

5th World Conference on Educational Sciences - WCES 2013

The effect of gifted students' creative problem solving program on creative thinking

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Abstract

The aim of this study was to determine the effect of creative problem solving teaching program designed for gifted students on the creative thinking skills of the middle school aged students. The study was conducted in summer 2010 with 47 gifted students in Istanbul Turkey. In this study, experiment and control groups were formed. Creative Problem Solving Program was applied to the experiment group. The Torrance Test of Creative Thinking (TTCT) was used to measure. Results indicated that there was not a significant difference ($p > .05$) between pretest scores of both group. Concerning post-test and pre-test, a significant difference ($p < .05$) was found in favor of experimental group. According to the research results the effect of creative problem solving on creative thinking skills was investigated in detail and suggestions were given.

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Selection and/or peer-review under responsibility of Academic World Education and Research Center.

Keywords: Gifted and talented education, creativity, creative problem solving, creative problem solving program

1. Introduction

One of the striking issues is how to develop the creative thinking skills of gifted students in the studies of gifted students, which is one of the most curious subjects in today's world. It is important to note that the gifted individuals found in every society with the rate of approximately 2-3% are trained according to the fields which they are capable (The Marland Report, 1972;). Renzulli (1986) suggesting that the gifted individuals have three sets of skills interacting with each other addresses these sets as the sets of specific skill levels, motivation and creativity. The general high skills are verbal-numerical reasoning, abstract thinking, recall of information and word fluency. The special skills are the skills required in technical fields such as music, theater, mathematics, science and chemistry. Motivation is considered as the ability to undertake superior tasks; however, creativity refers to creation of new ideas and using them while solving problem. The interaction between the three sets of skills should be provided in order to ensure superior success. When compared to all his peers in all the sets, an individual must be successful with the rate of %85. In addition, the individual is considered to be a gifted person on the condition that he/she shows 98% success in at least one of these sets (Renzulli, 1998, 1978, 1986).

The most extensive definition about creativity with regard to gifted skills was put forward by Torrance. Torrance (1974) states that creativity is to be sensitive to problems, lack of information, absent elements and incompatibilities; to determine the difficulties; to search for solutions; to make predictions; to hypothesize about

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deficiencies; to choose one of the solution ways and to try it; to retry and to reveal results. As discussed in the other skill models, and especially Renzulli's Three Sets Model, the sets of motivation and creativity can be developed through education while the normal set of gifted talented is permanent (Çetinkaya, 2012; Davashgil, 2004). Creativity and intelligence are not the characteristics which are only innate and inherently limited. This characteristic s can be developed because they are not stable (Çetinkaya, Çetin & Hızlı, 2012; Sternbeg & Grigorenko, 2002).

Many gifted talent theories propose that gifted talent can be developed by strengthening creativity. Guilford in one of these theories focuses on the creativity and problem solution researches which he intends to develop in The Structure of Intellect Model (Guilford, 1967). Guilford claims that intelligence cannot be measured exactly through the traditional intelligence tests. Therefore, he designs The Structure of Intellect Model in a three-dimensional classification system. This system is designed to regulate many possible skills according to;

1. Types of mental process used in the act of thinking (evaluation, production leading to single conclusion, production leading to many conclusions, memory and cognition);
2. Types of the content which the act of thinking contains (figural, symbolic, semantic and behavioral);
3. Types of the product at the end of the act of thinking (units, classes, relations, systems, transformations and inferences).

1.1. The Purpose of the Study

The main purpose of this study is to test the efficiency of The Education Program of Creative Problem Solving designed in order to develop the creative thinking skills of gifted children. The hypotheses to be tested in the scope of this main purpose could be listed as follows:

1. There is no significant difference between the TTCT pre-test scores of the experimental and control group students.
2. The TTCT post-test total scores of the experimental group to which the program was utilized are higher than the post-test total scores of the control group.

2. Methodology

2.1. The Method

This section provides information about the selection of the subjects forming the research group, research design, data collecting tools used in the study, and the statistical methods.

2.2. The Research Design

The quasi-experimental design with control group in which pre and post tests are not equalized was used in this study. The aim of choosing the quasi-experimental design was to investigate the effect of The Education Program of Creative Problem Solving on developing the children's creativity. 2x2 mixed design including experimental/control group, and pre/post test was employed in the present study. The research design is illustrated in the following table.

Table 1. The Research Design

| Groups | Pre-Test | Experimental Application | Post-Test |
|-----------------------------|----------|--------------------------|-----------|
| G1 : The Experimental Group | P1 | X | P2 |
| G2 : The Control Group | P3 | - | P4 |

Before conducting the research design showed in Table 1, Torrance Test of Creative Thinking (TTCT) was administered to all the subjects who took part in the experimental and control groups as the pre-test. Additionally, pre-processing measurement was performed. The sessions of The Education Program of Creative Problem Solving which continued for 15 weeks and consisted of 15 sessions were administered to the subjects during the implementation phase. The applications in the experimental and control group were terminated in the same week, and Torrance Test of Creative Thinking was utilized in all the groups as the post-test after the study had been completed.

2.3. The Research Group

A total of 20 subjects including 10 people for the experiment and 10 people for the control constituted the experimental and control groups of the experimental study.

2.4. The Data Collecting Tools

Torrance Test of Creative Thinking (TTCT) is one of the tests commonly used in order to measure creativity. This test consists of the forms of Figural A-B and Verbal A-B. The norm-based criteria in the test are fluency, originality, abstractness of titles, enrichment and resistance against early closure. The Criteria-based criteria which are named as Creative Power Control List are emotional expression, the ability to express story, movement of activity, expression power of titles, incomplete shapes and line synthesis, unusual visualization, internal visualization, extending boundaries, humor, richness and colorfulness of imagination, and fantasy (Aslan, 2001). The verbal part of the test which gained its current form in 1984 was administered to 10.271 and its figural part administered to 37.814 participants. The 50th year validity study of the test of which norm and validity study was made in 1974, 1984, 1990 and 1998 for four times was made in 2010 (Runko, Miller, Acar & Cramond, 2010).

3. Findings

In the study, firstly the homogeneity of variance which is the assumption of parametric tests was examined. The pre-test was employed in order to examine whether this assumption had been verified or not. Levene test was also used with the purpose of examining the homogeneity of variance related to the scores which were elicited in the post-test. It was observed in the test result that according to the pre-test measurements, the variances of the experimental and control groups were not homogeneous for all the dependent variables. More detailed findings of the analysis and the results obtained were presented in the following Table.

Hypothesis 1- There will be no significant difference in the TTCT pre-test scores of the experimental and control groups forming the study group. Mann Whitney U Test was applied on TTCT pre-test scores of the experimental and control with the aim of testing this hypothesis, and the result was given in Table 2.

Table 2. The Comparison of the TTCT Pre-test Scores of the Experimental and Control Group

| TTCT Sub Dimensions | Grup | N | \bar{X} rank | Σ rank | U | z | p |
|--------------------------|--------------|----|----------------|---------------|----------|--------|------|
| Fluency | Experimental | 47 | 48,96 | 2258,00 | 1079,000 | -,847 | ,847 |
| | Control | 47 | 46,96 | 2207,00 | | | |
| Originality | Experimental | 47 | 47,74 | 2244,00 | 1093,000 | -,087 | ,931 |
| | Control | 47 | 47,26 | 2221,00 | | | |
| Detailing | Experimental | 47 | 48,96 | 2279,00 | 1058,000 | -,719 | ,719 |
| | Control | 47 | 46,51 | 2186,00 | | | |
| Abstractness Of Titles | Experimental | 47 | 47,97 | 2254,50 | 1082,500 | -,167 | ,867 |
| | Control | 47 | 47,03 | 2210,50 | | | |
| Early Closure Resistance | Experimental | 47 | 50,94 | 2394,00 | 943,000 | -1,231 | ,218 |
| | Control | 47 | 44,06 | 2071,00 | | | |
| Total Standard | Experimental | 47 | 47,78 | 2245,50 | 1092,000 | -,098 | ,922 |
| | Control | 47 | 47,22 | 2219,50 | | | |

Mann Whitney U Test was conducted in order to determine whether the scores which the students in the experimental and control groups got from TTCT differentiated significantly. Accordingly, no significant difference was found between the experimental and control groups of TTCT which was applied before the experimental study. U=1079,000 z=-,847 p>.05 for Fluency; U= 1093,000 z=-,087 p>.05 for Originality; U=1058,000 z=-,719 p>.05 for Detailing; U=1082,000 z=-,167 p>.05 for Abstractness of Titles; U=943,000 z=-1,231 p>.05 for Early Closure Resistance; U= 1092,000 z=-,098 p>.05 for Total Standard Scores were found. When the mean of ranks for the

TTCT Total Standard Scores was scrutinized, it was seen that the score of the experimental group was lower than the students' of the control group before the application.

Hypothesis 2- The TTCT post-test total scores and all the subtest scores of the experimental group will be higher than the post-test and all the subtest scores of the control group. Mann Whitney U Test was performed on TTCT post-test scores of the experimental and control with the aim of testing this hypothesis.

Table 3. *The Comparison of the TTCT Post-test Scores of the Experimental and Control Group*

| TTCT Sub Dimensions | Grup | N | \bar{X} rank | Σ rank | U | z | p | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------------------|--------------|----|----------------|---------------|---------|--------|---------|--------------------------|--------------|----|-------|----------|---------|--------|---------|---------|----|-------|---------|--------------------------|--------------|----|-------|----------|---------|--------|---------|---------|----|-------|---------|--------------------------|--------------|----|-------|---------|---------|--------|---------|---------|----|-------|---------|--------------------------|--------------|----|-------|---------|---------|--------|---------|---------|----|-------|---------|----------------|--------------|----|-------|---------|---------|--------|---------|
| Fluency | Experimental | 47 | 58,46 | 2747,50 | 589,500 | -3,899 | ,001*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Control | 47 | 36,545 | 1717,50 | | | | Originality | Experimental | 47 | 64,71 | 3041,50 | 295,500 | -6,129 | ,001*** | Control | 47 | 30,29 | 1423,50 | Detailing | Experimental | 47 | 54,67 | 12569,50 | 767,500 | -2,589 | ,010** | Control | 47 | 40,33 | 1895,50 | Abstractness Of Titles | Experimental | 47 | 56,04 | 2634,00 | 703,000 | -3,050 | ,002** | Control | 47 | 38,96 | 1831,00 | Early Closure Resistance | Experimental | 47 | 63,40 | 2890,00 | 357,000 | -5,681 | ,001*** | Control | 47 | 31,60 | 1485,00 | Total Standard | Experimental | 47 | 64,53 | 3033,00 | 304,000 | -6,056 | ,001*** |
| Originality | Experimental | 47 | 64,71 | 3041,50 | 295,500 | -6,129 | ,001*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Control | 47 | 30,29 | 1423,50 | | | | Detailing | Experimental | 47 | 54,67 | 12569,50 | 767,500 | -2,589 | ,010** | Control | 47 | 40,33 | 1895,50 | Abstractness Of Titles | Experimental | 47 | 56,04 | 2634,00 | 703,000 | -3,050 | ,002** | Control | 47 | 38,96 | 1831,00 | Early Closure Resistance | Experimental | 47 | 63,40 | 2890,00 | 357,000 | -5,681 | ,001*** | Control | 47 | 31,60 | 1485,00 | Total Standard | Experimental | 47 | 64,53 | 3033,00 | 304,000 | -6,056 | ,001*** | Control | 47 | 30,47 | 1432,00 | | | | | | | | |
| Detailing | Experimental | 47 | 54,67 | 12569,50 | 767,500 | -2,589 | ,010** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Control | 47 | 40,33 | 1895,50 | | | | Abstractness Of Titles | Experimental | 47 | 56,04 | 2634,00 | 703,000 | -3,050 | ,002** | Control | 47 | 38,96 | 1831,00 | Early Closure Resistance | Experimental | 47 | 63,40 | 2890,00 | 357,000 | -5,681 | ,001*** | Control | 47 | 31,60 | 1485,00 | Total Standard | Experimental | 47 | 64,53 | 3033,00 | 304,000 | -6,056 | ,001*** | Control | 47 | 30,47 | 1432,00 | | | | | | | | | | | | | | | | | | | | |
| Abstractness Of Titles | Experimental | 47 | 56,04 | 2634,00 | 703,000 | -3,050 | ,002** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Control | 47 | 38,96 | 1831,00 | | | | Early Closure Resistance | Experimental | 47 | 63,40 | 2890,00 | 357,000 | -5,681 | ,001*** | Control | 47 | 31,60 | 1485,00 | Total Standard | Experimental | 47 | 64,53 | 3033,00 | 304,000 | -6,056 | ,001*** | Control | 47 | 30,47 | 1432,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Early Closure Resistance | Experimental | 47 | 63,40 | 2890,00 | 357,000 | -5,681 | ,001*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Control | 47 | 31,60 | 1485,00 | | | | Total Standard | Experimental | 47 | 64,53 | 3033,00 | 304,000 | -6,056 | ,001*** | Control | 47 | 30,47 | 1432,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Total Standard | Experimental | 47 | 64,53 | 3033,00 | 304,000 | -6,056 | ,001*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Control | 47 | 30,47 | 1432,00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Mann Whitney U Test was applied in order to determine whether the scores which the gifted students in the experimental and control groups received from the TTCT post-tests were differentiated significantly. Data analysis indicated a significant difference between the experimental and control groups in the TTCT applied before the experimental study. $U=589,500$ $z=-3,899$ $p<.001$ for Fluency; $U= 295,500$ $z=-6,129$ $p<.001$ for Originality; $U=767,500$ $z=-2,589$ $p<.01$ for Detailing; $U= 703,000$ $z=-3,050$ $p<.01$ for Abstractness of Titles; $U= 357,000$ $z=-5,681$ $p<.001$ for Early Closure Resistance; $U=304,000$ $z=-6,056$ $p<.001$ for Total Standard Scores were found. When the TTCT Total Standard Scores and the mean of ranks in all the sub-tests' scores were analyzed, it was noted that the score of the experimental group was significantly higher than the students' of the control group. Accordingly, it can be said that the study activities applied are effective for the increase in the creativity scores of the gifted students.

4. Result and Recommendations

In this study, 15 sessions were performed with the students during the testing period of the hypothesis. Guilford Intellect Structure Model was taken into consideration while the contents of the sessions were formed. Two sessions were performed every week, and each session lasted for 45 minutes. Variables such as age and gender were tried to be kept equal. The pre-test and post-test results of the students in the experimental and control groups showed that the TTCT total scores and the means of their sub-dimensions increased. It is detected that the study activities also tend to be effective separately in following dimensions: fluency, originality, detailing, early closure resistance and abstractness of titles.

These results are similar to Koray's (2003) study. It was observed that the students of the experimental group using the creative thinking skills had higher scores in the dimension such as creativity, problem solving and self-efficacy than the control group students. It can be said that Yaman & Yalçın (2005) developed the experimental group of problem-based learning approach in their study. Güngör (2006) concluded that the utilization of creative thinking techniques is influential in the development of creativity skill. Kadayıfçı (2008) stated that creative thinking-based teaching model which was developed in his model study based on creative thinking affected the creative skills of the students positively. The hypotheses in both studies are significantly similar. The effect of

creative thinking-based learning on the level of creative thinking in Koray's (2003) study shows similarities with the results of this study. The results obtained from Lawson's (2001) teaching study on creativity are also in the same line with the results of this study. Within this framework, it can be inferred that the programs having the content of problem solution increase creativity skills. In parallel to this inference, it can be said that the creative problem solving program applied is effective in improving the students' creativity skills.

Within this framework, the following suggestions can be presented in order to develop students' creativity: Compelling questions above the level of gifted students, resorting to different group studies, allowing them to expressing themselves on a given topic. In addition to these, details and elaborations in their answers should be included in the content of the problem solving processes. Besides this, care should be taken in choosing interesting topics which are different from the one proposed by the studies carried out so far and can arouse their curiosity. The teaching strategies which take students' interest and learning speed into consideration should also be utilized.

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