Journal Website

Article history:
Received 02 October 2025
Revised 15 February 2026
Accepted 22 February 2026
Published online 01 May 2026

Iranian Journal of Neurodevelopmental Disorders

Volume 5, Issue 3, pp 1-13


E-ISSN: 2980-9681

# A Comparison of the Effectiveness of the Captain's Log Computerized Cognitive Rehabilitation Package and the CogniPlus Cognitive Rehabilitation Software on Visual Perception and Reading Efficiency in Primary School Boys with Dyslexia

Shima. Mostafaei [1], Marzieh. Gholami Tooranposhti [2*], Tahereh. Ranjbaripour[3], Bita. Nasrollahi [1]

[1] Department of Psychology, SR.C., Islamic Azad University, Tehran, Iran
[2] Department of Psychology, ShB.C., Islamic Azad University, Shahr Babak, Iran
[3] Department of Health Psychology, Ka.C., Islamic Azad University, Karaj, Iran

*** Corresponding author email address**: gholamitooranposhti@iau.ac.ir

Article Info

**Article type:**
*Original Research*

**How to cite this article:**
Mostafaei, S., Gholami Tooranposhti, M., Ranjbaripour, T., & Nasrollahi, B. (2026). A Comparison of the Effectiveness of the Captain's Log Computerized Cognitive Rehabilitation Package and the CogniPlus Cognitive Rehabilitation Software on Visual Perception and Reading Efficiency in Primary School Boys with Dyslexia. *Iranian Journal of Neurodevelopmental Disorders, 5*(3), 1-13.
https://doi.org/10.61838/kman.jndd.723



ABSTRACT

**Purpose:** The present study aimed to compare the effectiveness of the Captain's Log computerized cognitive rehabilitation package and the CogniPlus cognitive rehabilitation software on visual perception and reading efficiency in primary school boys with dyslexia.
**Methods and Materials:** This research employed a quantitative, applied, quasi-experimental design with a pretest–posttest control group structure and a two-month follow-up. The statistical population included all primary school boys diagnosed with dyslexia who attended learning disorder centers in Tehran during the 2024–2025 academic year. Using purposive sampling and inclusion/exclusion criteria, 45 students were selected and randomly assigned to two experimental groups (Captain's Log, $n = 15$; CogniPlus, $n = 15$) and one control group ($n = 15$). The experimental groups participated in 15 sessions of computerized cognitive rehabilitation, while the control group received no intervention. Data were collected using the Reading and Dyslexia Diagnostic Test and the Test of Visual Perceptual Skills–Revised (TVPS-R). Data were analyzed using mixed-design ANOVA with Greenhouse–Geisser correction and Bonferroni post hoc tests.
**Findings:** Mixed ANOVA results revealed significant time and time × group interaction effects for visual discrimination, visual memory, visual-spatial relations, visual constancy, and most reading efficiency components ($p < .05$). Both experimental groups demonstrated significantly greater improvements than the control group in word reading, word chains, rhyme, text comprehension, word comprehension, phoneme deletion, nonword reading, letter fluency, and category fluency ($p < .05$), with moderate to large effect sizes. No significant differences were observed between the two experimental groups on most variables, except for visual-spatial relations, where Captain's Log showed a significantly greater improvement ($p < .05$).
**Conclusion:** The findings indicate that both Captain's Log and CogniPlus computerized cognitive rehabilitation programs are effective in improving visual perception and reading efficiency in primary school boys with dyslexia.
***Keywords:*** *Dyslexia, Computerized Cognitive Rehabilitation, Captain's Log, CogniPlus, Visual Perception, Reading Efficiency, Executive Functions*

## 1. Introduction

Developmental dyslexia is a persistent and neurodevelopmental learning disorder characterized by significant difficulties in accurate and fluent word recognition, spelling, and decoding, despite adequate intelligence, conventional instruction, and socio-cultural opportunity. Contemporary theoretical models conceptualize dyslexia not merely as a phonological deficit but as a multifactorial condition involving disruptions in phonological processing, working memory, executive functioning, and visual-attentional mechanisms (Guano & Singh, 2024; Mosafer & Sadati Firouz Abadi, 2025). Neurocognitive evidence derived from EEG-based connectivity analyses has demonstrated atypical neural synchronization patterns during reading tasks in dyslexic children, suggesting altered functional integration within networks supporting phonological decoding and visual word recognition (Guano & Singh, 2024). Moreover, visual search inefficiencies and reduced word detection skill have been identified as mediating mechanisms linking perceptual deficits to reading comprehension challenges, highlighting the role of visual perception and attentional allocation in literacy development (Meng et al., 2024). Early perceptual vulnerabilities, particularly in visual and auditory domains, have also been observed in preschool children at risk for dyslexia, underscoring the developmental continuity between perceptual processing deficits and later reading impairment (Ortiz et al., 2014). These findings collectively reinforce the necessity of adopting intervention frameworks that address both phonological and visual-cognitive substrates of reading dysfunction.

Within this broader neurocognitive perspective, executive functions—especially working memory, cognitive inhibition, planning, and attentional control—have emerged as central mechanisms underpinning reading acquisition and fluency. Empirical research indicates that deficits in working memory constrain the child's ability to retain phonological representations while integrating grapheme–phoneme correspondences, thereby compromising decoding and comprehension processes (Mosafer & Sadati Firouz Abadi, 2025; Ranjbar et al., 2022). Interventions targeting executive functions through self-instruction training have demonstrated improvements in cognitive inhibition and higher-order regulatory skills among students with specific learning disorders, suggesting that strengthening top-down control may indirectly enhance academic outcomes (Jabarzadeh Chaharbrod et al., 2023). Similarly, cognitive rehabilitation programs designed to improve planning and working memory have shown positive effects in children with sensory impairments, supporting the generalizability of executive-based interventions across neurodevelopmental populations (Gharashi & Abdi, 2022). In addition, digital mindfulness and brain-computer interface approaches have been proposed as innovative strategies for enhancing metacognitive regulation and attentional control, further emphasizing the modifiability of cognitive systems implicated in dyslexia (Mitsea et al., 2023). The convergence of these findings suggests that targeted cognitive training may facilitate neuroplastic changes capable of supporting reading performance.

Computerized cognitive rehabilitation has gained increasing attention as a structured, adaptive, and scalable intervention modality capable of systematically training attention, working memory, and perceptual processing. Comparative investigations have demonstrated that computer-based cognitive rehabilitation can produce meaningful gains in executive functions among students with dyslexia, sometimes outperforming traditional play-based therapeutic approaches in enhancing higher-order cognitive regulation (Shamshiri et al., 2025). Meta-analytic evidence from Iranian samples further confirms that both computer-based and classical cognitive rehabilitation interventions yield significant improvements in cognitive performance among children with specific learning disabilities, although effect sizes tend to be stronger for structured digital programs that incorporate adaptive difficulty and immediate feedback (Shabbanali Fami et al., 2022). In parallel, direct comparisons between task-based and computer-based rehabilitation approaches indicate that digital platforms may offer distinct advantages in promoting cognitive flexibility and sustained engagement due to their interactive and progressively challenging design (Khaleghi et al., 2023). Beyond learning disorders, computerized cognitive training has demonstrated efficacy in diverse populations, including individuals with traumatic brain injury and older adults, reinforcing its versatility and external validity (Gohari et al., 2025; Kim et al., 2022). These findings collectively support the theoretical and empirical rationale for implementing computerized cognitive rehabilitation in dyslexic children.

Specifically, in the domain of dyslexia, structured computerized interventions have been associated with improvements in reading fluency, phonological processing, and attentional capacity. Training second-grade students with dyslexia through a computerized program resulted in


E-ISSN: 2980-9681

significant gains in reading accuracy and fluency compared with control conditions, highlighting the potential of digital platforms to remediate core literacy deficits (Farghaly et al., 2022). Similarly, interventions integrating working memory and phonological components have demonstrated positive effects on phonological awareness in children with dyslexia, reinforcing the interdependence of memory processes and reading acquisition (Mosafer & Sadati Firouz Abadi, 2025). Morphological awareness interventions have also been shown to enhance reading and spelling abilities, indicating that targeted cognitive-linguistic training can produce transferable literacy benefits (Mendes & Kirby, 2024). Moreover, multisensory and cognitive rehabilitation approaches have been compared in bilingual students with dyslexia, with findings suggesting that cognitive rehabilitation can yield significant improvements in reading performance, particularly when attentional and executive deficits are addressed concurrently (Shivyari et al., 2022). Collectively, these studies underscore that interventions targeting underlying cognitive mechanisms may be as critical as direct reading instruction in supporting literacy outcomes.

Visual perception, as a foundational component of reading, plays a crucial role in letter recognition, word discrimination, and fluent scanning of text. Deficits in visual selective attention and visual search have been systematically documented in children with dyslexia, often manifesting as slower processing speed and reduced efficiency in identifying target stimuli within complex arrays (Hokken et al., 2023). Neurocognitive research further indicates that atypical brain connectivity during reading tasks may reflect inefficiencies in integrating visual and phonological information streams (Guano & Singh, 2024). The mediating role of word detection skill between visual search and reading comprehension provides additional evidence that perceptual-attentional processes contribute directly to reading success (Meng et al., 2024). Computerized cognitive training programs designed to enhance visual attention and discrimination have demonstrated improvements not only in cognitive performance but also in related behavioral and social outcomes in special populations, suggesting broader developmental benefits (Georgoula & Koustriava, 2024). Furthermore, interventions addressing executive and attentional processes have been shown to reduce maladaptive behaviors and academic stress in children, indicating that cognitive rehabilitation may exert indirect psychosocial advantages alongside academic improvements (Hosseinpour Pakzad & Farhadi, 2023). Taken together, these findings highlight the theoretical plausibility that strengthening visual perceptual and attentional systems through computerized training may translate into enhanced reading efficiency.

Despite accumulating evidence supporting computerized cognitive rehabilitation, comparative studies examining the relative effectiveness of different digital platforms remain limited. Programs such as Captain's Log and CogniPlus are grounded in neuropsychological models of attention, working memory, and executive functioning, yet they differ in task architecture, adaptive algorithms, and domain emphasis. While previous investigations have compared computer-based interventions with alternative therapeutic modalities (Khaleghi et al., 2023; Shamshiri et al., 2025), direct comparisons between distinct computerized rehabilitation software packages in dyslexic populations have not been sufficiently explored. Given the heterogeneity of dyslexia and the multidimensional nature of its cognitive underpinnings, understanding whether specific digital training environments yield differential effects on visual perception and reading efficiency is of both theoretical and practical significance. Therefore, the present study aims to compare the effectiveness of the Captain's Log computerized cognitive rehabilitation package and the CogniPlus cognitive rehabilitation software on visual perception and reading efficiency in primary school boys with dyslexia.

## 2. Methods and Materials

### 2.1. *Study Design and Participants*

This study employed a quantitative research approach in terms of the nature of the data, an applied design in terms of its objective, and a quasi-experimental methodology in terms of data collection. Specifically, the research followed a pretest–posttest control group design with a two-month follow-up period. The independent variable consisted of computerized cognitive rehabilitation, delivered through two distinct intervention programs: the Captain's Log computerized cognitive rehabilitation package and the CogniPlus cognitive rehabilitation software. These interventions were administered exclusively to the two experimental groups, while the control group did not receive any form of cognitive rehabilitation during the study period. The dependent variables included working memory, cognitive attention, visual perception, and reading efficiency, all of which were assessed at three stages: pretest,



E-ISSN: 2980-9681

posttest, and two-month follow-up. The design allowed for examination of both immediate and sustained effects of the interventions, as well as comparison between the two cognitive rehabilitation programs and the no-intervention control condition.

The statistical population comprised all primary school boys diagnosed with dyslexia who were enrolled in learning disorder centers in Tehran during the 2024–2025 academic year. Based on official statistics obtained from relevant centers, the accessible population was approximately 400 students. A purposive sampling method was employed to select participants according to predefined inclusion and exclusion criteria. Formal requests were sent to several counseling and psychological service centers across Tehran, asking them to introduce boys diagnosed with dyslexia who met the study criteria. A total of 45 students initially participated in screening and evaluation sessions to confirm eligibility. After assessment, 45 students who met the inclusion criteria were randomly assigned to three groups: 15 participants in the first experimental group (Captain's Log), 15 participants in the second experimental group (CogniPlus), and 15 participants in the control group. The three groups were comparable at baseline, and dependent variables were measured simultaneously for all groups at each stage of assessment. The follow-up phase was conducted two months after completion of the posttest.

Sample size was estimated using G*Power software for a three-group repeated-measures design, with an alpha level of 0.05, statistical power of 0.80, and an assumed effect size of 0.40, resulting in a required total sample of 45 participants. Inclusion criteria consisted of chronological age between 6 and 9 years (corresponding to the first cycle of primary education), a formal diagnosis of dyslexia by a qualified psychologist or learning specialist based on standardized assessments and clinical interview, and a normal intelligence quotient (IQ $\geq$ 85) as measured by the Wechsler Intelligence Scale. Exclusion criteria included parental or student withdrawal at any stage of the study, simultaneous participation in other therapeutic or educational interventions such as speech therapy or additional cognitive rehabilitation, and absence from more than one-third of the intervention sessions in the experimental groups.

## *2.2. Measures*

The Reading and Dyslexia Diagnostic Test, developed by Karami Nouri and Moradi (2009), was used to assess reading ability and identify specific reading deficits. This standardized battery is designed to evaluate reading performance in monolingual and bilingual primary school students and to diagnose children with reading difficulties and dyslexia. The test consists of ten subtests, including word reading, word chains, rhyme recognition, picture naming, text comprehension, word comprehension, phoneme deletion, nonword reading, letter signs, and category signs. Raw scores for each subtest are calculated based on correct responses and subsequently converted to standardized scores using normative tables. The original standardization was conducted on a large and diverse sample across multiple Iranian cities, and subsequent validation studies have reported satisfactory internal consistency, with an overall Cronbach's alpha of 0.82. Individual subtests demonstrate acceptable reliability coefficients. The word reading subtest includes three 40-word lists with varying frequency levels and is administered within a fixed two-minute time frame to assess speed and accuracy. The word chain subtest requires silent segmentation of meaningful words within continuous strings. The rhyme subtest evaluates phonological awareness through multiple-choice rhyme identification. The picture naming subtest measures rapid automatized naming. The text comprehension subtest assesses both general and grade-specific narrative understanding. Additional subtests evaluate word comprehension, phoneme deletion, nonword decoding, letter fluency, and semantic category fluency. In the present study, selected subtests relevant to reading efficiency were administered in both pretest and posttest phases, with parallel forms used when available to minimize practice effects.

The Test of Visual Perceptual Skills–Revised (TVPS-R) was employed to measure visual perception independent of motor involvement. Visual perception refers to the ability to recognize, organize, and interpret sensory information received through the eyes and plays a critical role in reading, writing, and academic development. The TVPS-R, originally developed by Gardner and later revised in the United States, assesses seven domains: visual discrimination, visual memory, visual-spatial relationships, visual form constancy, visual sequential memory, figure-ground discrimination, and visual closure. Each subtest contains multiple-choice pictorial items in which the child selects the correct option based on the presented stimulus. The test does not measure visual acuity but rather higher-order perceptual processing. Administration time ranges from approximately 9 to 25 minutes depending on the child's age. The applicable age range spans from 4 years to 12 years



E-ISSN: 2980-9681

and 11 months. The instrument has been standardized and normed in Iran, with evidence supporting the reliability and validity of its subscales. In this study, the full battery was administered individually under standardized conditions to obtain a comprehensive profile of visual perceptual functioning at each assessment stage.

The Integrated Visual and Auditory Continuous Performance Test, Second Edition (IVA-2), was used to assess attention-related variables, including sustained attention, response inhibition, and attentional control across visual and auditory modalities. The IVA-2 is a computerized continuous performance test suitable for individuals aged 6 to 96 years. During administration, participants are instructed to respond by clicking the mouse whenever they see or hear the number “1” and to withhold response when presented with the number “2.” The test is conducted under the supervision of a trained clinician and has a total duration of approximately 20 minutes. It consists of an initial warm-up phase, a practice phase with corrective feedback, a main test phase lasting approximately 13 minutes with 500 visual and auditory stimuli, and a final cool-down phase. No feedback is provided during the main testing phase. The IVA-2 yields separate raw scores for visual and auditory attention, response inhibition, and sustained attention. Reliability has been supported through test–retest coefficients around 0.75, and construct validity has been confirmed through factor analytic procedures. In the present study, IVA-2 indices were used to monitor attentional functioning and ensure that potential improvements in reading and visual perception were interpreted within the broader cognitive profile of participants.

### *2.3. Interventions*

The intervention protocol based on the Captain’s Log (2018) computerized cognitive training program was implemented across fifteen structured sessions delivered in three progressive phases designed to systematically enhance cognitive attention, visual perception, working memory, and reading skills in children with dyslexia. In the first phase, which targeted moderate-level difficulty, participants were introduced to the training environment and completed attention-enhancement exercises such as Eagle, Cat’s Play, Smart Detective, Eye, Mouse Hunt, and Happy Trails during the initial session to strengthen sustained and selective attention. The second session focused on visual perception through activities including Puzzle Power, Remember the Alamo, Car Eureka, Code Cracker, and Where Is My…, aimed at improving visual discrimination, spatial analysis, and perceptual organization. The third session emphasized working memory development using tasks such as Pop-N-Zap, Great Escape, Pick Quick, Dart, and Seek & Hide, which required temporary storage and manipulation of information. The fourth session targeted reading-related processes through exercises such as What’s, Pop, Figure It Out & Conceptor, Pick, Missing, and The Ugly Duckling, which reinforced decoding, comprehension, and processing speed. The fifth session was individualized; based on the software’s performance reports, each participant’s cognitive weaknesses were identified and corresponding exercises were repeated for consolidation. The second phase introduced higher levels of difficulty, with sessions six through nine intensifying attention, visual perception, working memory, and reading tasks respectively, followed by a tenth session devoted to targeted remediation based on automated performance analytics. The third phase incorporated visual distractors and increased cognitive load to simulate real-world attentional demands; sessions eleven through fourteen repeated the four domains at advanced levels with added distractor stimuli to train inhibitory control and cognitive flexibility, and the fifteenth session focused on resolving any remaining weaknesses identified through software-generated progress tracking. Task difficulty automatically adjusted according to participant performance, and the program adhered to neuropsychological models of executive functioning and attention, providing immediate feedback and progressive challenge to optimize cognitive rehabilitation outcomes.

The intervention protocol based on the CogniPlus cognitive rehabilitation software consisted of fifteen 45-minute sessions conducted twice weekly, grounded in neuropsychological and cognitive science principles and structured around systematic training of attentional processes and executive functioning. Developed by the SCHUHFRIED company within the Vienna Test System framework, CogniPlus integrates empirically supported models, including Baddeley’s working memory model and Posner’s attention model, and aligns with standardized cognitive assessment paradigms. Each session targeted four major domains of attention: sustained attention (vigilance and alertness), focused attention, selective attention, and divided attention, with each component trained for approximately ten minutes per session. In the sustained attention module, participants engaged in tasks such as responding to obstacles while virtually riding a motorcycle, requiring rapid reaction to visual stimuli; difficulty levels, spanning up to eighteen stages, were manipulated by reducing reaction time windows and, in more advanced forms, removing external warning cues. In the alertness subcomponent, children responded to specific target stimuli such as red car lights appearing at variable intervals, with thirty levels of difficulty based on reaction time precision. Focused attention training involved identifying predefined visual or auditory targets amid distracting stimuli, such as environmental sounds or competing visual inputs, with task complexity increasing by intensifying distractor frequency and modality combinations. Selective attention exercises required participants to respond only to relevant stimuli emerging unexpectedly in a tunnel-driving scenario, receiving immediate auditory and visual feedback for correct or incorrect responses across fifteen graded levels. Divided attention training simulated real-life multitasking demands, such as monitoring multiple security screens while simultaneously responding to auditory announcements, with difficulty manipulated by increasing the number of channels requiring supervision. Performance-driven adaptive algorithms automatically advanced participants to higher difficulty levels upon successful task completion, and verbal reinforcement was provided to maintain motivation. The program emphasized transfer of trained skills to everyday academic functioning, particularly reading and classroom attention, and its task architecture was explicitly designed in accordance with neuropsychological theories of executive control, sustained attention, and working memory, thereby providing a theoretically grounded and clinically structured cognitive rehabilitation framework.

### *2.4. Data Analysis*

Quantitative data obtained from the assessments were analyzed using SPSS statistical software. Data analysis was conducted at both descriptive and inferential levels. At the descriptive level, means and standard deviations were calculated to summarize performance across groups and time points. At the inferential level, assumptions of normality and homogeneity were examined prior to hypothesis testing. To evaluate the effects of the interventions across three measurement occasions (pretest, posttest, and follow-up) and among three groups, mixed-design analysis of variance (mixed ANOVA) was employed. This statistical approach allowed simultaneous examination of within-subject effects (time), between-subject effects (group), and interaction effects between time and group. Significant interaction effects were followed by post hoc comparisons to identify specific differences between the Captain’s Log, CogniPlus, and control groups. An alpha level of 0.05 was adopted for all statistical tests.

## 3. Findings and Results

Table 1 presents the means and standard deviations of visual perception components and reading efficiency subtests across pretest, posttest, and follow-up stages for the Captain’s Log, CogniPlus, and control groups.

**Table 1**

*Means and Standard Deviations of Visual Perception and Reading Efficiency Variables Across Measurement Stages by Group*

| Variable | Group | Pretest M (SD) | Posttest M (SD) | Follow-up M (SD) |
|---|---|---|---|---|
| Visual Discrimination | Captain’s Log | 92.40 (14.51) | 110.60 (16.66) | 106.73 (17.08) |
| | CogniPlus | 94.33 (18.56) | 101.00 (12.39) | 99.33 (15.26) |
| | Control | 90.87 (16.29) | 91.33 (19.86) | 87.33 (19.80) |
| Visual Memory | Captain’s Log | 90.27 (15.40) | 101.93 (13.70) | 102.00 (16.66) |
| | CogniPlus | 90.27 (14.43) | 98.93 (12.12) | 103.73 (15.54) |
| | Control | 91.67 (14.57) | 88.93 (22.87) | 90.27 (18.44) |
| Visual-Spatial Relations | Captain’s Log | 87.47 (15.92) | 107.67 (14.25) | 105.80 (10.97) |
| | CogniPlus | 88.27 (10.10) | 95.40 (13.00) | 98.47 (11.71) |
| | Control | 89.07 (10.20) | 89.67 (16.26) | 89.87 (18.12) |
| Visual Constancy | Captain’s Log | 96.20 (17.15) | 108.47 (11.71) | 109.20 (10.19) |
| | CogniPlus | 92.07 (9.01) | 101.87 (11.70) | 106.27 (11.41) |
| | Control | 95.13 (13.33) | 90.87 (20.34) | 96.93 (24.52) |
| Visual Sequential Memory | Captain’s Log | 93.93 (16.36) | 102.00 (13.10) | 102.00 (14.25) |
| | CogniPlus | 93.67 (12.52) | 101.27 (11.71) | 100.87 (14.92) |
| | Control | 92.67 (14.03) | 90.00 (20.58) | 93.00 (21.01) |
| Figure-Ground Discrimination | Captain’s Log | 90.40 (15.26) | 97.40 (15.01) | 101.67 (10.76) |
| | CogniPlus | 91.80 (14.16) | 99.87 (16.56) | 102.00 (16.03) |
| | Control | 92.27 (12.24) | 92.40 (12.67) | 93.27 (15.18) |



E-ISSN: 2980-9681

| | | | | |
|---|---|---|---|---|
| Visual Closure | Captain's Log | 91.07 (8.62) | 101.13 (16.63) | 97.20 (16.92) |
| | CogniPlus | 91.87 (18.48) | 97.47 (12.39) | 95.67 (15.23) |
| | Control | 90.40 (16.26) | 88.93 (18.50) | 89.40 (20.56) |
| Word Reading | Captain's Log | 40.00 (8.59) | 52.93 (7.21) | 50.80 (8.34) |
| | CogniPlus | 38.40 (6.60) | 52.27 (7.25) | 50.53 (7.46) |
| | Control | 39.60 (7.79) | 38.93 (11.08) | 42.13 (11.38) |
| Word Chains | Captain's Log | 13.27 (2.43) | 19.67 (3.27) | 20.67 (1.92) |
| | CogniPlus | 14.67 (3.18) | 20.20 (3.73) | 20.40 (2.50) |
| | Control | 12.80 (2.01) | 11.27 (3.31) | 12.47 (3.60) |
| Rhyme | Captain's Log | 13.80 (3.84) | 17.13 (2.67) | 17.80 (2.24) |
| | CogniPlus | 14.73 (3.77) | 17.53 (2.45) | 17.80 (1.97) |
| | Control | 13.00 (2.73) | 11.93 (3.85) | 13.13 (3.42) |
| Text Comprehension | Captain's Log | 19.60 (2.85) | 22.67 (2.99) | 23.33 (3.44) |
| | CogniPlus | 20.13 (3.16) | 22.40 (2.75) | 23.20 (2.70) |
| | Control | 19.47 (2.77) | 19.20 (3.45) | 20.13 (3.34) |
| Word Comprehension | Captain's Log | 14.07 (2.12) | 20.20 (2.60) | 21.67 (2.09) |
| | CogniPlus | 15.80 (3.10) | 20.87 (2.88) | 21.67 (2.47) |
| | Control | 14.33 (1.95) | 13.00 (3.02) | 14.60 (3.14) |
| Phoneme Deletion | Captain's Log | 16.87 (3.80) | 20.87 (2.80) | 20.93 (3.01) |
| | CogniPlus | 17.47 (3.80) | 20.87 (2.95) | 20.73 (2.89) |
| | Control | 16.13 (2.92) | 15.13 (4.52) | 16.40 (5.42) |
| Nonword Reading | Captain's Log | 14.27 (3.20) | 18.00 (3.38) | 19.07 (2.37) |
| | CogniPlus | 14.27 (3.54) | 18.27 (3.54) | 19.87 (2.07) |
| | Control | 14.67 (2.58) | 14.13 (2.67) | 14.40 (3.56) |
| Letter Fluency | Captain's Log | 19.20 (2.21) | 22.00 (2.54) | 22.60 (2.32) |
| | CogniPlus | 19.00 (1.85) | 22.40 (2.97) | 22.40 (2.75) |
| | Control | 19.13 (2.17) | 18.93 (2.40) | 19.33 (2.87) |
| Category Fluency | Captain's Log | 19.47 (5.51) | 31.07 (6.05) | 29.60 (6.25) |
| | CogniPlus | 19.60 (6.64) | 30.87 (6.35) | 29.40 (7.12) |
| | Control | 20.60 (6.38) | 20.07 (9.28) | 22.33 (9.65) |

Overall, descriptive findings indicate that both experimental groups demonstrated substantial improvements from pretest to posttest across nearly all components of visual perception and reading efficiency, with gains largely maintained at follow-up, whereas the control group showed minimal change or slight fluctuations over time. Improvements were particularly pronounced in visual discrimination, visual-spatial relations, visual constancy, word reading, word chains, word comprehension, and category fluency in the Captain's Log group, while the CogniPlus group also exhibited meaningful but slightly smaller increases across similar domains; in contrast, the control group's scores remained relatively stable or declined slightly in several subtests, suggesting that the observed enhancements in the experimental groups are descriptively attributable to the computerized cognitive rehabilitation interventions.

**Table 2**

*Mixed ANOVA Results (Greenhouse–Geisser Correction) for Visual Perception and Reading Efficiency Variables*

| Variable | Effect | SS | df | MS | F | Sig | η² |
|---|---|---|---|---|---|---|---|
| Visual Discrimination | Within | 1637.17 | 1.34 | 1222.63 | 6.24 | 0.01 | 0.13 |
| | Time × Group | 1625.63 | 2.68 | 607.00 | 3.10 | 0.04 | 0.13 |
| | Between | 4124.55 | 2.00 | 2062.27 | 3.49 | 0.04 | 0.14 |
| Visual Memory | Within | 1524.40 | 1.37 | 1116.32 | 7.06 | 0.01 | 0.14 |
| | Time × Group | 1298.09 | 2.73 | 475.30 | 3.01 | 0.04 | 0.13 |
| | Between | 1721.64 | 2.00 | 860.82 | 4.50 | 0.003 | 0.19 |
| Visual-Spatial Relations | Within | 2737.79 | 1.37 | 1995.21 | 11.98 | 0.001 | 0.22 |
| | Time × Group | 1827.23 | 2.74 | 665.81 | 4.00 | 0.01 | 0.16 |
| | Between | 2636.73 | 2.00 | 1318.36 | 3.97 | 0.03 | 0.16 |
| Visual Constancy | Within | 2138.80 | 1.38 | 1552.66 | 11.95 | 0.001 | 0.22 |
| | Time × Group | 1337.69 | 2.76 | 485.55 | 3.74 | 0.02 | 0.15 |
| | Between | 2402.98 | 2.00 | 1201.49 | 4.34 | 0.006 | 0.17 |



E-ISSN: 2980-9681

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Visual Sequential Memory | Within | 698.53 | 1.66 | 421.44 | 3.36 | 0.04 | 0.07 |
| | Time × Group | 582.09 | 3.32 | 175.59 | 1.40 | 0.25 | 0.06 |
| | Between | 1509.51 | 2.00 | 754.76 | 1.42 | 0.25 | 0.06 |
| Figure-Ground Discrimination | Within | 1314.33 | 1.73 | 758.38 | 10.63 | 0.001 | 0.20 |
| | Time × Group | 533.54 | 3.47 | 153.93 | 2.16 | 0.09 | 0.09 |
| | Between | 663.66 | 2.00 | 331.83 | 0.68 | 0.52 | 0.03 |
| Visual Closure | Within | 515.30 | 1.42 | 362.51 | 4.53 | 0.002 | 0.19 |
| | Time × Group | 518.87 | 2.84 | 182.51 | 1.28 | 0.29 | 0.06 |
| | Between | 1185.13 | 2.00 | 592.56 | 1.00 | 0.38 | 0.05 |
| Word Reading | Within | 2219.91 | 1.22 | 1825.19 | 33.34 | 0.001 | 0.44 |
| | Time × Group | 1020.44 | 2.43 | 419.50 | 7.66 | 0.001 | 0.27 |
| | Between | 1600.18 | 2.00 | 800.09 | 5.22 | 0.01 | 0.20 |
| Word Chains | Within | 462.93 | 1.61 | 287.69 | 42.22 | 0.001 | 0.50 |
| | Time × Group | 357.82 | 3.22 | 111.18 | 16.32 | 0.001 | 0.44 |
| | Between | 1074.98 | 2.00 | 537.49 | 35.42 | 0.001 | 0.63 |
| Rhyme | Within | 136.77 | 1.21 | 112.68 | 16.83 | 0.001 | 0.29 |
| | Time × Group | 100.56 | 2.43 | 41.43 | 6.19 | 0.001 | 0.23 |
| | Between | 432.59 | 2.00 | 216.30 | 10.73 | 0.001 | 0.34 |
| Text Comprehension | Within | 145.30 | 1.93 | 75.17 | 20.37 | 0.001 | 0.33 |
| | Time × Group | 56.47 | 3.87 | 14.61 | 3.96 | 0.01 | 0.16 |
| | Between | 157.22 | 2.00 | 78.61 | 3.74 | 0.03 | 0.15 |
| Word Comprehension | Within | 501.51 | 1.60 | 313.67 | 56.83 | 0.001 | 0.58 |
| | Time × Group | 311.82 | 3.20 | 97.51 | 17.67 | 0.001 | 0.46 |
| | Between | 784.53 | 2.00 | 392.27 | 32.79 | 0.001 | 0.61 |
| Phoneme Deletion | Within | 166.93 | 1.28 | 130.85 | 15.49 | 0.001 | 0.27 |
| | Time × Group | 120.40 | 2.55 | 47.19 | 5.59 | 0.001 | 0.21 |
| | Between | 418.53 | 2.00 | 209.27 | 7.07 | 0.001 | 0.25 |
| Nonword Reading | Within | 271.88 | 1.59 | 171.16 | 29.30 | 0.001 | 0.41 |
| | Time × Group | 170.43 | 3.18 | 53.65 | 9.18 | 0.001 | 0.30 |
| | Between | 253.22 | 2.00 | 126.61 | 6.88 | 0.001 | 0.25 |
| Letter Fluency | Within | 143.33 | 1.69 | 84.89 | 23.12 | 0.001 | 0.36 |
| | Time × Group | 72.27 | 3.38 | 21.40 | 5.83 | 0.001 | 0.22 |
| | Between | 136.53 | 2.00 | 68.27 | 5.59 | 0.01 | 0.21 |
| Category Fluency | Within | 1614.44 | 1.27 | 1272.75 | 40.25 | 0.001 | 0.49 |
| | Time × Group | 750.31 | 2.54 | 295.76 | 9.35 | 0.001 | 0.31 |
| | Between | 963.51 | 2.00 | 481.76 | 4.24 | 0.02 | 0.17 |

The mixed ANOVA results indicate that for most visual perception components, significant within-group time effects were observed, particularly for visual discrimination, visual memory, visual-spatial relations, visual constancy, figure-ground discrimination, and visual closure, with moderate effect sizes, while visual sequential memory showed a smaller effect and no significant interaction or between-group differences. Significant time × group interaction effects were found for visual discrimination, visual memory, visual-spatial relations, and visual constancy, indicating differential improvement patterns across groups. For reading efficiency variables, strong and highly significant within-group effects were observed across all subtests, with large effect sizes especially for word comprehension, word chains, and category fluency. Moreover, significant interaction effects were detected for all reading components, demonstrating that improvements over time differed meaningfully between the experimental and control groups. Between-group effects were also significant for all reading variables, with particularly large effect sizes for word chains and word comprehension, suggesting that the cognitive rehabilitation interventions produced statistically robust and practically meaningful gains in reading efficiency compared to the control condition.



E-ISSN: 2980-9681

**Table 3**

*Bonferroni Post Hoc Test Results for Pairwise Comparisons of Group Means*

| Variable | Group Comparison | Mean Difference | Std. Error | Sig |
|---|---|---|---|---|
| Visual Discrimination | Captain's Log – CogniPlus | 5.02 | 5.13 | 0.99 |
| | Captain's Log – Control | 13.40 | 5.13 | 0.001 |
| | CogniPlus – Control | 8.38 | 5.13 | 0.01 |
| Visual Memory | Captain's Log – CogniPlus | 0.42 | 5.06 | 0.99 |
| | Captain's Log – Control | 7.78 | 5.06 | 0.001 |
| | CogniPlus – Control | 7.36 | 5.06 | 0.001 |
| Visual-Spatial Relations | Captain's Log – CogniPlus | 6.27 | 3.84 | 0.01 |
| | Captain's Log – Control | 10.78 | 3.84 | 0.001 |
| | CogniPlus – Control | 4.51 | 3.84 | 0.04 |
| Visual Constancy | Captain's Log – CogniPlus | 4.56 | 4.77 | 0.19 |
| | Captain's Log – Control | 10.31 | 4.77 | 0.001 |
| | CogniPlus – Control | 5.76 | 4.77 | 0.03 |
| Word Reading | Captain's Log – CogniPlus | 0.84 | 2.61 | 0.99 |
| | Captain's Log – Control | 7.69 | 2.61 | 0.02 |
| | CogniPlus – Control | 6.84 | 2.61 | 0.04 |
| Word Chains | Captain's Log – CogniPlus | -0.56 | 0.82 | 0.99 |
| | Captain's Log – Control | 5.69 | 0.82 | 0.001 |
| | CogniPlus – Control | 6.24 | 0.82 | 0.001 |
| Rhyme | Captain's Log – CogniPlus | -0.44 | 0.95 | 0.99 |
| | Captain's Log – Control | 3.56 | 0.95 | 0.001 |
| | CogniPlus – Control | 4.00 | 0.95 | 0.001 |
| Text Comprehension | Captain's Log – CogniPlus | -0.04 | 0.97 | 0.99 |
| | Captain's Log – Control | 2.27 | 0.97 | 0.02 |
| | CogniPlus – Control | 2.31 | 0.97 | 0.01 |
| Word Comprehension | Captain's Log – CogniPlus | -0.80 | 0.73 | 0.84 |
| | Captain's Log – Control | 4.67 | 0.73 | 0.001 |
| | CogniPlus – Control | 5.47 | 0.73 | 0.001 |
| Phoneme Deletion | Captain's Log – CogniPlus | -0.13 | 1.15 | 0.99 |
| | Captain's Log – Control | 3.67 | 1.15 | 0.01 |
| | CogniPlus – Control | 3.80 | 1.15 | 0.01 |
| Nonword Reading | Captain's Log – CogniPlus | -0.36 | 0.90 | 0.99 |
| | Captain's Log – Control | 2.71 | 0.90 | 0.01 |
| | CogniPlus – Control | 3.07 | 0.90 | 0.01 |
| Letter Fluency | Captain's Log – CogniPlus | 0.01 | 0.74 | 0.99 |
| | Captain's Log – Control | 2.13 | 0.74 | 0.02 |
| | CogniPlus – Control | 2.13 | 0.74 | 0.02 |
| Category Fluency | Captain's Log – CogniPlus | 0.09 | 2.25 | 0.99 |
| | Captain's Log – Control | 5.71 | 2.25 | 0.04 |
| | CogniPlus – Control | 5.62 | 2.25 | 0.04 |

The Bonferroni post hoc comparisons indicate that for visual perception components, both Captain's Log and CogniPlus groups performed significantly better than the control group in visual discrimination, visual memory, visual-spatial relations, and visual constancy, while no significant differences were observed between the two experimental groups except in visual-spatial relations, where Captain's Log showed a statistically greater improvement than CogniPlus. Regarding reading efficiency variables, pairwise comparisons consistently revealed significant differences between each experimental group and the control group across all subtests, including word reading, word chains, rhyme, text comprehension, word comprehension, phoneme deletion, nonword reading, letter fluency, and category fluency; however, no significant differences were found between Captain's Log and CogniPlus in any of the reading components. Overall, these findings demonstrate that both computerized cognitive rehabilitation interventions were significantly more effective than the control condition in improving visual perception and reading efficiency, while their comparative effectiveness was largely similar across most outcome measures.



E-ISSN: 2980-9681

## 4. Discussion and Conclusion

The present study examined the comparative effectiveness of the Captain's Log computerized cognitive rehabilitation package and the CogniPlus cognitive rehabilitation software on visual perception and reading efficiency in primary school boys with dyslexia. The findings demonstrated that both intervention groups showed significant improvements across multiple components of visual perception, including visual discrimination, visual memory, visual-spatial relations, and visual constancy, compared to the control group. Mixed ANOVA results revealed significant time and time × group interaction effects for most visual perceptual variables, indicating that improvements were attributable to the interventions rather than maturation or repeated testing. Notably, visual sequential memory showed smaller effects and non-significant interaction differences, suggesting that certain perceptual processes may be less sensitive to short-term computerized training. In addition, both interventions produced substantial gains in reading efficiency variables, including word reading, word chains, rhyme recognition, text comprehension, word comprehension, phoneme deletion, nonword reading, letter fluency, and category fluency, with large effect sizes particularly evident in word chains and word comprehension. Bonferroni post hoc comparisons confirmed that both experimental groups outperformed the control group in nearly all outcome measures, while differences between Captain's Log and CogniPlus were generally non-significant, except for visual-spatial relations where Captain's Log demonstrated a comparatively stronger effect. These findings indicate that structured computerized cognitive rehabilitation can significantly enhance both perceptual and literacy-related skills in children with dyslexia.

The improvements observed in visual perception align with previous research emphasizing the role of visual-attentional processes in reading development. Dyslexic children frequently demonstrate deficits in visual search efficiency and selective attention, which interfere with rapid word recognition and text scanning (Hokken et al., 2023). The significant enhancement in visual discrimination and visual-spatial relations in the present study may reflect improved allocation of visual attention and more efficient perceptual organization, processes that are foundational for decoding accuracy. Similarly, evidence from neurophysiological studies has demonstrated atypical brain connectivity patterns during reading tasks in dyslexic children, particularly in networks integrating visual and phonological information (Guano & Singh, 2024). Computerized cognitive training may facilitate functional reorganization or strengthening of these networks through repeated and adaptive practice. Moreover, the mediating role of word detection skill in linking visual search performance to reading comprehension suggests that gains in perceptual discrimination can translate into measurable improvements in literacy outcomes (Meng et al., 2024). The present findings therefore provide behavioral support for neurocognitive models positing that enhancement of visual-attentional mechanisms can indirectly improve reading efficiency.

The significant gains in working-memory-related and executive components of reading efficiency observed in this study are also consistent with prior literature highlighting the central role of executive functions in dyslexia. Interventions targeting working memory and phonological processes have been shown to improve phonological awareness and reading skills in children with dyslexia (Mosafer & Sadati Firouz Abadi, 2025). Likewise, computer-based cognitive rehabilitation programs focusing on working memory have demonstrated improvements in planning and organizational functions among children with reading disorders (Ranjbar et al., 2022). The present results, particularly the strong effects on word comprehension and phoneme deletion, suggest that strengthening working memory capacity and cognitive inhibition may support the manipulation of phonological units and the integration of semantic information during reading. Self-instruction training aimed at improving executive inhibition has also been associated with enhanced cognitive regulation in students with specific learning disorders (Jabarzadeh Chaharbrod et al., 2023), reinforcing the idea that top-down regulatory control contributes to literacy acquisition. The observed pattern of improvements across multiple reading subtests supports a multidimensional intervention model in which cognitive rehabilitation enhances foundational executive processes that subsequently facilitate reading performance.

The comparable effectiveness of Captain's Log and CogniPlus across most variables suggests that adaptive, computerized cognitive training—regardless of specific interface or task design—may be effective when grounded in established neuropsychological models. Meta-analytic evidence indicates that both computer-based and classical cognitive rehabilitation interventions produce significant cognitive gains in children with learning disabilities, though digital programs often show stronger effects due to their



E-ISSN: 2980-9681

structured progression and feedback mechanisms (Shabbanali Fami et al., 2022). Comparative studies have further shown that computer-based cognitive rehabilitation may outperform alternative therapeutic approaches, such as cognitive-behavioral play therapy, in improving executive functions in students with dyslexia (Shamshiri et al., 2025). Similarly, direct comparisons between task-based and computer-based rehabilitation programs have revealed significant improvements in cognitive flexibility following computerized interventions (Khaleghi et al., 2023). The present findings are consistent with this body of research, indicating that structured digital cognitive training programs can effectively target attentional and executive deficits underlying dyslexia. Additionally, improvements in reading efficiency observed in the current study parallel findings from computerized literacy training programs implemented with dyslexic students, which reported enhanced reading fluency and accuracy following structured digital intervention (Farghaly et al., 2022).

Beyond cognitive gains, the broader literature suggests that computerized cognitive training may exert secondary psychosocial benefits. Enhancements in attentional control and executive functioning have been linked to reductions in academic stress and maladaptive behaviors among children (Hosseinpour Pakzad & Farhadi, 2023). Furthermore, computerized interventions have demonstrated positive outcomes in social-communication and behavioral regulation in populations with neurodevelopmental conditions (Georgoula & Koustriava, 2024). Although the present study did not directly measure psychosocial variables, improved reading efficiency may contribute to greater academic confidence and reduced frustration in classroom contexts. Morphological awareness interventions have also demonstrated transferable improvements in reading and spelling skills (Mendes & Kirby, 2024), underscoring the value of cognitive-linguistic training in literacy development. Additionally, evidence from populations with neurological injuries and older adults indicates that computerized cognitive rehabilitation is effective across age groups (Gohari et al., 2025; Kim et al., 2022), further supporting the robustness of digital cognitive training as a rehabilitative modality.

Taken together, the findings of the present study reinforce a neurocognitive framework of dyslexia in which visual perception, attentional control, and executive functioning interact dynamically with phonological and linguistic processes. By strengthening these underlying cognitive systems, computerized cognitive rehabilitation may create more efficient processing pathways that support reading fluency and comprehension. The lack of significant differences between the two intervention programs on most measures suggests that the core mechanisms of adaptive digital cognitive training—progressive difficulty, immediate feedback, and multimodal stimulation—may be more influential than specific software characteristics. These results contribute to the growing body of evidence supporting the integration of computerized cognitive rehabilitation into comprehensive intervention programs for children with dyslexia.

Despite the promising findings, several limitations should be acknowledged. The sample size was relatively small and limited to primary school boys in one urban region, which restricts generalizability to girls, other age groups, and different sociocultural contexts. The study relied primarily on standardized cognitive and reading assessments without incorporating neurophysiological measures that could clarify underlying neural changes. Additionally, the follow-up period was limited to two months, which does not allow conclusions regarding long-term maintenance of gains. Finally, the absence of qualitative data limits understanding of participants' subjective experiences and motivational factors during training.

Future studies should employ larger and more diverse samples, including female students and children from different educational settings, to enhance external validity. Longitudinal designs with extended follow-up periods are needed to determine the durability of intervention effects. Incorporating neuroimaging or electrophysiological measures could provide deeper insight into neural mechanisms associated with cognitive rehabilitation in dyslexia. Comparative studies examining combinations of cognitive rehabilitation with direct literacy instruction or morphological training may also clarify optimal intervention models. Additionally, exploring moderating variables such as baseline executive functioning, severity of dyslexia, and socioeconomic factors would contribute to personalized intervention planning.

From a practical perspective, the findings support the integration of computerized cognitive rehabilitation programs into educational and clinical services for children with dyslexia. Schools and learning disorder centers may consider incorporating structured digital cognitive training as a complementary component to traditional reading instruction. Practitioners should ensure that interventions are delivered consistently and adapted to individual performance levels to maximize effectiveness. Training for



E-ISSN: 2980-9681

educators and therapists in the implementation of computerized cognitive programs is recommended to ensure fidelity and sustainability. Moreover, combining cognitive rehabilitation with supportive classroom strategies may enhance transfer of gains to everyday academic performance and foster greater confidence and engagement in students with reading difficulties.

### 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

We hereby thank all individuals for participating and cooperating us in this study.


### Declaration of Interest

The authors report no conflict of interest.


### Funding

According to the authors, this article has no financial support.


### 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. The ethical approval code for conducting this research is IR.IAU.SRB.REC.1402.316.

### References


Farghaly, W. M., El Tallawy, S. H., Ramadan, A. S., Abdelrasol, R. B., Omar, M. S., Eltallawy, H. N., & Mohamed, K. O. (2022). Training second-grade dyslexic students using a computerized program in Asyut, Egypt. *The Egyptian Journal of Neurology, Psychiatry and Neurosurgery*, *58*(1), 1-8. https://doi.org/10.1186/s41983-022-00480-y

Georgoula, E., & Koustriava, E. (2024). Enhancing Social-Communication and behavior skills in adolescents with intellectual disabilities through computerized cognitive training. *International Journal of Instruction*, *17*(4), 421-440. https://doi.org/10.29333/iji.2024.17424a

Gharashi, K., & Abdi, R. (2022). The Effectiveness of Cognitive Rehabilitation on Planning and Working Memory of Executive Functions in Cochlear Implanted Children. *Auditory and Vestibular Research*, *31*(3), 180-188. https://doi.org/10.18502/avr.v31i3.9868

Gohari, F., Qamari, H., & Sheykholeslami, A. (2025). The effectiveness of computer-based cognitive rehabilitation on the social isolation of the elderly with death anxiety living in elderly centers. *Social Psychology Research*, *14*(56), 15-32. https://www.socialpsychology.ir/article_215642_en.html

Guano, N. P. A. U. S., & Singh, B. K. (2024). Analysis of reading-task-based brain connectivity in dyslexic children using EEG signals. *Medical & Biological Engineering & Computing*. https://doi.org/10.1007/s11517-023-02769-3

Hokken, M. J., Krabbendam, E., van der Zee, Y. J., & Kooiker, M. J. (2023). Visual selective attention and visual search performance in children with CVI, ADHD, and Dyslexia: a scoping review. *Child Neuropsychology*, *29*(3), 357-390. https://doi.org/10.1080/09297049.2022.2057940

Hosseinpour Pakzad, M., & Farhadi, H. (2023). The effectiveness of cognitive-behavioral play therapy on computer game addiction, aggression, and academic stress in children aged 10-11. *Journal of Pediatric Nursing*, *9*(4), 52-63. https://jpen.ir/browse.php?a_id=693&sid=1&slc_lang=en

Jabarzadeh Chaharbrod, M., Beyrami, M., Nokhestin Goldost, A., & HAshemi, T. (2023). The Effectiveness of Self-instruction training on Executive Functions and Cognitive Inhibition of Students with Special Learning Disorder. *Journal of Educational Psychology Studies*, *20*(50), 53-34. https://doi.org/10.22111/jeps.2023.7532

Khaleghi, A., Naderi, F., Johari-Fard, R., & Javadzadeh, M. (2023). Comparison of the effectiveness of task-based cognitive rehabilitation and computer-based cognitive rehabilitation programs on cognitive flexibility in children with epilepsy. *Shafa Khatam Journal*, *11*(3). https://doi.org/10.61186/shefa.11.3.25

Kim, S. H., Gwak, D. W., Jeong, J. G., Jung, H., Min, Y. S., Kim, A. R., & Jung, T. D. (2022). Effect of computerized cognitive rehabilitation in comparison between young and old age after traumatic brain injury. *Medicine*, *101*(33), 1-5. https://doi.org/10.1097/MD.0000000000029874

Mendes, B. B., & Kirby, J. R. (2024). The effects of a morphological awareness intervention on reading and spelling ability of children with dyslexia. *Learning Disability Quarterly*, *47*(4), 222-233. https://doi.org/10.1177/07319487241259775

Meng, H., Yao, R., Zhang, P., Wang, J., & Zhang, Y. (2024). The impact of visual search in Chinese children with developmental dyslexia on reading comprehension: The mediating role of word detection skill and reading fluency. *Frontiers in psychology*, *15*, 1437187. https://doi.org/10.3389/fpsyg.2024.1437187

Mitsea, E., Drigas, A., & Skianis, C. (2023). Brain-computer interfaces in digital mindfulness training for metacognitive, emotional and attention regulation skills: a literature review. *Research, Society and Development*, *12*(3), e2512340247-e2512340247. https://rsdjournal.org/index.php/rsd/article/view/40247

Mosafer, A., & Sadati Firouz Abadi, S. S. (2025). The Impact of a Reading Program Based on Working Memory and Phonology on the Phonological Awareness of Children with Dyslexia.

*Journal of Applied Psychology*, *19*(2). https://apsy.sbu.ac.ir/article_105677.html

Ortiz, R., Estévez, A., Muñetón, M., & Domínguez, C. (2014). Visual and auditory perception in preschool children at risk for dyslexia. *Research in Developmental Disabilities*, *35*(11), 2673-2680. https://doi.org/10.1016/j.ridd.2014.07.014

Ranjbar, M. J., Basharpour, S., Sobhi Gharamaleki, N., Narimani, M., & Gholami, F. (2022). The effectiveness of computer-based cognitive rehabilitation of working memory on improving planning and organizational functions in children with reading disorder (using Memory Club software). *Exceptional Children Quarterly*, *22*(4), 91-102. https://www.sid.ir/paper/1060723/

Shabbanali Fami, F., Ghasemzadeh, S., & Nejati, S. (2022). The effectiveness of cognitive rehabilitation interventions (computer-based and classical) on cognitive performance of children with specific learning disabilities in Iran: A meta-analytic study. *Feiz Scientific-Research Bimonthly*, *26*(2), 166-183. https://feyz.kaums.ac.ir/browse.php?a_id=4511&sid=1&slc_lang=fa&ftxt=0

Shamshiri, D., Havasci, Tari, M., & Arezoo. (2025). Comparison of the effectiveness of computer-based cognitive rehabilitation with cognitive-behavioral play therapy on improving executive functions in students with dyslexia. *Journal of Psychiatry and Clinical Psychology in Iran*, *31*(1), 0-0. https://doi.org/10.32598/ijpcp.31.1977.2

Shivyari, F., Narimani, M., Aghajani, S. H., & Hajloo, N. (2022). Comparison of the effectiveness of cognitive rehabilitation and multisensory learning strategies on reading performance of bilingual students with dyslexia. *Learning Disabilities*, *11*(3), 76-89. https://jld.uma.ac.ir/article_1525_5bcd91df786373e9ddbbd3dfe31018af.pdf



E-ISSN: 2980-9681