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REVIEW

Why do interventions framed within the phonological hypothesis of dyslexia work? A treatment-focused analysis

¿Por qué funcionan las intervenciones enmarcadas en la hipótesis fonológica de la dislexia? Un análisis centrado en el tratamiento

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ABSTRACT

Introduction: in the last decades, the Phonological Hypothesis of dyslexia has gained popularity into the field of psychology. This hypothesis holds that difficulties in learning to read are due to a neurocognitive disorder and, in consequence, suggests that the possibilities of learning and/or improving reading skills in these cases, depend on psychological treatments that correct or compensate for such deficiencies. The effectiveness of these interventions is often undestood as confirmatory evidence of the neurological causes of reading problems. However, the effectiveness of these interventions could be understood attending to their own properties, without the need to postulate specific effects (corrective or compensatory) at a neurological level.
Objective: the aim of the present study is to characterize the interventions framed in the Phonological Hypothesis of dyslexia and to analyze the factors that influence their effectiveness.
Method: in order to achieve this objective, a content analysis was performed on a set of systematic reviews that analyzed the effectiveness of this kind of interventions.
Results: the factors that influence the effectiveness of these interventions were identified and classified in three categories: 1) the dependent variable analyzed, 2) procedural aspects of their implementation and 3) the methodological rigor of the research.
Conclusions: the specificity of the interventions framed in the Phonological Hypothesis of dyslexia is discussed and an alternative interpretation is proposed to understand their effectiveness. or unstructured, no longer than 250 words; written in the past tense and in the third person singular.

Keywords: Learning Disability; Teaching Reading; Dyslexia; Intervention; Content Analysis.

RESUMEN

Introducción: en las últimas décadas, la Hipótesis Fonológica de la dislexia ha ganado popularidad en el ámbito de la Psicología. Esta hipótesis sostiene que las dificultades de aprendizaje de la lectura se deben a la existencia de un trastorno neurocognitivo y que las posibilidades de aprender y/o mejorar la habilidad lectora en estos casos, dependen de tratamientos psicológicos que corrijan o compensen tales deficiencias. La efectividad de estas intervenciones, suele esgrimirse como evidencia confirmatoria de las causas neurológicas de los problemas de lectura. Sin embargo, la efectividad de las intervenciones podría comprenderse atendiendo a sus propias características, sin la necesidad de postular efectos específicos (correctores o compensadores) a nivel neurológico.
Objetivo: el objetivo del presente estudio es caracterizar las intervenciones enmarcadas en la Hipótesis Fonológica de la dislexia y analizar los factores que influyen en su efectividad, con la finalidad de ofrecer

un marco para comprender la efectividad de estas intervenciones sin proponer la existencia de un trastorno neurológico.
Método: para alcanzar este objetivo, se realizó un análisis de contenido sobre un conjunto de revisiones sistemáticas que analizaron la efectividad de este tipo de intervenciones.
Resultados: se identificaron tres clases de factores que inciden en la efectividad de estas intervenciones: 1) la variable dependiente analizada, 2) aspectos procedimentales de su implementación y 3) la rigurosidad metodológica de la investigación.
Conclusiones: se discute la especificidad de las intervenciones enmarcadas en la Hipótesis Fonológica de la dislexia y se propone una interpretación alternativa para comprender su efectividad.

Palabras clave: Dificultad en el Aprendizaje; Dislexia; Intervención; Enseñanza de la Lectura; Análisis de Contenido.

INTRODUCTION

Worldwide, educational statistics show a high percentage of students who do not achieve functional levels of reading, writing, and mathematics.[1] This situation, which was traditionally understood in relation to the challenges of the task of educating/teaching itself and the influence of various social factors, is now interpreted by many people as an individual and organic problem, limited to each of the students involved, assuming that learning problems indicate the existence of neurological functioning disorders.[2,3,4] This articulation of medical and psychological discourses in the voices of mothers, teachers, and health professionals who participate in accompanying the school trajectories of students with learning problems leads to fragmented representations and interventions on the issue.[5]

This scenario calls for a careful analysis of the different ways in which the biomedical approach to learning problems in school impacts the functioning of educational institutions and the various actors involved in them.

Since the end of the 20th century, the influence of cognitive neuroscience on the way we understand and address school failure has grown to permeate common sense. In many countries, this way of conceiving school failure has even been institutionalized through the enactment of laws that mandate a biomedical approach from the fields of health and education. The recommended and endorsed "treatment" for learning difficulties is neurological/cognitive stimulation of phonological awareness and other neurocognitive abilities believed to be involved in reading. These treatments are thought to improve people's performance in reading tasks because they help to normalize and/or compensate for a neurological disorder that is believed to be the cause of reading difficulties or dyslexia.[3,8,9,10,11]

These beliefs about the effectiveness of cognitive treatments for dyslexia stem from the phonological hypothesis (PH) of dyslexia, the most widely studied etiological hypothesis of dyslexia in the field of neuroscience.[12] The PH of dyslexia is based on a conception of reading as a complex brain/cognitive function, specialized in the decoding or translation of written signs into articulated sounds, which is based on phonological awareness or the ability to identify and manipulate the sound segments of words and their graphic representations. It is assumed that as people learn to identify and manipulate the sound segments of speech, mental/brain representations of these segments are formed in their brains, which they can then combine to achieve different forms of writing and reading.[9,13] The HF of dyslexia proposes that difficulties in learning to read—when not due to brain damage, sensory, motor, or cognitive impairments, or teaching problems—are due to alterations in the development of phonological awareness.[9,10,13,14,15,16]

It is common to hear and read that around 10 % of the school-age population has this type of neurological disorder and, as a result, specific difficulties in learning to read or dyslexia. However, to date, no evidence has been provided to justify this claim, which is based solely on correlational studies[2,17,18], among which studies analyzing the effectiveness of interventions are particularly relevant. In these studies, the improvement in reading experienced by participants who receive phonological awareness training is conceived as an indicator of the impact (correction and/or compensation) of these treatments on hypothetical deficient neurocognitive mechanisms[3,8,9,10,11] and reinforces the belief that reading problems have a neurological cause.

This way of understanding school failure and the effectiveness of treatments corresponds to what Moncrieff[19,20] called a "disease-centered" explanatory model, in that it presupposes the existence of a disease and, based on that assumption, interprets the effects of treatment. This explanatory model, which allows us to understand the effectiveness of many medical treatments, becomes tautological when used to explain problems in the field of mental health in general and dyslexia in particular.[21] If a person's reading difficulties are explained by pointing out that they have dyslexia, and dyslexia can only be explained by pointing out reading difficulties, then the diagnosis of dyslexia does not explain the problem. To break out of this circularity, direct evidence of the presumed affected neurological mechanism, independent of its behavioral indicators, must be provided.

The effectiveness of treatments is often interpreted as evidence of such deficiencies; however, to constitute direct evidence of deficient neurocognitive mechanisms, two requirements must be met: 1) treatments must exert their therapeutic effects by impacting previously identified specific pathological mechanisms, and 2) these therapeutic effects should only be expressed in people who have the pathology in question.[20,21] Despite the amount of effort devoted to this, it has not yet been possible to provide direct empirical evidence of the neurocognitive mechanisms proposed as the cause of reading problems or dyslexia, their deficiencies, and their improvements following interventions within the HF framework of dyslexia.[6,22,23,24]

As an alternative to the "disease-centered" explanatory model, Moncrieff[19,20] proposes interpreting the effectiveness of (pharmacological) treatments from a "drug-centered" model, in which the therapeutic effects of these treatments are explained by the known and verifiable effects of the drug on the body. The author argues that psychiatric drugs are psychoactive substances that produce particular mental and physical alterations in anyone who ingests them, and that it is these alterations that produce the effects considered therapeutic, insofar as they affect the way of thinking, feeling, and/or acting. In this way, Moncrieff manages to explain the effectiveness of pharmacological treatments in mental health in a simple way and without proposing the existence of a neuropathological mechanism that can only be inferred from the effectiveness of the treatment.

Following this proposal, this paper conducted a review of the scientific literature with the aim of exploring the possibilities of understanding the effectiveness of interventions framed within the HF of dyslexia, based on their own characteristics. The following questions guided the review:

1) What do HF interventions for dyslexia consist of?
2) Why are they effective in improving participants' performance in reading tasks? What variables are analyzed?
3) What factors modulate the effectiveness of interventions based on the PH of dyslexia?

The objective of this study is to characterize interventions based on the Phonological Hypothesis of Dyslexia and analyze the factors that influence their effectiveness, with the aim of providing a framework for understanding the effectiveness of these interventions without proposing the existence of a neurological disorder.

METHOD

To explore the characteristics of interventions based on the PH of dyslexia and their effectiveness in addressing reading difficulties, a critical content analysis of the scientific literature on this topic was conducted. Content analysis is a qualitative research methodology that can be applied to any type of document and aims to identify themes and concepts that allow the meanings contained in the documents to be understood.[25] In the words of Díaz and Navarro[26], content analysis can be conceived as "a procedure designed to destabilize the immediate intelligibility of the textual surface, revealing aspects that are not directly intuitive but nevertheless present." One of the main purposes of content analysis is to identify certain elements of the documents (in this case, the focus was particularly on the characteristics of the interventions and the results of their implementation) and to classify them according to specific categories created to facilitate understanding of the phenomenon of interest.[27]

A search for information was conducted in the PubMed and Educational Resources Information Center databases. To this end, a search strategy was established using terms or keywords combined with Boolean operators. The title and abstract were used as search fields.

The search strategy was generally structured as follows: *((dyslexia[Title/Abstract]* OR *disability[Title/Abstract])* AND *(reading[Title/Abstract])* AND *(intervention[Title/Abstract]* OR *treatment[Title/Abstract]* OR *training[Title/Abstract]))*.

This strategy was adapted to the syntax of each database. For the ERIC search, the terms "systematic review" OR meta-analysis were added, while in PubMed, the search was restricted to the systematic review and meta-analysis categories offered by the platform.

Once the relevant articles had been identified, the process of reading and analyzing them began. For this process, categories created from the theoretical framework on which this research is based were used.

The inclusion criteria were established as those articles that, in addition to including the terms entered in the search in the title and/or abstract, were systematic reviews; analyzed the effectiveness of any type of reading instruction that involved the exercise of basic reading skills; and included in the sample school-age or preschool children with reading learning difficulties and no other learning or behavioral problems. As exclusion criteria, studies that evaluated the effectiveness of interventions based exclusively or mainly on tasks that did not involve reading, such as music education or stimulation of attentional functions, were discarded, as were those that analyzed the effects of teaching strategies on people with behavioral problems, ADHD, mental retardation, autism, brain damage, perceptual disorders, etc.

RESULTS

Characterization of Interventions Framed in the HF of Dyslexia

The analysis of the interventions included in each review revealed some relevant aspects. First, it confirmed that interventions framed within the HF of dyslexia consist mainly of different exercises aimed at developing phonological awareness. In addition, it was possible to identify many of the exercises used and organize them into different categories, as presented below:

-*Teaching grammatical rules:*[28,29,30,31,32] This category includes exercises in segmenting words into initial rhymes, phonemes, and morphemes; word spelling exercises; semantic analysis of the roots and affixes of compound words; activities in which the person must produce compound words; exercises in analyzing and manipulating verb tenses in compound words; exercises in classifying words based on morphological, phonological, semantic, or syntactic patterns; activities for understanding the etymology of words; explicit instruction in basic writing concepts, spelling rules, and phonological rules.

-*Identifying phonemes in speech:*[28,29,30,31,32] This category includes activities where the participant must classify or order figures according to the duration of the vowel in the pronunciation of the word, distinguishing between words that are phonologically identical except for the duration of the vowel, pronouncing syllables by removing a phoneme, formulating words that rhyme with the names of different objects, formulating words that begin with the same sound, pronouncing words slowly, individualizing each sound, such as directionality or letter and word.

-*Grapheme-phoneme relationship:*[28,29,30,31,32] This category includes activities aimed at learning the names of letters and the relationship between different phonemes and their corresponding written symbols, such as word analysis and comparison exercises.

-*Vocabulary:*[33,34] This category includes the direct teaching of the meaning and use of different words that will later be found in a text, for example, through exercises that involve using new words in meaningful contexts.

-*Reading/decoding exercises:*[33,34] This category includes various exercises in reading words and non-words, such as identifying words in a word search.

-*Reading/comprehension exercises:*[35,36,37,38,39,40] This category includes shared, repeated reading exercises with modeling and feedback; exercises where participants must identify the meaning of unknown words from context and co-text.

-*Writing exercises:*[35,36,37,38,39,40] This category includes phoneme writing exercises, such as filling in missing letters in incomplete words or forming syllables and words from phonemes using cards or cubes with printed letters.

Effectiveness of HF-based interventions for dyslexia

In general, all reviews reported a positive effect of HF-based interventions for dyslexia on participants' performance on various reading indicators. However, this result was affected by different factors:

-*Dependent variable analyzed:* many of the reviews analyzed agree that the effectiveness of interventions and/or their effect size varies depending on the variables analyzed, with greater and more consistent effects on skills/abilities of the same type as those trained and with little or no generalization to other skills/abilities. For example, Suggate[28], McArthur et al.[29], McArthur et al.[30] and Hall et al.[35], found that phonological awareness training improved participants' performance on tasks involving knowledge of the grapheme-phoneme relationship, spelling exercises, word segmentation or identification of rhymes between two or more words, reading words and non-words, etc., but did not improve performance on reading comprehension tasks.

-*Procedural aspects:* most of the factors that moderate the effectiveness of reading interventions are associated with procedural aspects of their implementation. Suggate[28] found that the effectiveness of interventions varies mainly according to the age or grade level of the participants, the type of intervention implemented, and the instructor-participant ratio. Specifically, the author suggests that individualized interventions (one-to-one ratio) could be important for working with older children or those in higher grades and with more complex strategies, while group interventions may be more effective for developing basic phonological skills in children in early grades. Goodwin and Ahn[32], in an analysis of the effectiveness of morphological instruction, identified that this type of instruction is only effective for the development of reading skills when presented in a more extensive phonological processing training program, but not when presented in isolation. Kim et al.([36] ()) ,Hall et al.[35] and Scammacca et al.[41] found a moderating effect of the duration of interventions in different ways. While the first two showed greater effectiveness in interventions of more than 10 and more than 20 sessions, the latter found greater effectiveness with interventions of less than 15 hours.

Finally, in the analysis of intervention strategies based on adjustments to the school program, Scammacca et al.[40] and Goldfeld et al.[39] reported that all successful interventions coincided in the following aspects: a) they included content related to the development of phonological awareness, teaching of grapheme-phoneme

relationships, and vocabulary development; b) they shared some pedagogical aspects, such as being designed as "interactive" activities, with modeling, explicit instruction, and scaffolding by the teacher; c) they shared procedural aspects such as working with small groups (of approximately 3-5 students) and with long programs (at least four weekly interventions over 3 to 6 months).

-Methodological rigor of research: Another factor moderating the effectiveness of interventions and, above all, the size of their effect, is the methodological rigor of the research. Many of the reviews analyzed identified that the magnitude of the effects is lower in studies with more rigorous methodologies, which mainly include working with larger samples, active control groups (involving participants in an activity equivalent in terms of time commitment, motivation, and cognitive demand), random assignment of participants to groups, greater fidelity in the implementation of interventions, use of standardized tests to evaluate the effects of the intervention, and greater rigor in the statistical analysis of the data.[33,34,37,38,39,42] Finally, Nelson et al.[34], found that different "traits" of participants, such as their performance in rapid naming tasks, their phonological processing ability, their knowledge of spelling rules, their memory capacity, the existence of behavioral problems, and sociodemographic aspects, affect the results of interventions in different ways. Although, in general, the reviews reported a correlation between the methodological rigor of the research and its publication date (with more recent studies showing greater methodological rigor), most detected methodological flaws in a large proportion of the studies reviewed, regardless of their publication date, and one even identified that certain methodological aspects had worsened compared to previous reviews.[43]

DISCUSSION

This study was designed to explore the possibilities of understanding the effectiveness of interventions framed within the HF of dyslexia, focusing on its own characteristics and avoiding postulating the existence of a disease. The results obtained enable an interpretation of the effects of these interventions from an approach that, to paraphrase Moncrieff[19,20], we can call a "treatment-centered" explanatory model.

The analysis presented allows us to infer that interventions within the HF framework for dyslexia consist fundamentally of the meticulous implementation of standard reading teaching exercises. Furthermore, their effectiveness is subject to the same type of factors that commonly affect reading instruction, such as the instructor-participant ratio, the intensity and/or duration of the intervention, and the inclusion of certain pedagogical-didactic aspects (e.g., the use of interactive activities, with modeling, explicit instruction, and scaffolding by the teacher).[34,39] Complementarily, some studies reported that attempts to stimulate the neurocognitive capacity of phonological awareness without including reading exercises (e.g., through musical exercises or cortical stimulation) fail to improve participants' performance on reading tasks.[44,45,46,47]

Given these data, it seems more appropriate to conceive of interventions framed within the HF of dyslexia as reading teaching strategies rather than as specific neurocognitive stimulation treatments. In fact, these are the same types of strategies proposed by psychology and cognitive neuroscience for teaching reading to the general population[48,49,50], which involves a conception of reading as a neurocognitive ability related to the decoding of written signs and the teaching of reading as the repeated and sustained exercise of this ability to promote its development.

It is important to note that the "interventions" or reading teaching strategies framed within the HF of dyslexia are effective in improving participants' reading performance (at least in the same type of abilities/skills that are exercised). However, the scope of these results is unclear. If it is assumed (as is common) that the initial poor performance was caused by a neurological deficiency, then it makes sense to interpret improvements in reading as evidence of a specific and exclusive effect of the intervention on those neurological deficiencies. However, if these interventions are considered to consist of different common reading teaching strategies applied methodically, their effectiveness can be interpreted as the achievement of certain objectives in a common reading teaching/learning process.

From this perspective, although the effectiveness of these teaching strategies has value in itself, it is possible to point out some aspects to consider about this approach to school failure: First, these results add little relevant information to existing knowledge about reading instruction/learning[51,52,53,54] and at best, reinforce the importance of ensuring the necessary conditions for addressing individual learning needs in each classroom. To make a more complete assessment of the effectiveness and usefulness of these reading teaching strategies, it is necessary to compare them with teaching strategies based on conceptual frameworks other than the neurocognitive one. Unfortunately, the reviews analyzed did not include studies with this type of comparison. Secondly, following the observation made by Benedek[5], it is possible that adopting a biomedical perspective to define and address reading learning problems contributes to the fragmentation of school issues and the disarticulation of the different actors involved in their identification, definition, and approach, resulting in an exacerbation of the problems.

Given this scenario, considering that 1) the problem classified as dyslexia refers to the group of students

whose performance in reading tasks is at the lower end of a continuum ranging from "very poor" to "very good"[6,22,23] that interventions based on the phonological hypothesis of dyslexia are common strategies for teaching reading, and 3) that their effectiveness is related to the direct practice of different aspects of reading and writing, in a sustained manner and in small groups, it would be advisable for their potential contributions to be discussed explicitly and within the framework of the question of how to teach reading, in comparison with other ways of conceiving reading and its teaching and, above all, without resorting to categories of biomedical discourse on health/illness.

BIBLIOGRAPHICAL REFERENCES

1. Olusanya BO, Smythe T, Ogbo FA, Nair MKC, Scher M, Davies AC, et al. Global prevalence of developmental disabilities in children and adolescents: a systematic umbrella review. Front Public Health. 2023;11:1122009. doi:10.3389/fpubh.2023.1122009

2. Perdue MV, Mahaffy K, Vlahcevic K, Wolfman E, Erbeli F, Richlan F, et al. Reading intervention and neuroplasticity: a systematic review and meta-analysis of brain changes associated with reading intervention. Neurosci Biobehav Rev. 2022;132:465–494. doi:10.1016/j.neubiorev.2021.11.011

3. Murphy KA, Jogia J, Talcott JB. On the neural basis of word reading: a meta-analysis of fMRI evidence using activation likelihood estimation. J Neurolinguistics. 2019;49:71–83. doi:10.1016/j.jneuroling.2018.08.005

4. Barquero LA, Davis N, Cutting LE. Neuroimaging of reading intervention: a systematic review and activation likelihood estimate meta-analysis. PLoS One. 2014;9(1):e83668. doi:10.1371/journal.pone.0083668

5. Benedek ME. Articulación en el acompañamiento de trayectorias escolares. Un estudio de casos en instituciones primarias privadas en Tucumán. Investigando en Psicología. 2023;24. doi:10.70198/iep.vi24.201

6. Christensen CA. Learning disability: issues of representation, power, and the medicalization of school failure. In: Sternberg RJ, Spear-Swerling L, editors. Perspectives on Learning Disabilities: Biological, Cognitive, Contextual. 1st ed. Boulder (CO): Westview Press; 1999. p. 227–249.

7. Morel S. La medicalización del fracaso escolar en Francia. Una forma contemporánea de etiquetaje de los alumnos con dificultades escolares. Rev Asoc Sociol Educ. 2015;8(3):321–334. Disponible en: https://dialnet.unirioja.es/servlet/articulo?codigo=5200263

8. Simos PG, Fletcher JM, Bergman E, Breier JI, Foorman BR, Castillo EM, et al. Dyslexia-specific brain activation profile becomes normal following successful remedial training. Neurology. 2002;58:1203–1213. doi:10.1212/WNL.58.8.1203

9. Goswami U. Reading. In: Reed J, Warner-Rogers J, editors. Child Neuropsychology: Concepts, Theory and Practice. Malden (MA): Blackwell Publishing; 2008. p. 340–356.

10. Goswami U. Neurociencia y Educación: ¿podemos ir de la investigación básica a su aplicación? Un posible marco de referencia desde la investigación en dislexia. Psicol Educativa. 2015;21:97–105. doi:10.1016/j.pse.2015.08.002

11. Luque JL, Giménez A, Bordoy S, Sánchez A. De la teoría fonológica a la identificación temprana de las dificultades específicas de aprendizaje de la lectura. Rev Logop Foniatr Audiol. 2016;36(3):142–149. doi:10.1016/j.rlfa.2015.10.001

12. Ripoll Salceda JC, Aguado Alonso G. Eficacia de las intervenciones para el tratamiento de la dislexia: una revisión. Rev Logop Foniatr Audiol. 2016. doi:10.1016/j.rlfa.2015.11.001

13. Goswami U. Learning to read in different orthographies: phonological awareness, orthographic representations and dyslexia. In: Hulme C, Snowling MJ, editors. Dyslexia: Biology, Cognition and Intervention. London: Whurr; 1997. p. 131–152.

14. Troia GA. Phonological awareness intervention research: a critical review of the experimental methodology. Read Res Q. 1999;34(1):28–52. doi:10.1598/RRQ.34.1.3

15. Eden GF, Moats L. The role of neuroscience in the remediation of students with dyslexia. Nat Neurosci Suppl. 2002;5:1080–1084. doi:10.1038/nn946

16. Fletcher JM. Dyslexia: the evolution of a scientific concept. J Int Neuropsychol Soc. 2009;15(4):501–508. doi:10.1017/S1355617709090900

17. Xia Z, Hancock R, Hoeft F. Neurobiological bases of reading disorder Part I: etiological investigations. Lang Linguist Compass. 2017;11(4):e12239. doi:10.1111/lnc3.12239

18. Danks D, Davis I. Causal inference in cognitive neuroscience. Wiley Interdiscip Rev Cogn Sci. 2023;14:e1650. doi:10.1002/wcs.1650

19. Moncrieff J. Hablando claro. Una introducción a los fármacos psiquiátricos. Barcelona: Herder; 2012.

20. Moncrieff J. Un enfoque alternativo del tratamiento farmacológico en psiquiatría. Rev Asoc Esp Neuropsiq. 2018;38(133):181–193. doi:10.4321/S0211-57352018000100010

21. Timimi S, Timimi Z. The dangers of mental health promotion in schools. J Philos Educ. 2022;56:12–21. doi:10.1111/1467-9752.12639

22. Elliot JG, Gibbs S. Does dyslexia exist? J Philos Educ. 2008;42(3-4):475–491. doi:10.1111/j.1467-9752.2008.00653.x

23. Elliot JG. It's time to be scientific about dyslexia. Read Res Q. 2020;55(S1):S61–S75. doi:10.1002/rrq.333

24. Bowers JS. The practical and principled problems with educational neuroscience. Psychol Rev. 2016;123(5):600–612. doi:10.1037/rev0000025

25. Gomes Campos CJ, Ribeiro Turato E. Análisis de contenido en investigaciones que utilizan la metodología clínico-cualitativa: aplicación y perspectivas. Rev Latino-Am Enferm. 2009;17(2). doi:10.1590/S0104-11692009000200019

26. Fernandez Chaves F. El análisis de contenido como ayuda metodológica para la investigación. Rev Cienc Sociales. 2002;2(96):35–53. Disponible en: https://www.redalyc.org/pdf/153/15309604.pdf

27. Piñeiro-Naval V, Igartua JJ, Marañón-Lazcano F, Sánchez-Nuevo LA. El análisis de contenido y su aplicación a entornos web: un caso empírico. In: Caffarel C, Gaitán JA, Lozano C, Piñuel JL, editors. Tendencias metodológicas en la investigación académica sobre Comunicación. Salamanca: Comunicación Social Ediciones y Publicaciones; 2018. p. 253–272. doi:10.52495/c6.2.emcs.2.mic6

28. Suggate SP. Why what we teach depends on when: grade and reading intervention modality moderate effect size. Dev Psychol. 2010;46(6):1556–1579. doi:10.1037/a0020612

29. McArthur G, Eve PM, Jones K, Banales E, Kohnen S, Anandakumar T, et al. Phonics training for English-speaking poor readers. Cochrane Database Syst Rev. 2012;(12):CD009115. doi:10.1002/14651858.CD009115.pub2

30. McArthur G, Sheehan Y, Badcock NA, Francis DA, Wang HC, Kohnen S, et al. Phonics training for English-speaking poor readers. Cochrane Database Syst Rev. 2018;(11):CD009115. doi:10.1002/14651858.CD009115.pub3

31. Galuschka K, Görgen R, Kalmar J, Haberstroh S, Schmalz X, Schulte-Körne G. Educational Psychologist. 2020;55(1):1–20. https://doi.org/10.1080/00461520.2019.1659794

32. Goodwin AP, Ahn S. A meta-analysis of morphological interventions: effects on literacy achievement of children with literacy difficulties. Ann Dyslexia. 2010;60:183–208. doi:10.1007/s11881-010-0041-x

33. Wanzek J, Stevens EA, Williams KJ, Scammacca N, Vaughn S, Sargent K. Current evidence on the effects of intensive early reading interventions. J Learn Disabil. 2018;51(6):612–624. doi:10.1177/0022219418775110

34. Nelson JR, Benner GR, Gonzalez J. Learner characteristics that influence the treatment effectiveness of early literacy interventions: a meta-analytic review. Learn Disabil Res Pract. 2003;18(4):255–267. doi:10.1111/1540-5826.00080

35. Hall C, Dahl-Leonard K, Cho E, Solari EJ, Capin P, Conner CL, et al. Forty years of reading intervention research for elementary students with or at risk for dyslexia: a systematic review and meta-analysis. Read Res Q. 2022;58(2):285–312. doi:10.1002/rrq.477

36. Kim D, An Y, Shin HG, Lee J, Park S. A meta-analysis of single-subject reading intervention studies for struggling readers: using improvement rate difference. Heliyon. 2020;6:e05024. doi:10.1016/j.heliyon.2020.e05024

37. Swanson HL. Reading research for students with LD: a meta-analysis of intervention outcomes. J Learn Disabil. 1999;32(6):504–532. doi:10.1177/002221949903200605

38. Dahl-Leonard K, Hall C, Capin P, Solari EJ, Demchak A, Therrien WJ. Examining fidelity reporting within studies of foundational reading interventions for elementary students with or at risk for dyslexia. Ann Dyslexia. 2023. doi:10.1007/s11881-023-00279-3

39. Goldfeld S, Beatson R, Watts A, Snow P, Gold L, Le HND, et al. Tier 2 oral language and early reading interventions for preschool to grade 2 children: a restricted systematic review. Aust J Learn Difficult. 2022;27(1):65–113. doi:10.1080/19404158.2021.2011754

40. Scammacca N, Vaughn S, Roberts G, Wanzek J, Torgesen JK. Extensive Reading Interventions in Grades K-3: From Research to Practice. Portsmouth (NH): RMC Research Corporation, Center on Instruction; 2007. Disponible en: https://files.eric.ed.gov/fulltext/ED521573.pdf

41. Scammacca NK, Roberts G, Vaughn S, Stuebing KK. A meta-analysis of interventions for struggling readers in grades 4-12: 1980-2011. J Learn Disabil. 2015;48(4):369–390. doi:10.1177/0022219413504995

42. Austin CR, Wanzek J, Scammacca NK, Vaughn S, Gesel SA, Donegan R, et al. The relationship between study quality and the effects of supplemental reading interventions: a meta-analysis. Except Child. 2019;85(3):347–366. doi:10.1177/0014402918796164

43. Toffalini E, Giofrè D, Pastore M, Carretti M, Fraccadori F, Szűcs D. Dyslexia treatment studies: a systematic review and suggestions on testing treatment efficacy with small effects and small samples. Behav Res Methods. 2021;53:1954–1972. doi:10.3758/s13428-021-01549-x

44. Celli RM, del Valle Soria S. Inclusive education and curriculum adaptations: strategies for school equity. Neurodivergences. 2024;3:124.

45. Cogo-Moreira H, Andriolo RB, Yazigi L, Ploubidis GB, Brandão de Ávila CR, Mari JJ. Music education for improving reading skills in children and adolescents with dyslexia. Cochrane Database Syst Rev. 2013;(8):CD009133. doi:10.1002/14651858.CD009133.pub2

46. Turker S, Hartwigsen G. The use of noninvasive brain stimulation techniques to improve reading difficulties in dyslexia: a systematic review. Hum Brain Mapp. 2022;43(3):1157–1173. doi:10.1002/hbm.25700

47. Robaina Castillo JI. Giftedness and double exceptionality: identification, support and development. Neurodivergences. 2024;3:146.

48. Germán Flores L. Specific Learning Disorders: Neurobiological Foundations, Differential Diagnosis, and Educational Implications. Neurodivergences. 2025;4:268.

49. Cancer A, Antonietti A. Music-based and auditory-based interventions for reading difficulties: a literature review. Heliyon. 2022;8:e09293. doi:10.1016/j.heliyon.2022.e09293

50. Gutiérrez-Fresneda R, Pozo-Rixo T. Lit Lingüíst. 2022;45:281–298. doi:10.29344/0717621x.45.2212

51. López Sánchez AA, Castillo-González W. Specific Learning Disabilities: New approaches to understanding and support. Neurodivergences. 2025;4:180.

52. Ferreiro E, Teberosky A. Los sistemas de escritura en el desarrollo del niño. Buenos Aires: Siglo XXI; 1979.

53. Jiménez J, O'Shanahan J. Enseñanza de la lectura: de la teoría y la investigación a la práctica educativa. Rev Iberoam Educ. 2008;45(5):2–22. doi:10.35362/rie4552032

54. Bowers JS. Reconsidering the evidence that systematic phonics is more effective than alternative methods of reading instruction. Educ Psychol Rev. 2020;32:681–705. doi:10.1007/s10648-019-09515-y

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