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Meta-analysis of National Research on the Effectiveness of Neuropsychological Interventions on Executive Functions

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Extended Abstract

Aim

The pathology and development of executive functions, which were initially investigated from a neurological standpoint, have recently been the subject of considerable interest among specialists, and considerable effort has been devoted to the implementation of interventions aimed at enhancing these functions (Plass et al., 2019). Neuropsychological interventions encompass a variety of activities centered around rehabilitation, such as cognitive training, pen-and-paper exercises, cognitive training utilizing games and computers, neurofeedback, and planning to enhance memory, attention, inhibition, planning, and cognitive flexibility (Veloso, Vicente, & Filipe, 2020). In addition, neuropsychological interventions make use of cognitive training, which is founded on the discoveries of the cognitive sciences (Thorell et al., 2009). In light of the considerable body of research pertaining to domestic executive functions, which occasionally yields conflicting findings, it appears that the most effective approach to synthesize these studies is to undertake a meta-analysis. A more holistic understanding of the efficacy of treatment approaches in this domain can be attained through the synthesis of the quantitative findings from these studies. Due to the scarcity of comprehensive research in Iran regarding the integration of neuropsychological intervention results on executive functions in a meta-analysis, and the delicate nature of neuropsychological interventions on components of executive functions, we undertook the present meta-analysis with the following objectives in mind: to integrate the results of studies, to select and estimate desirable intervention methods, and to address the following inquiries: The synthesis of findings from internal studies to determine the degree to which neuropsychological interventions influence executive function components. To what extent do each intervention's effects manifest in relation to executive functions? What is the degree of variation in the effects of intervention methods between clinical and normal societies? Which potential moderating variable influences the executive function components?

Methodology

The meta-analysis was employed in accordance with the objectives and characteristics of this research. The statistical population comprised all accessible scientific articles and literature pertaining to psychology and educational sciences in Iran over the past decade (2010-2020). These articles and studies employed experimental and quasi-experimental methods to examine the efficacy of neuropsychological interventions, including sensory-motor exercises, cognitive rehabilitation, neurofeedback, and planning, attention, memory, and inhibition. Among various d indices, the sample size was determined utilizing the purposive sampling method and Hedge's g index. Furthermore, effect sizes were computed through the utilization of CMA2 and SPSS25 software. Following the assessment of the inclusion and exclusion criteria, the CMA software was utilized to analyze 132 effect sizes derived from 71 studies.

Findings

The findings indicate that the average combined effect size of research examining the impact of neuropsychological interventions on executive functions was 1.12 for the fixed effects model and 1.22 for the random effects model. These effect sizes met Cohen's criterion at a significance level of 0.001. The Cochran's Q heterogeneity index, I-squared, and Tau correlation coefficients were calculated to be 344.814, 65.19, and 0.42, respectively. These results suggest that moderating variables play a substantial role in the association between neuropsychological interventions and executive functions. As a result, for the meta-analysis, a random model with a combined effect size of 1.22 was selected. The results of a class-based analysis of the combined effect size of neuropsychological interventions for improving executive functions revealed that the intervention targeting individuals with anxiety disorders had the smallest effect size, whereas the intervention targeting those with Attention Deficit/Hyperactivity Disorder (ADHD) had the largest effect size. The resultant effect size for the efficacy of neuropsychological interventions in enhancing executive functions, broken down by the constituent elements of executive functions, revealed that the working memory component experienced the most substantial effect, while the planning component exhibited the smallest effect. Additionally, the findings indicated that there was no statistically significant variation in the effect sizes of the various neuropsychological interventions.

Conclusion

In light of the findings of the current meta-analysis, which validate the critical functions involved in ameliorating clinical disorders and the efficacy of neuropsychological interventions, as well as the diverse adverse effects associated with medications in children, it is advisable for specialists to address clinical issues in children through neuropsychological interventions prior to prescribing drugs or combining proposed interventions with medication. Considering the substantial and significant impact that game-based rehabilitation interventions, including software and computer games, and neurofeedback have had on enhancing executive functions in children diagnosed with learning disabilities and Attention Deficit/Hyperactivity Disorder (ADHD), it is recommended that all rehabilitation and service centers affiliated with the Department of Education and Welfare adopt these approaches as a foundation for optimal utilization by individuals from lower socioeconomic backgrounds. Therapists and specialists are advised to employ neuropsychological interventions to enhance and advance the working memory, attention, inhibition, and planning capabilities of their clients, as indicated by the findings of the current study.

Keywords: Executive functions, Meta-analysis, Neuropsychological Interventions.

Ethical Considerations

Although the present article is of a meta-analytical nature and lacks human and animal samples, ethical considerations and integrity have been observed in referencing scientific texts and citations during its composition.

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Conflict of Interest

This article is devoid of any conflict of interest.

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