Comparison of the Effectiveness of Bakker Neuropsychological Interventions and the Phono-Graphix Method on Reading Attitude and Reading Performance in Elementary Students with Dyslexia

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Purpose: This study was conducted to compare the effectiveness of Bakker's neuropsychological interventions and the Phono-Graphix method on reading performance and reading attitude in elementary school students with dyslexia.

Methods and Materials: The present research followed a quasi-experimental design with three phases: pre-test, post-test, and follow-up, along with a control group. The statistical population consisted of all elementary school children with dyslexia from the six educational districts of Isfahan who were referred to the Learning Disorders Center during the 2022–2023 academic year. From this population, 45 children were purposefully selected and then randomly assigned (via lottery) to three groups (15 students per group). The Reading Attitude Scale (McKenna & Kear, 1990) and the Reading Performance Scale (Karami Nouri & Moradi, 2005) were utilized to assess the dependent variables across the three stages. The two intervention groups received the necessary training sessions, while the control group received no intervention. Data were analyzed using repeated measures ANOVA and Bonferroni post hoc test via SPSS version 26.

Findings: The results indicated that there was a statistically significant difference between the Bakker neuropsychological training and Phono-Graphix training compared to the control group regarding both reading attitude and reading performance (p < .001). Moreover, in the post-test phase, Bakker's neuropsychological intervention demonstrated greater effectiveness than the Phono-Graphix method; however, no significant difference was observed between the two interventions during the follow-up phase (p > .05).

Conclusion: Given the observed effectiveness of Bakker's neuropsychological training over the Phono-Graphix method in improving reading attitude and reading performance, it is recommended that both interventions be employed for children with reading disabilities in schools and counseling centers.

Keywords: Bakker neuropsychological intervention, Phono-Graphix intervention, reading attitude, reading performance, children with dyslexia

1. Introduction

Learning disabilities in children are among the most important and extensively studied topics in psychological research across the globe. Children with learning disabilities are a group who, despite having a normal appearance and average intelligence, face difficulties in acquiring and mastering certain academic skills (Bulut et al., 2024). Based on available data, approximately 2 to 10 percent of children are affected by a range of these disorders, with boys being three times more likely to be diagnosed than girls (Kelly et al., 2023). Unfortunately, these children often go unidentified during preschool years, and their difficulties with reading, writing, and mathematical comprehension gradually become apparent during the first and second years of school (Aro et al., 2022). Specific learning disabilities such as difficulties with calculation or reading can significantly impair the acquisition of key academic skills. Moreover, learning disabilities may be compounded by developmental disorders such as Attention-Deficit/Hyperactivity Disorder (ADHD), thereby complicating the challenges these children face (Drigas et al., 2022).

Among various types of learning disabilities, the most prevalent and significant in children is dyslexia, or reading difficulties (Ranjbar et al., 2019). Dyslexia is defined as a specific learning disability in which a child's reading progress is significantly below the expected level for their age, education, and intelligence (Kelly et al., 2023). Dyslexia affects reading ability and fundamental language-processing skills, and therefore, these children require support from both parents and teachers throughout their learning process (Xie et al., 2022). Two critical variables in children with dyslexia are reading attitude and reading performance.

Reading attitude is one of the most important variables in the domain of reading and learning through reading, encompassing a spectrum of positive to negative attitudes toward reading (Delgado-Vásquez et al., 2022). Reading attitude includes beliefs or evaluations regarding reading, as well as the value placed on reading as a tool for educational and occupational success. It also reflects emotional responses to reading and represents a kind of readiness to engage in reading activities (Huo & Zhang, 2022). Hence, fostering a positive attitude toward reading in children is linked to consistent engagement with reading-related tasks and assignments (Althewini & Al-Roomy, 2023). This continuous engagement acts as a mechanism that connects students' attitudes toward reading with their academic interactions and, subsequently, their reading success (Kartika, 2023). Students with negative reading attitudes engage less with academic texts and consequently tend to perform at lower levels compared to their peers who possess a positive reading attitude. Naturally, students' attitudes toward reading are influenced by various factors, including their academic experiences, which may change during the early years of school and vary between boys and girls (Al-Obaydi & Iddagoda, 2022). Research shows that reading attitude, beyond mere academic success and effort, influences and directs reading performance.

Reading performance essentially reflects how students engage with their academic tasks and responsibilities. When students, based on a positive reading attitude, sufficiently and effectively study and complete their academic tasks, they demonstrate favorable and strong reading performance. Conversely, when students avoid reading and fail to complete assignments to an adequate level for achieving academic goals, their reading performance can be considered weak or insufficient (Vafa & Hosseini, 2018). Evidence suggests that reading attitude and reading performance, in a forward trajectory, significantly impact reading development. Because reading is directly related to comprehension, it can influence overall academic progress and even achievement motivation during school years (Hossein Chari & Mehrpour, 2015; Marzban & Mansouri Qadikolaei, 2023). In fact, poor reading attitude and performance can reduce a student's willingness to read, ultimately contributing to reading disability (Adavi et al., 2021, 2022). Many children with dyslexia who do not receive appropriate interventions may experience repeated failure, leading to feelings of shame and humiliation. Over time, these feelings intensify, and children may gradually exhibit signs of depression, chronic anxiety, and low self-esteem in other areas of life (Izan & Ahmadi Aliabadi, 2023; Yahyazadeh et al., 2016).

The aforementioned consequences of reading attitude and reading performance highlight the need to provide tailored interventions for children with dyslexia. Significant efforts have been and continue to be made to support these children. Among various educational and therapeutic interventions, neuropsychological training and the Phono-Graphix method appear to hold considerable potential in addressing the needs of dyslexic children. According to Bakker's neuropsychological or Reading Balance Model, dyslexia is caused by dysfunctions in the structure and functioning of one or both hemispheres of the brain (Babapour Kheireddin

et al., 2014). In Bakker's neuropsychological model, reading comprises two major phases. The initial phase, governed by the right hemisphere and involving visuospatial processing, entails perceiving the visual-spatial features of words. At the beginning of reading, the brain analyzes the shape of written words before associating them with meaning (Bakker, 2006). As reading skills become more automatic, the importance of this phase diminishes. The second phase of reading, led by the left hemisphere, focuses on semantic comprehension. According to this model, reading is a complex process requiring a functional transition from the right hemisphere to the left. In children where this transition does not occur or occurs prematurely, reading problems emerge (Buchan, 2009). In Bakker's model, each hemisphere contributes to reading through different processes. This results in two types of dyslexia: perceptual dyslexia (type P), associated with early-stage reading, and linguistic dyslexia (type L), associated with advanced reading skills (Bakker, 2006). This educational and therapeutic approach involves both direct and indirect stimulation of the cerebral hemispheres (Babapour Kheireddin et al., 2014). For instance, targeted stimulation of the left hemisphere in children with perceptual-type dyslexia can be achieved via visual and tactile channels (Bazeat, 2009). Supporting evidence for the effectiveness of Bakker's neuropsychological training includes studies by Mousavi et al. (2023) on improving dyslexia symptoms (Mousavi et al., 2023), Sabeghi et al. (2022) on enhancing reading performance (Sabeghi et al., 2022), and Cancer et al. (2020) on the combined effectiveness of Bakker's neuropsychological model, action video games, and rhythmic reading strategies in perceptual dyslexic children (Cancer et al., 2020).

Alongside neuropsychological interventions, another promising approach for children with dyslexia is the Phono-Graphix method (Vafa & Hosseini, 2018). Phono-Graphix is a phonological-linguistic approach to teaching reading that integrates clinical experience with empirical research in the fields of reading, cognitive psychology, learning theory, child development, motivation theory, and linguistics (Adavi et al., 2021, 2022). This method is grounded in the principle that words are composed of smaller units called phonemes, which are the foundation for decoding words by mapping sounds to visual representations (Antonio & Santillan, 2020). In Phono-Graphix, the main challenge in dyslexic children lies in weak phonological and decoding skills. Therefore, the method includes key goals such as improving visual tracking from right to left (in Persian),

increasing the ability to segment and blend sounds in writing and speech, enhancing phoneme application in oral communication, and improving recognition of written words through sound imagery. The approach comprises four stages: the first involves segmenting words using picture cards representing the initial sounds. The second is mapping, where the child articulates the sound while writing the corresponding letter. The third stage focuses on sound application through reading both real and pseudo-words, identifying sounds, and recognizing letter rearrangement. The fourth stage involves segmenting and blending sounds to write and pronounce complete words, ending with story reading using the taught sounds and letters, with immediate correction of any mispronunciations (Vafa & Hosseini, 2018). Given that phonological deficits in phoneme recognition and blending are core components of dyslexia, the Phono-Graphix method may be highly beneficial. Supporting studies by Vafa and Hosseini (2018) and Adavi et al. (2022) demonstrate the method's effectiveness in improving reading performance and reading attitude in dyslexic students (Adavi et al., 2022; Vafa & Hosseini, 2018).

Considering the theoretical and empirical background, as well as the complex challenges faced by children with reading disabilities, implementing tailored interventions that align with these children's needs is both a humane and essential undertaking. Previous studies emphasize that reading attitude and performance are key variables in dyslexic children, and that both may be influenced by Bakker neuropsychological training and the Phono-Graphix approach. However, comparative research on the effectiveness of these two methods remains limited. Therefore, comparing Bakker's neuropsychological training with the Phono-Graphix approach can expand the repertoire of evidence-based educational interventions for children with reading difficulties. Based on these considerations, the present study aims to answer the following question: Is there a difference in the effectiveness of Bakker neuropsychological interventions and the Phono-Graphix method on reading attitude and reading performance among elementary students with dyslexia?

2.   Methods and Materials

2.1.   Study Design and Participants

The present study was a three-group quasi-experimental design consisting of a Bakker neuropsychological intervention group, a Phono-Graphix intervention group,

and a control group, implemented across three stages: pre-test, post-test, and two-month follow-up. The statistical population included all elementary school children with dyslexia from the six educational districts of Isfahan during the 2022–2023 academic year who had been referred to the Learning Disorders Center. From this population, 45 children with confirmed dyslexia diagnoses were selected through purposive sampling, following screening via the Wechsler Intelligence Scale and the Dyslexia and Reading Test (NAMA) by Karami Nouri and Moradi. These participants were then randomly assigned (by lottery) to three groups (15 children per group). The choice of 15 participants per group was based on the recommendation of a minimum of 15 participants per group in experimental studies.

Inclusion criteria consisted of being within the age range of 6 to 12 years, possessing an IQ between 90 and 110 or higher according to the Wechsler Intelligence Scale–Fifth Edition, having a diagnosed specific learning disorder with reading impairment and dyslexia, absence of childhood (for the child) or adult (for the parent) psychological disorders or other psychiatric conditions, no concurrent psychological or psychiatric treatment, and informed consent and willingness of both children and parents (according to the Ministry of Education regulations) to participate in the study. Exclusion criteria included lack of cooperation or unwillingness to continue attending sessions, failure to complete homework assignments, and absence from two or more training sessions. Ethical principles were observed in the form of obtaining written parental consent, ensuring confidentiality, using data solely for research purposes, granting participants full autonomy to withdraw at any stage, and providing the control group with educational access after completion of the interventions in the experimental groups upon request.

For data collection, following random assignment into three groups (two experimental: one receiving Bakker neuropsychological interventions and one receiving Phono-Graphix training, and one control group), children with dyslexia first completed the Reading Attitude and Reading Performance measures at the pre-test stage. Subsequently, both intervention groups participated in their respective training programs at a counseling center. After completing the training sessions, all participants completed the post-test and, after a two-month interval, the follow-up assessment. The Bakker neuropsychological intervention was implemented over six consecutive weeks, and the Phono-Graphix method was conducted in 12 sessions. Both interventions were delivered by an instructor with over 15 years of experience working with children with learning disorders. The control group received no training until the intervention period concluded.

2.2. Measures

2.2.1. Reading Attitude

To assess reading attitude, the McKenna and Kear (1990) Reading Attitude Survey was used. This instrument contains 20 items and two subscales: attitude toward reading outside school and attitude toward reading at school. The scale is based on a four-point Likert scale: very happy = 4, happy = 3, sad = 2, very sad = 1. The total score ranges from 20 to 80, and each subscale ranges from 10 to 40. Higher scores indicate a more positive reading attitude. The content validity of the questionnaire has been confirmed, and its reliability has been reported with Cronbach's alpha values ranging from .74 to .98 (Yahyazadeh et al., 2016). According to Asghari Nekah et al. (2009), the construct validity of the scale has been confirmed using exploratory factor analysis, supporting its two-factor structure, and reliability values have ranged from .74 to .83 (Asghari Nekah et al., 2009).

2.2.2. Dyslexia

To diagnose and screen children with dyslexia and to assess reading performance, the Reading and Dyslexia Test developed by Karami Nouri and Moradi (2005) was used. This instrument consists of ten subtests: word reading, word chains, rhyming, picture naming, text comprehension, word comprehension, phoneme deletion, nonsense word reading, letter identification, and word recognition. The Cronbach's alpha values for these ten subtests were reported as .75, .82, .76, .73, .83, .81, .77, .75, .82, and .81, respectively. Content validity of the subtests was based on correct reading and comprehension of words and sentences by learners and was approved by experts. The test is administered individually. After administering the subtests, correct responses are scored (one point per correct answer), and raw scores are calculated. Then, using the norm tables for each grade level, standardized scores are derived, and a reading performance profile is visualized. In the original study, the overall reliability coefficient of the test was reported as .82 (Karami Nouri et al., 2009).

2.3. Interventions

2.3.1. Bakker Neuropsychological Intervention

To stimulate the left and right cerebral hemispheres directly and indirectly in children with L-type (linguistic) and P-type (perceptual) dyslexia, 30 training sessions were conducted. Sessions occurred six days per week, each lasting 40 minutes. For visual channel stimulation, participants focused on a central fixation point on the screen. Words appeared every two minutes for several seconds. Responses were recorded, and for children with L-type dyslexia, concrete words were shown in the left visual field; for children with P-type dyslexia, abstract words were presented in the right visual field. For tactile stimulation, L-type children touched concrete letters and words with the left hand, while P-type children touched abstract letters and words with the right hand. Participants underwent ten tactile sessions, the first five dedicated to alphabet learning, and the second five to touching concrete and abstract words.

For indirect stimulation in L-type children, 20 words in varying fonts and sizes were presented per session; participants read them aloud. In P-type children, for the first five sessions, they were asked to identify semantically incongruent words from a list and read them aloud. In the second five sessions, they were instructed to form sentences from jumbled words.

2.3.2. Phono-Graphix

The intervention protocol consisted of twelve structured sessions designed to enhance phonological awareness and visual-auditory decoding skills in students with dyslexia. In the first three sessions, students were introduced to the concept that written text corresponds to spoken sounds and that reading occurs from right to left; each session included the practice of 10 visually similar words to develop visual discrimination and attention. In sessions four and five, 16 previously introduced words with subtle phonemic contrasts (e.g., rud, zud, dud) were practiced to reinforce auditory

discrimination. In session six, using paired word card sets placed face down, the instructor pronounced two sounds without showing them, and the student was required to find, pronounce, and write the corresponding word cards—targeting auditory-to-visual mapping. Session seven included reading short sentences composed of previously practiced words to reinforce contextual reading fluency. Sessions eight and nine introduced 30 new words where two letters represented a single phoneme (e.g., khwahar, khaabidan), teaching students that digraphs can produce unified sounds. In session ten, 20 exception words (e.g., to, khod) were practiced similarly to session eight, with an emphasis on the principle that a single letter may produce different sounds in different contexts. In session eleven, students reviewed all previously taught words, pronouncing each sound aloud as they wrote the words to strengthen phoneme-grapheme correspondence. Finally, in session twelve, the instructor and student collaboratively read a story, with the student guided to place their finger beneath each word while reading aloud to facilitate tracking and fluency.

2.4. Data Analysis

For data analysis, in addition to testing assumptions such as normality (via Shapiro–Wilk test), homogeneity of error variances (via Levene's test), homogeneity of variance-covariance matrices (via Box's M test), and sphericity (via Mauchly's test), means and standard deviations were calculated, followed by repeated measures ANOVA and Bonferroni post hoc tests. Data were analyzed using SPSS version 26. The significance threshold was set between $p < .05$ and $p < .001$.

3. Findings and Results

Table 1 presents the mean and standard deviation of reading attitude and reading performance scores across the three research groups and at the three measurement stages: pre-test, post-test, and follow-up.

Table 1

Mean and Standard Deviation of Reading Attitude and Reading Performance by Assessment Stage and Group

Variable	Group	Pre-test Mean	SD	Post-test Mean	SD	Follow-up Mean	SD
Reading Attitude	Phono-Graphix	29.6	2.37	38.7	1.95	36.7	2.49
	Bakker Neuropsych.	29.35	2.49	40.3	2.59	37.8	2.8
	Control	29.55	2.6	28.9	2.59	29.15	2.06
Reading Performance	Phono-Graphix	148.55	3.45	174.65	4.96	170.7	4.78
	Bakker Neuropsych.	148.45	4.11	177.8	4.09	172.45	4.27
	Control	148.15	4.28	149.2	4.38	149.25	4.48

As observed in Table 1, the mean scores for reading attitude and reading performance improved in both experimental groups at the post-test and follow-up stages. However, in the control group, no significant differences were observed across the three stages for either variable.

Before conducting repeated measures ANOVA, the assumptions were tested: normality via the Shapiro–Wilk test, homogeneity of error variances via Levene's test, and equality of the variance-covariance matrix via Box's M test—all of which were met (p > .05). However, the assumption of sphericity tested via Mauchly's test was violated (p < .05). Thus, the final results of the repeated measures ANOVA were reported using the Greenhouse–Geisser correction for degrees of freedom. The results are shown in Table 2.

Table 2

Results of Repeated Measures ANOVA for Reading Attitude and Reading Performance

Variable	Effect	Source	SS	df	MS	F	Sig.	η²	Power
Reading Attitude	Within-Subjects	Time	1386.54	2	693.27	414.79	.001	.87	1.00
		Time × Group	849.589	4	212.397	127.08	.001	.82	1.00
		Error	190.53	114	1.67	–	–	–	–
	Between-Subjects	Group	1561.74	2	780.87	52.99	.001	.65	1.00
		Error	839.917	57	14.73	–	–	–	–
Reading Performance	Within-Subjects	Time	12245.278	1.58	7718.68	1903.41	.001	.97	1.00
		Time × Group	5460.02	3.17	1720.83	424.35	.001	.94	1.00
		Error	366.7	90.42	4.05	–	–	–	–
	Between-Subjects	Group	11054.978	2	5527.489	110.56	.001	.79	1.00
		Error	2849.6	57	49.99	–	–	–	

As shown in Table 2, the within-subjects analysis revealed a significant main effect of time for both reading attitude (F = 414.79, p < .001, η² = .87) and reading performance (F = 1903.41, p < .001, η² = .97), indicating significant differences in scores over time. The time × group interaction was also significant for both reading attitude (F = 127.08, p < .001, η² = .82) and reading performance (F = 424.35, p < .001, η² = .93), suggesting that changes across pre-test, post-test, and follow-up varied significantly by group. In the between-subjects analysis, significant differences were also found between the groups for both reading attitude (F = 52.99, p < .001, η² = .65) and reading performance (F = 110.56, p < .001, η² = .79), indicating that the intervention groups performed differently from the control group.

Table 3

Post Hoc Test Results Comparing Three Groups by Research Variables at Each Stage

Variable	Stage	Groups Compared	Mean Diff.	SE	Sig.
Reading Attitude	Pre-test	Phono-Graphix vs Control	0.05	0.788	.950
		Bakker vs Control	–0.2	0.788	.801
		Phono-Graphix vs Bakker	–0.25	0.788	.752
	Post-test	Phono-Graphix vs Control	9.8	0.759	.001
		Bakker vs Control	11.4	0.759	.001
		Phono-Graphix vs Bakker	–1.6	0.759	.039
	Follow-up	Phono-Graphix vs Control	7.55	0.781	.001
		Bakker vs Control	8.65	0.781	.001
		Phono-Graphix vs Bakker	1.1	0.781	.165
Reading Performance	Pre-test	Phono-Graphix vs Control	0.4	1.25	.751
		Bakker vs Control	0.3	1.25	.812
		Phono-Graphix vs Bakker	0.1	1.25	.937
	Post-test	Phono-Graphix vs Control	25.45	1.42	.001
		Bakker vs Control	28.6	1.42	.001
		Phono-Graphix vs Bakker	3.15	1.42	.031
	Follow-up	Phono-Graphix vs Control	21.45	1.42	.001
		Bakker vs Control	23.2	1.42	.001
		Phono-Graphix vs Bakker	1.75	1.42	.226

As shown in Table 3, in the pre-test stage, there were no significant differences between the Phono-Graphix, Bakker neuropsychology, and control groups in either reading attitude or reading performance (p > .05). However, in both the post-test and follow-up stages, significant differences emerged between the Phono-Graphix and Bakker groups compared to the control group for both variables (p < .001). Furthermore, in the post-test stage, there was a significant difference between the two intervention groups in both reading attitude (p < .001) and reading performance (p < .001), favoring the Bakker group. However, by the follow-up stage, this difference between the two experimental groups was no longer significant (p > .05).

Based on the mean scores presented in Table 1, the Bakker neuropsychological intervention group demonstrated greater effectiveness in the post-test phase for both reading attitude and reading performance compared to the Phono-Graphix group, though this advantage was not maintained at the follow-up stage.

4. Discussion and Conclusion

This study aimed to compare the effectiveness of Bakker neuropsychological interventions and the Phono-Graphix method on reading attitude and reading performance in elementary school students with dyslexia. The findings indicated that both the Bakker neuropsychological intervention and the Phono-Graphix method were effective in improving reading attitude and reading performance among children with dyslexia. However, in the comparison between the two interventions, Bakker's neuropsychological approach demonstrated superior effectiveness in both variables.

A review of the literature revealed no studies that directly compared the Bakker neuropsychological intervention and the Phono-Graphix method in terms of their effects on reading attitude and performance in elementary school students with dyslexia. Therefore, the findings of the present study were compared with related studies that align in part with its results. In this context, the effectiveness of Bakker's intervention in enhancing reading attitude and performance is consistent with the findings of Mousavi et al. (2023), which showed the efficacy of neuropsychological interventions in alleviating symptoms of dyslexia (Mousavi et al., 2023), the results of Sabeghi et al. (2022) on the improvement of reading performance in children with dyslexia (Sabeghi et al., 2022), and the findings of Cancer et al. (2020) regarding the impact of a combined neuropsychological (Reading Balance) approach using action video games and rhythmic reading models on overall reading performance (Cancer et al., 2020).

The explanation for the effectiveness of Bakker's neuropsychological intervention in this study is rooted in the content and structure of the training model. Bakker's neuropsychological approach conceptualizes reading as a two-phase process. The first phase involves visuospatial processing—i.e., the perception of the visual-spatial aspects of a word—which is managed by the right hemisphere. In this phase, the brain analyzes the spatial shape of the written word and connects it to its meaning (Bakker, 2006). In the second phase, controlled by the left hemisphere, semantic processing occurs, guiding the child from word recognition to the final goal of reading comprehension. Given that Bakker's intervention systematically stimulates both the right and left hemispheres, it transforms reading and word comprehension into a rewarding and positive experience for children, thereby promoting improved reading attitude and performance.

In addition to the rationale for the effectiveness of Bakker's approach, the results showing the effectiveness of the Phono-Graphix method in this study are in line with the prior findings (Adavi et al., 2022; Vafa & Hosseini, 2018) which found this method effective in improving reading performance, and with Adavi et al. (2021), who reported its effectiveness in enhancing reading attitude (Adavi et al., 2021). The Phono-Graphix approach, focusing on phonological awareness, phonemic segmentation, and sound blending, offers children with dyslexia a structured path to overcome their decoding challenges. This is achieved through techniques such as segmenting using illustrated cards with initial letters, mapping letters to their corresponding sounds during writing, and ultimately practicing sound blending and pronunciation. These steps allow children to shift from repeated reading failure to successful experiences, which in turn nurtures their reading attitude and performance.

Another finding of the present study is that Bakker's neuropsychological intervention showed greater effectiveness than the Phono-Graphix method in enhancing reading attitude and performance. No prior studies were identified that directly evaluated the comparative effectiveness of these two interventions; thus, the discussion focuses on plausible theoretical interpretations of this difference. One possible explanation is that Bakker's intervention engages both cerebral hemispheres—right and left—which may be essential, as dyslexia appears to involve

deficits in both hemispheric functions according to this study. Stimulating both hemispheres might provide a more comprehensive neural activation that empowers children with dyslexia to mobilize greater cognitive resources in overcoming their reading challenges. This dual-hemispheric stimulation may explain the superior efficacy of Bakker's method over Phono-Graphix in improving reading-related outcomes.

Overall, the findings of this study suggest that, in order of effectiveness, Bakker neuropsychological interventions followed by the Phono-Graphix method can significantly enhance reading attitude and reading performance. Given that improvements in these two areas can meaningfully affect the educational trajectory of children with dyslexia, it is recommended that both interventions—particularly Bakker's—be implemented in clinical and counseling settings serving this population.

It is important to note several limitations of the present study. The research focused exclusively on elementary school children with dyslexia, thus caution is needed when generalizing findings to children with other learning disabilities or from different age groups. Additionally, the assessments were conducted through self-report questionnaires, which may lack depth and nuance. For future research, it is recommended that scholars examine the effectiveness of Bakker's neuropsychological intervention and the Phono-Graphix method not only in relation to reading attitude and performance, but also with regard to variables such as academic motivation and achievement. These evaluations should incorporate more in-depth methods such as structured interviews alongside questionnaires and be extended to children with other types of learning disabilities.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the study and participated in the research with informed consent.

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