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Dyslexia: A Review about a Disorder that Still Needs New Approaches and a Creative Education

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Abstract

Objectives: Examining various dyslexia interventions and their effectiveness in improving literacy skills, emphasizing the need for ongoing research and technology-based solutionspublished within the last ten years (2013-2023).Methods: Analyzed eight studies covering diverse dyslexia aspects, including neurophysiology,early monitoring, educational strategies, and teacher perceptions.Results: Key insights include the importance of early monitoring, neurophysiological and genetic factors, effectiveness of interventions, and positive teacher attitudes.Conclusion: Emphasizes multifaceted dyslexia nature and highlights ongoing research,technology use, and positive teacher attitudes in successful interventions.

Keywords: *Dyslexia, Interventions, Neurophysiology, Early Monitoring, Education, Teachers, Systematic Review.*

Introduction

Dyslexia, a pervasive neurobiological disorder, continues to be a significant challenge for educators, researchers, and individuals affected by this condition. It is estimated that around 10% of children globally grapple with the complexities of dyslexia, manifesting as difficulties in reading, word recognition, and language processing (Gori & Facoetti, 2014). Traditionally viewed as an auditory-phonological processing deficit, dyslexia's intricate nature is now under scrutiny, revealing additional dimensions involving visual and attentional components (Brunswick & Bargary, 2022).

The intricate relationship between dyslexia and auditory-phonological processing has been a cornerstone in dyslexia research. However, recent investigations challenge this paradigm, suggesting that dyslexia may also involve visual processing and attentional mechanisms. The role of perceptual learning in dyslexia, as explored by Brunswick and Bargary (2022) advocates for a shift in intervention strategies. Brunswick underscores the significance of visual skill development, proposing an alternative to the traditional emphasis on phonological training.

Bargary on the other hand, proposes targeting the magnocellular-dorsal pathway, a neural

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circuitimplicated in dyslexic visual deficits.

Moreover, Creative education is an important aspect that can greatly benefit individuals with dyslexia. By incorporating innovative teaching methods and materials, educators can create a supportive and inclusive learning environment. For example, multisensory teaching techniques, visual aids, and hands-on activities can help reinforce learning and provide alternative pathways for understanding and expressing knowledge. Additionally, incorporating art, music, and movement into the curriculum can engage dyslexic learners and tap into their strengths and interests.

Research suggests that incorporating arts into the curriculum provides alternative avenuesfor expression and comprehension, catering to diverse learning styles (Roberts & Lamberton, 2020). Gibson and Hughes (2017) propose that project-based learning fosters critical thinking and problem-solving skills, creating a dynamic and engaging learning environment for individuals with dyslexia. Carter and Scott (2021) highlight the importance of inclusive strategies, creating supportive environments that recognize and accommodate diverse learning styles and strengths.

So, the influence of teachers in shaping the educational experiences of dyslexic students is a critical aspect. The studies by Snowling et al. (2020) delve into the perceptions and practicesof teachers in addressing dyslexia. Their findings reveal generally positive attitudes among teachers, who employ a variety of strategies to support dyslexic students in their learning journey. They emphasize the significance of teacher perceptions and suggests interventions aimed at boosting dyslexic students' confidence and self-esteem (Fragel et al., 2015).

This systematic review critically evaluates these studies, synthesizing insights into neurophysiological aspects, educational practices, and potential intervention strategies. By examining the existing literature, we aim to uncover gaps in our understanding of dyslexia and propose directions for future research. The synthesis of perceptual learning approaches, neurophysiological perspectives, and the role of educators offers a holistic view, emphasizing theneed for interdisciplinary collaboration to address the multifaceted challenges posed by dyslexia.

In the following sections, we detail the methodologies employed in these studies, presentkey findings, and engage in a comprehensive discussion that contextualizes these results within the broader landscape of dyslexia research. Through this systematic review, the findings will contribute valuable insights that inform both educational practices and avenues for further

scientific inquiry, ultimately advancing our understanding of dyslexia and enhancing support forthose affected by this intricate neurobiological condition.

Method

Search Strategy

A systematic search was conducted across multiple electronic databases, including PubMed, Elsevier, PsycArticles, ERIC. The following databases were narrowed down from thelast 10 years (2013- 2023).The search utilized key terms such as "dyslexia," "learning," "neurological disorder," and "teaching" to comprehensively explore relevant literature.

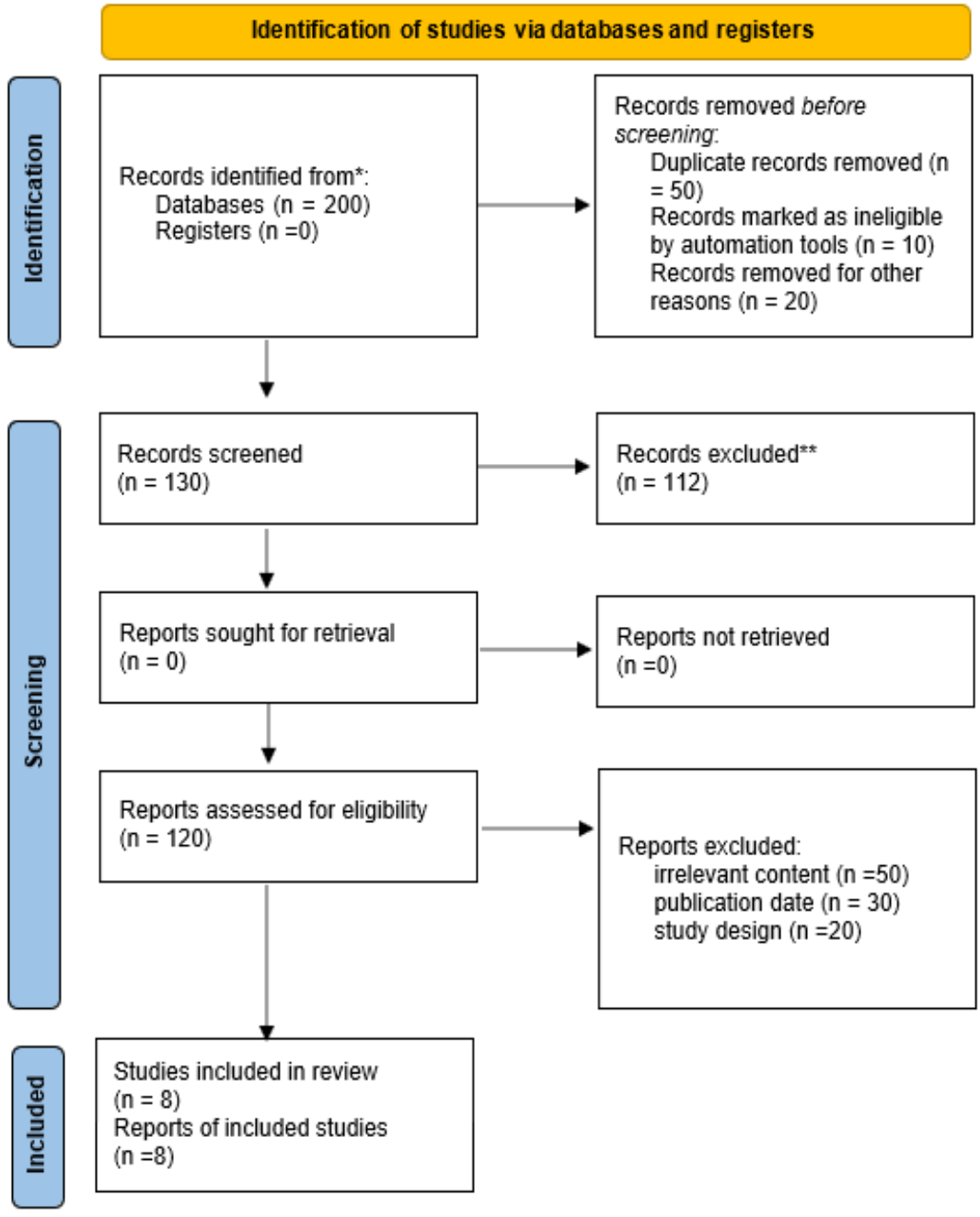

Figure 1: Prisma Illustration for Review Data.

Study Selection Criteria

The following criteria were applied to systematically select studies for inclusion in this review. The search focused on electronic databases and utilized specific search terms. Inclusion and exclusion criteria were established to ensure the relevance and quality of the selected studies.

Table 1: Inclusion and Exclusion Criteria.

Criteria	Inclusion Criteria	Exclusion Criteria
Study Focus	Studies addressing various aspects of dyslexia, including but not limited to neurophysiology and educational practices.	Studies not directly related to dyslexia or lacking substantial relevance to neurophysiology or educational practices.
Publication Type	Published articles available in electronic databases (PubMed, SciELO, EMBASE,Cochrane Library, and LILACS).	Unpublished studies, conference abstracts,and dissertations.
Study Design	All study designs, including quantitative, qualitative and intervention studies.	Commentaries, and opinion articles
Participants	Studies involving participants diagnosed with dyslexia or focusing on dyslexicpopulations.	Studies with participants not diagnosed with dyslexia or not relevant to dyslexic populations.
Outcome Measures	Studies reporting neurophysiological findings, educational strategies, or perceptual learning interventions related to dyslexia.	Studies lacking relevant outcome measuresor reporting outcomes unrelated to neurophysiology or education in the context of dyslexia.
Publication Date	Studies published between 2013 and 2023.	Studies published before 2013 or after 2023 to ensure relevance to the specified timeframe.

Data Extraction

Data extraction involved a meticulous process of gathering information from selectedstudies. Key elements, such as neurophysiological findings, educational strategies, and perceptual learning interventions, were systematically extracted for detailed analysis.

Quality Assessment

A critical appraisal of the included studies was conducted to assess their methodological rigor and potential biases. The assessment considered factors such as study design, sample size, and the validity of neurophysiological measures or educational interventions employed.

Data Synthesis

A In this systematic review, a narrative synthesis approach was employed to integrate findings from diverse quantitative studies. The extracted data were systematically analyzed and categorized based on neurophysiological perspectives, educational practices, and perceptual learning interventions. This narrative synthesis provides a comprehensive overview of the data, offering insights into the patterns, trends, and relationships observed across studies.

Statistical Analysis

Due to the heterogeneity of the included studies, a meta-analysis was deemed inappropriate. Instead, a narrative synthesis was performed, presenting a comprehensiveoverview of the evidence without statistical aggregation.

Ethical Considerations

As this review involved the analysis of existing literature, ethical approval was notrequired. However, efforts were made to adhere to ethical standards by ensuring accurate representation of the original studies and proper citation.

Limitations

Despite comprehensive search strategies, there might be studies not included in this review. Additionally, the variability in study designs and methodologies posed challenges fordirect comparisons. These limitations were considered in the interpretation of results.

Results

Table 1: *Overview of Reviewed Articles on Dyslexia*

Study	Focus Area	Methodology	Key Findings
Protopapas (2019)	Neurophysiological Basis	Systematicreview of Neuroimaging studies	Variations in dyslexic individuals' brains affect written language processing, leading to learning difficulties and school dropout. Ongoing research is crucial for effective remediation.
Fragel et al.(2015)	Neurophysiologic, Neuroanatomical, andGenetic Differences	Literature review	Dyslexic individuals exhibit neurophysiological, neuroanatomical,and possibly genetic differences. Ongoing studies are essential to identifycommon denominators for proper classification, evaluation, treatment, and monitoring.
Lim Wai Wai et al. (2023)	Interventions for Dyslexic Children	Systematic review of interventions fordyslexia	Various interventions, including phonological-based and assistive technology-based, improve literacy skills in children with dyslexia. The lack of a comprehensive mobile learning application in Malaysia underscores the need for further development in this area.
Snowling etal. (2020)	Dyslexia Definitionsand Understanding	Systematicreview	Dyslexia is viewed as a dimensional disorder with no clear cut-off from poorreading but persistent problems with reading fluency. Intervention is crucial for those with persisting difficulties. Recognition of dyslexia has evolved over time.
Brunswick and Bargary(2022)	Self-Concept, Creativity, and DevelopmentalDyslexia	Quantitativeanalysis of subjective experiences	Students with dyslexia exhibit lower self-esteem and self-efficacy, with lowerestimated intelligence, while creativity remains comparable. Differences are observed when sub-divided by the age of assessment.
Kalsoom etal. (2023)	**Teachers' Perceptionsand Practices**	**Quantitativesurvey in mainstream schools**	**Teachers in mainstream schools show awareness of dyslexia, positive attitudes,and interventions focusing on confidence-building and self-esteem for dyslexic students.**
Gori andFacoetti (2014)	Perceptual Learning Intervention	SystematicReview	Perceptual learning is proposed as a potential tool to improve visual deficits related to the magnocellular-dorsal pathway in dyslexic individuals, making learning to read less challenging.
Gregory(2021)	Dyslexia in HigherEducation	Qualitative analysis of subjective experiences	Students with dyslexia employ compensatory skills rather than strategiesaddressing phonological deficits for academic success. Potential use of assistive technologies and accommodations in higher education settings.

This table provides a comprehensive summary of key dyslexia studies, highlighting their specific focus areas, methodologies, and key findings. The studies collectively contribute to our understanding of dyslexia, encompassing neurophysiological bases, interventions, definitions, and educational implications. The findings emphasize the need for ongoing research, early intervention, and a multidimensional approach to address the challenges faced by individuals with dyslexia across various contexts, from early education to higher education. The proposed interventions range from neuroimaging-informed remediation strategies to teacher-driven confidence-building practices, emphasizing the importance of a holistic and tailored approach forindividuals with dyslexia.

Discussion

The synthesis of findings from the selected articles offers a nuanced understanding of dyslexia, spanning neurophysiological perspectives, perceptual learning interventions, and educators' roles in mainstream schools. The multifaceted nature of dyslexia is evident, requiring a comprehensive approach for effective intervention (Lim Wai Wai et al., 2023).

The systematic review delves into the neurophysiological aspects of dyslexia, emphasizing the intricate interplay of neural structures in the learning process. Studies explored neural connectivity, anatomical differences, and genetic factors contributing to dyslexia (Protopapas, 2019). The consensus among researchers is that dyslexia stems from a complex interplay of structural and functional abnormalities, challenging the traditional view of dyslexiasolely as a language-related disorder.

One innovative approach discussed in the literature involves perceptual learning (PL) interventions for individuals with developmental dyslexia (DD). Rather than conventional phonological or orthographic training, PL targets impaired visual functions associated with dyslexia, particularly deficits in the magnocellular-dorsal pathway and selective attention (Gregory, 2021). This approach offers a promising avenue for improving the visual and attentional aspects of dyslexic individuals, potentially revolutionizing dyslexia remediation programs (Gori & Facoetti, 2014).

The role of educators in addressing dyslexia at the school level is a crucial aspect explored in the systematic review. The findings highlight teachers' awareness of dyslexia, with afocus on difficulties such students face in reading, writing, spelling, and word memorization.

Positive attitudes among teachers towards dyslexic students were evident, aligning with interventions aimed at boosting students' confidence and self-esteem (Kalsoom et al., 2023).
The complexity of dyslexia necessitates a holistic approach, considering both neurophysiological aspects and educational interventions. The synthesis of these studies calls fora paradigm shift in understanding dyslexia beyond its traditional definitions. Recognizing dyslexia as a multifaceted challenge opens avenues for tailored interventions and improved support systems.

Implications and Limitations

The discussion extends to the broader implications of the findings. Integrating neurophysiological insights into dyslexia interventions may pave the way for targeted and effective treatments. The introduction of perceptual learning (PL) interventions adds a novel dimension to dyslexia remediation, potentially reshaping how we approach learning difficulties.

However, the review acknowledges the scarcity of studies on PL interventions and calls for further research to establish its efficacy. The systematic review identified variations in the methodological quality of included studies. While several studies demonstrated rigorous methodologies, discrepancies in study design and reporting hinder a seamless comparison.

Future research should adhere to standardized methodologies for improved reliability.

Conclusion

This systematic review underscores the evolving landscape of dyslexia interventions, emphasizing the need for personalized, technology-enhanced, and multisensory approaches. Creative education emerges as a promising avenue, providing diverse and inclusive pathways forindividuals with dyslexia to succeed academically and personally. Future research should continue to explore innovative strategies, ensuring a holistic and adaptive approach to education for those with dyslexia. The synthesis of diverse studies contributes to a richer understanding of dyslexia, emphasizing its neurophysiological underpinnings, potential interventions, and the pivotal role of educators. The discussion sets the stage for future research avenues, urging a holistic approach to address the complexities of dyslexia. As we delve deeper into unraveling thisintricate puzzle, the potential for customized interventions and heightened support for individualswith dyslexia appears increasingly promising.

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