problems. Furthermore, some studies have demonstrated a significant relationship between early reading difficulties and problems of social adjustment, juvenile delinquency and other social issues (Hulme & Snowling, 2016).

Another aspect affecting individuals' lives is the diagnosis. A late diagnosis can result in difficulties integrating the child into school, as they are often labeled as lazy, immature and uninterested. Consequently, these children become victims of labels and prejudices for not meeting the societal ideal of a student without learning difficulties. As a result of these labels, they tend to experience greater difficulties and higher academic failure (Nash et al., 2013).

Thus, Dyslexia still appears to be an obstacle to educational progress, potentially having long-term negative effects on the development of cognitive, social and emotional abilities in children.

Conclusion

This study has contributed to a more profound understanding of Specific Learning Disorder with a reading deficit, commonly known as Dyslexia, with the goal of improving intervention with children who have this disorder. Recognizing the characteristics and early warning signs of this disorder enables more targeted interventions, ultimately supporting these children's educational success and emotional well-being.

The main objective of this work was to the Specific Learning Disorder with a reading deficit to assist those involved in the educational process, namely parents, therapists, technicians, and teachers, in identifying this disorder.

The primary objective of this research was to analyze Specific Learning Disorder with a reading deficit to assist those involved in the educational process, including parents, therapists, practitioners and teachers, in identifying and addressing this disorder. Current evidence indicates that if learning difficulties are

not diagnosed early, they can persist and lead children to academic failure and the development of emotional and social integration problems.

This article highlights the long-term impact of delayed diagnosis, which can extend into adulthood. By raising awareness of the warning signs associated with Dyslexia, this study allows educators to better understand its characteristics, promoting early and accurate diagnosis. An early and correct diagnosis helps to find the most effective strategies to support children and help them learn to read.

To prevent early school dropout and the choice of less demanding educational paths, it is crucial that the main stakeholders in the educational process are aware of the difficulties these children face. Moreover, a late diagnosis can lead to complications in the child's integration into school, resulting in academic failure.

Future research should prioritize analyzing the prevalence of Dyslexia in the Portuguese population, as current data remains outdated. Awareness of the defining characteristics and early indicators of Dyslexia should extend to the general public, especially those professionals who interact closely with affected children. If this disorder is diagnosed early, it becomes easier to implement appropriate support strategies from a young age and help children learn to read.

In summary, understanding this learning issue makes it easier to comprehend Dyslexia and facilitates the adaptation of support for children, emphasizing the importance of early and appropriate intervention for each case.

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