

The Effectiveness of Perceptual-Motor Exercises on Reading and Dictation Performance in Second-Grade Female Students at Primary School with Learning Disabilities in Tabriz

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Abstract

Background and Objective: This study aimed to determine the effect of perceptual-motor exercises on reading and dictation performance in second-grade female students at primary school with learning disabilities in Tabriz.

Method: The research method is descriptive in terms of quasi-experimental type in which a pre-test-post-test research design with a control group was used. The statistical population included all second-grade female students at primary school with learning disabilities in Tabriz. The statistical sample was 20 students who were selected using the convenience sampling method and assigned randomly to the experimental and control groups. Perceptual-motor interventions were performed in 10 sessions by the researcher for the experimental group in two 45-minute sessions per week. The tools used included the educational package of exceptional education called timely intervention for education and rehabilitation of new students with general learning difficulties and reading diagnostic test. Research data were analyzed by analysis of covariance method. Software (SPSS) was used for data analysis.

Findings: Findings indicated that perceptual-motor exercises had an effect on reading speed and accuracy and dictation of students in the experimental group.

Conclusion: Calculated effect size on reading and dictation indicates the high effect of perceptual-motor exercises.

Keywords: Learning disabilities/ Perceptual-Motor / Reading / Dictation.

1. Introduction

Learning is one of the fields with a special importance in psychology. The most common childhood disorder is learning disability. There are three types of learning disabilities, including reading disability, writing disability, and math disability [1]. The term learning disabilities derives from the necessity to identify and serve students who consistently fail in their homework; however, they do not include into the traditional context of exceptional children. Learning disabilities refers to a heterogeneous group of disorders in acquiring, listening, speaking, reading, writing, reasoning, or mathematical abilities.

Children with dictation or dysgraphia disability or writing deficiency (writing disorder) are much weaker than expected from their chronological age, IQ and educational background. The child cannot write easily and makes grammatical, punctuation, paragraphing and educational mistakes in writing and has a terrible handwriting [1]. According to researchers, the most important components of written expression disorder are: handwriting, spelling and

composition [2]. Dictation and spelling require lettering with letters in an acceptable way. Words can be spelled orally. However, their written form is far more important [3].

Dyslexia or reading disability is a term for children who, despite having normal intelligence and without significant sensory impairment, have problems in reading, understanding, spelling, and writing, so that these problems emerge in processing speed, short-term memory, and perception of visual and auditory perception chains [4]. Visual-spatial ability is a complex process that includes the child's ability to visualize objects mentally, the ability to distinguish between objects, orientation, left and right detection, and the ability to recognize relationships between objects in space [5].

In a broad sense, perceptual-motor action is any voluntary movement that relies on sensory information to process performance information. In fact, all voluntary movements may be considered as a perceptual-motor action. Movements that are controlled in the lower parts of the brain (reflexions) are the only movements that do not require elements of perception. "Reference [6]" indicated in their research that teaching perceptual-motor skills to students with special learning disabilities can improve students' academic performance in reading, writing and math skills. Cornoldi & et al. [7] in a study indicated that children differ in the type of learning difficulty, gender, and performance. In a study conducted by Doabler & et al. [8] and also in a study conducted by Bakker & et al. [9] on dyslexia or reading disability, etiology of this study showed that the right hemisphere of the brain plays a significant role in learning to read.

In a study conducted by Rachel Sermier Dessemontet et al. [10], the effects of a phonology-based reading intervention program were assessed, students in the treatment and experimental group had a significant improvement in (Word) and non-word reading designed by the tester. This study aimed to examine the effectiveness of perceptual-motor exercises on visual-spatial processing and reading performance of second grade female students at primary school with learning disabilities in Tabriz and its results can be used in schools and centers for learning disabilities and counseling centers.

2. Research methodology

The research method was quasi-experimental and a pre-test post-test research design with control group. The statistical population included all second-grade female students at primary school with learning disabilities in Tabriz. Statistical sample included 20 students who were selected from the centers of learning disabilities in Tabriz using the convenience sampling method, and were randomly assigned to the experimental and control groups. The tools used in this study included the educational package of exceptional education called timely intervention for education and rehabilitation of students with general learning difficulties and reading diagnostic test [11].

To assess the placement of basic skills and education prerequisites and the intervention program, the educational package of exceptional education called timely intervention of education and rehabilitation of new-learners with general learning problems (feebleminded) was used in which the sample of proposed educational and rehabilitation strategies is presented separately by verification lists and observance of the hierarchy of educational steps. The content validity of this package is approved by the experts of the Exceptional Education Organization which is currently used in the exceptional schools [12].

During the intervention process, the 10-student experimental group received ten 45-minute sessions of educational content of perceptual-motor games and 2 sessions before the intervention and after the intervention were allocated to pre-test and post-test. The educational content of perceptual-motor games was made by the researcher and approved by the professors of the Islamic Azad University and the professors of exceptional education (Table 1).

Table 1. Intervention

Time	Content of perceptual_ motor games training	Session
45 minutes	Familiarity with the method, explanation of the purpose and necessity of intervention for parents- Familiarization of the child with the coach and playroom	1
45 minutes	(Connecting similar shapes) - Play with directions (left, right, up, down, etc ...) - (Moving - standing - going back) - (Threading the beads according to the pattern) - two-part commanding	2
45 minutes	Cutting- Visual completion (completing the shape) - Lee Lee game - Recognizing the touch of different parts of the body to strengthen the sense of depth	3
45 minutes	Touching objects and enhancing the sense of depth with the sense of touch - Crossing the obstacle - Jumping - Using the upper hand - Recognizing polygon shapes and copying them	4
45 minutes	Walking on the board - balancing and standing on one foot - picking dominoes - recognizing sounds	5
45 minutes	Recognizing the shape from the background - Practicing writing with the help of the sense of touch - Puzzle games – cutting- playing with words	6
45 minutes	Visual completion - Use of non-superior hand - Pencil movement game between thumb and fingers - playing with words	7
45 minutes	Puzzle game - Lee Lee game - Cutting- Drawing a line and a dot - Playing with words (similarity in rhyme - beginning - end)	8
45 minutes	Visual completion - playing cards - word completion - writing the word on sand or salt	9
45 minutes	Going through the maze with the touch of hand and coloring it - moving the pencil between the lines - completing the word - playing cards to strengthen visual skills - playing with words	10

SimaShirazi and Nilipour's[11] reading diagnostic test were used to collect dictation data. This test consists of 25 words, 6 of which are given in the form of combinations of described and adjective or added and possessive (with the aim of examining how to connect two words to each other). This test includes twenty two 25-point sentences, the number of words that the child has written correctly is counted, and in 2-word combinations, each word that is written correctly is given a point, and finally the percentage of the child's dictation point is calculated.

$$\frac{\text{The number of correct words}}{25} * 100$$

The test validity means the efficiency of test in measuring the target variable. Since the first Persian book was used as a criterion in making the texts for reading this test, the list of all the words in this book with their frequency was completely examined. It was asked from three teachers of first grade students and three linguists about these texts, and then 605 first-grade children in 20 schools in 10 districts were studied experimentally and approved by Exceptional Education.

SimaShirazi and Reza Nilipour's[11] reading diagnostic test was used to collect data. The reading diagnostic test is an individual test consisting of a text reading test and supplementary

tests. How to calculate the accuracy score of sum errors is -20 and reading speed (number of words per minute) was obtained through $(51 \text{ divided by per second multiplied by } 60) \left(\frac{51}{\text{second}} * 60 \right)$ and the percentage of correct answers by the method $(\text{number of correct answers divided by } 5 \text{ multiplied by } 100) \left(\frac{\text{number of correct answers}}{5} * 100 \right)$ and the percentage of errors are obtained by $(\text{counting errors divided by the sum errors multiplied by } 100) \left(\frac{\text{counting error}}{\text{sum errors}} * 100 \right)$.

In order to examine the effect of perceptual-motor exercises on improving the reading performance of primary students, to maintain the effect of pre-test scores of reading performance constant in children of the experimental group (group undergoing perceptual-motor exercises) and the control group (group not received any program) and comparison of their post-test scores, analysis of covariance was used (Table 2). Perceptual-motor exercises had an effect on the reading performance of second-grade female students of primary school with learning disabilities in Tabriz

Table 2: Descriptive statistics of research variables based on pre-test-post-test

	Post-test								Pre-test					Group
	kurtosis	skewness	Thelowest	Thehighest	SD	Mean	kurtosis	skewness	Thelowest	Thehighest	SD	Mean	Number	
/2271	0/983	61	30	/9008	/1042	/7590	0/670	50	20	/8888	/1032	10	Dictation	Reading Experimental
/358-0	0/175	18	6	/5733	/1012	/169-0	0/168-	/5017	4	/0864	/4510	10	Reading accuracy	
/558-0	0/198	42	11	9/72	/1830	1/20-	0/135-	27	12	/3485	/87816	10	Reading speed	
/488-0	1/071	19	2	/6135	/53711	/111-0	1/016-	25	2/50	/2997	/28114	10	Reading error	
/0410	1/457	4	1	/1741	2/40	/8010	0/378-	4	0	/4181	1/30	10	Comprehension	
/2790	0/785	70	15	/89516	/9038	/0431	0/613	68	14	/50516	/8035	10	Dictation	Reading Control
/148-0	1/712	19	5	/0915	/1512	/140-0	1/712-	19	4/75	/1805	/97511	10	Reading accuracy	
/0052	4/971	/0747	12	/91412	/46914	/6141	2/040	35	/6010	/9017	/9916	10	Reading speed	
/4800	3/368	25	2/35	/5695	/87912	/5960	2/049	24	5	5	/32513	10	Reading error	
/4170	1/706	4	0	/7671	1/70	/9680	0/703-	5	0	/9551	1/40	10	Comprehension	

Table 3 shows the mean of experimental and control groups in the variables of accuracy, speed and error of reading and cube design in the post-test.

Table 3: Descriptive statistics of reading components in post-test in terms of group

SD	Mean	Number	Group	Variable
3/573	12/10	10	Experimental	Reading accuracy
5/0913	12/15	10	Control	
2/319	30/18	10	Experimental	Reading speed
2/749	14/469	10	Control	
5/613	11/5370	10	Experimental	Reading error
5/569	12/8790	10	Control	
1/174	2/40	10	Experimental	Comprehension
1/767	1/70	10	Control	

M-Box test was used to examine the equality of variance-covariance matrix of dependent variables, the results of which are as follows:

Table 4: Box test for variance-covariance matrix parity

Significant level	Df2	Df1	F	M-box test
0/179	1549/004	10	1/389	18/408

Table 4 shows that the significance level is greater than 0.001. After assuming the equality, the variance-covariance matrix is not violated; the condition of assuming the equality of the variance-covariance matrix is established to perform analysis of covariance.

The Levene's test was used to examine the assumption of equality of variances, the results of which are presented in the table 5. Table 5 shows that the significance level of the variables of accuracy, speed and error of reading and comprehension is greater than 0.05. According to the assumption of homogeneity of variances, if the significance level is greater than 0.05, the presumption of homogeneity of variances is observed.

Table 5: Levene's test to examine the assumption of equality of variances

Significant level	Df2	Df1	F	Dependent variable
0/217	18	1	1/637	Reading accuracy
0/373	18	1	0/835	Reading speed
0/680	18	1	0/176	Reading error
0/239	18	1	1/484	Comprehension

In order to evaluate the effect of perceptual-motor exercises on improving reading performance of primary students, to maintain the effect of pre-test scores of reading performance constant in children of the experimental group (group undergoing perceptual-motor exercise) and the control group (group not received any program) and comparison of their post-test scores, analysis of covariance was used. According to the results of Table 6, considering that the significance level is 0.002 which is less than 0.05 ($P < 0.05$, $F = 9.319$). The research hypothesis is confirmed.

Table 6: Results of multivariate analysis to evaluate the effectiveness of perceptual-motor exercises on reading performance

Eta square	Significant level	Df error	Df hypothesis	F	Statistic	Test
0/772	0/002	11	4	9/319	0/228	Wilks's Lambda

Perceptual-motor exercises had an effect on the dictation performance of second-grade female students of primary school with learning disabilities in Tabriz. Table 7 shows that the mean of experimental and control groups is 42.10 and 38.90, respectively. Levene's test was used to examine the assumption equality of variances. The significance level of variables is greater than 0.05. According to the assumption of homogeneity of variances, if the significance level is greater than 0.05, the assumption of homogeneity of variances is observed.

Table 7: Descriptive statistics of dictation in post-test in terms of group

SD	Mean	Number	Group
8/900	42/10	10	Experimental
16/895	38/90	10	Control

According to the results of Table 8, the calculated statistical value for the post-test scores of dictation performance in students of both experimental and control groups is significant after maintaining the effect of pre-test constant. ($P < 0.05$, $F = 17.689$). As a result, there is a significant difference between the mean post-test scores of dictation performance in experimental and control group students by maintaining the effect of pre-test scores constant. The calculated effect size ($P = 0.510$) indicates the high effect of perceptual-motor exercises. Thus, the independent variable explains 51% of the variance of dependent variable.

Table 8: Results of analysis of covariance to evaluate the effectiveness of perceptual-motor exercises on dictation performance

Effect size	Significant level	Statistic (F)	Average squares	df	Sum squares	Component
0/933	0/000	236/497	3061/716	1	3061/716	Pre-test
0/510	0/001	17/689	229/010	1	229/010	Group
			12/946	17	220/084	Error
				20	36138	Total

Comparison of the adjusted means of the two groups shows that the mean score of dictation performance in the control group's students ($M= 37.060$) is lower than the experimental group ($M= 43.920$). Thus, perceptual-motor exercises had an effect on the dictation performance of the experimental group's students who received this program compared to the children in the control group who did not receive this program (Table 9).

Table 9: Comparison of adjusted means of experimental and control groups

Up limit	Low limit	SD	Mean	Group
46/334	41/507	1/144	43/920	Experimental
39/493	34/666	1/144	37/060	Control

3. Research findings

Findings indicated that perceptual-motor exercises had an effect on students' reading accuracy and comprehension and dictation performance of the experimental group. Perceptual-motor exercises had an effect on the reading performance of second-grade female students at primary school with learning disabilities in Tabriz. Analysis of covariance was used to answer this hypothesis and the results showed that there was a significant difference between the mean scores of speed, accuracy of reading and comprehension in the experimental and control group's students with maintaining the effect of pre-test scores constant. The calculated effect size indicates the effect of perceptual-motor exercises. However, there was no significant difference between the mean scores of reading error in the experimental and control students with maintaining the effect of pre-test scores constant. The results of the present study are consistent with the findings of Saleki et al. [13], Lindsay et al. [14], Rezaei et al. [15], Zare and Taraj[16].

Therefore, considering that one of the effective factors in dyslexia is deficit in motor skills and cognitive-motor exercises lead to the improvement of motor learning, the best way for children to achieve optimal development in perceptual-motor skills is to develop and implement programs based on the science of motor development and regular perceptual-motor activities from the early years of child growth, especially preschool and primary school. This issue cannot be achieved except by scientific planning and optimal implementation of psychologists, officials, specialists in education and training and physical education to improve the perceptual-motor skills of students with learning disabilities. Consequently, motor skills develop cognitive abilities. Students will not be able to read, write, and perform math at the level required by ordinary schools without proper perceptual-motor skills. As a result, one of the appropriate and necessary solutions to correct and repair the learning problems of such students is to design a selected movement program based on education standards and finally implement this plan in all grades of primary education.

According to the results of the second hypothesis, perceptual-motor exercises had an effect on the dictation performance of second-grade female students at primary school with learning disabilities in Tabriz. Analysis of covariance was used to answer this hypothesis and the results showed that there was a significant difference between the mean post-test scores of dictation performance in the experimental and control group's students with maintaining the

effect of pre-test scores constant. The calculated effect size indicates the high effect of perceptual-motor exercises. Therefore, 0.510% of the variance of the dependent variable is explained by the independent variable. Comparison of the adjusted means of the two groups shows that the mean score of dictation performance in the students of the control group is lower than the experimental group. Thus, perceptual-motor exercises had an effect on the dictation performance of the experimental group's students who received this program compared to the children in the control group who did not receive this program.

The results of research findings are consistent with research findings of Dortaj and Asemi[17], Aghdaei& et al [18], Lupu[19]. Also, the findings of the present study are consistent with the findings of ShahaniYilagh et al. [20], Farid[21] in terms of the importance of motor skills in spelling disability. Although the results of this study are consistent with most of the findings of other researchers on the effect of perceptual-motor skills on students' education performance (such as reading and writing), Singer [22] and SalamatManesh's[23] studies have a significant relationship between perceptual-motor abilities and education performance. The results explain that the outcome of weakening perceptual-motor coordination will be weakening of performance in educational tasks. Thus, perceptual-motor skills by reinforcing underlying processes such as gross motor skills, fine motor skills, eye-hand coordination, and pencil and paper exercises, provide the basis for improving the academic performance of students with special learning disabilities [24].

The findings of this study are also consistent with theories of multisensory and perceptual-motor therapy for learning disabilities. According to these theories, sense and movement are the input channels of information to the brain; therefore, it is necessary that educational measures to focus on strengthening the senses and movements in the process of educating children with special learning disabilities. Educational strategies such as gross motor skills form the development of self-awareness and the role of organs and fine motor skills form the treatment framework. Therefore, considering that one of the effective factors in dysgraphia is deficit in motor skills and cognitive-motor exercises lead to the improvement of motor learning, the best way for children to achieve optimal development in perceptual-motor skills is to develop and implement programs based on the science of motor development and regular perceptual-motor activities from the early years of child growth, especially preschool and primary school. This issue cannot be achieved except by scientific planning and optimal implementation of psychologists, officials, specialists in education and training and physical education to improve the perceptual-motor skills of students with learning disabilities.

Delakato is among the group of experts who consider movement problems as the cause of slow learning. He concluded that students must remove motor coordination such as symmetry, orientation, etc. by practicing on various neuromuscular movements to be able to reach more advanced levels in reading, writing and mathematics [25]. Also, Caparte believes that since a person's first learning is "motor learning", it must be stated that the development of perception and cognition has a motor base, so that the child must have reached the stage of motor generalization to achieve full development of intelligence. In other words, the child needs certain motor generalizations in order to achieve his full mental performance [26]. Consequently, motor skills develop cognitive abilities. Students will not be able to read, write, and perform math at the level required by ordinary schools without proper perceptual-motor skills. As a result, one of the appropriate and necessary solutions to correct and repair

the learning problems of such students is to design a selected movement program based on education standards and finally implement this plan in all grades of primary education.

Limitations: (1) Conducting research only on second-grade primary school students limits the generalization of results to higher education levels; (2) The prevalence of corona disease and the limitations of society, as well as the fear of families (fear of disease) has limited the students' participation in the prepared educational program, which inevitably, the researcher spent a lot of time for conducting research.

Practical suggestions: (1) Educational workshops should be held to raise teachers' awareness, and several effective ways of working with some learning problems (problems of reading, writing, mathematics, concentration, memory, visual-spatial perception, etc.) as well as appropriate intervention methods for any of the problems of such students should be taught in these workshops practically and some books should be introduced to teachers in this field; (2) According to the importance of the first years of school, it is suggested that the sports instructors of these grades take a special course for familiarity and timely diagnosis of the perceptual-motor problems and the necessary awareness of the impact of these problems on children's academic performance; (3) Using educational games without leading to failure, fatigue and complaining can increase reading learning and improve other learning disabilities.

Research suggestions: (1) This research can be conducted in other primary grades of education for greater generalizability; (2) Given that this study was conducted among female students, further researches are suggested to be performed on both genders.

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