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The Effects of Problem-Solving Teaching on Creative Thinking among District 2 High School Students in Sari City

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ABSTRACT

Introduction: Nowadays, regarding the learners' needs and social conditions, it is obviously needed to revise and reconsider the traditional methods and approaches in teaching. The problem solving approach is one of the new ways in Teaching and learning process. This study aimed at studying and examining the effect of "problem-solving" approach on creative thinking of high school female students. **Methods:** An experimental method is used for this research. In this research, 342 out of 3047 female-students from Sari high schools were randomly selected. These 342 students were divided into two groups (experimental and control) in which there were seven classrooms. The total number of students in every group was about 171. After testing them with Jamal Abedi creativity test, it was revealed that two groups were equal in creativity score. The tests were done through Requirements. The experimental group was taught by problem solving method for three months while the control group was taught by traditional method. **Results:** The research results showed that using descriptive indices and t-test for the two independent sample groups in which problem solving teaching method was used in teaching processes had an effect on creativity level in comparison with traditional method used in the control group. **Conclusion:** Considering the results of this study, the application of problem-solving teaching methods increased the creativity and its components (fluidity, expansion, originality and flexibility) in learners, therefore, it is recommended that students be encouraged to take classes on frequent responses on various topics (variability) and draw attention on different issues, and expand their analysis on elements in particular courses like art (expansion). To enhance the learner's mental flexibility and attention to various aspects, they are encouraged to provide a variety of responses.

Keywords: Teaching Methods, Critical Thinking, Students, High School, Sari, Mazandaran, Iran.

1. INTRODUCTION

We are witnessing comprehensive changes in today's world encompassing various aspects of human life including social, cultural and educational dimensions. Being encountered with various unforeseen issues is the consequence of these rapid developments in the daily life. Nowadays, emphasizing on reading, writing and calculating which were the educational goals of that past is not enough to resolve the human problems. That is why most advanced educational systems have put aside the traditional approaches to education such as teacher-centered methods and teaching methods such as lectures and description turning to new ways of teaching-learning in which students play an important role. One of the approaches to achieve such objective is problem-solving approach which is exceedingly beneficial in teaching methods and in areas related to real-life problems. The application of problem solving approaches in education was first seriously addressed by John Dewey. Dewey believed that problem solving approach was in fact the thinking process or thinking process is a form of problem-solving. Applying such approach requires a situation in which there is a problem to solve and this is the teachers' role to provide such opportunity to arise in classrooms.

Today, educational researchers and practitioners believe that one of the main goals of education is to train a generation of creative and innovative people, therefore, the main improvement of educational programs in teaching content, teaching methods, assessment methods, and physical environment of the school should be considered (1). In the history of modern education, emphasis on creative and investigative teaching through problem solving approach can be traced in the William James's and John Dewey's philosophical thoughts. After Dewey, professionals like Monte Syrian, **Kilpatrick**, Hachin, Piaget, Bruner and Schwab created various forms of changes in curricula and teaching methods and evaluation procedures. The ideas and trends especially in the second half of the twentieth century were emerged with the development of curriculum programs such as child-centered, problem-based, experience-based and process-oriented programs (2) (Kramol, 1993). According to Dewey,

the teaching process goal is to provide an environment in which students can interact with each other and learn how to learn and solve problems based on teacher's teaching and expectations . In successful problem solving environment, students should be encouraged to postpone judgment to consider all the possibilities before offering solutions (3). However, studies show the fact that schools in Iran did not achieved much success in educating and creating superior intellectual capacity for our students. For example, in an international study conducted by Ogle et.al (2001) on International Comparisons in Fourth-Grade Reading Literacy: Findings from the Progress in International Reading Literacy (PIRLS) of 2001 (4), it has been proved that Iranian students did not have the ability to efficiently elicit, think and create the proper answers. This means that the educational system in our country made students to be consumers of thoughts but not the creators. Generally, researches cast light on the inability of Iranian students to demonstrate the argument, logic, analysis, and review for students and instead of thinking of ideas they focus on doing the teachers' orders (5). Accordingly, it can be understood that the other students' creativity is very important but major initiatives were not taken to develop it. The main problem is how the students' creativity is addressed in our educational system and to what extent the teaching methods are consistent with the creativity level.

2. MATERIALS AND METHODS

The study is experimental in nature adopting an applied field approach using Jamal Abedi's creativity questionnaire for data collection. The statistical population of the study comprised all secondary school students of district 2 in Sari summing up to 3047 based on the education department report. Using Cochran formula, 342 students were randomly selected as the study sample. Because it was not possible to divide a class into experimental and control groups, seven classes for the experimental group and seven classes for the control group were randomly considered among secondary schools. The number of students in classrooms varied and approximately 171 students were placed in each group (178 for experimental group and 175 for the control group). Since there was no possibility of removing students from classes for data analysis, the number of people who were more than the sample size was not considered. After sampling, the experimental and control groups were tested for initial creativity test and the students' performance were compared using independent t-test. After ensuring the samples' homogeneity, the experimental group received problem-solving technique for three month and the control group was taught in the traditional way. After conducting the treatment, the creativity tests were applied again and the differences between groups were analyzed using independent t-tests. The Jamal Abedi's creativity questionnaire was used for the data collection as the assessment tool. The validity of the questionnaire was estimated to between 15 and 45 percent using concurrent validity and the Torrance Creativity Test in 1984 in Tehran so that the greatest impact was on the fluidity.

The test-retest method was used to estimate the reliability on the Jamal Abedi's creativity in 1984 using Chronbach's alpha. The results showed that the questionnaire four components reliability were as follows: the fluidity with 0/85, originality with 0.82, flexibility with 0/84, and extension with 0.80. Using SPSS software, the raw data were reviewed and analyzed. The descriptive statistics of percentage and frequency were used and the paired and independent t-tests in inferential statistics were applied regarding the relative large sample size and scores normality. The independent t-test was used to compare the two experimental and control group and the paired t-test was used to evaluate the treatment effect on the experimental group.

3. RESULTS

Before conducting the treatment on the students in the experimental group, the fluidity average score in the control group and the experimental group were 38.65 and 39.15, respectively. The t-test results indicate that the two groups were not significantly different in the pre-test before the treatment because the probability level was 0.05. The fluidity average score in the experimental group after the treatment was equal to 49.51 and the mean score of the control group that did not receive the treatment was equal to 38.48. Regarding the inequality of variances hypothesis, the t-test showed that the probability value obtained for both groups was less than 0.05, therefore, the null hypothesis of equality between the two groups in the test was rejected and the hypothesis is confirmed. That is, the fluidity score of the students who have used problem-based teaching methods and those who did not use such treatment were statistically significant (Table 1).

Prior to conducting the treatment on students in the experimental group, the expansions mean score in the control and experimental groups were 6.20 and 6.19, respectively. The t-test results also imply that the two groups were not significantly different before the treatment since the obtained probability was higher than the 0.05. ($P > 0.05$, $df = 340$). The expansion mean score in the experimental group after treatment was equal to 18/24 while the average score for the control group with no treatment was 15.20. The t-test results show that the probability value obtained was less than 0.05 ($p < 0.05$), therefore, the null hypothesis on the equality between the control and experimental groups is rejected and the hypothesis developed in the research is approved. There was a statistically significant difference between the students who received problem solving training and those without such training.

Hypothesis 2: There is a significant difference between expansion score of the students who have used problem solving teaching and those without such training.

Hypothesis 3: There is a significant difference between originality score of the students who have used problem solving teaching and those without such training. Before conducting the treatment, the originality score for both the experimental and control group was 29.63 and 29.25, respectively. The t-test results also revealed that there is no significant difference on the equality of variances between the two groups before the treatment because the probability obtained score was higher than the 0.05. ($P > 0.05$, $df = 325$). The average originality score in the experimental group after training was equal to 35.94 and such score for the control group with no treatment was 29.51. The t-test results show that the probability value obtained was less than 0.05 ($p < 0.05$), therefore, the null hypothesis on the equality between the control and experimental groups is rejected and the hypothesis developed in the research is approved. There was a statistically significant difference between the students who received problem solving training and those without such training.

Components	Before and after training	Groups	F	Mean	SD	T	DF	Probability	Test Level
Fluency	Before and after training	Experimental	171	39.15	7.06	0.602	340	0.547	0.05
		Control	171	38.65	7.96				
	After training	Experimental	171	45.91	5.32	21.22	324	0.000	0.05
		Control	171	38.48	4.23				
Expansion	Before training	Experimental	171	29.96	3.54	-0.277	340	0.782	0.05
		Control	171	20.06	3.49				
	After training	Experimental	171	24.18	3.06	13.156	340	0.000	0.05
		Control	171	20.15	2.60				
Originality	Before training	Experimental	171	29.25	4.86	-0.641	325	0.522	0.05
		Control	171	29.63	6.04				
	After training	Experimental	171	35.94	4.21	15.39	340	0.000	0.05
		Control	171	29.51	3.47				
Flexibility	Before training	Experimental	171	19.43	3.07	-1.277	327	0.203	0.05
		Control	171	19.91	3.76				
	After training	Experimental	171	23.91	2.88	12.79	340	0.000	0.05
		Control	171	19.99	2.77				

Table 1. Comparing the fluidity, expansion, originality and flexibility features in both experimental and control groups

Components	Phase	Groups	F	Mean	SD	T	DF	Probability value	Test level
Creativity	Before training	Experimental	171	107.79	16.07	-0.248	340	0.804	0.05
		Control	171	108.26	18.74				
	After training	Experimental	171	133.54	12.65	21.161	312	0.000	0.05
		Control	171	108.13	9.29				

Table 2. Comparing the originality score before and after the treatment

The average flexibility score in the experimental group after the treatment was equal to 23.91 and the flexibility average score in the control group with no treatment was equal to 19.99. The t-test results show that the obtained probability value is less than 0.05 ($p < 0.05$), therefore, the null hypothesis on the equality between the control and experimental groups is rejected and the hypothesis developed in the research is approved. There was a statistically significant difference between the students who received problem solving training and those without such training.

Hypothesis 4: There is a significant difference between the flexibility score of the students who have used problem solving teaching and those without such training.

Problem solving teaching has significant effects on students' originality scores. Prior to conducting the problem solving teaching treatment, the originality score of the students in both experimental and control groups were 108.26 and 107.79, respectively. The t-test results also revealed that there is no significant difference on the equality of variances between the two groups before the treatment because the probability obtained score was higher than 0.05. ($P > 0.05$, $df = 340$)

The average originality score in the experimental group after the treatment was equal to 133.54 and it was equal to 108.13 in the control group with no treatment. The t-test results show that the obtained probability value is less than 0.05 ($p < 0.05$), therefore, the null hypothesis on the equality between the control and experimental groups is rejected and the hypothesis is approved. There was a statistically significant difference between the students who received problem solving training and those without such training (Table 2).

4. CONCLUSION

The results showed that the originality scores of the students who received problem-based teaching approach and those who were taught in the traditional approach were statistically significant and problem-based teaching approach increased the originality and its related components. Ghasemi and Oghlidos (2005) in a research on examining the effect of teaching the developing creativity lessons in children on increasing the creativity of third grade female students of child-minder sciences in vocational schools of Shiraz concluded that increasing the score showed the creativity in experimental group. The experimental group's score on other elements of fluidity, expansion, flexibility and originality showed significant superiority (6).

Dehghanizadeh (2002) in a research on evaluating the effect of life skills education (problem solving and decision making) on creativity promotion of fifth grade male students in Yazd concluded that there were significant differences between experimental and control groups in the areas of creativity (7).

There was a statistically significant difference between the originality score of the students who received problem solving training and those without such training. The above findings are consistent with these research findings.

Ahmadi (2001) conducted a research on the effects of problem-based teaching on fifth grade male primary student's creativity in West Islamabad and stated that after analyzing the results of the tests, 4 hypotheses were confirmed and only the fifth hypothesis was rejected. That is, there were not any significant difference between the male students in both groups on receiving and not receiving the treatment which is consistent with the results of this study (8). Yee (1996) conducted a research on brainstorming, problem definition and creativity and stated that both methods significantly increased the students' creativity and its components including flexibility. Such orientation has been approved in many other studies pointing to the fact that problem solving teaching method had a significant effect on increasing the students' creativity (9).

Ahmadpour (1997) conducted a research on the effect of problem-based teaching on learning psychology course among

high school students in Birjand and showed that the application of problem solving approach led to increased students' creativity (10).

Conducting a research on investigating the relationship between the open-endedness of activities and the creativity of young children, Yan (2005) concluded that such activities significantly increase children's creativity. Thus, according to research findings and existing consistencies of different researches, the unique impact of problem solving teaching method on enhancing the students' creativity is evident, but we still witness the continuation and emphasis of teacher-centered teaching methods and directly transferring course material to the students some evidence of which is given in the introduction. It is clearly asserted that the problem-solving teaching approach influences the creativity and its related components in today's world (11).

5. RECOMMENDATIONS

Considering the results of this study, the application of problem-solving teaching methods increased the creativity and its components (fluidity, expansion, originality and flexibility) in learners, therefore, it is recommended that students be encouraged to take classes on frequent responses on various topics (variability) and draw attention on different issues, and expand their analysis on elements in particular courses like art (expansion). Also, students must be encouraged on innovative responses to and developing creativity in the teaching and learning process (creativity/originality). To enhance the learner's mental flexibility and attention to various aspects, they are encouraged to provide a variety of responses.

It is recommended that in-service teacher training institutions and courses, teachers' creativity should be fostered and they should be taught to apply the importance of teaching problem solving techniques.

It is suggested that in the design and construction of schools and training centers, training facilities as well as the selection of creative colors must be considered.

CONFLICT OF INTEREST: NONE DECLARED.

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