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Comparing the Effects of Cooperative Teaching Method and Probing Method on Boy Student Creativity in Science Curriculum of the Third Grade Elementary Schools of District 4

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ABSTRACT

The present study comparatively studies the effectiveness of cooperative teaching method and probing teaching method on boy student creativity in science curriculum of the third grade elementary schools of District 4 of Tehran in 94 - 95 academic year. The methodology was semi-experimental of pretest-posttest type with two experimental groups. The population included all boy students of District 4 of Tehran. The sampling has been done by multi-stage cluster random sampling in a way that at first District 4 was divided into two parts, and then one of them was randomly selected. After that, two schools were randomly selected among the schools in this part and Torrance's pretest of creativity was performed for both groups. After the implementation of independent variables (cooperative and probing teaching patterns), Torrance's posttest of creativity was performed for both groups after two months and half. Data collection was carried out with the help of Torrance's creative thinking (form B) and the results were discussed. The data obtained using descriptive statistics (means, standard deviation, and the average standard error) and inferential statistics (t - test of independent groups) were analyzed. The results of the analysis showed that cooperative teaching method is more effective than probing teaching methods to foster creativity (the factor of flexibility) in science curriculum. In total, the results show the superiority of cooperative teaching methods on probing teaching methods in fostering creativity of science curriculum.

Keywords: teaching, cooperative teaching patterns, probing teaching patterns, creativity.

Introduction

Education has been the most important thing in life of all ages and generations, so that advanced countries refer their excellence to having advanced training and education and backward countries also are undeveloped due to the fact that their educational system is weak and not coordinated with other organizations. One of the goals of education is strengthening the esprit of research and thinking, investigation and contemplation, criticism and the initiative (Maleki, 2005). The

initiative and creativity are among the issues there is no consensus on the nature and its definition between researchers and psychologists to date. Guilford (1967) believes that creativity is to shape subjective elements as new combinations meeting certain requirements or being somehow useful; the more heterogeneous are new combinations, the process of resolving is more creative. Rogers knows creativity as the expression of existence and preserving human personality (Asadi, 2010, 21). Mucchielli (1967) defines creativity fostering what is related to the ideas, invention, thinking and imagination. Torrence (1979) knows creativity as a process including the sensitivity to issues, bottlenecks, and inconsistencies. Vernon (1989) defines creativity as the ability to create new ideas, theories, insights, or objects and rebuild in science and other fields that is considered by as an initiative and scientifically, aesthetically, technologically and socially valuable phenomenon. Accordingly, this question arises why some people suffer from a lack of creativity, initiatives and innovation. School as one of the most important components of the educational system could significantly affect the process of thinking and mental skills and learning methods of students so that they can easily progress in the direction of new and critical thinking and the discovery of the unknowns and finally provide a good solution to the problems. Teacher in the school plays a key role as an example. Teacher forms the atmosphere of the classroom and plays the most important role in fostering students' creativity and also can play this role through methods of teaching in class. Generally, the importance of creativity in the present study is due to the fact that how we can face with all the changes to the current communities and how we should equip ourselves. We cannot succeed in this war with the help of steel and machine, but with the help of imagination and creativity we would be the winner. As J. J Sarvan points out, "imagination, inspiration, revelation are the specific creativity of spirit and creativity is the key element of this success.

Research methodology

The present study is considered as an applied research in terms of objective; an applied research's objective is achieving a scientific goal and its emphasis is on the prosperity and wellbeing of the masses and the desirability of activities. In this study, researcher intends to examine the impact of two cooperative and probing methods of teaching on the creativity of students using semi-experimental due to the lack of access to random individuals and replacing them in the target groups. The difference here is that the group membership of real test problems is determined by researcher, while the group membership in semi-experimental problems is determined naturally and without researcher's interference. Intervening and disturbing variables in a real experiment are under control while it is not the same in semi-experimental problems. So any conclusion should be taken with the utmost caution (Hooman, 2001, 258).

Findings

Inferential statistics were used to analyze the data. In the first place, Lone test option would be reviewed. In this analysis, the equal variances assumption, which is higher than 0.05, is not accepted and the secondary information are used. T-statistic is the difference of averages (3.45) divided by the standard difference error (0.519) that is equal to (4.71). The degree of freedom of T is 198 and the decision criteria is significant at the level of 0.05 due to the fact that the upper

and lower bounds are both positive. We conclude that the difference is significant at the level of 0.05 and there is a significant difference between the average scores of creativity (fluidity) with two different approaches. Since the students with the approach of cooperation in fluidity achieved higher scores (21.30) than the students with probing approach (18.85) and the significance level obtained was less than 0.05, so the hypothesis research is confirmed.

The mean flexibility scores of students who trained with cooperative method were higher than the students trained with probing approach.

Table1.Descriptive statistics related to the mean flexibility scores for both groups in pretest

Method	Number	Mean	S.D	Average standard error
Flexibility	Cooperative	20	17.5030	.84082
	Probing	20	15.7255	.97676

The first table shows descriptive statistics of cooperative approach, the mean (17.50), standard deviation (0.840) and probing approach, the mean (15.72), standard deviation (0.976).

Table 2. Lon's and t-tests results about the mean flexibility scores in pre-test

Variable		Lon's test		t-test of equal means				Confidence distance		
		F	Significance level of equal variances	t-statistic	Degree of freedom	Significance level of equal means	Difference of means	Standard error of difference	Lower bound	Upper bound
Flexibility	Equality of variances	1.09	302/0	6.16	38	000/0	1.77	288/0	1.19	2.36
	Inequality of variances	-	-	-	-	-	-	-	-	-

The equal variances assumption in the present analysis, which is higher than 0.05, is accepted and the primary information are used. T-statistic is the difference of averages (1.77) divided by the standard difference error (0.288) that is equal to (6.16). The degree of freedom of T is 38 and the decision criteria is significant at the level of 0.05 due to the fact that the upper and lower bounds are both positive. We conclude that the difference is significant at the level of 0.05 and there is a significant difference between the average scores of flexibility with two different approaches. Since the students with the approach of cooperation in creativity achieved higher scores (17.50) and the significance level obtained was less than 0.05, so the hypothesis research is confirmed. The mean authenticity scores of students who trained with cooperative method were higher than the students trained with probing approach.

Table 3. Descriptive statistics related to the mean authenticity scores for both groups in pretest

Method	Number	Mean	S.D	Average standard error	
Authenticity	Cooperative	20	29.2400	1.96934	.44036
	Probing	20	21.7250	3.73277	.83467

The first table shows descriptive statistics of cooperative approach, the mean (29.24), standard deviation (1.96) and probing approach, the mean (21.72), standard deviation (3.73).

Table 4. Lon's and t-tests results about the mean authenticity scores in pre-test

Variable		Lon's test		t-test of equal means				Confidence distance		
		F	Significance level of equal variances	t-statistic	Degree of freedom	Significance level of equal means	Difference of means	Standard error of difference	Lower bound	Upper bound
Authenticity	Equality of variances	1.09	302/0	7.51	28.81	0.05	1.77	0.943	1.19	2.36
	Inequality of variances	-	-	-	-	-	-	-	-	-

The equal variances assumption in the present analysis, which is higher than 0.05, is not accepted and the secondary information are used. T-statistic is the difference of averages (7.51) divided by the standard difference error (0.943) that is equal to (7.96). The degree of freedom of T is 28.81 and the decision criteria is significant at the level of 0.05 due to the fact that the upper and lower bounds are both positive. We conclude that the difference is significant at the level of 0.05 and there is a significant difference between the average scores of authenticity with two different approaches. Since the students with the approach of cooperation in creativity achieved higher scores (29.24) than the students with probing approach (21.75) and the significance level obtained was less than 0.05, so the hypothesis research is confirmed. The mean expansion of materials scores of students who trained with cooperative method were higher than the students trained with probing approach.

Table 5. Descriptive statistics related to the mean expansion of materials scores for both groups in pretest

Method	Number	Mean	S.D	Average standard error	
Expansion of Materials	Cooperative	20	47.4500	1.23438	.27601
	Probing	20	54.9500	2.87411	.64267

The first table shows descriptive statistics of cooperative approach, the mean (47.45), standard deviation (1.23) and probing approach, the mean (54.95), standard deviation (2.87).

Table 6. Lon's and t-tests results about the mean expansion of materials scores in pre-test

Variable	Lon's test		t-test of equal means						
	F	Significance level of equal variances	t-statistic	Degree of freedom	Significance level of equal means	Difference of means	Standard error of difference	Confidence distance	
								Lower bound	Upper bound
Expansion of Materials	Equality of variances	-	-	-	-	-	-	-	-
	Inequality of variances	7.57	009/0	10.72	25.77	0000/0	7.50-	699/0	8.93

The equal variances assumption in the present analysis, which is higher than 0.05, is not accepted and the secondary information are used. T-statistic is the difference of averages (7.50) divided by the standard difference error (0.699) that is equal to (10.72). The degree of freedom of T is 25.77 and the decision criteria is significant at the level of 0.05 due to the fact that the upper and lower bounds are both positive. We conclude that the difference is significant at the level of 0.05 and there is a significant difference between the average scores of authenticity with two different approaches. Since the students with the approach of cooperation in creativity achieved higher scores (47.45) than the students with probing approach (54.95) and the significance level obtained was less than 0.05, so the hypothesis research is confirmed.

Table 7. Descriptive statistics related to the mean creativity scores for both groups in pretest

	Method	Number	Mean	S.D	Average standard error
Creativity	Cooperative	20	115.4930	2.97323	.66483
	Probing	20	111.2505	5.94160	1.32858

The first table shows descriptive statistics of cooperative approach, the mean (115.49), standard deviation (2.97) and probing approach, the mean (11.25), standard deviation (5.94).

Table 8. Lon’s and t-tests results about the mean creativity scores in pre-test

Variable		Lon’s test		t-test of equal means					Confidence distance	
		F	Significance level of equal variances	t-statistic	Degree of freedom	Significance level of equal means	Difference of means	Standard error of difference	Lower bound	Upper bound
eCreativity	Equality of variances	-	-	-	-	-	-	-	-	-
	Inequality of variances	7.11	011/0	2.85	27.95	0000/0	4.24	1.48	1.19	7.28

al variances assumption in the present analysis, which is higher than 0.05, is accepted and the primary information are used. T-statistic is the difference of averages (4.24) divided by the standard difference error (1.48) that is equal to (2.85). The degree of freedom of T is 25.95 and the decision criteria is significant at the level of 0.05 due to the fact that the upper and lower bounds are both positive. We conclude that the difference is significant at the level of 0.05 and there is a significant difference between the average scores of authenticity with two different approaches. Since the students with the approach of cooperation in creativity achieved higher scores (115.95) than the students with probing approach (111.25) and the significance level obtained was less than 0.05, so the hypothesis research is confirmed.

The mean fluidity scores of students who trained with cooperative method were higher than the students trained with probing approach.

Table 9. Descriptive statistics related to the mean fluidity scores for both groups in pretest

	Method	Number	Mean	S.D	Average standard error
Fluidity	Cooperative	20	26.7000	1.12858	.25236
	Probing	20	22.3000	1.97617	.44189

The first table shows descriptive statistics of cooperative approach, the mean (26.70), standard deviation (1.12) and probing approach, the mean (22.30), standard deviation (1.97).

Table 10. Lon’s and t-tests results about the mean fluidity scores in pre-test

Variable		Lon’s test		t-test of equal means					Confidence distance	
		F	Significance level of equal variances	t-statistic	Degree of freedom	Significance level of equal means	Difference of means	Standard error of difference	Lower bound	Upper bound
Fluidity	Equality of variances	3.001	091/0	8.64	38	0000/0	4.40	508/0	3.36	5.43
	Inequality of variances	-	-	-	-	-	-	-	-	-

The equal variances assumption in the present analysis, which is higher than 0.05, is not accepted and the secondary information are used. T-statistic is the difference of averages (4.40) divided by the standard difference error (0.508) that is equal to (8.64). The degree of freedom of T is 38 and the decision criteria is significant at the level of 0.05 due to the fact that the upper and lower bounds are both positive. We conclude that the difference is significant at the level of 0.05 and there is a significant difference between the average scores of fluidity with two different approaches. Since the students with the approach of cooperation in creativity achieved higher scores (26.70) than the students with probing approach (22.30) and the significance level obtained was less than 0.05, so the hypothesis research is confirmed. The mean flexibility scores of students who trained with cooperative method were higher than the students trained with probing approach.

Table 11. Descriptive statistics related to the mean flexibility scores for both groups in pretest

Method	Number	Mean	S.D	Average standard error
Flexibility	Cooperative	20	20.2540	.93502
	Probing	20	15.7255	.97676

The first table shows descriptive statistics of cooperative approach, the mean (20.25), standard deviation (0.935) and probing approach, the mean (15.72), standard deviation (0.967).

Table 12. Lon's and t-tests results about the mean expansion of materials scores in pre-test

Variable		Lon's test		t-test of equal means				Confidence distance		
		F	Significance level of equal variances	t-statistic	Degree of freedom	Significance level of equal means	Difference of means	Standard error of difference	Lower bound	Upper bound
Flexibility	Equality of variances	533/0	470/0	14.97	38	000/0	4.52	302/0	3.91	5.14
	Inequality of variances	-	-	-	-	-	-	-	-	-

The equal variances assumption in the present analysis, which is higher than 0.05, is accepted and the primary information are used. T-statistic is the difference of averages (4.52) divided by the standard difference error (0.302) that is equal to (14.97). The degree of freedom of T is 38 and the decision criteria is significant at the level of 0.05 due to the fact that the upper and lower bounds are both positive. We conclude that the difference is significant at the level of 0.05 and there is a significant difference between the average scores of flexibility with two different approaches. Since the students with the approach of cooperation in creativity achieved higher scores (20.25) and the significance level obtained was less than 0.05, so the hypothesis research is confirmed. The mean authenticity scores of students who trained with cooperative method were higher than the students trained with probing approach.

Table 13. Descriptive statistics related to the mean authenticity scores for both groups in pretest

Method	Number	Mean	S.D	Average standard error
Authenticity	Cooperative	20	44.5500	1.63755
	Probing	20	33.9000	2.42574

The first table shows descriptive statistics of cooperative approach, the mean (44.55), standard deviation (1.63) and probing approach, the mean (33.90), standard deviation (2.42).

Table 14. Lon’s and t-tests results about the mean authenticity scores in pre-test

Variable	Lon’s test		t-test of equal means					Confidence distance	
	F	Significance level of equal variances	t-statistic	Degree of freedom	Significance level of equal means	Difference of means	Standard error of difference	Lower bound	Upper bound
	Authenticity	-	-	-	-	-	-	-	-
	Equality of variances	-	-	-	-	-	-	-	-
	Inequality of variances	3.53	068/0	16.27	38	000/0	10.65	654/0	932/0 11.97

The equal variances assumption in the present analysis, which is higher than 0.05, is not accepted and the secondary information are used. T-statistic is the difference of averages (10.65) divided by the standard difference error (0.654) that is equal to (16.27). The degree of freedom of T is 28.81 and the decision criteria is significant at the level of 0.05 due to the fact that the upper and lower bounds are both positive. We conclude that the difference is significant at the level of 0.05 and there is a significant difference between the average scores of authenticity with two different approaches. Since the students with the approach of cooperation in authenticity achieved higher scores (44.55) than the students with probing approach (33.90) and the significance level obtained was less than 0.05, so the hypothesis research is confirmed.

Table 15. Descriptive statistics related to the mean expansion of materials scores for both groups in pretest

Method	Number	Mean	S.D	Average standard error
Expansion of Materials	Cooperative	20	100.7500	2.42520
	Probing	20	68.3500	.93330

The first table shows descriptive statistics of cooperative approach, the mean (100.75), standard deviation (2.42) and probing approach, the mean (38.35), standard deviation (0.933).

Table 16. Lon's and t-tests results about the mean expansion of materials scores in pre-test

Variable		Lon's test		t-test of equal means					Confidence distance	
		F	Significance level of equal variances	t-statistic	Degree of freedom	Significance level of equal means	Difference of means	Standard error of difference	Lower bound	Upper bound
Expansion of Materials	Equality of variances	-	-	-	-	-	-	-	-	-
	Inequality of variances	7.38	010/0	55.76	24.50	0000/0	32.40	581/0	31.20	33.59

The equal variances assumption in the present analysis, which is higher than 0.05, is not accepted and the secondary information are used. T-statistic is the difference of averages (32.40) divided by the standard difference error (0.581) that is equal to (55.76). The degree of freedom of T is 24.50 and the decision criteria is significant at the level of 0.05 due to the fact that the upper and lower bounds are both positive. We conclude that the difference is significant at the level of 0.05 and there is a significant difference between the average scores of authenticity with two different approaches. Since the students with the approach of cooperation in expansion of materials achieved higher scores (100.75) than the students with probing approach (68.35) and the significance level obtained was less than 0.05, so the hypothesis research is confirmed.

Table 17. Descriptive statistics related to the mean creativity scores for both groups in pretest

Method	Number	Mean	S.D	Average standard error
Creativity	Cooperative	20	192.2540	3.66485
	Probing	20	140.2755	3.97370

The first table shows descriptive statistics of cooperative approach, the mean (192.25), standard deviation (3.66) and probing approach, the mean (140.27), standard deviation (3.97).

Table 18. Lon's and t-tests results about the mean creativity scores in pre-test

Variable		Lon's test		t-test of equal means					Confidence distance	
		F	Significance level of equal variances	t-statistic	Degree of freedom	Significance level of equal means	Difference of means	Standard error of difference	Lower bound	Upper bound
Creativity	Equality of variances	685/0	413/0	43.002	38	0000/0	51.97	1.20	49.53	54.42
	Inequality of variances	-	-	-	-	-	-	-	-	-

The equal variances assumption in the present analysis, which is higher than 0.05, is accepted and the primary information are used. T-statistic is the difference of averages (51.97) divided by the standard difference error (1.20) that is equal to (43). The degree of freedom of T is 38 and the decision criteria is significant at the level of 0.05 due to the fact that the upper and lower bounds are both positive. We conclude that the difference is significant at the level of 0.05 and there is a significant difference between the average scores of fluidity with two different approaches. Since the students with the approach of cooperation in creativity achieved higher scores (192.25) than the students with probing approach (140.27) and the significance level obtained was less than 0.05, so the hypothesis research is confirmed. The research findings showed that the creativity score of students trained with cooperative method is higher than students trained with probing method and the significance level of the factors (initiative, flexibility, creativity, fluidity, and extending material) was less than 0.05. Thus, research hypothesis is confirmed.

Discussion and conclusion

The first sub-hypothesis

There is a significant difference between the average scores of fluidity of students trained with probing method and those trained with cooperative method. This hypothesis was confirmed according to the results. In other words, analysis of the data obtained showed that there is a significant difference between cooperative and probing teaching methods in fostering fluidity and the cooperative teaching method is more effective than the other one. Analysis of the data showed that descriptive statistics of cooperative approach is higher than probing approach. Since the students with the approach of cooperation in fluidity achieved higher scores (21.30) than the students with probing approach (18.85) and the significance level obtained was less than 0.05, so the hypothesis research is confirmed. The findings of Conani (1390), Samavi (1380), Shokoufi Nejad (1380), Ghazaei (1388), Moshkelati (1376) are in line with the results of the first research hypothesis.

The second sub-hypothesis: The second sub-hypothesis states that there is a significant difference between the average scores of flexibility of students trained with probing method and those trained with cooperative method. This hypothesis was confirmed according to the results. In other words, analysis of the data obtained showed that the cooperative teaching method is more effective than the other one. Analysis of the data showed that descriptive statistics of cooperative approach is higher than probing approach. Since the students with the approach of cooperation in creativity achieved higher scores than the students with probing approach and the significance level obtained was less than 0.05, so the hypothesis research is confirmed.

The third sub-hypothesis: The third sub-hypothesis states that there is a significant difference between the average scores of authenticity of students trained with probing method and those trained with cooperative method. This hypothesis was confirmed according to the results. In other words, analysis of the data obtained showed that the cooperative teaching method is more effective than the other one. Analysis of the data showed that descriptive statistics of cooperative approach is higher than probing approach. Since the students with the approach of cooperation in authenticity achieved higher scores than the students with probing approach and the significance

level obtained was less than 0.05, so the hypothesis research is confirmed. The findings are consistent with the results of Gliss (2003), Sheffer (2002), Chekernik and Micomic (1973), Halpran (2008), Rejikner (1982), Beliq (1972), Li Mangju (1996).

The fourth sub-hypothesis: The fourth sub-hypothesis states that there is a significant difference between the average scores of expansion of materials of students trained with probing method and those trained with cooperative method. This hypothesis was confirmed according to the results. In other words, analysis of the data obtained showed that the cooperative teaching method is more effective than the other one. The findings are consistent with the results of Conani (1390), Samavi (1380), Shokoufi Nejad (1380), Ghazaei (1388), Moshkelati (1376), Seyf (1374) in Iran and Copper and Smith (1967), Scaelo and Sitha (1993), Kalager and Aktar (1963), Gliss (2003), Sheffer (2002), Chekernik and Micomic (1973), Halpran (2008), Rejikner (1982), Beliq (1972), Li Mangju (1996) in the world. Because all these studies indicate the usefulness of cooperative teaching method in fostering creativity (expansion of materials) among students. According to the studies conducted in this regard and above studies, the findings indicate that cooperative teaching methods have more effects on learning rather than probing teaching methods and the creativity scores of students trained with cooperative method were more than those with probing method. Generally, since creativity and the use of creative methods while teaching in the class is more effective, teachers should use more of them and pay more attention to the students' interest in using cooperative methods according to the result of the present study.

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