

# The Effectiveness of Play Therapy in Improving Attention and Working Memory in Students with Specific Learning Disorders

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## Abstract

**Background:** One of the most prominent challenges faced by students with learning disorders is attention and working memory deficits. This study aimed to investigate the effectiveness of play therapy in improving attention and working memory in students with specific learning disorders.

**Methods:** The study employed a quasi-experimental design with pre-test and post-test measurements, including a control group. The statistical population consisted of all fourth-grade students with specific learning disorders in Dezful, Iran, in 2022. Thirty students were purposively selected and allocated to either an experimental or control group, with 15 participants in each group. The experimental group received play therapy sessions (ten 90-minute sessions and one session per week), while the control group received no intervention. The Test of Variables of Attention (TOVA) and the Working Memory Test Battery for Children (WMTB-C) were used for data collection. The analysis of covariance was used to analyze the data via SPSS version 26.

**Results:** The study included 30 students with specific learning disorders, aged  $10.24 \pm 2.26$  years. In the pre-test stage, the experimental group's mean scores for central executive, visual-spatial sketchpad, and phonological loop were  $59.47 \pm 2.03$ ,  $44.80 \pm 3.21$ , and  $64.27 \pm 1.62$ , respectively. In the post-test stage, these means increased to  $71.87 \pm 3.24$ ,  $59.87 \pm 2.97$ , and  $78.73 \pm 2.93$ , respectively. Furthermore, the experimental group's mean attention scores increased from  $69.53 \pm 16.81$  in the pre-test stage to  $84.93 \pm 14.35$  in the post-test stage. The findings indicated that play therapy was effective in improving the attention and working memory of students with specific learning disorders ( $P < 0.001$ ).

**Conclusion:** The results suggested that play therapy can be an effective intervention for improving academic achievement by enhancing attention and working memory in students with specific learning disorders.

**Keywords:** Learning disabilities, Play therapy, Attention, Memory, Students

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## 1. Introduction

Specific learning disorder is a prevalent childhood developmental disorder (1). It refers to a condition in which one or more fundamental psychological processes, such as language comprehension or usage, are impaired, resulting in difficulties with listening, thinking, speaking, reading, writing, spelling, or performing mathematical calculations (2). Learning disorders are not indicative of impaired intelligence or motivation. Children with learning disorders are not lazy or unintelligent; they possess the same level of intelligence as their peers, but their brains process information differently (3, 4). Specific learning disorders affect 5% to 15% of children, with boys more likely to be affected than girls (5).

Impairment in executive functions can both cause and be a result of specific learning disorders. Executive function skills coordinate cognitive-

motor output, performed by the prefrontal or front striatal areas, with the cooperation of other neural circuits. As a result, targeted behaviors are executed in a planned, flexible, relevant, timed, and appropriate manner (6, 7). Executive functions refer to a general term for cognitive processes that include working memory, attention, problem-solving, verbal reasoning, cognitive flexibility, planning, response inhibition, and initiation and monitoring of activities (8). Attention, response inhibition, and working memory are among the most important executive functions (9). Attention is closely related to an individual's memory, and individuals with attention impairment cannot process information, lose opportunities to store and recall information, and experience memory impairments (10). Defects in these processes also affect other cognitive processes, particularly learning (11).

Working memory is a cognitive system with

a limited capacity that can hold information temporarily (12, 13). This strategy allows individuals to impose an organizational framework on the material they intend to learn and make it meaningful. This framework can be specific to new information, such as a type of internal organization, or linked to present knowledge. Since working memory has limited capacity and we cannot focus on many learning items simultaneously, we can use organization to reduce memory loads, enhance concentration power, and improve attention to enhance our performance (14).

Currently, several methods are employed to aid children with learning disorders and promote their abilities, including play therapy (15). Play therapy is the systematic use of a theoretical model to create an interpersonal process that helps prevent and solve the client's problems, achieve favorable development, and nurture using the therapeutic power of play (16). For a child with these problems, play therapy includes targeted games and systems based on reward and deprivation. Play therapy is described as a creative task in child psychotherapy (17, 18). Today, the progress of play therapy has advanced so much that it is now considered as an effective and helpful factor in individuals' mental health. The therapeutic power of play therapy is utilized in various ways (19, 20). Research has suggested the effectiveness of play therapy in improving sustained attention and working memory in children with attention deficit hyperactivity disorder (ADHD), improving executive functions, and reducing anxiety in students (21-25).

Given the challenges faced by children with learning disorders in their social development and the fact that only their academic performance has been considered thus far, there is a need to investigate and address these factors through play therapy. The results obtained can serve as a guide for researchers and therapists working in the field of learning disorders and provide a practical program for public and private schools dealing with learning disorders. Accordingly, this study aimed to investigate the effect of play therapy on improving attention and working memory in students with specific learning disorders.

## 2. Methods

This study was quasi-experimental research

with a pre-test-posttest design and a control group. The statistical population of the study consisted of all male and female fourth-grade students with specific learning disorders who received educational and rehabilitation services at public and private centers for learning disorders in Dezful city, Iran in 2022. The inclusion criteria were as follows: living with both parents, not being a child of divorced parents, obtaining parents' consent for their children's participation in the study, having no diagnosis of autism or intellectual disability, not taking medication, and studying in the fourth grade of elementary school. Exclusion criteria included being absent from more than two treatment sessions and undergoing drug therapy. Thirty eligible participants were selected randomly and assigned into either the play therapy intervention group or the control group, with 15 participants in each group. The sample size was determined based on G\*Power, with a test power of 0.95, an effect size of 1.27, and a significance level of 0.05 (26). To comply with ethical principles, a summary of play therapy sessions was also provided to the control group after the end of the intervention sessions.

### 2.1. Measures

#### 2.1.1. The Test of Variables of Attention (TOVA)

The Test of Variables of Attention (TOVA) is a continuous performance test designed to measure attention. Originally introduced to evaluate children with ADHD, it is currently the most commonly used tool for diagnosing continuous attention. The test uses language-independent visual stimuli and is scored by a computer system. Improvements in continuous attention are indicated by reduced reaction times, omission errors, and response presentation errors, as well as an increase in the number of true responses. TOVA scores range from 38 to 105, with a higher score indicating greater attention (27). A study by Hosseini and Talepasand (28) reported Cronbach's alpha coefficient of 0.82 for this test. In the current study, eleven experts confirmed the validity of the TOVA, with a content validity index (CVI) of 0.92 and a content validity ratio (CVR) of 0.89. The Cronbach's alpha coefficient was 0.87.

#### 2.1.2. Working Memory Test Battery for Children (WMTB-C)

The Working Memory Test Battery for Children

(WMTB-C) was designed by Pickering and Gathercole (29) based on Baddeley and Hitch's three-component model (central executive, visual-spatial sketchpad, and phonological loop) to measure the working memory (overall cognition and development) of children and adolescents aged 5-15 years. The total score of an individual's performance in these three components specifies their working memory quotient. The minimum score in the central executive, visual-spatial sketchpad, and phonological loop is 48, 38, and 57, respectively, and the maximum score in these three subscales is 86, 70, and 90, respectively. A higher score indicates greater working memory. Delfani and colleagues (30) reported Cronbach's alpha coefficient of 0.93 for this test. In this study, eleven experts confirmed the validity of the WMTB-C, with a content validity index (CVI) of 0.97 and a content validity ratio (CVR) of 0.94. The Cronbach's alpha coefficient was 0.90.

## 2.2. Procedure

The participants in this research were divided

into two groups, an experimental group and a control group, using a table of random numbers and a simple random assignment method. In this method, even numbers were assigned to the game therapy group, while odd numbers were assigned to the control group. Each student was randomly assigned into one of the groups based on the allocation of odd or even numbers. After the participants were assigned into the experimental and control groups, a pre-test was conducted using the research tools. Play therapy sessions were conducted in ten weekly group sessions, each lasting 90 minutes, based on play therapy techniques (31). A summary of the play therapy sessions is presented in Table 1. The control group did not receive any intervention program during this period. After the play therapy sessions, both experimental and control groups underwent a post-test.

## 2.3. Statistical Analysis

Descriptive statistics including mean and standard deviation were used to analyze the data

**Table 1:** The explanation of play therapy sessions

Sessions	Session Content	Tool
First	Diagnosing the students' functional levels, familiarizing children with each other, reinforcing the members' communication, promoting balance and stability, increasing the spatial awareness level, increasing eye-hand and eye-foot coordination, increasing kinetic and tactile awareness	Balance board
Second	Learning new skills and normal communication, obtaining information regarding oneself and one's problems, promoting eye tracking ability, improving the lateral status and orientation, the ability to distinguish and decode vision, hand-eye coordination	Tracking marbles on the ramp
Third	Discharging energy and reducing impulsive behavior, improving coordination and agility, eye-hand and eye-foot coordination	Tire game
Fourth	Focusing the treatment on self-control, increasing accuracy and concentration, and strengthening hand fingers	Marble playing
Fifth	Teaching solutions regarding the ways of treating people, teaching skills for the student's daily performance, reinforcing the visual perception of the image and context, recognizing differences and similarities, improving transfer patterns in eye-foot coordination	Ladder- stepping
Sixth	The student understands the importance of the level of success in performing a task, increasing hand-eye coordination, developing self-concept, and helping the child jump off the ground	Palanger (touches intended objects by jumping)
Seventh	Improving hand movement coordination and balance, improving body image and body awareness, improving sequence skills, auditory association, and specification	Bending (the person must place the intended hand and foot on the pointed geometric shapes)
Eighth	Identifying their cognitions, helping identify cognitive distortions, and replacing maladaptive thinking with adaptive thinking	Tangram (a picture is shown, and the person must complete the picture with the help of visual memory)
Ninth	Accepting responsibility, expressing the interaction between the student's thoughts-feelings and behavior, increasing self-concept, discharging energy and spatial awareness, improving hand-eye coordination	Foot thrower game
Tenth	Increasing and reinforcing the skill of coping with negative emotions and problem-solving skills given the chronological age, improving flexibility, improving muscle strength, improving social reaction	Tube game

in the pre-test and post-test stages. Inferential statistics, specifically the analysis of covariance, were also employed. Normality of the data was assessed using the Kolmogorov-Smirnov test, and Levene's test was used to verify the assumption of homogeneity of variances. The means of the experimental and control groups were compared using independent t-tests, paired t-tests, and chi-square tests. The data was analyzed using SPSS version 26.

### 3. Results

Participants in this study were four male and female students with specific learning disorder. The mean and standard deviation of the age of the students in the play therapy and control groups were  $10.03 \pm 2.19$  and  $10.44 \pm 2.32$  years, respectively. Table 2 displays the demographic characteristics of the students. The mean and standard deviation of the research variables in the pre-test and post-test stages for both the experimental and control groups are presented in Table 3.

Before analyzing the data related to hypotheses, the assumptions of the analysis of covariance were assessed to ensure that the data for this research met these assumptions. For this purpose, normality of the data was assessed using the Kolmogorov-Smirnov test, which indicated that the working

memory variables of the central executive subscale ( $F=1.332$ ;  $P=0.177$ ), the visual-spatial sketchpad subscale ( $F=1.217$ ;  $P=0.200$ ), and the phonological loop subscale ( $F=1.136$ ;  $P=0.159$ ), as well as the attention variable ( $F=1.203$ ;  $P=0.061$ ), followed a normal distribution. Additionally, Levene's test was used to assess the homogeneity of variances (to determine the similarity of the variances of the two experimental and control groups) and was obtained in the working memory variables of the central executive subscale as ( $F=1.164$ ;  $P=0.307$ ), in the visual-spatial sketchpad subscale as ( $F=0.035$ ;  $P=0.872$ ), and in the phonological loop subscale as ( $F=0.441$ ;  $P=0.510$ ), as well as in the attention variable as ( $F=1.264$ ;  $P=0.287$ ).

Based on these results, the analysis of covariance test can be used. The analysis of covariance was then used to compare the experimental and control groups based on post-test scores, after controlling the effects of pre-tests, to determine the effect of play therapy intervention on working memory and attention in children with specific learning disorders. The results of the analysis of covariance indicated that the play therapy and control groups had significant differences in at least one of the dependent variables ( $P < 0.001$ ). The F ratio of the univariate analysis of covariance for the dependent variables showed a significant difference in attention and working memory between the play

**Table 2:** Demographic characteristics of the students

Groups	Age (year)	Gender		Birth order of the child in the family		
		Girl	Boy	First	Second	Third
Play therapy	$10.03 \pm 2.19$	7 (46.67%)	8 (53.33%)	8 (53.33%)	5 (33.33%)	2 (13.34%)
Control	$10.44 \pm 2.32$	9 (60.00%)	6 (40.00%)	9 (60.00%)	3 (20.00%)	3 (20.00%)
P	0.615	0.472		0.684		

**Table 3:** Mean and standard deviation of research variables regarding experimental and control groups in the pre-test and post-test

Variables	Groups	Pr-etest	Post-test	P (within-group comparisons)
		Mean $\pm$ SD	Mean $\pm$ SD	
Working memory (central executive)	Play therapy	$59.47 \pm 2.03$	$71.87 \pm 3.24$	0.001
	Control	$59.60 \pm 1.72$	$59.47 \pm 1.99$	0.850
P (Between-group comparisons)		0.851	0.001	-
Working memory (visual-spatial sketchpad)	Play therapy	$44.80 \pm 3.21$	$59.87 \pm 2.97$	0.001
	Control	$46.47 \pm 2.13$	$47.20 \pm 2.78$	0.426
P (Between-group comparisons)		0.104	0.001	-
Working memory (phonological loop)	Play therapy	$64.27 \pm 1.62$	$78.73 \pm 2.93$	0.001
	Control	$64.20 \pm 1.93$	$65.67 \pm 4.96$	0.294
P (Between-group comparisons)		0.915	0.001	-
Attention	Play therapy	$69.53 \pm 16.81$	$84.93 \pm 14.35$	0.010
	Control	$61.47 \pm 8.14$	$64.67 \pm 9.85$	0.340
P (Between-group comparisons)		0.106	0.001	



therapy and control groups, indicating that play therapy improves attention and working memory in students with specific learning disorders ( $P < 0.001$ ).

#### 4. Discussion

The aim of the present study was to investigate the effect of play therapy on improving attention and working memory in students with specific learning disorders. One of the key findings of this research was the effectiveness of play therapy in improving attention, which is consistent with the results of Kazemi and colleagues' study on the effectiveness of play therapy in improving attention among students (32). This finding can be explained by the fact that attention and focus are based on coordination and balance of general ability and cognitive proficiency. Previous research on children with learning disorders has shown that these children possess potential abilities that are not able to emerge and manifest due to the presence of some neurocognitive disorders (32). The treatment process for these children includes identifying their potential abilities, developing them, identifying neurocognitive disorders, and engaging in regular exercises to eliminate and adjust them.

One of the prominent characteristics of children with learning disorders is the presence of significant differences between their potential ability and their actual ability (2). Regular motor-cognitive exercises can be effective in actualizing the abilities of these children. Play therapy involves various cognitive exercises that focus on identifying and developing the child's potential abilities. The play therapist identifies the child's strengths and weaknesses through various games and motor-conceptual exercises and emphasizes the strengths to facilitate the development of potential abilities. However, children with learning disorders also suffer from brain defects. In the temporal section of children with learning disorders, the left hemisphere is less asymmetric than the right hemisphere (33). Children with reading disorders may experience more weaknesses in their effective memory and decoding processes than in their attention or long-term memory. Overall, it is hypothesized that developmental factors contribute to the incidence of learning disorders (31). Regular sports exercises and motor-sensory games can be effective in increasing the coordination between the two hemispheres.

On the other hand, the results indicated that play therapy was effective in improving working memory in students with specific learning disorders. This finding is consistent with the results of Karamalian and colleagues' study on the effectiveness of child-centered game therapy on the working memory of children with learning disabilities (34). To explain this finding, it can be said that one of the problems that has attracted the attention of psychologists and physicians in recent years is learning disorders. Various characteristics have been suggested for these children, including limited and inefficient communication with the outside world and improper use of memory. Children with learning disorders have difficulties in remembering visual-auditory stimuli and using memory strategies. Teaching these constructs can lead to improving the child's academic performance. Play therapy with specific content and goals targeting memory components, including visual-auditory stimuli, was implemented for children using play equipment, images, numbers, and letters (34). Games such as "Tell me soon what was on the table" aim to recall images, and auditory memory games in the form of happy and exciting games make the child's attention focused on the images and sounds, leading to the empowerment of visual-auditory memory in children. This enables them to recite stories and poems and describe past week's memories in detail, culminating in increasing the child's self-confidence. Research on children with learning disorders indicates that memory impairments in working memory are associated with reading, writing, and mathematics disabilities (32). Thus, the use of visual-auditory memory exercises is effective in improving children's working memory and, hence, reducing learning problems.

##### 4.1. Limitations

The limitations of this research included the lack of control over the educational, economic, and social levels of the families, the limited generalizability of the results to higher educational levels, and the restriction of the research to academic levels. Furthermore, since the statistical population of the research was limited to students with learning disorders in the city of Dezful, caution should be taken when attempting to generalize the results to other cities. The lack of a follow-up stage also precludes investigation into the generalizability of the results over time. It is recommended that

future studies combine the research variables with gender controls to allow for comparison between male and female students with learning disorders. In addition, to evaluate the durability of the results over time, conducting a follow-up phase is suggested for future studies.

## 5. Conclusion

In conclusion, play therapy has been shown to be effective in improving attention and reducing working memory problems in children with learning disorders. These students often struggle with visual-auditory perception and spatial orientation. The use of perceptual-motor games has been found to be effective in improving brain function in students with learning disorders. By developing visual, auditory, and spatial information processing, the use of perceptual-motor games can lead to improvements in cognitive and verbal performance in children with these challenges.

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## Ethical Approval

The study was approved by the Ethical Committee of Islamic Azad University-Ahvaz Branch with the code of IR.IAU.AHVAZ.REC.1401.006. Also, written informed consent was obtained from the participants.

**Conflict of Interest:** None declared.

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