



The University of Tehran Press

Implementation of Cognitive Rehabilitation Intervention on the Comprehension, Generation, and Calculations of Numerical Data among Students Suffering from a Specific Learning Disability and Mathematical Impairment

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Extended Abstract

Aim

Specific Learning Disorder with Mathematical Impairment (SLDMI) is a neurodevelopmental disorder characterized by impairments in numerical understanding, memorization of facts, calculation, and true mathematical reasoning (Banker et al., 2021). Approximately 7 percent of students without cognitive impairments suffer from SLDMI (Geary, 2011). Most children with SLDMI lack the necessary abilities in concentration, accuracy, and attention required for learning (Shalev et al., 2005). Their developmental progress in achieving accuracy and natural attention is often delayed.

The aim of the present study is to apply cognitive rehabilitation intervention to improve numerical comprehension, production, and calculation skills in students with SLDMI. The study seeks to examine whether cognitive rehabilitation can enhance the performance of elementary school students in numerical understanding, production, and calculation, thereby improving the cognitive abilities of students with SLDMI.

Methodology

Based on the practical objectives, quantitative methodology, and data collection, the present study employs a quasi-experimental research design with pre-test and post-test assessments, comprising experimental and control groups. The population consists of fourth-grade elementary students with specific learning disorders from regions 1 and 2 in Rasht, who were referred to the quadruple learning disorder centers (Dehkhoda 1 and 2, Shahid Eskandari, and Shahid Yaghoubi) during the educational year 1398-1399 and received educational services from these certified centers due to their diagnosis of learning disorders with mathematical impairment.

Using available sampling, 30 students were selected as representatives and allocated to two experimental groups (15 individuals each) and a control group (15 individuals) through random assignment. The data were collected using the Key Mathematical Diagnostic Test (KMDT), the Raven's Colored Progressive Matrices (RCPM), Standardized Achievement Test and Diagnostic Test or Mathematical Account (SATDMA) and Mathematical Reinforcement Training Program Based on Intervention Response Model (MRTPBIRP).

Regarding curriculum content and student numbers, the experimental group underwent an educational rehabilitation program using Quiet Software (targeting working memory and attention) for 12 sessions (two sessions lasting 45 minutes each week), while the control group received no instruction and

remained on a waitlist. Following a one-day trial period (to prevent learning interference and ensure curricular efficacy), the mathematical achievement and diagnostic tests were administered again as post-tests.

The entrance criteria for the study were as follows: fourth-grade male students who consented to participate in educational sessions, with the cooperation and written consent of parents, average or above-average intelligence, healthy visual and auditory senses, and a diagnosis of specific learning disorder with mathematical impairment based on expert opinion. Exclusion criteria included non-cooperation of participants and their families, effects of physical diseases on cognitive function, and intolerance of research conditions.

Additionally, confidentiality, voluntary participation until completion of data collection, and commitment to sharing results with students and their families were ethical considerations of this study. Data were analyzed using multivariate covariance analysis and SPSS 22 software.

Findings

The results of the covariance analysis revealed a significant difference between the experimental and control groups in the post-test regarding the variables of numerical understanding, production, and calculation at the 0.001 significance level. Thus, it can be inferred that the implementation of cognitive rehabilitation led to an increase in scores for numerical understanding, production, and calculation in the experimental group compared to the control group. Employing the Bonferroni Correction method, and considering three dependent variables, the significance level should be adjusted to less than 0.017. This adjustment holds true for all three variables. Put differently, individual analysis of each variable using the Bonferroni-adjusted alpha level indicated significant differences between the experimental and control groups in the post-test concerning the three components of numerical understanding, production, and calculation ($P < 0.017$).

Conclusion

The aim of the present study is to determine the effectiveness of Cognitive Rehabilitation Intervention (targeting working memory and attention) on the numerical understanding, production, and calculation abilities of elementary school male students. The results of the multivariate covariance analysis indicate that teaching through cognitive rehabilitation significantly enhances the students' abilities in numerical understanding, production, and calculation, particularly among those suffering from specific learning disorders with mathematical impairment. Based on the findings of this study, the application of a cognitive rehabilitation program leads to a substantial increase in students' proficiency in numerical skills.

To elucidate the results, it is essential to acknowledge that specific learning disorders with mathematical impairment are cognitive disorders that hinder the acquisition of mathematical skills, resulting in significant challenges in numerical understanding, production, and calculation for affected students. Consequently, the implementation of cognitive rehabilitation proves crucial in addressing these challenges. This intervention equips students with the ability to discriminate, recognize, and comprehend mathematical concepts in various formats.

In summary, teaching cognitive rehabilitation can enhance the speed and accuracy of numerical application, processing, production, and mathematical problem-solving. The findings of this study suggest that integrating cognitive rehabilitation programs into educational interventions can effectively improve numerical abilities and should be considered as part of empowerment initiatives in educational settings (Stievano et al., 2018).

Keywords: Cognitive Rehabilitation, Special Learning Disorder, Numerical Production, Numerical Understanding, Numerical Calculations.

Ethical Considerations

Ethical principles were adhered to in this article. Confidentiality of information was maintained, and participants were granted the option to withdraw from the study at any time.

Financial Support

The current research did not receive financial assistance from any funding organizations.

Authors' Contributions

All authors contributed to the design, implementation, and writing of all aspects of the study.

Conflict of Interest

The present research declares no conflicts of interest with any sources or individuals.

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Cite this article: Nemati, S., Badri-Gargari, R., Vahedi, S., & Mehreganfardeh-Jirandeh, Z. (2024). Implementation of Cognitive Rehabilitation Intervention on the Comprehension, Generation, and Calculations of Numerical Data Among Students Suffering from a Specific Learning Disability and Mathematical Impairment. *Journal of Applied Psychological Research, 15*(1), 53-72. doi: 10.22059/japr.2024.333955.644085.



Publisher: University of Tehran Press
DOI: <https://doi.org/10.22059/japr.2024.333955.644085>

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