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Investigating the Effectiveness of the Rehabilitation Package on the Cognitive Flexibility and Social Interaction of Students with Autism Spectrum Disorder Based on Executive Functions

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Extended Abstract

Aim

Autism spectrum disorder (ASD) is a neurodevelopmental condition characterized by repetitive behaviors and difficulties in social skills and communication (Joon et al., 2021). Individuals with ASD exhibit significant differences in executive function abilities (Demetriouet al., 2019). Impairments in executive functions impact various aspects of life, including increased risks of academic underachievement and learning difficulties (John et al., 2018). These impairments can persist, leading to serious challenges in daily activities, professional tasks, and social behaviors (Smith-Spark et al., 2016). Cognitive flexibility, a core domain of executive functions, enables individuals to shift between tasks or adapt to new situations (Kelly & Reed, 2020). Children with ASD often lack cognitive flexibility, and this inflexibility is linked to behavioral and emotional difficulties (Ozsivadjian et al., 2021). Furthermore, these children often exhibit abnormal social behaviors and face challenges in expressing their needs, emotions, and feelings (Guralnick, 2019). Executive functions represent a promising target for intervention. Preliminary evidence suggests that treatments aimed at improving these functions yield positive outcomes, including cognitive rehabilitation. Cognitive rehabilitation involves educational and therapeutic strategies, such as repetition and practice, to restore impaired functions (Kanellopoulos et al., 2016).

The aim of this study was to investigate the effectiveness of a cognitive rehabilitation program designed to enhance executive functions on the cognitive flexibility and social interactions of students with ASD.

Methodology

This applied research employed a quantitative approach with a quasi-experimental design, including a pre-test, post-test, and follow-up phases, as well as a control group. The study population comprised all students with ASD in Tehran during 2022–2023. Using an availability sampling method, 20 male students from a specialized autism school in Tehran were selected. Participants were then randomly assigned to experimental and control groups. Before implementing the intervention, a pre-test was conducted for both groups. The cognitive rehabilitation package developed by Ghasemi et al. (2019) was utilized. This program, delivered via computer software, includes a series of games aimed at improving executive functions, such as cognitive flexibility, processing speed, and attention. The intervention consisted of 20 sessions, each lasting 20–30 minutes, conducted twice weekly. In addition

to computer-based activities, manual worksheets were developed to align with the cognitive and behavioral characteristics of students with ASD, providing ongoing practice to reinforce executive functions. Data were collected using the Wisconsin Card Sorting Test (WCST) (Grant & Berg, 1993) and the Social Interaction Subscale of the Gilliam Autism Rating Scale (GARS) (Gilliam, J. E., 2014 cited by Karren, 2017) at three time points: pre-test, post-test, and two months after the intervention. Statistical analysis was conducted using repeated measures ANOVA via SPSS 24 software.

Findings

The data indicated that the highest levels of cognitive flexibility and social interaction were observed during the follow-up phase, followed by the post-test phase, and finally the pre-test phase. Table 1 highlights the between-group effects. The results revealed a statistically significant improvement in cognitive flexibility and social interaction across the three measurement phases ($\alpha=0.01$\alpha = 0.01). Specifically, the cognitive rehabilitation package based on executive functions significantly enhanced these abilities in students with ASD ($P<0.001$, $P<0.001$).

Table 1. Between-Subject Effects in Experimental and Control Groups

Variable	Group	SS	df	MS	F	Significance level
Cognitive flexibility	**Experiment and control**	2356.26	1	2356.26	24.19	0.001
	Error	1753.06	18	97.39		
Social interaction	**experiment and control**	1197.06	1	1197.06	36.06	
	Error	597.53	18	23.19		

SS: Sum of squares **MS**: Mean of squares

Conclusion

The findings demonstrated that the cognitive rehabilitation program significantly improved cognitive flexibility in students with ASD. Benyakorn, et al. (2018) similarly found cognitive training effective for children with ASD and intellectual disabilities through a 25-session computer-based program. In this study's intervention, students practiced shifting attention between activities and adapting their responses to new tasks, thus enhancing their cognitive flexibility. Executive functions, which regulate and direct behavior, are also associated with social skills critical for daily functioning. Training targeting executive functions appeared to indirectly improve social skills (Kenworthy et al., 2014). This program emphasized rule-following, turn-taking, and cooperative behaviors, fostering social interaction among students. For instance, students practiced asking to join games and learned to relinquish their turn upon completion.

In conclusion, the cognitive rehabilitation program enhanced cognitive flexibility and increased social interaction among students with ASD. This intervention is recommended for strengthening executive functions and reducing behavioral challenges in children with ASD.

Keywords: Autism Spectrum Disorder, Cognitive Flexibility, Cognitive Rehabilitation, Social Interaction.

Ethical Considerations

The study adhered to ethical principles, including maintaining confidentiality, obtaining written consent, and ensuring voluntary participation. Ethical approval was obtained from the Faculty of Psychology and Educational Sciences at Tehran University (Ethics Code: IR.UT.PSYEDU.REC.1401.081).

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Conflict of Interest

This study received no financial support, and there are no conflicts of interest among the authors.

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