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Original Article

The Effectiveness of Verbal Self-Instruction Training on Math Problem-Solving of Intellectually Disabled Students

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Objectives: Self-instruction training assists students to organize thinking patterns, learning, self-assessment, and self-awareness. This study was aimed to determine the effectiveness of verbal self-instruction training on math problem-solving of intellectually disabled male students in Tehran Provinces.

Methods: This study was an experimental research with pre-test and post-test design with control group. 30 intellectually disabled male students were selected randomly through cluster sampling method from 9th grade students. They were assigned to experimental and control group equally. Experimental group participated in 8 sessions and were trained by verbal self-instruction program but control group did not. All students answered to a teacher-made math problem-solving test before and after the training sessions. Data were analyzed by analysis of covariance.

Results: Findings showed that there was a significant difference between two groups according to math problem-solving performance ($p<0.002$).

Discussion: As the performance of math problem-solving of experimental group promoted after the intervention sessions in comparison to control group, it seems that verbal self-instruction has led students to use thinking skills for acquiring and retention of fundamental mathematics facts. It can conclude that verbal self-instruction training probably leads to promote math problem-solving performance of intellectually disabled boy students.

Key words: Boy Students, Intellectually Disabled, Math Problem-solving, Verbal Self-Instruction

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Introduction

Intellectual disability refers to people who have significant limitations in intellectual functions and adaptive behavior and their problems begin before 18 years old (1). Its prevalence is 2 or 3 percent in a community. In most communities, they have been trained as same as normal children, but they are not able to learn successfully. Their failure might relate to their special characteristics (such as attention, memory, and language problems), also teaching methods (2). One of the most important factors for promoting the education of a country is paying attention to students with intellectual disability (3). As these children have retardation in comparison with normal children, they cannot take advantage of mainstream training (4). Math problem-solving is a skill which is more relating to memory and thinking. Processes such as observation, measurement, analysis, inference, and comparison help us to perceive information and models precisely. Problem solving requires analysis of problem, evaluation of program before its implementation, and evaluation of its consequences. These issues are not only limited to thinking and knowledge organization, but also include arrangement, planning, revising and evaluating of the consequences (5).

One of the problems of intellectually disabled students is that they cannot arrange their mental activities for answering in correct way. Problem-solving is required the students to do complex activities in order to acquire the suitable and logical solution (6). To some extent that the thinking level is deeper, intellectually disabled students have more memory problems in comparison to normal students. As far as, failure in reading math problems leads to the consequences such as: school problems, low

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self-concept, and depression, this might be lead to absence and escape from school. Therefore, planning appropriate teaching methods is essential and important for improving scholastic skills in students with intellectual disability.

In recent years, training with the purpose of enhancement and encouragement of self-instruction skills has been emphasized (7). Self-instruction training assists students to organize thinking patterns, learning, self-assessment, and self-awareness (8). The main purpose of verbal self-instruction is that learners are converting to independent individuals in order to supervise and modify their cognitive and learning processes toward specific objectives (9). Self-instruction has been used in a wide range of academic skills. Some evidence show that the programs based on self-instruction are effective on improving learning of students with intellectual disability (10). Such programs have been used for a wide range of areas, including academic skills (i.e., reading and math), behaviors relating to classroom (i.e., selective attention relating to a task), emotional skills (i.e., causal attribution) and social skills (11). Self-instruction focuses on a set of self-guiding instructions about how to do a task, besides of emphasizing on helping students revising and coordinating their activities.

Self-instruction is a set of modeling and exercises which involve these steps: 1) cognitive modeling; 2) overt external guidance; 3) overt self-guidance; 4) decreasing self-guidance; 5) latent self-instruction (12). Comprehensive studies have done on verbal self-instruction at different ages and various areas. Osborn is paying attention to the studies which done about the effectiveness of learning strategies and stated that it is possible to teach various strategies to the students. It is helpful for them to act consciously when they are learning or thinking, so they are able to use profitable strategies when facing with different learning tasks and academic problems (13). Many studies have confirmed the effectiveness of verbal self-instruction on the performance of students with learning disabilities. The findings showed that learning how to use these strategies is important for learning. Such strategies facilitate the acquirement of knowledge, skills, and knowledge organization (14). Some research showed the positive effect of self-instruction training on the performance of students with learning disabilities. For example; Brayant (15), Teong (16), Wiltz (17), Slavin (18) have confirmed the positive effects of self-instruction on enhancement of math problem-solving and learning motivation of students with learning disabilities. Montague studied the efficacy of self-instruction on math problem-solving performance in students with dyscalculia. The finding showed that the students who were trained by self-instruction, perform better in math in comparison to peers (19). Dehghani studied the effectiveness of meta-cognitive strategies training on math problem-solving of students with dyscalculia in primary school in Isfahan. Findings showed that instruction of meta-cognitive strategies has positive effect on problem-solving of student with dyscalculia (20).

Paying attention to researches which have investigated the effect of self-instruction training on students with learning disabilities, we perceive that such training is effective positively on problem-solving in students with dyscalculia. Asintellectually disabled students have delay in mental development and they are 3 or 4 years behind of normal peers to get abstract thinking, their motivational problems relating to their success and failure in academic performance, the present study tries to answer whether verbal self-instruction training is effective on math problem-solving of students with intellectual disability or not.

Methods

The present study was a semi-experimental study with pre-test and post-test design with control group. Thirty boy students with Intellectual disability were selected randomly by cluster sampling from middle school in Tehran Province. The study was formally approved by Exceptional Education Organization ethics and Committee of University of Social Welfare and Rehabilitation Sciences in Iran. The students were educating in specific schools (middle school; 9th grade) aged 13-17 years old. After supplying written informed by parents of students, the students were assigned to experimental and control group equally (15 individual in each group). Experimental group participated in 8 intervention sessions, once a week, and were trained by verbal self-instruction program, but control group did not participated. Wechsler Intelligence Scale for Children was used for matching the subjects according to IQ. A teacher-made test was used for evaluating math problem-solving of students before and after the sessions. Data were analyzed by analysis of covariance (ANCOVA) by using SPSS, software, version 19.

Wechsler Intelligence Test for Children-Revised form (WISC-R) and Math Problem-Solving Test (Teacher-Made) were used in this study. The WISC-R is composed of 12 subscales and provides three intelligence quotient (IQ) scores: verbal, nonverbal and total IQ. To assess verbal IQ, the scores of subscales: information, similarities, arithmetic, vocabulary, comprehension, and digit span were summed up. For assessing nonverbal IQ, the scores of subscales: performance, picture completion, picture arrangement, block design, object assembly, coding, and mazes were calculated. Total IQ was calculated by the summation of verbal and nonverbal IQs. The reliability and validity of WISC-R was measured and reported 0.73 for its reliability and correlation quotients for verbal, nonverbal and total IQs were 0.84, 0.74, and 0.85 respectively (21). The Math Problem-Solving Test (Teacher-Made) is established based on math problems of 9^{th} grade special for students with intellectual disability. This test is composed of 2 parallel forms (A and B) which were made by department of mathematics with collaboration of expert teachers in 2012-2013 school years. Criterion-related tests and the views of three math teachers were used to test its content validity. The teachers evaluated each question in three categories: useful, useless, necessary. According to teachers' evaluation about each question, it was eliminated or confirmed (if two teachers evaluate a question as useless, the question was deleted). Validity coefficients for the forms A and B were 0.94 and 0.91 respectively. Agreement between experts was used to determine the reliability. Three evaluators considered independently the subjects' responses. The correlation between the scores of three evaluators was considered as reliability index. The reliability coefficient of forms A, and B was 0.87, 0.93 in respect (22). In present study, the Verbal Self-Instruction Package which has proposed by Harris and Graham was used. The package was used by Bashavard for students with intellectual disability in Iran for the first time. Its validity and reliability was reported 0.89 and 0.82 respectively (23). The package was administered in 8 sessions and the content of each sessions are presented in table (1).

Table 1. The content of intervention sessions separately

session	Content
1	Making the students familiar to verbal self-instruction and its application
2, / 3	Describing cognitive modeling including: reading, retelling the problem, imagination, determining the phases, hypothesizing, guessing, and review the phases.
4	Presenting cognitive modeling with teacher overt guidance
5	Presenting cognitive modeling with overt self-guidance
6	Presenting teacher and student cooperation
7	Gradually omission of self-guidance
8	Presenting latent self-instruction

Results

Descriptive indices of math problem-solving performance in experimental and control groups were shown in table (2). There was no significant difference between experimental and control group in math problem-solving in pretest. According to table (2), the mean of math problem-solving of experimental group increased in comparison to control group in post-test.

Table 2. Mean and standard deviation of math problem-solving performance of two groups in pretest and post-test

Groups	Situation	Mean	Standard deviation
Experimental	pre-test	3.6	1.02
	post-test	17.5	0.87
Control	pre-test	3.7	1.36
	post-test	4.1	1.23

Analysis of covariance (ANCOVA) was used to measure the effect of verbal self-instruction on math problem-solving performance of experimental and control group. It is required to test the assumptions of ANCOVA. The normality of variables and the sameness of variances were tested. The Kolmogorov-Smirnov test showed that all variables were normal and Leven test was no significant (p= 0.64). The results of ANCOVA have reported in table (3).

Table 3. Results of ANCOVA for comparing math problem-solving of two groups

Source of change	SS	df	MS	F	p	η^2
Pre-test	0.581	1	0.581	0.487	<0.607	0.07
Group	163.655	1	163.655	62.938	<0.002	0.69
Error	43.384	27	1.606			
Total	1023.044	30				

As indicated in table (3), there was a significant difference ($p<0.002$) between experimental and control groups according to math problem-solving performance. Considering $\eta^{2,}$, we can conclude that 69% of variation of math problem-solving can be explained by participating in verbal self-instruction training sessions.

Discussion

The present study was aimed to determine the effectiveness of verbal self-instruction on math problem-solving of 9th grade students with intellectual disability in Tehran Provinces. The results of ANCOVA showed that there was a significant difference between the mean of math problem-solving in experimental and control group. We can conclude that verbal self-instruction had a positive effect on improvement of math problem-solving performance in boy students with intellectual disability. The present results are consistent with some studies (i.e., (6,9,10,20,23,24). These studies showed that verbal self-instruction training is effective on improvement of academic performance in different students. One explanation for this result might be that in verbal self-instruction sessions, the teacher is a model for students to think with loud voice. Gradually the students learn how to use the model, and they are able to control their own thoughts without the supervision of a teacher. As far as, the process of teaching for students with intellectual disability requires continuous repeating, it is preferred to select the issues which are emphasizing on memory. Such instructions which are considering this aspect of education will be effective on enhancing learning skills of these students. Verbal self-instruction training is considered as a program that is able to promote the problems of the students especially their memory (25). This study limits to small sample size, boy students and Tehran Provinces. These limitations make it difficult to generalize the findings on general population, girl students and other places except Tehran. It is recommended to investigate the effectiveness of verbal self-instruction on different student with special needs and compare these results simultaneously.

Conclusion

Considering that the performance of math problem-solving of experimental group promoted after the intervention sessions in comparison to control group, it seems that verbal self-instruction has led students to use thinking skills for acquiring and retention of fundamental mathematics facts. Therefore, it is required to teach such learning strategies to the students directly. The students who have learned these strategies are able to show high performance in math problem-solving tests (26). In sum, the present findings show the important role of these strategies on learning. To train these learning strategies will cause significant promotion in knowledge of students with intellectual disability to some extent that they will be able to control and apply these strategies while solving math problems. As a consequence, if parents, teachers, counselors and other experts will be informed about the effectiveness of verbal self-instruction, it could be expected that the academic performance of students with intellectual disability will improve.

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