

Evaluate the effectiveness of teaching problem solving in mathematics achievement, creativity and first-grade students in Bazman in the academic year 2015-2014

Amenehsadat Sajjadi¹, Saeed Khorramroei², Seyed Amanollah Sajjadi³

^{1,3} Department of Educational Research, M.A. of Educational Research, Anar Branch, Islamic Azad University, Anar, Iran.

² PhD, Anar Branch, Islamic Azad University, Anar, Iran.

Received: May 14, 2015

Accepted: August 27, 2015

ABSTRACT

The aim of this study is to determine the effect of training in problem solving on mathematics achievement, creativity and first-grade students, male and female, in Bazman. The research is, experimental, and with pre-test and post-test with control group. The sample was consisted of 4 classes in 120 patients (60 males and 60 females) who were selected by random sampling. The research instrument a researcher test, the mathematics achievement and children Torrance Test of Creativity. In this study, the experimental group was trained, seven sessions of 45 minutes by teachers to approach problem solving, but control group continued, with the traditional approach to its activities. The results showed that academic achievement and creativity of the students in the experimental group was higher than the control group. The results showed the effect of sex, the boys acted than girls, better and more successful method of problem solving in groups. And they showed that, compared to girls, creativity and better progress.

Conclusion: Learning through problem solving, beneficial and effective to improve academic achievement and increase students' creativity.

KEYWORDS: academic achievement, problem solving and creativity

1. INTRODUCTION

When, formal education, has increased, in human societies, fostering higher cognitive abilities, has been emphasized, as well as understanding, perception, reasoning, thinking, creativity, problem solving and judgment. Over the last century, the emphasis was to remember knowledge, gradually for some time, with the development of human knowledge and increasing production and the formation of schools and universities. And development of higher cognitive faculties, fell slightly, but did not deny the importance of education. In recent decades, country's education system tries to promote higher cognitive abilities, especially creativity, problem solving and critical thinking. Today, all those involved with education experts believe that one of the main goals of education should be creative and innovative generation upbringing. Therefore, the basic elements of curriculum reform and change, very important, the content of education, teaching methods, evaluation methods, school psycho-social environment and physical space (Elvin & Chamders, 1997)

Of course, teaching methods, teacher, architect of cognitive organization and methods of evaluation, he is for the mental energy, motivation and guidance of the student's educational activities, of these elements. Thus, reform and innovation in the way teachers teach, the most basic concerns of practitioners and researchers in the last few decades in education and training. Training so that is the outcome of this process, has repeatedly stressed the role of teaching by solving Cognitive problems in the development of innovative and creative organization.

In problem-solving thinking, education has been one of the major objectives of the educational and training needs of teachers and parents, on education. Psychologists and theorists have different emphases, has always stressed the importance of activities related to the problem, the development of effective learning. Problem and attempt to solve it, is part of everyone's life, and teachers have been enthusiastic, traditionally they learn reasoning, thinking, creativity and responsibility, to his disciples (Gelarar, 2007). In education, there are several factors, including participation in courses, textbooks use of audio-visual equipment, software and computer networks, to create learning and creativity, that it is paving the way for academic achievement. But undoubtedly, active teaching methods, has an essential role in learning, creativity and development of students among these factors, such as problem solving. Problem solving method is, in fact, a kind of preparation, learning to real life, because life, when faced with problems, and attempt to solve them. In this way, educational activities will be

* **Corresponding Author:** Amenehsadat Sajjadi, Department of Educational Research, M.A. of Educational Research, Anar Branch, Islamic Azad University, Anar, Iran.

adjusted, so that it is inclusive in mind, matter, and he is eager to find his quest for a solution to the problem (Safavi, 2009).

Novak believes that the problem needs to reorganize information in the memory, to achieve a specific purpose and a new (problem solved), and if the issue of demand, more new data in this case is the process of exploring and dynamism, will be necessary, the (FathiAzar, 2003).

1.1 Definitions of terms and concepts

1.1.1 Problem

Problem solving process, which combines learning the principles previously learned earlier, at that, so he could not solve a new problem, therefore, is not a problem; just use the principles learned earlier, but a process, which provides new learning (Seyf, 2010). Also we can define, problem solving for diagnosis and application of knowledge and skills which makes the learner finds the correct response to the situation or the learners reach his target. So the basic elements of problem solving and application of knowledge and skills already learned in new situations. Or they have defined problem solving, application of knowledge and skills to achieve certain goals.

In this research, problem-solving techniques come into force with a Puglia problem solving process. These steps include:

1- Understanding the problem; 2- Plan; 3-Implementing; 4- Review and test questions, the application of problem solving procedure, carried out in seven 45-minute sessions.

1.2 Achievement

Academic achievement, progress and achieve the purpose of training students in the (Seyf al, 2010).

Academic achievement, the score, the students gain in math achievement test developed by the researchers.

1.3 Creativity

Creativity: Creativity, a set of capabilities and the features that they lead to the production of the most important of these features are unique in divergent thinking

In fact, creativity is formed, the Geliford, the four elements of fluency, flexibility, originality and elaboration, as follows:

1. Fluid Creativity is the ability to create, and create a great number of ideas, answers and solutions in the form of image or assumed in a particular domain. In this case, the creative person's mind to offer ideas in a particular domain of thought, and it is included, the number of possible answers and ideas.

2. Creativity development: it is, a person's ability to deal with the details. The creative person, and enable the implementation of an idea and add details, as well as the individual's ability to complete the idea of a picture on it.

3. Creativity, originality or novelty: it is a person's ability to develop and create new ideas, unique, unusual and clever to solve a problem, which is, however, different from common ideas. The creative person is able to produce new ideas and new.

4. Creative flexibility: it is a person's ability to develop and create different ideas, if you change the difficulty. The creative person is able, strength and ability necessary to shift our thinking on the problem and ask for it from the other (Kefayat, 1994).

Creativity is a score which earned the subjects in the standard test of creativity.

1.4 Problem-based teaching methods

"The ability to learn", is considered the main purpose of the educational system, in the twenty-first century. Tafer believes the greatest skill will be the ability to learn, forget, and re-learn, in the twenty-first century. In fact, the rate of change and need to adapt to changing conditions, in such a way that operates in a way the past cannot meet current demand. As David Blunkett said: "The ability to learn is the most important skill of the students, even before they enter the world of work and career» (Deylamghani, 2007). Learning increases when a person is associated with the texture of problem solving. Classes are not traditional, effectiveness, because they are dependent on the particular time and place and they cannot provide real texture and perfect for learning (Fayyaz, 2004).

The aim of this study is to determine the effect of training in problem-solving on math achievement, and creativity in first-grade students. In addition to the above theoretical goals of this study is, to provide an effective way, and applied problem solving strategies to students in the practical purposes, to help, to the creativity of students and academic achievement in mathematics, and that the to be used in respect mathematics teachers, and give it a share of education to teach problem-solving, as well as effective methods, design, and writing textbooks. Research objectives are, briefly, as follows:

1.5 Research Objectives

1.5.1 Main objective

To evaluate the effectiveness of teaching methods of problem solving on mathematics achievement, creativity and first-grade students;

1.5.2 Minor objectives

1. Determine the effectiveness of problem solving in math achievement of students;

2. Determine the effectiveness of problem solving the students' creativity;
3. The Moderating Role of Gender, in solving the mathematical achievement;

1.6 Hypothesis

1. Training with problem solving method, impact on the academic achievement of students in mathematic.
2. Training with problem solving method has an effect on students' creativity.
3. Gender impact on student achievement in mathematics.

2. Literature

- Nirmalakhandan (2005), has done research "computer adaptive assessment and improving learning using problem solving skills" at the State University of New Mexico, He came to the conclusion that the application of effective problem solving skills, education computer. The experimental group was trained in problem solving, and the control group was trained with traditional training. Compare the two groups showed that students who had been trained, using problem-solving, they had a lot of skills to solve new problems and as such, this research has shown that students prefer, solution question the traditional methods and the study reported that this method can be used in different classes.

- Carolyn & Tracy did a study entitled "Plan application problem solving approach in teaching methods and research" at the University of Manchester (2009), who participated in these study 51 students. The results showed that students who were trained, with this method, they could use the key issues, problem-solving manner that they are interested in it. The students believed that a person can be kept, your information and knowledge for a long time using problem-solving, and this is used for later use and the old way of learning more, and this is effective in understanding and a learning process.

- Demercheli (2001) noted, the effect of training in creative problem solving process problems troubleshooting, problem solving and the use of problem-solving, creative problem solving training issues has increased, tend to generate ideas and action, idea generation, and also the improved performance problem finding and problem solving.

- Momtaz (2001) examined the effect of this method, the development of abstract thinking, college students, in the fields of mathematics, science, and humanities, research, entitled "The impact on the wording of the problem solving process the level of abstract thought "to review. There was no significant difference in overall performance between the two types of questions, a formula independent groups t, ($t = 3/2$ df178 $p < 0/01$), and the performance was better in some questions.

- Heydari, and FathiAzar (2006), compared the effects on group problem, and traditional education, the critical thinking of students, teachers, and they showed that the critical thinking disposition (component systematic in research and investigative maturity in judgment) is greater in the group, they were trained, using problem-based learning group, compared to the controls which they were trained, with the traditional method. But there is no difference in other components of critical thinking (truth-seeking, curiosity, being analytical, self-confidence and open-mindedness) between the two groups.

- Ajam (2004), show that, in the relationship between creativity, science teachers, students guidance to solve the problems of religious-public ordinary schools in Tehran, that creative teachers can solve problems of students, including incentives, lack of attention, lack of participation and lack of comprehension and understanding.

3. Research Methodology

Now, research is a pilot, and we used the pretest, and posttest control group. In this study, the researchers, one or more groups, as the groups under certain conditions (independent variable), in order to discover causal relationships, and compared the results (the dependent variable), a group or a control group who were not under such circumstances. Diagram of the project are as follows:

Experimental group $O^2X O^1$
Control group O^2O^1

Where O^1 is the pre-test, and X is a pilot operation and O^2 is post-test. The project has been carried out, participants in the experimental group, and control than ever before, but the class was done, as the experimental and control groups, randomly. The study population included all primary school students, who are studying in the academic year 2014-2013 in Bazman. We used the sampling method for sample selection. We've used, from colleagues who were taught, first base, to participate in the study. We have detected that schools that were willing to cooperate (4 schools), that they were, including two schools and two secondary schools. We have considered, first base a boys' school, and a girls' school, as the experimental group, and we have to consider, first base, two more schools, by gender, as a control group. The total number of students is 120, which are, in the experimental group, 30 boys and 30 girls, and they are, in the control group of 30 girls and 30 boys.

We did a study for the library, to set the theoretical bases, and data were collected through field study. To collect these data, Abedi's standard questionnaire creativity is used. The study used a questionnaire creativity of children, the teachers, and first-grade math achievement test, the researcher has proposed, based on educational goals, in collaboration with the regional departments, the first base leader, and expert management of primary

education, the researcher chose math book, only 30 pages of the book, due to the volume of first-grade math book, and also questions the design of these pages, they are, at the levels of knowledge, understanding and comprehension application and analysis. This study has been developed and implemented, problem-solving strategies, based on George Puglia, in the form of lesson plan 7 meeting. The meeting took place within 45 minutes, and with the following goals and headlines.

4. Research Findings

4.1 Descriptive data

4.1.1 Study groups

Table1. Participants in the study groups

Group	frequency	Percent reliability
Test	60	50
Control	60	50
Total	120	100

According to Table 1, in this study, 60 patients (50%) were replaced in the experimental group and 60 patients (50%) in the control group of 120 participants.

4.1.2 Gender

Table 2. The status of participants by gender

Group	Frequency	Percent reliability
Boy	60	50
Girl	60	50
Total	120	100

According to the results presented in Table 2, in this study, 60 patients (50%) males and 60 (50%) were female, from 120 participants.

4.2 Testing hypotheses

First hypothesis: the teaching methods of problem solving, has a different effect on math achievement of students, by gender. The second hypothesis: learning to problem-solving approach, a different impact on the creativity of students, by gender.

4.2.1 Descriptive indicators variables

Table3. Descriptive statistical analysis of the subjects in the experimental and control variables, creativity and achievement

Categories	Variables	No.	mean	Standard deviation	Skewness	elongation	Kolmogorov-Smirnov test	Degrees of freedom	Sig.
Experiment	Pre-test of achievement	60	13.73	3.9	-0.84	0.71	0.145	60	0.003
	Post-test of achievement	60	16.25	3.06	0.74	-0.39	0.13	60	0.013
Control	Pre-test of achievement	60	12.15	4.49	-0.63	-0.49	0.242	60	0.001
	Post-test of achievement	60	12.76	4.54	-0.48	-0.58	0.154	60	0.000
Experiment	Pre-test of creative	60	63.66	12.57	-0.54	-0.45	0.103	60	0.17
	Post - test of creativity	60	72.96	5.12	0.32	0.81	0.137	60	0.003
Control	Pre-test of creative	60	60.6	11.82	-0.24	-0.37	0.076	60	0.2
	Post- test of creativity	60	62.1	6.26	-0.3	0.58	0.127	60	0.017

According to Table 3 shows the descriptive indicators, variables, academic achievement and creativity, in the pre-test and post-test. Results showed that academic achievement is not the variables, normal conditions, the experimental and control groups in the pre-test and post-test. And variable creativity, there is, normal conditions, the pre-test and control groups, but not in the test. And this is quite variable, but it was not established, the normal condition, the variable of academic achievement.

4.2.2 Multivariate Wilkes Lambda index testing

Table4. Index multivariate test

Effects	value of Wilkes lambda	F	Degrees of freedom hypothesis	Degrees of freedom	Sig.	2η
Effect of Gender	0.996	0.24	2	108	0.78	0.004
The effect of trials	0.8	13.489	2	108	0.000	0.2
Effect of Pre achievement test	0.147	313.461	2	108	0.000	0.853
The effect of pre-test creative	0.801	13.401	2	108	0.000	0.199
Gender * Pre-test the interaction of academic achievement	0.989	0.622	2	108	0.53	0.011
Gender * Pre-test the interaction of creativity	0.997	0.143	2	108	0.86	0.003
* Before the trial operation interaction - achievement test	0.863	8.565	2	108	0.000	0.137
* Pre-test the effects of experimental interaction creativity	0.979	1.154	2	108	0.31	0.021
Interaction Gender * action * Pre-test achievement test	0.98	1.076	2	108	0.34	0.02
* Action * Pre-test pilot interaction of Gender Creative	0.977	1.254	2	108	0.28	0.023

The results of the equality of variance showed that the index of M-Box is significant, in terms of Emma, $P = 0.000$, $F(154203,9.2) = 3.417$, (Box's $M = 31.74$), as a result, rejected the assumption of the equality of covariance the assumption is resistant groups in violation of it, but due to the volume. And we can accept the premise of equality of covariance (Tabachnik and Fidel, 2007: 252). The results in Table 4 show that, due to all the interactive effects of second order (interaction of gender, test operation and the achievement test, the effect of the interaction of gender, practice test and pre-test creative and interactive effects of the first order (gender, the achievement test, Sex, the creativity test, trial practice, the achievement test, practice test, pre-test creative) are not meaningful. As a result, the condition of equality or homogeneity of regression lines between groups is confirmed.

4.2.3 Index homogeneity of variance between groups

Table 5. The index homogeneity of variance (Levene test) between the experimental and control groups

Group	F	numerator of Degrees of freedom	Denominator of Degrees of freedom	Sig.
Post - test achievement	1.601	1	116	0.19
Post - test of creativity	1.344	1	116	0.26

Table 5 shows the index Levene test for homogeneity of variance between groups. Results showed that academic achievement and creativity in the post-test variance is homogeneous.

4.3 MANCOVA

4.3.1 Multivariate Index

Table6. multivariate index test

Effects	F	Wilkes value of lambda	Degrees of freedom hypothesis	Degrees of freedom error	Square of Etta	Sig.
Pre-test of academic achievement	342.822	0.141	2	113	0.85	0.000
Pre-test of creativity	10.539	0.843	2	113	0.157	0.000
Effect of gender	16.951	0.769	2	113	0.23	0.000
Effect of experimental action	119.768	0.321	2	113	0.679	0.000
operation of experimental action-Gender interaction	0.415	0.993	2	113	0.007	0.66

Results Table 6 shows the interaction effect was not significant between experimental conditions (control and test) and gender, ($P = 0.66$, $F_{(2,113)}=0.415$ Wilks' Lambda = 0.993). However, the main effect of experimental action, is significant, ($P = 0.000$, $F_{(2,113)}=119.768$) and 67.9 percent explains the role of education, the variance of the dependent variables, and explains, the main effect gender ($P=0.000$, $F_{(2,113)}=16.951$) and 23% ($\eta^2=0.23$) variables related to gender variance.

Table7. Intergroup analysis

Resource change	After the test	Total squares	Degrees of freedom	Mean squares	F	p	Square of Etta
Effect of gender	Achievement	11.503	1	11.503	6.452	0.008	0.054
	Creativity	512.044	1	512.044	26.068	0.02	0.186
Effects of experimental action	Achievement	130.423	1	130.423	73.157	0.000	0.391
	Creativity	3041.445	1	3041.445	154.836	0.000	0.576
Error	Achievement	203.236	114	1.783			
	Creativity	2239.3	114	19.643			

Results from Table 7 shows, analysis of variance, for academic achievement, and creativity. Results showed that a significant main effect of trial operation, the variable creations ($P=0.000$, $F_{(1,114)}=836.154$), and education explains, 57.6% variance creativity, and experimental group was, on average larger. The results showed that the effect of the trial on academic achievement is significant. Explain the role of education, ($P=0.000$, $F(1,114)=73.157$) and the variance of academic achievement 39.1%, and has better academic achievement tests.

5. Conclusion

5.1 The results showed that the teaching methods of problem solving have an effect on students' mathematical achievement.

The results showed that the teaching methods of problem solving have a different effect on math achievement of students by gender. And better academic achievement tests than the control group. And also have better academic achievement of boys compared to girls. This hypothesis was tested using analysis of covariance and it showed, gender affects, in teaching mathematical problem solving method, namely, the achievement test scores of the experimental group was higher in boys than girls, the effect of training in problem-solving methods, significantly, compared with the scores of the control group, who were trained in the traditional way. Hence, in the absence of intelligence and previous academic achievement, the control, the results of this study are consistent with previous research, including, Shabani (2001), Caroline and terrace (2006), Momtaz (2001), Ahmadizadeh (2005), Nirmalkendan (2005). Teach problem-solving approach, along with the traditional method with the traditional method of teaching, alone, are generally effective in improving mathematical problem solving ability. The problem-solving strategies with the traditional method in comparison to conventional treatment alone was more effective in solving problems of algebra and geometry problems account, and is effective on academic achievement. According to existing research and findings it can be said that, to teach problem-solving approach makes learning and increase student achievement in math. And this development is more in boys than girls.

5.2 Teaching by problem solving, impact on student creativity.

The results showed that different teaching methods are problem-solving impact on creativity of the students by gender. The results showed that the main effect of experimental work on creativity is a significant variable, the teaching methods of problem solving, the impact on the creativity of the students in math, and students who have been trained with this method, the proportion of students who trained have traditionally showed more creativity, to solve problems, and according to the obtained results, the main effect of gender on creativity is a significant variable, the gender impact on creativity, and this creativity in boys than girls More were observed and the results showed that boys performed better than girls, according to the same training given, the method of problem solving in the experimental group compared to the control group, and showed a better performance creativity test and this is indicative of the fact that the teaching method of problem solving involved in the creativity of the students, and has led the development of creativity in them, and the boys showed more creativity in solving problems than girls . The results of this study are consistent and in line with previous research, including Heydarifarfar, (2006) and Demercheli (1993).

5.3 Gender factors have an impact on student achievement in mathematics.

According to the obtained results, the assumption is that gender the effect on student achievement is accepted, and due to higher average boys in the test, it is clear that, more successful in math than boys act Girls, and have a better performance in this lesson.

5.4 Genders affect students' creativity.

The results of this research line are consistent with results HabibiBaghi (2002), Ajam (2004) and Heydarifarfar, (2006). In analyzing the obtained results showed that the method of problem solving has an effect on students' creativity. Method of problem solving influence on the creativity of the son or daughter students, and in the study of creativity is a function of gender. Overall, the results indicate that the use of problem-solving method has great influence on the creativity of the students, and gender affect it and gives better performance of students in mathematics, and the desired result can be seen better in boys

6. Suggestions

According to the findings, the effect of education on academic achievement and creative problem solving first-grade students in math, according to the following, in terms of education and academic achievement in students is essential:

1. Epidemic to it, at all stages of academic and teacher training in this area, to the right and opportunity costs for the project by the Ministry of Education, the better and more effective educational system will benefit.
2. Equipment and the resources and tools necessary to implement active methods, such as problem-solving and cooperative learning group, given to schools.

REFERENCES

1. Ahmadiadeh, Mohammad Javad (1994), to evaluate the effectiveness of problem-solving skills on some of the features of personality juvenile welfare centers, Master Thesis, Faculty of Letters and Human Sciences of AllamehTabatabai University.
2. Ajam, Ali Akbar (2004), the relationship between creativity, science teachers in grade schools with student problems - in Tehran, Faculty of Science, University martyr Beheshti.
3. Carolyn H & Tracy. B. Problem solving techniques in childrearing, www.mtsu.edu/studskl/hd/hemis.html 2009/10/4, 2003.
4. Demercheli, Yadollah (1993), the effect of education on the process of creative problem solving, problem finding, problem solving and application of the solution, Master Thesis, School of Basic Sciences, Tarbiat Modarres University.
5. Deylamghani, M. (2007), learning on the matter. *Journal of Educational Technology*, No. 189.
6. Elvin & Chamders (1997), Evaluation of learning in science. in B. Bloom. j.
7. FarfarHeidari, Ali Akbar (2006), to determine the effects of problem solving training on the creativity of students in Tabriz, Master Thesis, School of Humanities, University of Tabriz.
8. Fathiazar, Eskandar (2003), teaching methods and techniques, Tabriz Tabriz University Press.
9. Fayyaz, Fatemeh (2004), e-learning, knowledge and future *Quarterly*, Issue tenth.
10. Glover, John, and Roger H. Browning (2007), *Educational Psychology: Principles and their application*, translation of Alinaghi Kharrazi, Tehran University Publication Center.
11. HabibiBaghi, Masoomeh (2002), examines the relationship between participative management style and creativity from the perspective of Tehran Municipality Cultural Organization. School of Management, Tehran University.
12. Kefayat, Mohammed (1994), The relationship between parenting style and attitude with creativity first year high school students in Ahwaz. Master's thesis, Faculty of Humanities, University of Chamran martyr.
13. Momtaz, Vahid (2001), students' expression on the process of solving the problem at the level of abstract thinking in pre-university students, Master Thesis, Department of Literature and Human Sciences, Shiraz University.
14. Nirmalakhandan, N. (2005). computerized adaptive tutorials to improve assess problem solving computers & education, 49 1321-1329
15. Safavi, Amanollah (2009), general teaching methods and techniques, Tehran: contemporary.
16. Saif Ali Akbar (2010), learning methods and study, Tehran Publication Doran.
17. Shabani, Hasan (2001), the effect of problem solving as a group on critical thinking and academic achievement in fourth grade math students in Tehran. Thesis Educational Psychology, Faculty of Literature and Human Sciences, TarbiatModarres University.
18. Tabaching, B, & Fidell, L,S(2007), *Using multivariate statistics*. NEWYORK: Happer Collins college.