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Orginal Article

Comparison of the Effectiveness of Executive Function Training and Play therapy on Promoting the Learning of Mathematical Concepts of Students with Learning Disabilities

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Introduction

This study aimed to compare the effectiveness of executive function training and play therapy in promoting mathematical concept learning among students with learning disabilities. Learning mathematics is one of the fundamental subjects related to science and has been the focus of numerous studies and theories. Students learn not only to perform calculations but also to apply reasoning to solve real-life problems. Difficulties in mathematical calculations can manifest in various ways, such as trouble determining sizes or naming numbers, an inability to count, and challenges in comparing or performing both mental and practical calculations. Children with math disorders experience significant difficulties with mathematical calculations or reasoning abilities. Due to the varying definitions of learning disabilities and the diverse educational goals for these children, the prevalence of math disorders is estimated to fluctuate between 1% and 30%. It is important to note that mathematical learning is a critical aspect of science education and has been the subject of extensive research. While students learn to perform calculations, they also develop reasoning skills that help them address real-world problems. Mathematics, despite its abstract nature, serves as an effective tool for cultivating students' logical

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thinking and cognitive processes. However, some students struggle with foundational mathematical operations—addition, subtraction, multiplication, and division—attributable to mathematical learning disorders. These disorders may manifest as difficulties in identifying sizes, naming numbers, counting, comparing, or executing both mental and practical calculations. According to clinical studies, approximately 20% of children with learning disabilities are estimated to have math learning disorders, although this disorder is diagnosed in only about 1% of all students. Executive functions represent a set of high-level cognitive processes that assist individuals in deciding which activities to engage in and how to organize their behaviors over time. The key components of executive functions, including inhibition, selective attention, and working memory, are critical for predicting learning outcomes in children. In recent years, play therapy has gained attention as an effective method for addressing the needs of children with learning disabilities. Play enables children to connect their inner thoughts with the external world, helping them to overcome barriers and express their feelings more freely. Research has demonstrated that play therapy can enhance attention, improve math and reading performance among students with math disabilities, and foster academic achievement overall.

Method

The current study utilized a quasi-experimental design with a pretest-posttest approach that included a control group. The sample comprised 45 third-grade elementary students, who were selected through an availability sampling method and divided into three groups: executive functions training, play therapy, and a control group .

To assess the students, the research employed the Tabrizi Learning Disorder Checklist (2010) and the K-Matt mathematical test. Participants underwent training across 10 sessions, each lasting 90 minutes. After administering the pretest, the students were randomly assigned to the three groups: 15 students were placed in the control group, 15 in the executive functions training group, and 15 in the play therapy group.

In the pretest stage, arithmetic skill levels were measured using the mentioned questionnaires. Subsequently, the researcher applied various educational methods (executive functions training, play therapy, and standard education) to the groups over the course of 10 sessions. At the conclusion of the training period, the researcher collected post-test scores related to learning mathematical concepts and arithmetic skills from all three groups: executive functions, play therapy, and control.

Results

The findings indicated that there was no significant difference in the effectiveness of executive function training compared to play therapy for learning mathematical concepts ($P < 0.01$). The sample size for this study included 45 individuals. After administering a questionnaire to the participants, a pretest-posttest experimental design with a control group was implemented. Participants were randomly assigned to three groups: 15 individuals in the control group, 15 in the executive function training group, and 15 in the play therapy group.

During the pretest phase, arithmetic skill learning was measured using the questionnaires. The researcher then applied the training methods (executive function training, play therapy, and conventional training) to the groups over a span of 10 sessions. At the conclusion of the training period (posttest), the researcher collected scores from the mathematical concepts learning questionnaire and arithmetic skills for all three groups.

Establishing the normality of the distribution of error scores is a critical assumption in the use of multivariate analysis of covariance. This normality was assessed using the Kolmogorov-Smirnov test. When the significance level of this test exceeds 0.05, it confirms the assumption of normality for the distribution of error scores, allowing the researcher to proceed with this analysis.

The results regarding the normality of the error score distribution within the research variables were examined. Since the significance level of the Kolmogorov test for arithmetic skills was greater than 0.05, the null hypothesis (that the distribution of error scores is normal) was confirmed. Consequently, the hypotheses were analyzed through multivariate and univariate analyses of covariance, the results of which will be reported subsequently. In this analysis of covariance, the scores of both the criterion and auxiliary variables (pre-test) were utilized to extract their mean, standard deviation, and covariance according to the levels of the experimental variable (the study groups). The indicators for arithmetic skills provided below will serve as the basis for calculating the multivariate analysis of covariance.

Discussion

The results indicated that both executive function training and play therapy interventions have positive effects on students with learning disabilities in understanding mathematical concepts. It can be concluded that there is no significant difference in the effectiveness of these two approaches for teaching mathematical concepts to students with learning disabilities. In

other words, both group training in executive functions and play therapy are effective for enhancing the mathematical understanding of these students.

Moreover, the beneficial impact of play therapy on learning mathematical concepts can be explained by the idea that children's interest in play serves as a foundation for deep learning in mathematics. Play therapy is an effective method for developing imagination, analytical thinking, and creativity in children. Through play, children can explore concepts such as size, weight, length, volume, and distance in a hands-on manner, which helps to increase their attention and engagement.

Attention is critical in the learning process, particularly in mathematics. As Bandura states, any learning begin with attention and insufficient attention can hinder an individual's ability to learn. Therefore, since attention is a vital factor in teaching and learning, enhancing attention skills through executive function training can also improve mathematical performance.

Keywords: Executive functions, play therapy, mathematical concepts, mathematical learning disability

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