The Effectiveness of Verbal Self-instruction on Sustained Attention (Based on Continuous Performance Test) among Students with Mathematics Learning Disabilities

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Abstract

The aim of this research was to investigate the effectiveness of verbal self-instruction on sustained attention (based on Continuous Performance Test) among students with mathematics learning disabilities in Ardabil city. The study has used causal – comparative method. Research population of this study covers all students with mathematics learning disabilities in Ardabil city in 2015-16 school year, that using multi-stage sample of cluster sampling of 30 people were selected. Continuous Performance Test is used to collect data and to analyze the data from multivariate analysis of covariance (MANCOVA) is used. Results showed that the experimental group after verbal self-instruction training in Continuous Performance Test on sustained attention compared to the control group, they earn more score (0.01 > p). So it can be concluded that verbal self-instruction training has an effect on the ability to sustain attention of students with mathematics learning disabilities.

Keywords: verbal self-instruction, sustained attention, continuous performance, mathematics learning disabilities.
Introduction

The characteristics of children with mathematics learning disabilities, difficulty in learning and remembering mathematical concepts and the second feature of difficulty in computing, inadequate strategies in problem solving, long time to discover solutions and high levels of error do the math (Geary, 2004). Studies have shown that children of three features, aspects, family and social environment as the main factors affecting the formation of children's disorders (Masten & Garnezy, 1985; Werner & Smith, 1992; Morrison & Cosden, 1997; Hyman and Briggs, 2008; quoted by Soleimani, 2015). Among these factors, addressing the characteristics of children (intrapersonal factors) is important and cognitive factors including the individual factors that influence learning and executive functions is one of the individual variables (Lynn Brink and Pintrich, 2002 quoted by Soleimani, 2015). Mathematical problem solving is defined as the skills that deals with an understanding of mathematical terms and converted into mathematical symbols and also issue the challenge of transition because in problem solving, students should have knowledge gained from solving previous problems in new situations used (Fuchs & Fuchs, 2005). Students with mathematics learning disabilities fundamental problems in cases such as verbal problem solving and skills related to that, obviously, in the sense of the data, the use of self-regulation and self-monitoring strategies in the process of doing their homework assignment and keep the attention of the end. (Pedrotty, 2008; Lerner, 2003, Gagnon & Maccini, 2001) Despite the importance of problem solving, research has shown that students with mathematics disorder, significant weaknesses in math problem solving skills are required (Montague, 2007). Studies have shown that a group of students to solve problems with the operation to know but because of the attention problems of some confusion in regard to signs, columns, write the full number and are adjacent to coding and may not calculate the numbers here look and a number (Tabrizi, 2005) And the speed and attention to the problem of the students is significantly lower than the normal students (Dowker, 2008; Kendall & Braswell, 1993). Given that the ability to sustain attention as a conscious activity, rational and purposeful seen as the culmination of human capabilities and learning is the main reason for carrying out studies to mathematics, successful resolution of problems in social adjustment and academic performance is an important factor and the skills associated with academic achievement, self-regulation, self-efficacy and success in the task (Behzadpour, Sadat Motahari and Goudarzi, 2014, Nasri, Saleh Sedghpouri and Cheraghian Radi, 2014). Attention and optimal arousal is one of the great works of the mind and only one of the main aspects of cognitive structure that plays an important role in the structure of intelligence, memory and perception. Attention deficit is one of the core learning disorders (DuPaul, McGoey, Eckert & VanBrakle, 2001; Seidman, 2006; Swanson & Jerman, 2006). To evaluate the due maintenance of the Continuous Performance Test (CPT) is used. The first test was developed in 1965 by Rozvold and colleagues and initially was used to measure brain lesion but in the 1990s, was used as the most common laboratory technique in the evaluation of children with attention deficit hyperactivity. The purpose of this test is the assessment of sustained attention and impulsivity (Hadianfard, Najarian, Shekarshekan, Mehrabi Zadeh, 2000). Esther (2004) in their study showed that people with a learning disability in visual selective attention, shifting attention and sustained attention have the poorer performance. Garcia Pereira and Fukuda (2007) showed that auditory selective attention ability in children with learning disabilities, decreased in comparison with normal children. Amirani, Tahaei and Kamali (2011) showed
that the auditory divided attention, students with learning disabilities have poorer performance compared with the normal students and the results of Soleimani (2015) showed that students with mathematics disorder than normal students in the Tower of London and scale performance have more consistently poor performance, so students with math problems and problem-solving ability and less ability to sustain attention. These results have important implications for a therapeutic intervention is to improve executive functions and subsequent academic achievement. One of the ways in which it affects the attention of students with math learning disorders, is verbal self-instruction training. In fact, one of the most widely used therapies in the field of children's mental disorders is verbal self-instruction training methods. This therapy has its roots in the works of Vygotsky and Loria that eventually by Mayknbam and his colleagues developed as a therapy was introduced. A recent method of monitoring a process during which, the first speech to reveal the inner and outer tests, then when I learned what to do, do it internally and using verbal directed their behavior in order to solve the problem guides and during this process, to continue problem-solving activities to strengthen the uses of the word. This process takes place in five stages: 1) Cognitive model: a model patterns, tutorials are performing a task teach with loud voice. 2) Apparent outer guide: student while providing training to teachers, doing homework. 3) Apparent self-directed: Students in the line of duty, loudly repeat lessons. 4) Hidden self-directed: Students doing homework, whisper training. 5) Hidden self-education: students from inner (inner speech) to do their homework (Alizadeh, 2006). Research in the field of verbal self-instruction training is focused on disorders. In this context Hashemi, Alilou and Eghbali (2008) examined the effects of different verbal self-instruction training to improve the symptoms of children with conduct disorder and showed that children with attention deficit in executive functions of verbal self-instruction causes in improving symptoms and function of these children self-control. That self-expression due to their own behavior and using their plans and programs to guided authority of their behavior. Research results of Alizadeh and Zahedi Pour (2005) showed that of students with math learning disorders inhibition functions, decision-making, planning and organizing and significantly weaker than students without visual impairment. Ashtari Zadeh (2001) in a study pay to study the inhibition in children with attention deficit hyperactivity disorder and indicated that training alone has a positive effect on increasing the amount of attention and the improvement in behavior related to neglect, is stable. So we can say that children with mathematics learning disabilities have difficulty in math administrative processes and the problem may be in attention and deficits in sustained attention. Due to the negative effects of mathematics learning disability, finding a solution that can be reduced or eliminated this problem is of great importance and the fact that the verbal self-instruction training method is used sparingly, conducting research in this field is essential. Thus, according to the above, this research is trying to answer the questions that is verbal self-instruction has an effect on the ability to sustain attention (based on Continuous Performance Test) students with mathematics learning disabilities?

**Research Methodology**

This study was a clinical trial. In this study, treatment of verbal self-instruction training and lack of training (control group) as independent variables and the dependent variable due to the variable maintenance is considered. To select the students studied samples, the multi-stage cluster sampling method was used. Which means the entire of Ardabil city was divided
into two different areas 1 and 2 and the elementary schools from each district randomly 20 primary schools and 680 students randomly multistage among male students six elementary schools selected. Then, using the Keymath math test and dyscalculia suspected cases were structured clinical interview and finally to the selected students has no intellectual disabilities, Raven's IQ test scores given in the case of students, and students whose IQ lower than 90 were excluded from the sample. Finally the students with math problems, 30 randomly chosen and were replaced in the 15-person experimental and control groups. Both groups were evaluated post-test with continuous performance test. The experimental group received eight sessions of one hour verbal self-treatment and the control group received no treatment. In the post-test both control and experimental groups were re-evaluated by Continuous Performance Test. MANCOVA analysis with software SPSS16 was used for data analysis (multivariate analysis of covariance).

**Research Tools**

Continuous Performance Test: The test for the first time in 1968 by Rozvold and colleagues were prepared. The Persian version of the test that runs through the computer, a Persian numbers as a stimulant. The numbers 30 drivers (20 percent) as the target drive. The distance between two stimuli presented 500 milliseconds and 150 milliseconds the time of each stimulus. In this form, the subjects have to time your attention to a relatively simple set of visual stimuli (numbers 1 to 9, which delivers unordered) and the advent of incentives aimed at attracting respond by pressing space key. The goal was to get the most out of its subjects and at the same speed, have the best performance. Test reliability coefficients different parts in study of Hadianfard and colleagues (2000), with an interval of 20 days was carried out on 43 school boys; located on the slopes of between 0.59 and 0.93. All coefficients calculated has significant correlation in 0.001. Validity test by way of criterion validity by comparing the normal group (30 school boys) and attention deficit hyperactivity (25 school boys) were performed. Statistical comparison of the two groups in different parts of the test, showed a significant difference between the performance of the two groups (0.001> P). In this test after the extraction of indicator response time 1, response errors remove two wrong answers 3 investigated.

The process of implementation of verbal self-instruction program: The experimental group in 8 sessions received verbal self-instruction training program. The educational program consisted of weekly one-hour sessions with a short course and practice was started. In short lesson, skills were explained in the training, participants were asked to run their skills to help the researcher. In addition, the participants were expected after the training, educational opportunities and duties apply at home or in other communications and in the event of problems, the researchers during their next meeting. The content of the training sessions is as follows:

First session: Welcome and explanation on how to develop and implement educational programs and planning in order to familiarize students with each other.
Second session: Explaining the nature of verbal self and its implementation process according to the images, and encourage participants to plan for verbal and written problems.
Third session: Providing for the implementation of the verbal self-instruction and talking loud to himself/herself. In the first stage researcher would ask him/her loudly and then he/she responded. In the second stage, the previous stages were expressed aloud by researchers and students to conduct training. In the second phase, the previous steps to provide students with a loud voice, speech and then executed. In the practice, a researcher in his daily routine as a student wanted to write. First, discuss your problems and respond to herself. This part also in three steps.

Fourth session: Describing first stage of verbal self-instruction. In the first stage students listened to the researcher said he saw the agents force; secondly they were doing. In practice, the first and second stages of verbal self was run by a new issue.
Fifth Session: Describing second stage of verbal self-instruction. Students were told instructions aloud to themselves and as telling them they did it.
Sixth session: Describing fourth stage of verbal self-instruction. Students were told instructions softly to themselves and as telling them they did it.
Seventh session: Describing fifth stage of verbal self-instruction. Students were whispering instructions to themselves and as whispering them they did it.
Last session: Five steps of verbal self-instruction reviewed. In practice, the homework was conducted in five stages of verbal self-instruction.
At the end of each training session, the students' assignments can be done at home and at the beginning of each session (of the third session onwards) were assessed assignments last week.

Findings

The mean and (standard deviation) respond error in a group of students with math learning disorders in the pre-test and post-test in the test group are respectively 8.67 (1.96) and 8.02 (1.94) and in response error removal are respectively 8.19 (2.41) and 7.52 (2.17). The mean and (standard deviation) number of correct responses in this group of students with math learning disorders in pre-test and post-test sequence in the test group are respectively 131.72 (3.74) and 140.5 (3.98) and the mean and (standard deviation) is an indicator reaction time in the group of students with math learning disorders in pre-test and post-test sequence in the test group are respectively 832.231 (38.56) and 876.65 (39.33). The mean and (standard deviation) in a group of students with math learning disorders respond error in the pre-test and post-test sequence in the control group are respectively 8.96 (1.99) and 8.76 (1.95) and in response error elimination are respectively 8.25 (2.49) and 8.52 (2.27). The mean and (standard deviation) number of correct responses in this group of students with math learning disorders in pre-test and post-test sequence in the control group are respectively 132.67 (3.78) and 134.42 (3.85) and mean and (standard deviation) is an indicator reaction time in the group of students with math learning disorders in pre-test and post-test in the control group are respectively 820.131 (37.93) and 820.52 (37.92).
Table 1: Mean and standard deviation scores of students with mathematics learning disabilities in sustained attention in both experimental and control groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Experiment Pre-test</th>
<th>Experiment Post-test</th>
<th>Control Pre-test</th>
<th>Control Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Respond error</td>
<td>8.67</td>
<td>1.96</td>
<td>8.02</td>
<td>1.94</td>
</tr>
<tr>
<td>Reply delete error</td>
<td>8.19</td>
<td>2.41</td>
<td>7.52</td>
<td>2.17</td>
</tr>
<tr>
<td>Number of correct answers</td>
<td>131.72</td>
<td>3.74</td>
<td>140.5</td>
<td>3.98</td>
</tr>
<tr>
<td>Response Time Index</td>
<td>832.231</td>
<td>38.56</td>
<td>876.6</td>
<td>39.33</td>
</tr>
</tbody>
</table>

Results

The table above shows the average scores of students with mathematics learning disabilities after applying verbal self-instruction training in the variable of sustained attention (CPT) and post-test is better than the pre-test. Before using parametric multivariate analysis of covariance to comply with its assumptions, Box and Levene test was used. Based on the Box test that is not significant for any of the variables, the condition of homogeneity of variance matrix / covariance is properly observed (P = 0.86, F = 0.216 and BOX = 1.571). In any case, Levene test and non-significant for all variables, the condition of equality of variance between groups is observance. Wilks Lambda test results showed that the group's combined dependent variables were significant (eta = 0.876 and P < 0.001 and F (6, 23) 702,29 and Lambda = 0.044). The above test permitted the use of multivariate analysis of variance (MANCOVA). The results showed that by taking a pre-test scores as a covariate, verbal self-instruction training has led to differences between the experimental and control groups.

Table 2: Summary of test results between subjects

<table>
<thead>
<tr>
<th>Variable</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
<th>eta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>1</td>
<td>58.94</td>
<td>28.61</td>
<td>0.11</td>
<td>0.65</td>
</tr>
<tr>
<td>Respond error</td>
<td>1</td>
<td>280.9</td>
<td>82.68</td>
<td>0.000</td>
<td>0.586</td>
</tr>
<tr>
<td>Reply delete error</td>
<td>1</td>
<td>245.02</td>
<td>57.56</td>
<td>0.000</td>
<td>0.562</td>
</tr>
<tr>
<td>Number of correct answers</td>
<td>1</td>
<td>1155.6</td>
<td>125.05</td>
<td>0.000</td>
<td>0.508</td>
</tr>
<tr>
<td>Response Time Index</td>
<td>1</td>
<td>451137.6</td>
<td>146.08</td>
<td>0.000</td>
<td>0.622</td>
</tr>
</tbody>
</table>

As reported in Table 2, there is a significant difference between the experimental and control groups in the Continuous Performance Test (respond error, reply delete error, number of correct answers and response Time Index). This means that the difference in post-test is in favor of the experimental group. Investigating eta coefficient of each variable indicate that 59% of the respond error variance and 57% of the reply delete error variance, 50% of the number of correct answers and 63% response time index in CPT is explained by group membership.
Discussion

The aim of this research was to investigate the effectiveness of verbal self-instruction on sustained attention (based on Continuous Performance Test) among students with mathematics learning disabilities. The results showed that there were significant differences between mean scores of post-test of two groups experimental and control components of respond error, reply delete error, number of correct answers, response time index (CPT). So verbal self-instruction training in the experimental group led to a reduction in respond error and reply delete error and increased the number of correct answers, response time index. This result was consistent with the findings of Alizadeh and Zahedi Pour (2005), Ashtari Zadeh (2001). These results are also consistent directly with the findings of Soleimani (2014). This finding can be said to explain mathematical problems and low performance in mathematics is one of the issues at least half of elementary school students struggling with it (Ariapooran, Azizi and Dinarvand, 2013). To explain these findings, we can say that dynamic deployment and ongoing activities of each person affected by the nature and quality of planning and organization of the individual. In particular the organization and planning of mathematics learning activities in this regard, is the most basic. And a favorable adjustment to shape teaching and learning activities requires full attention to due process that should be considered at the same time students. Since the problem-solving ability as a conscious activity, rational and purposeful seen as the culmination of human capabilities, it needs high attention and learning problems in social adjustment and academic performance so successful resolution is an important factor and the associated skills and academic achievement, self-regulation, self-efficacy and success in the task (Behzadpour, Sadat Motahari and Goudarzi, 2014, Nasri, Saleh Sedghpour and Cheraghian Radi, 2014). Children with learning disabilities are mathematics; the natural growth process of acquiring attention is delayed or interrupted. Children with mathematics learning disabilities with the known mathematical operations well, but mistakes due to inattention to symptoms such as inattention, lack of attention to the column ones, tens, hundreds, complete lack of attention to writing numbers, calculated by taking a and set numbers are numbers that the problem arises due to neglect. So children to learn math homework should have a set of skills mastered these skills, including attention, memory and so on. The acquisition of these skills is through experience, education and learning. Most of these children acquire these skills automatically. However, children with mathematics learning disabilities and difficulties in learning these skills should be taught to them. The primary school teachers should be teaching math to children especially the children with mathematics learning disabilities such as attention to the antecedents of mathematics learning, pay attention. One of the therapies in the field of mental disorders such as dyscalculia is verbal self-instruction training methods. The first person to reveal the inner speech and external tests, then when I learned what to do, it does internally and using verbal self-directed guide their behavior in order to solve the problem and during this process, to continue problem-solving activities to strengthen the use of the words (quoted by Soleimani, 2015). Verbal self-instruction training could be improved and higher levels of academic performance. In other words, verbal self-instruction training results in improvement in attention and subsequently causes to improve and strengthen students' math performance. The verbal self-reinforcing and thus lead to neuropsychological given as a prerequisite for improving math performance by students with learning disabilities (Rezaei et al., 2014).
Conclusion

The results showed that verbal self-instruction training has an impact on learning math failure and if this group of students engaged in this type of training, you can achieve some progress in this field. This study was conducted on students with math learning failure and its results cannot be generalized easily to other learning disabilities. Also in this study due to time constraints and lack of cooperation with school authorities' attendance of students in schools, the implementation of the follow-up period to assess the continuing effectiveness of verbal self-instruction training was not possible. Counselors and psychologists suggest that by holding these courses and encourage students to participate in these courses; students are prevented from increasing problem. It is recommended to evaluate long-term effects of verbal self-instruction training, follow-up studies carried out similar studies in different basic education and other learning disabilities done using attention learning.

Acknowledgments
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