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The effectiveness of sensorimotor games on the learning rate of children with dyslexia

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Abstract
The purpose of this research is the effectiveness of sensorimotor games on the learning rate of children with dyslexia. The population of this research includes all primary school students in Shiraz city in the academic year 2023_2024. In the quasi-experimental research, 30 people are selected for sampling. And since the current research is of a quasi-experimental type, 32 people were selected for random sampling.
To measure the studied variable, the reading test questionnaire of Karami Nouri and Moradi was collected before and after the intervention in both groups. The findings showed that sensory-motor games significantly Improved the performance of people in the experimental group in the reading variable in the post-test stage.
The results of analysis of covariance also showed that sensorimotor skills effectively improve balance and reading ability In dyslexic children. Therefore, attention to these findings and the effective mechanism of this treatment method can have a useful therapeutic effect to reduce the problems of people with dyslexia.
Keywords: sensorimotor games, learning, children, dyslexia

Introduction and statement of the problem
Among the challenges facing our education system are learning disabilities that lead to academic failure and retardation. Persian is one of the most difficult languages, with several exceptions that make learning difficult for students with learning disabilities. Reading and writing are essential in today's world and a person who has trouble with these two basic skills is at a huge disadvantage. (Staki et al., 2015).
Reading is one of the most important methods of acquiring knowledge. Weak reading skills show great vulnerability in learning different subjects in all school years and beyond.(Khademi et al., 2022).
Playing as a game is one of the most important ways for children to learn and grow. Educational and psychological researchers have argued that play is a powerful mediator in learning various skills throughout people's lives. Movement programs and goal-directed games and other learning and training activities are a suitable platform to practice and repeat some movement concepts in elementary grades (Keshavarz and Mohammadzadeh, 2022)
The important processes of childhood, which are considered integral activities of children, as well as countless discoveries, on the one hand, movement is the most important game, and on the other hand, it is a basic cognitive tool for child development.
Movement, especially rule-based games, which are simple forms of drama, music, poetry and song, have qualities such as rhythm, harmony, song and music; So that the sensory and motor skills of children are used purposefully in this type of games. Children who experience movement and coordination in purposeful play gain more control and confidence in outdoor spaces.
Sensory and motor exercises ultimately lead to brain skills, skills that increase children's spatial and social perception (Faramarzi et al., '2019). Errors in children's executive functioning predict their academic success in school to a large extent. These skills are

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internal processes that children use to learn and to manage and control learning tasks.

If neuropsychological deficits, such as deficits in executive functions, are not diagnosed early and treated appropriately, such problems persist into adulthood and cause children to have problems with school work and social behavior (Pishghadam et al., 2017).

In this regard, Zelazo and Muller ”2010) reported that early educational and psychological interventions are effective in improving skills or key growth Indicators, including children’s executive functions and attention.

Therefore, such children's problems can be overcome by timely action, for example playing. As Diamond (2013) argued, teaching children early In their development through games and fun activities can enhance higher cognitive levels such as executive functions. Playing Is one of the most important factors in children's life, and children can learn and develop their basic skills through playing.

It is very important to make the most of the situations and areas of the game to transmit educational messages directly, or non-verbally, verbally or not, to expand cognitive behavior, developing motor skills, generalization and social responsibility.

In this context, movement and physical activity in games support children's learning, but are useful for expressing children's needs, emotions, interests and creativity. In addition, games are an opportunity for the growth and development of fine and gross motor skills and provide the basis for the child's physical health (Hossein Khanzadeh et al., 2018).Sadati-Firouzabadi and Abbasi (2017) conducted a study on the effectiveness of computer-based interventional therapy for reading problems in students with learning disabilities. Studies have shown that cognitive-motor interventions lead to improvements in the reading problems of students with learning difficulties.

Snowling et al. (2020) conducted a study Dyslexia and developmental language disorder: disorders with specific effects on reading comprehension. The results indicated that, considering these findings and the mechanisms of effectiveness of this treatment method, it can have a useful therapeutic effect in solving the problems of people with dyslexia. Children with dyslexia are at risk for reading comprehension. However, for various reasons, such as poor decoding in dyslexia or poor oral language skills, different forms of intervention are necessary for this group of children.

Eroğlu et al (2022) conducted a study on multisensory learning in children with dyslexia. The results showed that the experimental group showed significantly less complexity than the typically developing group at the lowest and middle time scales. In addition, the experimental group received 60 sessions of neurofeedback and multisensory learning, each lasting 30 minutes, along with automatic brain training. After treatment, the lower complexity of the experimental group increased to that of the developing group at lower and intermediate levels in all channels.

Akbar and Tohar (2021) conducted a study titled Basic Motor Skills and Sensory Movement Strategies for Early Childhood Learning.

The results showed that young children need systematic and controlled movement skills in everyday life, such as running, jumping, playing with objects and self-control. Learning movements based on the principles of movements and sensory movements is an alternative to provide children with a sensory experience. Motor Learning Solutions These activities are integrated into early childhood learning processes. Therefore, online basic skills and sensory motor exercises for participatory learning and independent experiences in children's early learning are very important to optimize children's growth and development.

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Considering the prevalence of dyslexia among Iranian children and the negative impact of this disease on children's personal and social life and educational development, as well as Its negative psychological effects, the rest of the family economy will face insurmountable problems. And since the research results In this area are full of apparent contradictions, this study was conducted to find out the effectiveness of sensory games on the learning speed of children with dyslexia.

research method

This study is a quasi-experimental study focusing on pre-test, post-test and control group. The subjects of both groups were evaluated in two phases: a test before the start of the training and a post-test after the training. The statistical population of the study consisted of all students aged 6 to 12 who were studying in Shiraz schools in 2022_2023.

After referring to the education department of Shiraz and making the necessary arrangements and according to the information obtained, 10 boys' primary schools were randomly selected from the list of schools in this city.

First, in each primary school, the third grade teachers were asked to introduce the students who are weaker than their classmates in terms of reading such as reading words fluently and reading comprehension. A total of 64 students suspected of having reading problems were introduced by the teachers.

After the initial screening, all students were evaluated based on the diagnostic criteria of reading disorders included in the Diagnostic and Statistical Manual of Mental Disorders, including verbal intelligence above 90, reading and spelling progress lower than expected, and the absence of emotional problems or sensory deficits.

To evaluate the students' reading and comprehension performance, the Karami Nouri and Moradi reading tests were used, and the Children's Verbal Intelligence subtest was used to evaluate their verbal intelligence. After evaluating the above criteria, 32 out of 64 students were selected as dyslexic. Subjects were matched based on pre-test scores and verbal Intelligence and were randomly assigned to two experimental and control groups.

For two months, the experimental group received 12 sensory-motor stimulation intervention sessions with an emphasis on the senses. While the control group did not receive any Intervention and only participated In the usual educational programs of the school and participated in pre-test and post-test evaluation sessions.

The considered exercises were performed In a group In a quiet room, away from disturbing audio and visual stimuli, while observing security issues. And the research tools were used individually for each student present in the above research and the desired answer was recorded. Finally, the data was analyzed using descriptive (mean and standard deviation) and inferential (covariance analysis) methods using SPSS-21 software.

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Research findings

Table 1: Descriptive data of the performance components of the participants in the pre-test and post-test according to the experimental and control groups.

Post-test		Pre-test			
standard deviation	Mean	Standard deviation	Mean	Groups	Variable
۶/۶۲	۱۸/۳۴	۵/۳۴	۱۲/۸۹	Experiment	Reading performance
۴/۶۷	۱۳/۲۲	۴/۶۵	۱۲/۹۲	Control	

As the data in Table 1 shows, there was a difference between the average of the two groups at different execution times and in two scales.

Covariance analysis was used to examine the difference between the means and to test the hypotheses due to the presence of an extraneous source of diffraction with a minimum distance scale that cannot be directly experimentally controlled (pre-test) and due to the existence of a dependent variable.

To ensure that the normality and homogeneity of variance assumptions were not violated in the analysis of covariance test, the Kolmogorov Smirnov test was used and to check the homogeneity of variances, Levin's test was used.

None of these two tests were significant in all research variables (P>0.050); This means that the desired variables in the research community had a normal and homogeneous distribution. Therefore, there is no obstacle to using covariance analysis test.

Table 2. Summary of the results of the covariance analysis of the difference between the two groups

Test power	Eta coefficient	P	F	Mean	Degree of freedom	Total	Source of change	Variable
۱/۰۰	۰/۸۹	۰/۰۰۱	۴/۰۳	۱۱۳/۱۰	۱	۱۱۳/۱۰	Pre-test	Reading performance
		۰/۰۰۱	۱۰/۲۹	۴۲۵/۵۱	۱	۴۲۵/۵۱	Group (post-test)	
		-	-	۳۱/۴۱	۲۹	۱۲۱۸/۵۵	Error	
		-	-	-	۳۲	۴۸۲۱۶	Total	

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In order to test the effect of intervention programs on the dependent variable, the pre-test effect was neutralized as a confounding factor. The results of Table 2 show that the difference between the studied groups in the test of balance performance and reading performance was statistically significant.

Based on these results and considering the pre-test scores as a covariance variable, the intervention methods led to a significant difference between the two experimental and control groups ($P < 0.001$).

In addition, the value of eta coefficients in the reading performance test was 0.89. That is, 89% of the variance of reading performance post-test scores is explained by intervention.

Conclusion

The present study was conducted with the aim of the effectiveness of sensorimotor games on the learning rate of children with dyslexia. As the findings of the research showed, there was a significant difference between the pre-test and post-test scores in the experimental group under sensorimotor games and this treatment improved the reading performance of dyslexic children.

The results of the present research are in line with the findings of Sadati Firouzabadi and Abbasi (2017); Snowling et al. (2020); Eroglu et al. (2022) and Akbar and Toher (2021), in which the effectiveness of sensorimotor games improves the performance of dyslexic children in different areas.

In explaining these findings, it can be continued throughout life, but progress in movement skills requires reaching biological and psychological systems, and learning also plays an undeniable role in this progress.

In following the growth of children's movement skills, it is clear that the changes in movement behaviors progress through a hierarchical system from simple movements to complex movements. Any defect in these steps will cause stoppage and defects in more complex steps. Gross and fine motor skills are among these skills (Emmons and Anderson, 2005).

In explaining the findings of this hypothesis, it can be said that game-based learning is an interactive activity that is based on games, which are inherently attractive, and increases learning through a positive emotional experience.

Games are not only fun, but they can deepen communication and enable more learning.

By introducing challenging activities that are attractive to students and facilitate their connection to exploration. Educational games can create valuable skills such as logical thinking, planning, communication, use of numbers, negotiation skills, group decision-making, and data acquisition (Johansen, 2018).

Sensorimotor models can strengthen students' life skills, and children who master fine motor skills are believed to have better self-esteem and confidence. These movements are basic movements or basic patterns for other specific skills, but complex movements are used at later stages of development, when children play. Information about sensory input difficulties can help educators identify and analyze different types of barriers.

(Duff et al., 2019).

This study had several limitations, including the failure to use follow-up tests, which means that future studies would be better off considering the follow-up period as a more accurate indicator of the man's condition. Sampling was also important in this study. Modeling is a type of model that can be used with limited generality. It is recommended to choose a larger sample than a random sample to increase the generalizability of the results.

According to the results of this research and similar researches in this field, it is suggested that the lesson activity, reading, should be accompanied by a sensory-motor game so that the pleasantness of the game is linked with the lesson and the student becomes

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interested in the lesson. Therefore, educational programs of sensory-motor games should be used in schools to teach reading, to increase internal motivation and interest in Persian reading.

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