Original Article

The Effectiveness of Conceptual Map Training Method on the Achievement of Social-Economic Skill Course in Male Students with Intellectual Disability[1]

Masoume Pourmohamadreza-Tajrishi, PhD.
Pediatric Neurorehabilitation Research Center
University of Social Welfare and Rehabilitation Sciences, Tehran, Iran
Mohammad Alipour[2]
Baghch-e-Ban Exceptional Center, Tehran, Iran
Soraya Chapari-Ilkhchi
Exceptional Education in Eastern Azarbayjan Province, Tabriz, Iran

Objectives: The aim of present study was to determine the effectiveness of conceptual map training method on the achievement of social-economic skill course in male students with intellectual disability.

Materials & Methods: This study was semi-experimental and 34 male students with intellectual disability who were educating in 3rd grade at pre-professional level in high school selected randomly from Talash Exceptional Center in Tabriz City. Their academic achievement in social-economic skill course were assessed by teacher-made and performance tests. Subjects were assigned in control and experimental groups randomly and equally. Experimental group participated in 8 sessions and were trained by conceptual map method for one month (8 sessions; 2 sessions weekly). At the end of eightieth session and one month later, subjects answered to teacher-made and performance tests again. Data were analyzed by analysis of covariance.

Results: Findings showed that the conceptual map training method had positive effect on achievement of social-economic skill in students ($p<0.01$). But, its effectiveness wasn't persistent after one month in follow-up test.

Conclusion: Regarding to positive effects of conceptual map training method on meaningful learning, it seems as an effective method for intellectually disabled male students who require deep learning to understand the content of their lessons.

Keywords: Conceptual Map, Meaningful Learning, Social-Economic Skill, intellectual disability.

Submitted: 9 Nov. 2012
Accepted: 29 Feb. 2013

Introduction

Nowadays, the role of teacher has changed from informing and transferring knowledge to guide and facilitate students' learning. As far as, the philosophy of training methods has changed, transferring of knowledge by teacher and book has exchanged with making knowledge through meaningful learning. This development has been done with the transition from behaviorism to cognitive paradigm (1).

In constructivism, learning is defined as a dynamic and internal process during which learners make knowledge actively by linking new information to what they have learned before. In other words, knowledge is dependent to a learner. Therefore, training is a learner-centered method in which emphasizes on activity of the learner. By the way, a learner is making knowledge by connecting new concepts to the previous ones. So, students should make schema and their mental maps personally and revise, develop and reconstruct them (2).

One of the modern approaches that are more related to constructivism is conceptual map training method. In this method, new issues can connect to the present cognitive structure. In 1960s, Novak used conceptual map as a training strategy for representing knowledge

1- This paper derived from Master thesis, Department of Psychology and Education of Exceptional Children.
2- All correspondences to Mohammad Ali pour, email: <meshki-coffenet@hotmail.com>

graphically. He introduced it as an instrument for showing the relations between concepts in coherent and hierarchical manner (3).

By using conceptual map, learning issues are repeated for students several times, both during representing and when preparing them. In prepared maps, students review the issues visually and when supplying maps, review them in written form. When students prepare a conceptual map for an issue, they will understand that there are many probable relations between the concepts, so that they will encounter a mental challenge for selecting these concepts and their relations. This might cause students to perceive more concepts and learn meaningfully (4). Cheng (5) commented that the issues will extend in conceptual map training method and it will help the students to form their new knowledge. Also, the teachers will get feedback through this method and understand its efficacy on students' learning, so they can recognize their probable training difficulties. There are different ways to display ordered diagrams of conceptual maps. Different topics require different types of conceptual maps. Some of them include: spider conceptual map (the original concept is in center and related concepts are shown with arrows to it), pedigree conceptual map (in which, information has ordered in classified structure and the relations of concepts are seen obviously).

One type of conceptual map which may be useful for students with intellectual disability is to apply keywords instead of visual presentation. In this method, keywords can use for 5 aims: 1) to identify main and important concepts of a lesson, 2) to determine main and sub-concepts, 3) to deicide about determining the number of main and sub-branches, 4) to think more than before in order to reform keywords, and 5) to provide the questions by teachers in order to make deep learning in students.

Some studies (6-10) showed the positive effect of conceptual map as a facilitator for storage and retrieval of information. Regarding to the limitation of intellectually disabled students to organize the issues and their inability in preserving the concepts and generalizing them to real life, the purpose of present study was to determine whether the conceptual map method can be considered as a strong pre-organizer and also, as an effective teaching-learning strategy in these students. Considering the importance of applying social-economic skills in real life, the present study has focused on study the efficacy of conceptual map training method on learning social-economic skill in male students with intellectual disability.

Methods

This study was approved by ethics committee in University of Social Welfare and Rehabilitation Sciences. This was a semi-experimental study with pretest and posttest design with control group. Conceptual map training method and the achievement of social-economic skill were considered as independent and dependent variables respectively. 34 male students with intellectual disability who were educating in 3rd grade in Talash Exceptional Pre-professional Center selected randomly according to inclusion standards (ages 15; 9 to 18; 1 years old and their IQ ranging from 55 to 69 according to Laiter test) and exclusion standards (students with physical or motor problems, partially-sighted, partially-hearing, and male students who were using stimulant drugs for their medication). Subjects were assigned equally and randomly in experimental and control groups (17 individuals in each). All students completed teacher-made academic achievement test.

Teacher-made academic achievement test: the test used to measure the social-economic skill of 3rd grade students with intellectual disability. The test included two subtests: essay and performance tests (simulated situations) which are designed according to educational goals.

Essay test: at first, educational experts prepared and provided an essay test which included 30 questions associated with educational goals of social-economic skill course. Essay test composed of 10 restricted-response questions which are scored from zero to 15 points (each answer gets maximum 1.5 score). Zero is considered for lack of response (unrelated response) and 1.5 points for complete response. Test total score was considered as a criterion for achievement measure in social-economic skill. In the case of false answer, 0.25 points is subtracted from each question.

Performance test (simulated situations): in social-economic skill course, a kind of social and economical skill which is related to everyday life was taught to the students. Performance test used to assess the social-economic skill achievement of the students. This test was scored from zero to 5 points. In performance test, students were asked to do correct actions which are related to special activities in sequences. Each student should do all of the special activities for the learned concepts such as:

borrowing money or taking care of a child. Each of these special activities is scored 0.25 point and by adding these points, total score of a student was calculated.

To determine the content validity of performance test, teachers who works in exceptional pre-professional schools were asked to rate the relevance of each question with the behavioral objectives relating to social-economic skill course. After gathering their comments, the test was changed according to the required corrections. The correlation between students' scores in performance test and their mean score of social-economic skill in last year was used for criterion validity of the test. These correlation coefficients were 0.80, 0.90 and 0.85 for pre, post and follow-up tests respectively. Cronbach's alpha coefficient was 0.80 after gathering the answers of a group of students twice with one month interval.

After getting permission from the Ministry of Education in Eastern Azearbaijan Province and the manager of Talash Exceptional Center, some issues were selected from social-economic skill course. Then, keywords related to these issues were prepared by teachers. The teachers were educated in relation to the objectives of the project, and the way of training according to conceptual map method through using keywords. Students were selected according to inclusion and exclusion standards and assigned randomly to experimental and control groups. All subjects gave their informed consent prior to their inclusion in the study.

To assess the students' mastery on issues which are relating to social-economic skill, pre-test was implemented by using teacher-made tests (essay and performance tests). Experimental group participated in eight sessions for one month (twice a day; each session lasting one hour). They were trained about the issues of social-economic skill through the conceptual map training method. Control group received main stream training method and didn't participate in intervention sessions. At the end of eighth session, the teacher-made tests were implemented for both groups (posttest). In order to determine the persistence of subjects' learning, the teacher-made tests were performed one month after the eightieth session in all participants. Four students don't continue their participation in the project; two students from control group moved to the other pre-professional center and two subjects from experimental group were excluded from the project because of their absences were more than two sessions. Steps and content of conceptual map training method were as follows:

1. Preparation: students were encouraged to participate in teaching-learning process actively. They were asked to read the instructional text and recognize important keywords which are associated with the significant concepts by the assistance of their teacher.
2. Fluency: students were asked to think individually about the issues which were related to specified keywords and write them on a paper.
3. Accompaniment of parent: the teacher observed and inspected the sentences which were made by the students. Then, students were asked to continue making the sentences with the assistance of their parents in their home.
4. Keyword training: students should write the sentences which they were made at home, on the white board in their class individually and reread them in order to involve their vision, hearing and touching senses.
5. Gestalt: students have inspected the sentences with their teacher in order to correct them. Each student considered the other students' comments about his sentences. In this way, the students could receive the other sentences which were related to his keywords and could formulate the concept which he is considering to train.
6. Discriminating the main concept from subordinate: teacher and students exchanged their views about the probable number of main and subordinate branches of keywords of a given concept.

These steps were implemented for training the concepts (such as: pay the bill; take care of a child; good and appropriate behavior; take a loan) during eight sessions. Two sessions were considered for teaching each concept.

Analysis of covariance was used to compare the effectiveness of conceptual map method on achievement of social-economic skill in male students.

Results

Kolmogrov-Smirnov test showed that the distribution of the scores of social-economic skill achievement were normal. By drawing dispersion diagram through SPSS software, it was identified that there is no deviation from linearity. Descriptive indices of social-economic achievement have shown in table (1).

Table 1. Descriptive indices of achievement of socio-economical skills course in three situations

Group	M	SD
	Pre-test	
Experimental	7.56	4.23
Control	5.93	4.54
	Post-test	
Experimental	16.53	4.42
Control	11.66	4.62
	Follow-up	
Experimental	15.06	3.39
Control	9.30	5.40

As indicated in table 1, the mean of achievement of all students has increased in post test and follow-up situations in comparison to pre test situation.

To determine whether these increases in means are due to a real difference or error and chance, the analysis of covariance was used. After mediating the pre-test effects, the mean and standard deviation of social-economic achievement in experimental group were 16.02 and 0.95 respectively. These indices in control group were 12.18 and 0.95 in respect. In fact, the mean of experimental group was 3.84 higher than the control group.

In order to compare the means of social-economic achievement of two groups, analysis of covariance was used. The results showed that there was a significant difference between the mean of achievement of two groups ($p<0.009$). According to the effect size, it can conclude that 4.04% of students' achievement was due to the conceptual map training method. In other hand, conceptual map training method has led to increase the scores of social-economic skill of students compared to main stream method (table 2).

Table 2. Analysis of covariance for examining the effect of instruction on achievement of social-economic skills

Variation source	SS	df	MS	F	P value	Effect size
Pre-test	213.15	1	213.15	16.01	<0.001	4.04
Group	106.69	1	106.69	8.01	0.009	
Error	359.41	27	13.31			
Total	750.20	29				

Also, analysis of covariance showed that there was no significant difference between the mean of social-economic skill in students according to participating in conceptual map training sessions or not ($p=0.073$). According to the effect size, we can explain that 0.11% of the social-economic achievement was due to the conceptual map training method. Also, it confirmed that the increase of achievement was not significant after one month follow-up test (table 3).

Table 3. Analysis of covariance for examining the persistence of instruction in follow-up

Variable source	SS	df	MS	F	P value	Effect size
Post-test	150.928	1	150.928	8.563	0.007	0.241
Group	61.134	1	61.134	3.468	0.073	0.114
Error	475.905	27	17.626			
Total	876.242	29				

Discussion

The finding showed that the use of conceptual map training method has significant and positive effect on the achievement of social-economic skill in experimental group ($p<0.01$). This finding was in accordance with the previous research which showed the positive effect of conceptual map on academic learning (11-14).

The results confirmed the first hypothesis which stated: the conceptual map training method led to the social-economic achievement more than the main stream method. Generally, using conceptual map training method through presenting keywords has positive effect on social-economic achievement of male students with intellectual disability. This was in agreement with meta-analysis studies (2, 15). Meta-analysis study of Horton on 19 researches showed that conceptual map has positive effects on

both academic achievement of students and their attitudes. Also, most of findings showed that the use of conceptual map has a positive effect on academic indices (6, 8, 16-19) and various topics (20, 21).

There is one explanation about the effectiveness of conceptual map method on students' achievement. It is possible that students are passive in main stream training method. It means that they do not assimilate new information with present concepts in their cognitive structures. So, they memorize only without understanding or perception of the issues. As far as the issues were irrelevant and not integrated with each other, it was not possible to remember or evoke them (22). Second, in conceptual map training method, the instructional issues include all of the characteristics of verbal meaningful learning which was considered by Azubel. As far as, the conceptual map is the same as a pyramidal structure which represents the information in the mind and displays the relations of concepts and issues in a hierarchical form, the concepts becomes specialized up to down and the general issues are locating above the map (23). Third, conceptual map is presenting key words in order so that, the learner will recognize the important concepts and issues of the text and arrange them in a meaningful hierarchical pattern and use them successfully (2). Fourth, the students are more active in conceptual map training method and involve in learning issues. So, better understanding and stable learning will be expected (24). Finally, by using the conceptual map training method, the learners are assured that they have learned the content and feel they get mastery on the issues. However, new information will integrate with the cognitive structure of the learners (25).

Totally, the conceptual map method has many positive consequences. This method helps the learners to combine a lot of issues in order to understand inter-relations of them. Also, these issues play as a pre-organizer role in a well-organized conceptual map before teaching. The learner can summarize what is learnt by this method after the end of learning process too (26).

Roth and Roychoudhury confirmed that the effectiveness of conceptual map in meaningful learning. They commented this method helps the learner to become aware of his/her cognitive processes and can control them. Also the learners can develop an integrated cognitive framework in their mind through conceptual map method (27).

According to Akinsanya and Williams when the students consider a subject, they will be able to understand its relations with other concepts. So, they confront a challenge for selecting the related concepts and inter-relations of them. As a result, this challenge leads to more and deeper leaning (4).

Since, the conceptual map method was considered as an organizational strategy, it can provide a learner to write the main and subsequent ideas in short by using keywords and phrases in order. This strategy converts the text to a plan or a map so that the learners can recognize the main concept of a text at first. Then, the learners can determine the subsequent concepts which are related to the main text. At last, the learners are able to join the subsequent ideas to the main ones. It is recommended that the learners who are using the conceptual map should organize the important information and key concepts and analyze them, represent them in an imaginary manner and connect them to each other (10, 11).

Regarding to the second hypothesis, "the effect of conceptual map training method persists on students' achievement for a long time", the findings showed that the effectiveness of conceptual map was not significant on the remembrance of 3rd grade male students with intellectual disability. This is not in agreement with the results of Hall and O Donnell's study (28), which indicated that the conceptual map facilitates the memorization and remembrance of information. According to levels of processing theory, issue processing is done in deeper levels if we use keywords in conceptual map method. Therefore, it leads to the lasting and longer memorization, rapid and easier remembrance. As far as, the conceptual map combines and integrates verbal and visual information (29) it improves the performance of memory. In this method, the issues are repeating for the learner for several times. A map represents a clear and comprehensive image of concepts and their relations in a small space so that a person will be able to focus on any part of it easily and review the illustrative summaries faster (10). Also, it is essential that the learner should be involved as an active learner in conceptual map training method in order to recognize the main concepts and associate them (30). This leads to an additional processing of the issue by the learner and results in effective storage of information in memory and easy access to them (31).

As earlier indicated, many studies confirmed that conceptual map strategy will increase the ability of memorizing and retention of issues and generalization of them for a long time. In present

study, it is showed that there was no significant difference between post test and follow-up scores of remembrance of social-economic skills in experimental group. It can be explained that students with intellectual disability have limitation in retention and generalization of the issues for a long period of time. It may be explained by several reasons. First, these students are not being able to rehearse and repeat the learnt issues of social-economic skill daily. It is possible that if follow-up was done for several and different intervals, the results might be different. Second, there is a few appropriate equipment and resources for instructing intellectually disabled students in exceptional pre-professional centers. Finally, students with low average IQ could not memorize the issues for a long time without the assistance of appropriate strategies. So, they can not generalize the learned issues outside their classes and school (22).

The results were limited to 3rd grade male students with intellectual disability in pre-professional level. Also, the results of remembrance were limited to what have obtained from teacher-made tests. It is recommended that the use of alternative tests to measure the memory (especially long-term) of students is beneficial for more comparison. Also, it might be useful for students to provide appropriate books which are ordered in a conceptual map manner. It is better that the follow-up tests be done in many intervals, instead of only one month later. Also, the authorities of exceptional children should pay attention to special needs of these children and provide the required resources for instructing them.

References

1. Bransford JD. How people learn: Brain, mind, experience and School. Washington, D.C: National Academy Press; 2004.
2. Mesrabadi J, Alavi A, Ostovar N. Comparing the effectiveness of conceptual map as a teaching-learning strategy in academic achievement of different subjects. Abstract Book of National Conference of Educational Innovation. Tehran: Institute of curriculum, research, and educational innovation; 2006.
3. Chiu CH. Evaluating system-based strategies for managing conflict in collaborative concept mapping. Journal of computer Assisted Learning. 2004; 20 (2):124-132.
4. AKinsanya C, Williams M. Mapping for meaningful learning. Nurse Education Today. 2004; 24 (1):41-46.
5. Chang KE. Learning through computer-based concept mapping with scaffolding aid. Journal of Computer Assisted Learning. 2005;17 (1):21- 33.
6. Guastello EF, Beasley TM, Sinatra RC. Concept mapping effects on science content comprehension of low-achieving inner-city seventh grade. Remedial and special Education. 2000; 21 (6):356-365.
7. Hazel E، Prosser M, Trigweel K. (2002). Variation in learning orchestration in university biology courses. International Journal of Science Education. 2002; 24 (7):737-751.
8. Fajonyomi MG. (2002). Concept mapping, students' Focus of control and gender as determinants of Nigerian high school student's achievement in biology. An international journal of IFE psychology. 2002; 10 (2):100-112.
9. Mitchell D, Hutchinson CJ. Using graphic organizers to develop the cognitive domain in physical education. Journal of Physical Education. 2003; 74 (9):42-47.
10. Wang WM, Cheung CF, Lee WB, Kwok SK. Self-associated concept mapping for representation، elicitation and inference of Knowledge. Knowledge-based. 2008; 21 (1):52-61.
11. Kimber K, Pillay AH, Richards C. Techno literacy and learning: An analysis of the quality of knowledge in electronic representations of understanding. Computers & Education. 2007;48 (1):59-79 .
12. Radel R, Sarrazin P, Legrain P, Wild TC. Social contagion of motivation between teacher and student: Analyzing underlying processes. Journal of Educational Psychology. 2010; 102(3): 577-587 .
13. Banning M. Approaches to teaching: current opinions and related research. Nurse Education Today. 2004; 25(7): 502-508
14. Hallett D, Nunes T, Bryant P. Individual differences in conceptual and procedural knowledge when learning fractions. Journal of Educational Psychology. 2010; 102(2):395-406 .
15. Horton PB, McConny AA, Gallo M, Woods AL, Hamelton O. (1993). An investigation of the effectiveness of concept mapping as an instructional tool. Science Education. 1993; 77 (1):95-111.
16. Okebukola PA. Attaining meaningful learning of concepts in genetics and ecology: an examining technique. Journal of Research in Science Teaching. 1990; 27(5):493-504.
17. Jegede OJ، Alaiyemola FF. The effect of concept mapping on students anxiety and achievement in biology. Journal of Research in Science Teaching. 1990; 27(10):951- 960.
18. Alfieri L, Brooks PJ, Aldrich NJ, Tenenbaum HR. Does discovery-based instruction enhance learning? Journal of Educational Psychology. 2011;103(1):1-18 .
19. Huai H. Concept mapping in learning biology: Theoretical Review on cognitive and learning styles. Journal of interactive Learning Research. 1997; 8:38-48.
20. Mesrabadi J, Fathiazar A, Ostovar N. The effectiveness of presenting individual and group conceptual map as an educational strategy. Quarterly of Educational Innovations. 2005;13:11-31.
21. Rahmani A, Mahjal A, Fathiazar A, Abdollahzadeh M. The effect of conceptual map training method in nursing course of university students. M.Sc. thesis. Tabriz Medical Sciences University; 2007.
22. Shabani H. Teaching techniques and methods. (1st Ed.). Tehran: Samt Publishing; 2007.
23. Graham S, Harris KR.Components analysis of cognitive strategy instruction: Effects on learning disabled students' compositions and self-efficacy. Journal of Educational Psychology, 1989; 81(3):353-361 .
24. Liaghatdari M, Abedi M, Jafari A, Bahrami F. Comparing the methods of group lecture teaching method with discussion method. Quarterly of Educational Innovations.

2003; 13:11-21.
25. Hatami J, Abdolahmirzaee R, Abbasi G. Quality improvement of training chemistry concepts through concept maps. Psychological Quarterly of Tabriz University. 2009; 4(3):296-281
26. Beitz JM. Concept mapping: Navigating the learning Process. Nurse Educator. 1998; 23 (5):35 – 41.
27. Roth WM, Roychoudhury A. The concept mapping as a tool for the collaborative construction of knowledge: a microanalysis of high school physics students. Journal of Research in Science Teaching. 1993; 33:569- 600.
28. Hall RH, O Donnell AM. Cognitive and affective outcomes of learning from knowledge maps. Contemporary Psychologist. 1996; 2(1):94-101.
29. O Donnell AM, Reeve J, Smith JK. Educational psychology: reflection for Action. (2nd Ed.). USA: John Wiley & Sons, Inc; 2007.
30. Heinz-Fry JA，Novak JD. Concept mapping brings long term movement toward meaningful learning. Science Education. 1990; 77:461-472.
31. O Donnell AM. Learning from knowledge maps: the effects of map orientation. Contemporary Educational psychology. 1994; 19:33-44.