Original Article



Comparing selective visual attention in children with learning disabilities and normal children

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ABSTRACT

Introduction: With 5% prevalence in school-age children, learning disorders are among the most common disorders at this age. These children often struggle in various areas such as attention, memory, cognition and learning. The present study was an attempt to compare selective attention in children with learning disabilities and normal children. **Materials and Methods:** This case-control study was conducted on 92 children with learning disabilities and 109 normal children in Hamadan. The participants were compared using available sampling method and psychiatric diagnosis, and the Stroop test was used to examine selective attention. **Findings:** The research results demonstrated that there is a significant difference between the two groups of students with learning disabilities and normal students in the Stroop test (p < 0.001). **Conclusion:** Compared to normal children, those struggling with learning disabilities show more disorders in selective attention.

Keywords: Learning Disabilities, Selective Attention, Children, Stroop test.

Introduction

Studies have demonstrated that deficits in children's neuropsychological skills including attention largely predict their educational performance in school and given the negative effects of learning disabilities, finding a solution that can curb or eliminate this problem is of paramount importance ^[1]. Due to the significance of executive functions and attention in neuropsychological theories, attention functions have been studied mostly in children with attention deficit and hyperactivity disorder, while fewer studies have been dedicated to attention in children with learning disabilities. The general objective of this study was to compare the performance of selective visual

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How to cite this article: Mahdieh Seyedi, Sheyda Javadipour, Homeira Zarei. Comparing selective visual attention in children with learning disabilities and normal children. J Adv Pharm Edu Res 2020;10(S4):78-84. Source of Support: Nil, Conflict of Interest: None declared. attention in students with learning disabilities and normal students and allow for the necessary treatments and preventive measures by identifying problems in this area.

According to the definition of the Fifth Statistical Diagnostic Guide in Mental Disorders, special learning disorders refer to a disorder in one or more cases of the basic psychological processes playing a role in understanding or using spoken or written language ^[2]. This disorder is diagnosed by functioning below the expected level in standardized tests for reading, arithmetic and writing skills based on the age and intelligence of the learners and their level of education ^[3, 4].

The prevalence of this disorder has been reported to be between 3% and 12% all over the world ^[5]. Learning disabilities consist of one or more basic psychological processes pertaining to the understanding of spoken or written language in listening, thinking, speaking, reading, writing, spelling, or doing math ^[6]. This disorder is diagnosed when reading, writing and mathematical skills are significantly lower than expected. It greatly interferes with academic achievement or daily activities that require reading, writing, and mathematical skills.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms. One type of learning disability is the inability in written expression. Written language disorder has been described as a problem in the development of writing. Despite having normal mental capabilities and proper education, children with this condition lack normal reading ability.

Reading disorders occur in 4% of school-age children. Its prevalence ranges between 2% and 8% and its rate is the same in boys and girls. These disorders are usually caused by damage to the central nervous system and have different symptoms depending on the damaged area. The term 'learning disability' incorporates conditions such as perceptual disabilities, brain injuries, minor brain disorders, and developmental aphasia ^[7]. Various educational, environmental, psychological and even genetic factors are involved in the development of learning disorders such as neurological, educational, social, emotional and adaptive defects. There is evidence suggesting that children with learning disabilities have difficulty in executive functions [8]. Executive functions are defined as a combination of processes (such as inhibition, working memory, and the ability to plan and organize) that affect basic cognitive abilities such as attention, language, and perception.

Various studies on the relationship between executive functions and children's skills demonstrate that executive functions are good predictors of performance. Attention deficit also plays a fundamental role in children with learning disabilities. Based on Brad Bennett's theory, children with special learning disabilities have difficulty in attention and concentration ^[9]. Attention is one of the most important activities of the mind. In itself, it is one of the main aspects of cognitive structure that also plays an important role in the structure of intelligence, memory and perception. Attention deficit is a common cause of learning disabilities ^[7]. Attention is a crucial factor in teaching and learning processes. It is a complex structure in which the disorder is considered a major defect in many disorders ^[1]. Meltzer, McCloskey, and Dioner have written that attention is among the abilities needed by children to learn at school ^[9, 10] and Epsy et al. have stated that children's ability to perform executive functions and attention in preschool can predict their ability in reading and using mathematics in later years ^[11]. Selective attention also refers to attention to the stimulus while irrelevant information or stimuli that cause distraction are present. It might also refer to the ability to avoid the interference of irrelevant information in doing homework and selecting information related to the goal.

Deficiencies in concentration undermine children's attention and the opportunity to process, store and retrieve information. Hallahan's research demonstrated that, unlike normal children, children with learning disabilities could not focus on the important features of the task and their attention was uncontrolled. Students with learning disabilities encounter problems while paying attention to relevant stimuli and focusing their attention ^[12]. Ester's study on eight adolescents with learning disabilities and eight normal adolescents with homogeneous backgrounds showed that individuals with learning disabilities in selective visual attention, focused attention, and sustained attention, have poorer performance and the difference between the two groups is significant ^[9].

Tests such as academic achievements, process tests, informal reading, writing, calculation, and developmental methods are employed to assess children with learning disabilities in the areas of mental, linguistic, perceptual, cognitive, and sensory channels ^[13]. However, in this study, we will use the Stroop test to assess selective visual attention in these children. Swanson has showed that students with learning disability have difficulty in focusing on relevant stimuli and sustained attention ^[5].

In the study conducted by Lindsay et al., the attention function of 26 students with disabilities in mathematics compared to 56 subjects in the control group, showed their lack of attention ^[13]. In this study, the Stroop test was used to examine selective attention. The Stroop test or Stroop effect was introduced in 1935 by John Ridley Stroop and is one of the most well-known findings in cognitive psychology. Among the cognitive processes that are mostly considered in the implementation of this test are selective attention and inhibition and this test evaluates the defects in these two functions ^[14]. Considering the above findings and the significance of selective attention in students' learning, the general purpose of this study is to compare the performance of selective attention among elementary school students with learning disabilities (i.e. reading, writing, mathematics) and normal students in Hamadan. This study is conducted to identify problems in this area and recommend the necessary treatments and the preventive measures that should be taken.

Another effective factor in learning is the level of attention and how learners pay attention to the content. To enter information from sensory memory to active memory, information must be first considered to be transferred to long-term memory. By focusing one's attention, the lesson materials are learned and recalled properly when necessary. Attention maintenance is defined as the maintenance of controlled processing in the performance of a task. Deficiencies in the maintenance of attention may curtail the opportunity to process, store, and retrieve information. Furthermore, in the study conducted by Hallahan et al., it was found that unlike normal children, those with learning disabilities cannot focus on the important features of the task and their attention is uncontrolled ^[4]. Among the areas in which children with learning disabilities have limitations, we can refer to the lack of attention among people that may be inattentive or distracted and have difficulty in orienting sensory stimuli to the environment. Attention Deficit Disorder has negative impacts on daily life and academic performance and interferes with children's ability to do their homework ^[15].

In another study, Rajabi and Pakizeh (2012) compared the profile of memory and attention among students with learning disabilities with normal students. Five groups of 15 participants were studied (15 normal students, 15 students with learning disabilities in dictation and spelling, 15 students with learning disabilities in mathematics, 15 students with learning disabilities in reading, and 15 students with combined learning disabilities). The results showed that normal students have a higher level of attention and memory ability compared to the other groups of students with learning disabilities. The results of this study also suggested that the students who have dyslexia and especially a combination of two or three learning disabilities, have weaker memory and attention $^{[16]}$.

In a study, Narimani et al. (2012) compared selective attention between normal children and children with learning disabilities. The objective of this study was to compare the response of children with learning disabilities and normal children demonstrated by the Stroop test. The subjects of the study were 65 students (15 participants with reading disabilities, 15 participants with writing disabilities, 15 participants with mathematical disabilities and 20 normal participants) in the fifth grade of elementary school who were selected by multi-stage cluster sampling, diagnostic interviews and Colorado Learning Disabilities Test. Then, Stroop test was performed on the selected sample members and the subjects' response time and the number of errors were recorded. The results showed that there is a direct and significant relationship between the subjects' learning difficulties and the number of errors and response time to Stroop task. The difference in the performance of the study groups is significant in terms of total response time and total error number ^[5]. In another study, Ghalamzan et al. (2014) compared executive functions profile and attention of normal children and children with learning disabilities. Conner's diagnostic neuropsychological questionnaire and Raven's progressive matrices were used to collect data. The data were analyzed using multivariate analysis of variance. The findings showed that there is a significant difference between the attention and executive functions of the two groups of normal participants and those with learning disabilities. The results show that children with learning disabilities have poorer performance in executive functions and focused attention as compared to normal children [17].

Given the importance of executive functions and attention in neuropsychological theories, they have been mostly studied in children with attention deficit hyperactivity disorder, whereas attention deficit and executive functions in children with learning disabilities have not been addressed in detail.

Based on the above research, it is concluded that children with learning disabilities are different in terms of performance in executive functions and attention compared to normal children, which in itself can affect self-esteem, profession, social communications and daily activities. Hence, it seems important to pay attention to these influential areas considering the high prevalence of learning disabilities and the importance of attention in learning for children with this disorder. Suggestions based on the results of this study can pave the ground for learners and the teachers of students with learning disabilities to improve their academic performance, harness their abilities and talents, and prevent the loss caused by academic failure, which can ultimately prevent socio-cultural and socio-economic impacts. Moreover, this research also seems necessary given the role of selective attention in the educational process and success in daily and future ventures. For the reasons mentioned above, the function of selective visual attention in children with learning disabilities and normal children was investigated in this study.

Materials and Methods

The present study was a causal-comparative research with an experimental and control group research design. It was conducted from December 2015 to May 2016 in ordinary schools and four centers for children with learning disabilities in Hamadan. The statistical population of the study was comprised of children with learning disabilities and normal from the age of 7 to 11 in primary school in Hamadan. The participants were included in the study via the non-probability sampling method (i.e. available samples) with a diagnosis of learning disability, an IQ above 90 (based on children's files), general health (meaning that the participant has no special hearing, visual, and psychoemotional problems), no orthopedic disorders such as orthopedic problems of the upper limbs and spine and their consent. Due to their limited number, all samples were selected using the method of complete enumeration from this school. Samples were based on the available population and then normal students were also selected to be compared to this group. School grades, gender and age were considered to obtain homogeneous groups.

Data Collection instruments

In this study, the continuous performance test (CPT) was used to assess attention and impulsivity and the Stroop color and word test was used to evaluate selective attention. Background and medical information from the children's files were also used based on entry-exit criteria.

The Stroop Color and Word Test (SCWT)

This test is one of the most widely implemented tests for selective visual attention or focused attention and response inhibition. It was developed by Stroop in 1935 to assess specific attention and cognitive flexibility. Since then, different types of this test have been developed including the Delis test in 1987, the Golden type test in 1978 and the graph type in 1995. The number of cards used in each of these tests is different. The Stroop test is a laboratory model for measuring selective attention which is used as a basic test for the function of the upper part. ^[18] Ghadiri et al. (2006) reported the test-retest reliability of all three trials of this test as 0.60, 0.83 and 0.97, respectively ^[19].

In the present study, the computer type was used which consists of the following three stages:

- A. In the first stage, which is the stage of coordinated efforts, the names of the four main colors appear in black in the center of the screen, and the participant must quickly press one of the blue, red, yellow or green keys on the keyboard based on the color names.
- B. In the second stage, the names of the four main colors appear in their own color in the center of the computer's

screen and the participant must press the key corresponding to each color on the keyboard as quickly as possible.

C. The third stage is the stage of uncoordinated efforts or interference in which the names of the four main colors appear on the screen with a different color from their ink color and the participant is asked to press the corresponding keys on the screen based on the color of the word as quickly as possible. For example, the word red is written in a different color (e.g. green) and the participant must specify the color of the ink instead of the meaning of the word.

The indicators measured in this test are the following:

- 1. Accuracy (number of correct answers)
- Speed (average response time of correct responses to stimuli in one millisecond)

Procedure

This study was conducted under the auspices of the Vice Chancellor for Research and Technology at Hamadan University of Medical Sciences. The study began once the research plan was approved by the University Research Council and the ethics committee. Schools and centers for learning disabilities were visited after obtaining a license from the university and the department of education in districts 1 and 2 and the department of education for exceptional children. According to the psychologist's diagnosis mentioned in the child's file and the report of the teacher and parents indicating that they had difficulty in learning, children with learning disabilities were identified and the study commenced after describing the study to the children's parents and obtaining their consent for their children to participate in the research. At the beginning of the stage, the questionnaire of demographic information was completed by the researcher in the form of an interview. Then, the subjects were included in the study. After ensuring the children's access to computers, their ability to use it, and familiarity with the test instructions provided by the researcher, the Stroop test was completed by the children. At the end of the procedure, the collected data were compared and analyzed according to statistical calculations.

Data analysis method

After coding, the data obtained from the questionnaires were analyzed in SPSS/21. Because of the normality of the data, the related parametric tests were employed. The comparison of quantitative variables between the two groups was performed using t-test. The P-value was considered below 0.05. for the significance level.

Findings

Descriptive Statistics

This retrospective, case-control study was performed on 201 children and 109 children with learning disabilities were matched with 92 healthy children of the same age and sex.

Table 1. Frequency distribution of students' demographics					
Frequency Percentage	Frequency	Variable			
62.7	126	Male	Gender		
37.3	75	Female	Gender		
19.9	40	First			
28.9	58	Second			
16.9	34	Third	Grade		
15.4	31	Fourth			
18.9	38	Fifth			
100	201		Total		

According to Table 1, the mean age of children with learning disabilities was 8.880 ± 1.459 , the mean age of healthy children was 8.820 ± 1.369 , and there was no statistically significant difference between the two groups in terms of mean age. As can be seen in the table, most of the participants were female in the second grade of elementary school.

Analytical statistics Research hypothesis

Selective attention in children with learning disabilities is different from normal children. The independent t-test was used to compare the groups because normality was assumed for all variables in different groups. The software outputs are summarized in the table below. There was a statistically significant difference between the two groups in terms of the first stage error, the first stage response time, the second stage response time, the second stage error, and the third stage error and response time demonstrated in Stroop test. The results are given in Table 2.

Table 2. Comparison of selective attention (error and response time of the first, second and third stages) in the two groups of participants with learning disability and normal participants

p-value	M & SD	Groups	Scale	Index
0.029	4.584 ± 3.030	Experimental	First stage	Selective attention (Stroop Test)
	2.269±1.720	Control	error	
001.0<	$0.438{\pm}1.671$	Experimental	First stage	
	$0.380{\pm}~1.460$	Control	response time	
0.344	2.017 ± 1.800	Experimental	Second stage error	
	2.431 ± 1.740	Control		
001.0<	$0.270{\pm}\ 1.465$	Experimental	Second stage	
001.0<	0.249±1.320	Control	response time	
0.007	$7.002{\pm}~6.480$	Experimental	Third stage error	
	5.289 ± 4.150	Control		
0.004	$0.411{\pm}1.862$	Experimental	Third stage	
	$0.445{\pm}1.684$	Control	response time	

According to the results in Table 2, there is a difference between the experimental group and the control group in terms of the error of the second stage. In other words, the control group has fewer errors than the experimental group, but this difference is small and not statistically significant. The box plot of the second and third stage response time and the histogram of the second stage response time given in Stroop test for both experimental and control groups are shown in Figure 1.



normal learning disorder Figure 1- a) The response time of the third stage in selective attention.



Response Time Figure 1- b) The response time of the second stage in selective attention

Discussion and Conclusion

This study was an attempt to compare selective visual attention in children with learning disabilities and normal children. The main issue of the study was to compare selective attention in children with learning disabilities with normal children. Except for the second stage error, in other cases of selective attention which were the first stage error, the first stage reaction time, the second stage reaction time, the second stage reaction time, the third stage error and reaction time in Stroop test, there was a statistically significant difference between the two groups. The results of this section of the study corroborate the results of the research performed by Protopapas, Archonti and Skaloumbakas (2006) who examined the negative relationship between the reading ability and performance in Stroop task. The findings also confirmed the results from the research performed by Kapoula et al. (2010) indicating poor dyslexic performance in Stroop test with reference to the role of executive performance in calculations. The results are also consistent with the findings of Brunmiller (2008) suggesting that there is a significant relationship between students' performance in Stroop homework and mathematics ^[5]. In this study, it was concluded that there is a significant difference between the performance pattern in the word-color stroop test of children with learning disabilities and attention and the normal group.

The proponents of the theory of shortness in the scope of learning disabilities believe that children with special learning disabilities have difficulty in concentrating, paying attention, and accuracy. Ross (1976) believes that children with special learning disabilities have a delayed developmental process in gaining normal attention and concentration. The findings of this study can be based on the theory of delay in development explained by Bender (1987). The advocates of this theory argue that children with learning disabilities absorb environmental awareness and stimuli more slowly compared to their peers. Therefore, they act like younger children. Accordingly, students with disabilities behave more like younger children and, as a result of slow processing and more distractions, they require more time and make more errors in their answers compared to their peers ^[5].

The results showed that attention deficit is one of the main nuclei of learning disorders, especially mathematical disorders. Moreover, children with learning disabilities have poor performance in visual search than normal children. Even some findings indicate that attention deficit in these individuals continues into adulthood ^[20].

In explaining the research findings, it can be asserted that these findings show poor performance in children with learning disabilities in terms of active memory and attention including selective attention, sustained attention and attention capacity. Attention deficit disorder can lead to cognitive and educational problems in children. Information processing needs attention. Among the stimuli received from the environment by sensory receptors, only those that are selectively considered are fully processed. It seems that due to the limited capacity of attention on the one hand and the large number of environmental stimuli on the other hand, children with learning disabilities have poor performance in distinguishing between the main and required stimuli and other unnecessary stimuli. Therefore, in the process of cognitive development, the ability to create attention can be important in directing and moderating the attention of these children. To achieve this goal, valid tests must be used so that children at risk of learning disabilities can be identified and an appropriate intervention program can be designed for them. On the other hand, it can be asserted that executive functions are abilities that are crucial for the learning process. Executive functions help the child evaluate his or her performance and identify and address potential barriers to improvement. These skills are acquired through experience, training and learning. Most children perform these skills automatically, but young children with learning disabilities have difficulty in learning these

skills and need to receive training. Executive functions are the basic functions that create the complex and purposeful systems that underlie cognition. The development of executive functional skills is effective in the overall development of children. The development and strengthening of these skills in children in the early years of life might be the basis for the development of perceptual skills and especially the cognitive system. Therefore, early comprehensive evaluation of executive functions can be effective in helping children with learning disabilities for their future academic performance.

Research limitations

One of the research limitations was the low level of cooperation offered by the department of education and the department of exceptional education.

Research recommendations

Generally, according to the findings of this study, it can be said that children with learning disabilities in executive functions and attention have poor performance compared to normal children. Therefore, it is suggested that all areas of executive functions and selective attention be examined in clinical and educational works. On the other hand, it is suggested that the managers and educators of preschool centers design rich educational environments along with educational attention and focus games so that children can make the most of these games in order to strengthen and improve the performance of executive functions and attention.

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