



## Comparison of the Effectiveness of Fernald's Multisensory Training and Computer Game Training on Dyslexia in Elementary Students with learning Disabilities

Elham Zamani Behbahani<sup>1</sup>, Parviz Asgari<sup>2\*</sup>, Alireza Heydari<sup>2</sup>, Fatemeh Sadat Marashian<sup>3</sup>

1. PhD Student in Exceptional Child Psychology, Department of Psychology, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran.
2. Associate Professor, Department of Psychology, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran.
3. Assistant Professor, Department of Psychology, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran.

### Article history:

Received: 2020/11/21

Accepted: 2021/03/21

Published: 2021/03/21

### Keywords:

Fernald Multi-Sensory Instruction,  
Computer Games, Dyslexia

### Abstract

**Purpose:** The aim of this study was to compare the effectiveness of Fernald's multisensory training and computer game training on dyslexia in primary school students with learning disabilities in Ahvaz.

**Methodology:** This study was applied in terms of purpose and in an experimental framework (pre-test-post-test design with control group). The statistical population in the present study consisted of all elementary students with learning disabilities in the first and second grade of elementary learning centers in Ahvaz in 2019. The sample consisted of 45 students with learning disabilities in the first and second grade of elementary school. The research instrument included Wexler (1945) dyslexia questionnaire. Data were analyzed using repeated measures analysis of variance and multivariate covariance of Manqua and ANCOA.

**Findings:** The results of data analysis showed that Fernald's multisensory training reduced dyslexia in elementary students with learning disabilities in the experimental group (1) compared to the control group and training in the use of computer games reduced the dyslexia in elementary students with learning disabilities in the experimental group (2). In comparison with the control group, it was found that there is a difference between the effectiveness of Fernald's multisensory training and computer game training on dyslexia of elementary students with learning disabilities and Fernald's multisensory training compared to computer game training in elementary students with dyslexia. Learning disabilities were more effective.

**Conclusion:** As a result, it can be said that Fernald's multisensory training methods and computer game training reduce the dyslexia of elementary students with learning disabilities and Fernald's multisensory training is a more effective method to reduce the dyslexia of elementary students with learning disabilities.

**Please cite this article as:** Zamani Behbahani E, Asgari P, Heydari A, Marashian F S. (2021). Comparison of the Effectiveness of Fernald's Multisensory Training and Computer Game Training on Dyslexia in Elementary Students with learning Disabilities. *Iranian Journal of Educational Sociology*. 4(1): 58- 67.

\* Corresponding Author: Askary47@yahoo.com

## 1. Introduction

Many children have a natural appearance, their physical growth; height and weight indicate that they are normal. Their intelligence is more or less normal, they talk well, they play like other children and they communicate with others like their peers, they have the necessary help in their home, they do well the tasks entrusted to them by their parents, and their behavior, morals Have normal. But when they go to school and want to learn to read, write, count, they run into serious problems. Attention to the issue of learning disabilities has recently developed dramatically and has attracted the attention of many educators, child education professionals. Exceptional school institutions and special classes were organized to educate these children with obvious disabilities, and a set of curricula was provided for the separate education of these different groups (Hatton, 2013). According to some experts, inadequate and incorrect teaching can be a factor in many learning disabilities. It seems that a number of children with learning disabilities have not received adequate and appropriate education (Safikhani, 2019). Students with learning disabilities have an important aspect of their academic performance that affects their cognitive, psychosocial health. Students with learning disabilities in dyslexia have major problems in the process of academic growth and development and develop cognitive and academic conflicts (Serlin, 2013). In fact, learning disabilities lead to problems in the field of emotion regulation. (Metsala, Galway, Ishaik & Barton, 2019) Special learning disabilities can play a pivotal role in students' academic failure and failure. These disorders can become chronic if left unattended and go into later stages of childhood. Also be transferred (Walda, Weerdenburg, 2014). Special learning disabilities in children will face serious problems and consequences that can be related to special learning disabilities with behavioral problems in children (Carballal, et al, 2018) Attention problems (Maehler and Schuchardt, 2016), Anxiety And noted depression (Nelson & Gregg, 2018), academic failure, dropout, and peer and teacher communication problems (Forkosh & Meer 2019), mental health problems in adulthood (Aro, et al, 2018).

Education experts have identified a significant number of children with delayed learning of speech, proper use of language, development of normal perceptions of sight, hearing, reading, writing, spelling, and arithmetic. Some of these children do not understand language but are not deaf, some of them cannot understand what they see but are not blind, and some of them cannot learn with the help of normal teaching methods while they are not mentally retarded. The problem of these children today is a special learning disability (Becer, Gabriel & dolnad, 2014). On the other hand, one educational method that has been reported to be effective in improving learning problems during research is teaching computer games. Video-video games are a group of electronic media that appeal to the senses of sight, hearing, touch and reach a wide variety of audiences, and its main activity is entertainment and recreation. Its communication channels include PC, Atari, Sega, Nintendo, Sony, PlayStation, and Genesis. The main audience of this media is teenagers (Mohseni, 2018). Most computer games target young boys and men, with very serious, competitive maps, and most games fall into the animated, strategy, adventure, simulation, and sports classes (Moradi, 2019). Pedro, et al (2017) concluded that computer game training improves the level of behavioral performance. (Emdar & Alvenson, 2017) In another study, they showed that computer game education for students with learning disabilities reduces the rate of dyslexia. Dyslexia is one of the most acute school problems. One of the main reasons for the incompatibility of the study period is the serious consequences for the school. According to Strong (1990), reading difficulties are the most important factor in school failure and this issue is in fact the simplest sign that can be used to predict students' problems in many other fields of study (Khanjani, Mahdavian and Ahmadi, 2017) .

One of the advantages of this type of game is that it is used through the web and its availability. In sum, these computer games help to develop cognitive components (Rosen, Spa & Georgiou, 2015). The results of Robertson Howells (2014) research showed that computer games increase students' enthusiasm and motivation and lead to a positive attitude towards learning. Teaching through games and simulators is a potential factor in interacting with students (Demirbilik & Tamer, 2016). Research by Van Eck (2015)

showed that games promote learning and reduce teaching time for a large number of students. Also, the results of Papastergiou (2009) and Yang Chen & (2010) study of the effect of computer games among students showed that teaching with computer games is more effective in students' knowledge development. Bayrami (2020) in a study on students with learning disabilities investigated the effect of computer-cognitive game teaching methods on written and academic performance. The study was conducted on 30 students with learning disabilities. The results showed that there was a difference between pre-test and post-test written and academic performance in the experimental group and the written and academic performance of these students improved due to receiving computer-cognitive game training intervention. As a result, they stated that the measures of the computer-cognitive game training project have an effect on increasing the written and academic performance of students with learning disabilities. Costa (2019) in a study investigated the effect of Fernald's multisensory method on dyslexia in students with learning disabilities. Students with learning disabilities with dyslexia were divided into two groups and the experimental group received Fernald's multisensory method. The implementation of the multisensory method in the experimental group made a significant difference in the dyslexia of the experimental group and it was determined that the Fernald multisensory method has a significant effect on reducing the dyslexia of students with dictation disorder.

Therefore, the research gap on comparing the effect of Fernald's multisensory education and computer game training on the problem of dyslexia in primary school students with learning disabilities is felt and it is necessary to examine what educational method can work best on the problems of students with learning disabilities. Such research can be of great help to families, teachers, and the educational system in treating students with this problem, and more clearly identify the educational solution that can better treat this problem in elementary students with learning disabilities. Research in this field can be an important step in the field of applied research in the country and provide appropriate feedback to the Education Organization and those in charge of learning disabilities. The results can be provided to the education organization, schools, colleges that provide the groundwork, increase the use of more effective educational methods in reducing dyslexia problems of students with learning disabilities for academic achievement; Therefore, research in this field is considered important and necessary; Therefore, in the present study, the question is whether there is a difference between the effect of Fernald's multisensory training and computer game training on the problem of dyslexia of students with learning disabilities?

## 2. Methodology

This research is applied in terms of purpose and in an experimental framework (pre-test-post-test design with control group). The statistical population in the present study consisted of all primary school students with learning disabilities in the first and second grade of elementary learning centers in Ahvaz in 2019. The sample of this study included 45 students with learning disabilities in the first and second grades of elementary school who were selected by purposive sampling. The criteria for entering the research process were dyslexia, difficulty in spelling for at least 6 months, and the ability to attend training sessions, no cognitive, personality and other physical disorders, and the criteria for leaving learning disabilities other than spelling, dyslexia, inability to attend training sessions and other cognitive-personality and physical disorders. In this study, experimental research method (pre-test-post-test design with equal control group) was used along with the follow-up stage (one month after the post-test stage). For data collection, learning disabilities were referred to Ahvaz city centers and 45 elementary students with learning disabilities were selected by purposive sampling. Among the research sample, 15 elementary students with learning disabilities were randomly selected in experimental group 1 (Fernald multisensory method training), 15 Elementary students with learning disabilities were assigned to experimental group 2 (computer game training) and 15 elementary students with learning disabilities were assigned to the control group.

Dyslexia Questionnaire (Wexler, 1945): This questionnaire, which consists of subtests of high-frequency, medium, low-frequency words, word chain test, rhyme, image naming, reading comprehension, words, deletion of sounds, non-word reading, and sign test, is based on The basis of students' average performance in the test of high-frequency, medium, low-frequency words, word chain test, rhyme, naming pictures, reading comprehension, words, deletion of sounds, reading of non-words, signs that teachers (therapist) gave a 60-item questionnaire based on students' reading score Low (1), medium (2), high (3) indicate that scores between 85 and 180 indicate dyslexia (Tabatabai, et al., 2011). Tabatabai, et al. (2011) reported the validity of the questionnaire through correlation coefficient with academic anxiety test for subscales between 0.57 to 0.76 and for the whole questionnaire 0.68 that all coefficients were significant at the level of 0.001 and showed that has high validity of the questionnaire. Fernald Multisensory Method Training: Fernald Multisensory Method Training Based on the practical guide of Fernald (1921) multisensory method, it was performed in 8 sessions of 45 minutes, which are described in Table 1.

**Table1.** Fernald Multisensory Method Training Sessions

meetings	Session description
First session	Introduction to the method: The role of Fernald's method on students' reading performance was pointed out.
second session	Cartography and mental imagery of words strengthen memory in cartography.
third session	The word was clearly pronounced and counted for the student.
fourth Session	Improving visual memory in spelling, in addition to touching words, other learning styles were also considered and the student's defect in spelling and dyslexia was recognized.
fifth meeting	In this session, touching the words was practiced
Sixth Session	When the student showed that he / she was paying attention to the word, he / she tried to write it down in the air or in salt with his / her eyes closed.
Seventh session	Card writing with the practice of touching words and reading words to strengthen visual memory
Eighth Session	Summarizing the educational solution and conducting the post-test

Computer game training: Computer game training based on computer games from different sources and based on cognition was performed during 8 sessions of 45 minutes. Meetings are described in Table 2.

**Table2.** Computer games training

meetings	Session description
First session	Introduction, talk about the type of computer game and introduction of the game and computer application training
second session	Run the memory matrix game
third session	Run the memory matrix game
fourth Session	Run the memory matrix game
fifth meeting	Increase the speed of cognitive processing with the game Lost in migration
Sixth Session	Increase the speed of cognitive processing with the game Lost in migration
Seventh session	Increase the speed of cognitive processing with the game Lost in migration
Eighth Session	Summarize sessions and practice computer games

Data were analyzed using computer software (SPSS) version 22 and multivariate covariance of Mancoa and ANCOA.

### 3. Findings

The descriptive findings of this study include statistical indicators such as mean and standard deviation for dyslexia, dictation disorder and behavioral adaptations in the groups of Fernald Multisensory Education Group (1), Computer Games Application Training Group (2), and Control Group (3). Shows pre-test, post-test and follow-up steps.

**Table3.** Mean and standard deviation of dyslexia in experimental (1) - (2) and control groups in pre-test, post-test and follow-up stages

variable	group	the level	average	Standard deviation	Number
Dyslexia	Experiments (1)	pre-exam	19/53	3/06	15
		So jtest	8/26	2/34	15
		Follow up	11/20	3/23	15
	Experiments (2)	pre-exam	22/73	2/25	15
		So jtest	15/20	3/80	15
		Follow up	10/86	2/19	15
	Control	pre-exam	23/40	1/84	15
		Post-test	21/66	1/83	15
		Follow up	21/26	2/37	15

As can be seen in Table (3), the mean and standard deviation of dyslexia of students with learning disabilities for the experimental group (1) in the pre-test, post-test, follow-up stages were 19.53, 3.06, respectively; 26/8, 34/2 and 20/11, 23/3; For the experimental group (2) in the pre-test, post-test, follow-up, 22.73, 2.25; 20/15, 80/3; 23.40, 2.19 and for the control group in the pre-test, post-test and follow-up stages, 23.40, 1.84; 21.66, 1.83 and 21.26, 2.37 were obtained. The results of Levin test showed that due to ( $p < 0.05$ ) and lack of significance, the use of covariance analysis is allowed. This means that the experimental and control groups were homogeneous in terms of variances before the experimental intervention (in the pre-test stage). Pre-test and post-test regression patterns were not significant in experimental and control groups ( $p < 0.05$ ); Therefore, the interaction of regression slopes of dyslexia variables with the group is not significant and the assumption of homogeneity of regression slopes is confirmed. To test the research hypotheses, multivariate analysis of covariance, univariate analysis of covariance (in Mankova text) and Bephroni post hoc test were used.

**Table4.** Results of univariate analysis of covariance in Mankova text on post-test scores and dyslexia follow-up

Source		Variable	Total squares	Degrees of freedom	Average squares	F	The significance level	Effect size
Post-test	group	Dyslexia	132/87	2	66/43	7/77	0/002	0/34
Follow up	group	Dyslexia	80/41	2	40/2	8/12	0/002	0/35

As Table (4) shows, the F-ratio of univariate analysis of covariance is significant for the dyslexia variable.

**Table5.** Adjusted mean, standard error, low limit and upper limit of the variable in three groups of experiment 1, experiment 2 and control

	group	Statistical indicators			
		Average	The standard error	Low limit	upper line
Post-test	Fernald Multisensory Training	8/7	2/08	4/47	13
	Learning to use computer games	14/69	1/76	11/08	18/3
	Witness	21/69	3/44	14/64	28/75
Follow up	Fernald Multisensory Training	10/18	1/58	6/39	13/43
	Learning to use computer games	9/19	1/34	6/44	11/94
	Witness	23/94	2/62	18/57	29/31

As can be seen in Table (5), the adjusted mean and standard error of the research variables are significant.

**Table6.** Results of Benferoni post hoc test to compare the adjusted means of dyslexia of experimental and control groups

Hypothesis	Compared groups	Adjusted averages	The difference between the means	The standard error	The significance level
1	Group 1 - Control group	21/69 و 8/74	12/95	5/36	0/067
2	Group 2 - Control group	21/69 و 14/69	7	5	0/51
3	Group 1 - Group 2	14/69 و 8/74	5/95	1/57	0/002

4	Group 1 - Control group	23/94 و 10/18	13/76	4/08	0/006
5	Group 2 - Control group	23/94 و 9/19	14/75	3/81	0/002
6	Group 1 - Group 2	9/19 و 10/18	0/99	1/19	1/00

As shown in Table (6), in the first hypothesis, the difference between the mean of the control group and Fernald's multisensory training group in dyslexia is 12.95, which is not significant at the 0.05 level. This finding shows that there is no significant difference between the control group and Fernald's multisensory training group in dyslexia; therefore, it rejects the first hypothesis of the research; That is, Fernald's multisensory training is not effective in dyslexia in elementary students with learning disabilities in the post-test phase. In the second hypothesis, the difference between the mean of the control group and the training group for the use of computer games in dyslexia is 0.7, which is not significant at the level of 0.05. This finding shows that there is no significant difference between the control group and the computer game training group in dyslexia; therefore, it rejects the second hypothesis of the research; That is, teaching the use of computer games is not effective on dyslexia of elementary students with learning disabilities in the post-test stage. Also, the difference between the mean of Fernald's multisensory training group and the training group of using computer games in dyslexia is equal to 5.95, which is significant at the level of 0.5. This finding shows that there is a significant difference between Fernald's multisensory training group and the computer games application training group in dyslexia in favor of Fernald's multisensory training group; Therefore, it confirms the third hypothesis of the research; that is, Fernald's multisensory training and computer game training have different effects on dyslexia in elementary students with post-test learning disabilities.

In the fourth hypothesis, the difference between the mean of the control group and Fernald's multisensory training group in dyslexia is 13.76, which is significant at the level of 0.05. This finding shows that there is a significant difference between the control group and Fernald multisensory training group in dyslexia in favor of Fernald multisensory training group; Therefore, it confirms the fourth hypothesis of the research; That is, the effect of Fernald's multisensory training group on dyslexia of primary school students with learning disabilities has continued in the follow-up phase of 1.5 months. In the fifth hypothesis, the difference between the mean of the control group and the training group on the use of computer games in dyslexia is 14.75, which is significant at the level of 0.05. This finding shows that there is a significant difference between the control group and the computer game training group in dyslexia in favor of the computer game training group; Therefore, it confirms the fifth hypothesis of the research; That is, the effect of the computer game training group on dyslexia of primary school students with learning disabilities has continued in the follow-up phase of 1.5 months. In the sixth hypothesis, the difference between the mean of Fernald's multisensory training group and the training group of using computer games in dyslexia is equal to 0.99, which is not significant at the level of 0.05. This finding shows that there is no significant difference between Fernald's multisensory training group and the computer games training group in dyslexia; Therefore, it rejects the sixth hypothesis of the research; That is, the effect of Fernald's multisensory training group and the computer game training group on dyslexia of primary school students with learning disabilities at the 1.5-month follow-up stage was not different.

#### 4. Discussion

The aim of this study was to compare the effect of Fernald's multisensory training with computer game training on the problem of dyslexia in primary school students with learning disabilities in Ahvaz. The results show that there is a significant difference in the dyslexia variable between Fernald's multisensory training groups. Therefore, in explaining this finding of the research, it can be said that in Fernald's multisensory education, reading skills are developed through auditory, visual, motor, and tactile motivations. In this method, an attempt is made to develop auditory, visual, tactile, and kinetic skills. Find

(Stockdal, 2015). Also in this method, children are told special stories that are specific to each of them and are repeated until they learn it well; therefore, the student will have a selection of vocabulary. In this method, children say the word, see the written word, tap and track on it, write the word using their memory, see the word again, and read it aloud to their teacher (Cachen, 2018). In this method, children are told specific stories that are specific to each of them and are repeated until they learn it well; therefore, the student will have a selection of vocabulary. In this method, children say the word, see the written word, tap on it and track it, write the word using their memory, see the word again, and read it aloud to their teacher.

Findings show that there is a significant difference in the dyslexia variable between the groups of computer game training; therefore, in explaining this finding of the research, it can be said that many researches with abundant evidence indicate that computer games can have objective psychological benefits for children and adolescents. Part of this evidence comes from informal studies of the effects of computer games, and part shows the psychological value of these games in clinical therapies. The positive effects of computer games on cognitive skills may be generalized to the development of social skills. According to one view, young people who engage in these games can expand their social relationship through this. Especially when playing with his peers in playgrounds (Mohseni 2018). Teaching computer games on a regular basis and choosing a strategy considered by the game designer increased the senses of sight, hearing, and touch in these students who had dyslexia. The use of computer games in these students had an educational framework and due to the specific educational goals caused students with reading difficulties to develop their motor coordination according to the type of game, mental and visual skills are strengthened and visual information in these students Be strengthened. It should be said that computer game training increased students' attention, concentration, imagination, creativity, motivation and performance.

The results show that there is a significant difference in the dyslexia variable between Fernald's multisensory training groups and computer games training and control; Therefore, in explaining this finding of the research, it can be said that by researching the effect of Fernald's multisensory method, which according to the findings is one of the most complete methods that creates a special coherence of visual, auditory, motor and tactile perception Has been able to improve the rate of attention problems, can be a more effective way to reduce dyslexia problems of students with learning disabilities. So it can be said that Fernald's multisensory training in features such as misreading by deleting, adding and modifying words, difficulty in distinguishing letters in shape and size, poor spelling, inability to remember nouns, and so on. The sound of the letters does not pay attention to punctuation and they are unaware of the meaning of the word, they repeat the words they have just read, they change the reading speed and the minimum comprehension, etc. In elementary students with learning disabilities, the effect of learning to use computer games Has had more.

Explaining the results of this study, it was found that there is a difference between the effect of Fernald's multisensory education and computer game training on the dyslexia problem of elementary school students with learning disabilities. Learning disabilities are more effective in teaching Fernald's multisensory learning than using computer games due to the creation of a vocabulary using storytelling, and the student's active participation in the teaching process. This intervention was more effective than computer games in reducing dyslexia. It should also be noted that in Fernald's multisensory approach to computer games due to enhanced visual memory, tracking, distinguishing, generalization and also preventing the intensification of emotion to the use of games that increase excitement in these students, the degree of confusion in the reading process, dyslexia Decreased further; Because in this intervention, the student has the right to choose the computer game intervention that determines the goal of the treatment user, and the subject of the story was chosen by the student, and this method increased the motivation of learning in these students and increased cognitive processing speed, situational decision making, adaptation. Became more and more flexible; Therefore, it should be said that in Fernald's multisensory method compared to the computer game

method, because students actively increase their visual, auditory and follow-up senses, as well as the dimensions of touch, movement, sound, hearing and decision-making power in this method compared to computer games. The more, the more effective it is in reducing dyslexia.

The results show that Fernald's multisensory training and computer game training have different effects on dyslexia; therefore, it is recommended that educational packages be prepared and implemented in schools based on Fernald's multisensory teaching techniques and computer game training in order to reduce learning disabilities. Since the results of this study showed that the symptoms of learning disability and related variables such as dyslexia can be managed, it is recommended that due to its high prevalence in schools, school counselors identify students with symptoms. Follow up on learning disabilities and provide them with the necessary training and strategies. Therapists are advised to consider using Fernald's multisensory training alongside other training models. Since Fernald's multisensory training in reducing the symptoms of learning disabilities is a relatively new method, it is desirable to study other socio-cultural groups. It is also suggested that in future therapeutic research, other groups with medication and placebo be placed alongside the experimental and control groups to allow further comparison. It is also suggested that in future research, this study be performed on clinical and non-student samples in different areas and using other treatment packages and other approaches.



## References

- Aro T, Eklund K, Eloranta A, et all. (2018). Associations Between Childhood Learning Disabilities and Adult-Age Mental Health Problems, Lack of Education, and Unemployment. *Journal of Learning Disabilities*, 52(1): 71-83.
- Bayrami M R. (2020). The effect of computer-cognitive game teaching method on written and academic performance in students with learning disabilities. Master Thesis. Chamran martyr of Ahwaz University.
- Becer A, Gabriel M, dolnad S. (2017). The efficacy of multi-sensory writing instruction Fernald on the disorder dictation of student's disorder dictation. *Journal of Child Psychology & Psychiatry & Allied Disciplines*, 40: 757-768.
- Behzadi N. (2020). The effect of teaching Fernald multisensory method on dyslexia of students with learning disabilities. Master Thesis. Islamic Azad University of Tehran.
- Cachen P. (2018). The effect of teaching multi-sensory writing instruction fernald VAKT on the on the dyslexia of students disorder learning. *Journal of Play Therapy*, 6 (2): 53-73.
- Carballal Mariño M, Gago Ageitos A, Ares Alvarez J, et all. (2018). Prevalence of neurodevelopmental, behavioral and learning disorders in paediatric primary care. *Anales de Pediatría (English Edition)*, 89(3): 153- 161.
- Costa A. (2019). The efficacy of multi-sensory writing instruction Fernald on the dyslexia. *Journal of personality and Social psychology*. 32: 323-334.
- Costa, A. (2019). The efficacy of multi-sensory writing instruction Fernald on the dyslexia. *Journal of personality and Social psychology*. 32: 323-334.
- Demirbilik M, Tamer S.L. (2016). Math teachers' perspectives on using educational computer games in math education. *Journal of Procedia Social and Behavioral Sciences*, 9: 709-716.
- Emdar H, Piter L, Alvenson M. (2017). The efficacy of computer games on the dyslexia of Students Disorder learning. *Journal of Instructional Psychology*. 22(1): 77-87.
- Forkosh Baruch A, Meer Y. (2019). Academic support model for post-secondary school students with learning disabilities: student and instructor perceptions AU - Lipka, Orly. *International Journal of Inclusive Education*, 23(2): 142-157.
- Hatton G. (2018). The efficacy of multi-sensory writing instruction Fernald on the disorder dictation and performance academic. *Journal of Educational*. 10: 241-253.
- Maehler C, Schuchardt K. (2016). Working memory in children with specific learning disorders and or attention deficits. *Learning and Individual Differences*, 49: 341-347.
- Metsala J L, Galway T M, Ishaik G, Barton V E. (2017). Emotion knowledge, emotion regulation, and psychosocial adjustment in children with nonverbal learning disabilities. *Child neuropsychology*, 23(5): 609-629.
- Mohseni K. (2018). The effect of computer game education on dyslexia in students with reading difficulties. Master Thesis. Islamic Azad University of Tehran.
- Moradi N. (2019). the effect of cognitive-computer game education on maladaptive behavior and anxiety of students with anxiety disorders. Master Thesis. Shahid Chamran University.
- Nelson J M, Gregg N. (2018). Depression and Anxiety among Transitioning Adolescents and College Students with ADHD, Dyslexia, or Comorbid ADHD/Dyslexia. *Journal of Attention Disorders*, 16(3): 244-254
- Nolsen A. (2019). The effect of teaching multi-sensory writing instruction Fernald VAKT on the dyslexia of student's disorder learning. *Journal of psychology*, 35: 123-134.
- Papastergiou M. (2009). Digital Game-Based learning in high school computer science education: impact on educational effectiveness and student motivation. *Computers & Education*, 52(1): 1-12.
- Pedo G, Benson S, Ruke M, et all. (2017). The efficacy of computer games on the performance academic of student's disorder mathematics. *Journal of Psychology & Psychiatry & Allied Disciplines*, 40: 757-768.
- Pirn A. (2017). The efficacy of multi-sensory writing instruction fernald on the dyslexia of dysgraphia and behaviour adjustment of student's dyslexia, disorder mathematics. *Journal of personality and Social psychology* 95 (1): 181-196.
- Rezaei Sh. (2017). The effect of Fernald multisensory training on dyslexia of students with learning disabilities. Master Thesis. Chamran martyr of Ahwaz University.
- Robertson J, Howells C. (2014). Computer game design: Opportunities for successful learning. *Computers & Education*, 50(2): 559-578.

- Rosen G, Spa M, Georgiou A. (2015). The efficacy of computer games on the dyslexia of students Disorder learning. *Journal of Human Reproduction*. 19 (2): 375-383.
- Safikhani S. (2019). Comparison of stubbornness, adaptation in students with reading and dictation disorders with normal students. Master Thesis. Fars University of Research Sciences.
- Serlin A. (2013). The comparison of obsessive rumination and coping with stress of student dyslexia and disorder learning reading, mathematics. *Journal of Psychology*, 34: 43-54.
- Van Eck R. (2015). Digital Game-Based Learning: It's Not Just the Digital Natives Who Are Restless, *EDUCAUSE Review*, 41(2): 16–30.
- Walda S A, Weerdenburg M. (2014). Progress in reading and spelling of dyslexic children is not affected by executive functioning. *Research in Developmental Disabilities*.
- Yang J C, Chen S Y. (2010). Effects of gender differences and spatial abilities within a digital pantomimes game. *Computers & Education*, 55: 1220–1233.