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The effect of differentiation approach developed on creativity of gifted students: cognitive and affective factors

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The aim of the study is to develop a differentiation approach for the mathematics education of gifted middle school students and to determine the effect of the differentiation approach on creative thinking skills of gifted students based on both cognitive and affective factors. In this context, the answer to the following question was searched: "Is there any effect of the differentiation approach developed based on mathematics education of gifted students on the creativity of gifted students?" In the present study, in the scope of quantitative research the model of pre test-post test with control group was used. The sample of the study consists of 54 gifted students studying at 5th and 6th grade in a private school in Maltepe district of Istanbul. As a data gathering tool, Mathematics achievement test, Torrance Creativity test, Divergent Feeling test and multiple intelligence test were used. When the experimental group to whom the activities designed based on differentiation approach was applied compared with the control group, the creative thinking skills based on fluency, flexibility, originality and elaboration scores and creative thinking skills based on curiosity, imagination, risk-taking and complexity increased in a significant way. These results show that the developed differentiation approach increased the creativity of the students.

Key words: Differentiation, gifted student, creativity, mathematics education.

INTRODUCTION

The consciously selected stimulants, tools and equipments, consciously organized teaching environments and activities which will be presented to the gifted students will support these children in a healthy way and enable them to use their own capacities at the highest level (MEGEP, 2007). Peterian (1916) said in his book entitled as "The Rise of Gifted One" that 'Giftedness is always an opportunity for the success and it is an available situation for the achievement but it is not the success itself'. He stated with this expression that gifted child cannot be successful with only his/her intelligence but he/she needs to use this intelligence in suitable conditions (Taller, 2004). The school programs are primarily organized for the needs of the majority and children who have middle

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level or close to middle level skills. This situation does not allow gifted students to improve their existing potentials. Therefore, students do not have interest in school and its program and their information level stays behind the optimum level according to their mental levels. In this case, the child uses most of his existing potential on other fields (Ataman, 1998).

The foundation of raising successful individuals is laid in childhood. The individuals whose imagination and creation desires are supported become extremely productive and creative in their adulthood (URL-2). Creativity is an important requisite feature of our age. There is an opportunity after birth to acquire this skill that will be useful to a child in his/her future studies and in his/her school and professional life. Therefore, making and planning some studies for having students to acquire this skill in teaching programs enables children to be able to have different perspectives against life and events, to produce new and different ideas, to interpret the environment differently and to have problem solving skills (Madi, 2012). Different types of activities supporting creativity are needed in learning environments also for gifted students as for all students. There are positive findings in the subject that creativity can be improved by using proper materials and methods in proper and available educational environments (Orhon, 2011).

In normal class programs, it is essential to make suitable arrangements according to needs and characteristics of gifted students (MEGEP, 2007). It was determined that gifted students need deepening and enrichment activities in mathematics and opportunities that will enable them to develop their creativity, abstract thinking, reasoning, problem solving and problem posing skills. Besides, it is needed to make differentiations that will help them to carry their existing potentials to higher levels (Aygün, 2010).

The general objective of an approach for enrichment is to increase the quality and learning experiences levels for all students in any and every part of curriculum (Renzulli and Reis, 2008a). The basic objective of teaching enrichment is to provide independent and effective learning instead of dependent and passive learning (Renzulli and Reis, 2008b). The purpose of differentiation is to diversify curriculum, content, pedagogy and evaluation for fulfilling the individual needs and interests of students by teachers (Marsh, 2009). It is suggested to emphasize subjects such as creativity, mental initiative, critical thinking, socialization, taking responsibilities and leadership in differentiating curriculum. VanTassel-Baska and Worley (2006) state the necessity for creating more complicated curriculums which deals with students in depth according to their needs, use discoveries and based on experience. It is accepted as important to increase the amount of experiences obtained in learning environments and to diversify them (Karasu, 2010).

It is necessary for primary school students to concretize information, to make them understand how to get information and in this way teach them how to produce information and at the same time to use the most effective method to provide the permanence of the information (Ceran and Önder, 2012). In recent years, there have been some studies to re-organize teaching and learning environments and to carry out modern educational principles. Lately, the project-based learning is the most popular approach which allows us to use various disciplines together with different teaching and learning approaches (Korkmaz and Kaptan, 2002). The purpose of project-based learning is to have a product completely. The purpose of production process is to make students understand the concepts and to have learning through the understanding of the subject contents (Türkmen, 2009).

The purpose of the research is to develop a differentiation approach for the mathematics education of the middle school gifted students and to determine the effects of this developed approach on the creativity of the gifted students in terms of both cognitive and affective creative factors. A differentiation approach which will provide a learning environment in which students will have an opportunity to advance further rather than satisfying in current objectives, in which students can develop self-confidence, they will take responsibilities and they will enjoy sharing the obtained product with their friends, they will take risks when necessary, they will personally experience the elapsed time from collecting information to present this information, which enables them to correlate mathematics with real life, interact with their friends and to be social and active and at the same time they will have opportunities to improve their creative thinking skills which are necessary in every part of life, which will provide chances to learn by living, will appeal to their interests and skills and which can improve their existing potentials has been designed for the mathematics education of the gifted students in our country. Thanks to designing a differentiation approach, a deficiency was tried to be removed. It was tried to determine the effect of the developed differentiation approach on the creativity according to both cognitive and affective factors with more solid evidence by calculating creativity scores.

In this sense the answer to the following problem ‘Is there an effect of the developed differentiation approach on the creativity of gifted students?’ was searched for. The answer to the following sub-problem was searched in accordance with the purpose of this study: Is there a significant difference between creative thinking skills of the gifted students in control and experimental groups before and after implementation?

METHOD

A quantitative research design was used in this study. Pre-test post-test with control group model was used within the scope of a quantitative research and the effect of the developed differentiation approach on the creativity of gifted students was analyzed. The

universe of the study is composed of fifth and sixth grade gifted students studying in middle schools from Maltepe District in Istanbul. The sample of the study is composed of 54 fifth and sixth grade gifted students (27 students at 5th grade-27 students at 6th grade) who are studying in the same private school from Maltepe district in Istanbul. In the private school, there are classes in which all the students are gifted. The students were identified as gifted by using some intelligence tests and then they were brought together in a class by their schools. In the present study there were 4 classes. Two of them are at 5th grade and the others are 6th grade. Convenience sampling was conducted due to some practical reasons such as ease of transportation, implementing the study rigorously and eases of communication.

Data collection instruments

Data collection instruments used within the scope of this study; Mathematical Achievement Test, Creative Thinking Test (Torrance), Creative Thinking Test (Divergent Feeling Test) and Multiple Intelligence Inventory.

Mathematics Achievement Test: The study was carried out with 5th and 6th grade gifted students. Two implementations were conducted with gifted students who are studying in 5th grade on 'Tables and Graphics' subject and 'Ratio and Proportion' subject with 6th grade gifted students. While preparing the achievement tests for the study, the objectives stated in the National Education curriculum were considered and draft achievement tests were created. The compatibility of the draft test with the related objectives and grade levels was analyzed by controlling these tests by the researcher, academician and 6 mathematics teachers. The draft achievement test was carried out with students who are studying in one upper grade level than the grade level of the related subject in some different primary schools (One class each and small sample) and final control of the tests were made by deciding the necessary time needed to be given for tests. In the next level, item analysis (total item-remaining item- item discrimination) of the tests were made according to the obtained data by having pilot implementation (big sample-approximately 200 persons) with students who are studying in one upper grade level than the grade level of the related subject. Item analysis (item sum-item remaining-item discrimination) were conducted according to the obtained data. As a result of the item analysis of the prepared achievement tests, Cronbach alpha values were found as respectively 0,780 and 0,852. Also, control and experimental group were determined according to the achievement tests.

Creative Thinking Test (Torrance): Torrance creative thinking tests were composed of figural and verbal tests (Cramond et al., 2005). There were two forms as A and B in each test (Cramond et al., 2005, cited in Torrance, 1966, 1974). Figural A and B forms can be used as pre-test and post-test (URL-1). The validity, reliability and construct validity of the test was analyzed and it was determined that the test reached desired results in terms of linguistic equivalence, reliability and validity studies (Aslan, 2001).

Total creativity score was obtained in this study by considering flexibility, fluency, originality and elaboration scores which are known as the cognitive factors of the creativity. Verbal creativity test was conducted for calculating flexibility scores since there was not flexibility sub-dimension in Torrance figural creativity test. In this sense, figural forms of Torrance creativity tests (A and B Forms) were used for obtaining fluency, originality and elaboration scores and verbal forms (A and B forms) were used for obtaining flexibility scores. The overall creativity score was obtained by calculating the arithmetic mean after converting them into 100. Torrance figural and verbal creativity tests (A and B Forms) were used when comparing the lessons carried out based on the developed differentiation approach with the lessons carried out in the scope of the curriculum included in National Education. They were also used as pre-test and post–test regarding the implementations of the 5th grade Tables and Graphics subject and 6th grade Ratio-Proportion subject. Cronbach alpha coefficient for the Torrance creativity test obtained after two implementations within the scope of this study was found as 0.820.

Creative Thinking Test (Williams-Divergent Feeling Test): Test of Divergent Feeling was designed for testing affective creative components of the creativity. As a result of the test, overall feeling creative score which is based on curiosity, complexity, imagination and risk-taking is obtained. The scale is in likert type and consisted of 50 items which students will answer individually (Claxton, Pannells and Rhoads, 2005). Among these items, there are 12 items for curiosity and imagination and 13 items for risk-taking and complexity (Williams, 1993). Williams' creativity evaluation scale was adapted to Turkish culture by Erdoğdu (2005). In this study, the scale was conducted to all the students and Cronbach alpha value was found as 0.69.

Multiple- Intelligences Inventory: 'Multiple-Intelligences Inventory' which was prepared by Saban (2005) was used for determining the dominant intelligence domains of the students. The inventory was in likert type and 'Multiple-Intelligences Inventory Evaluation Profile' which was provided by Saban (2005) was used for the evaluation. While determining dominant intelligence domains, students' scores from Multiple-intelligences inventory were considered and students' level of development in intelligence domains was determined as 'highly developed' for the students whose total score is between 32 and 40 in intelligence domain. Groups were created by combining students who are in the same dominant intelligence domains. Project topics were prepared by considering the dominant intelligence domains of the students. Students or group of students were asked to prepare projects which were suitable to their dominant intelligence domains.

Teaching material

In terms of developing a curriculum differentiation approach, in a topic which was selected from National Education curriculum, some differences were made in content, process, product and learning environment. While making these differences, content, process, product and learning environment dimensions were defined as in the following:

Content= Elaborated Objectives + Theme (The Content and subject stated in National Education Curriculum)
Process= Determining multiple-intelligence domains of the students + Teachers' strategies + Basic Skills + Research Skills + Productive Skills
Product= Productions
Learning Environment=Creative Thinking +Multiple-Intelligences +Different Disciplines +Project-based

Since elaborated objectives were important for determining the topic, they were paired with theme in the content dimension. Since the determination of multiple intelligences of students would affect strategies of teachers and projects of students, it was dealt with in process dimension. Current grade level objectives were given in Theme part (subject, content). 'The Determination of Multiple Intelligences of Students', 'Elaborated Objectives' and 'Strategies of Teachers' were added in the differentiation approach which was developed as an addition to the theme, basic skills, research skills, productive skills and products stated in the lesson plan of Kaplan model.

The Multiple intelligences of students were determined by

conducting 'Multiple-Intelligences Inventory for Students'. Besides, the data obtained as a result of conducting this inventory were used in determining the project topics of students, in the selection of teaching strategies that will be used by the teacher and in determining what to consider for motivating students (addressing the interests and skills of the students). In the consideration of information obtained from the inventory, it was concluded that the inventory was successful in determining the intelligence domains of the children as the project topics was internalized by the students and as they expressed that project topics were suitable to their interests and skills.

While designing differentiation model, the models designed for the education of gifted students in abroad were used. These models are; Williams model, Maker model, Kaplan model, Autonomous Learner model and Maker Matrix. Among the 5 problem types stated within the scope of Maker matrix model, Type III and Type V were emphasized. Project topics were presented to students by determining the outlines of them. Students were made responsible from all stages including problem, method...presentation stages in projects. For this reason the projects were examples of Type V problems of Maker Matrix. Besides, they were also examples of Type III in terms of giving chances to different solutions and hence having different answers.

During the enrichment of the objectives phase, enrichment was made by selecting objectives from an upper grade. In using strategies, strategies stated at the second dimension of the Williams model had been considered. However some of these strategies were skipped and new strategies were added (written in bold type). These are; intriguing question, property listings, analogy, visualization, Interdisciplinary approach, depending on uncertainty, intuitive expression, evaluation of cases, organized random research, research skills, creative reading skills, creative listening skills, discrimination, Topic relation, Historical perspective, samples of changes, contradiction, creative writing skills, creative process study.

In the developed differentiation approach, students were faced with different, exciting project topics which were suitable to their skills and interests and addressing extra objectives. That is, both vertical and horizontal elaborations were made. For this, elaborations were made both in objective and activity dimensions. Within the scope of the designed differentiation approach, it was examined that the strategies in Williams' model fitted to which process changes in Maker model. The purpose here is to determine process changes that will be made in the curriculum via the strategies that will be used according to subjects. Students developed some products (such as journals, papers, songs, slide shows, plays, theatres…) through strategies. These are evaluated by their teachers and peers through listening. Students who are making the presentations are subjected to peer and teacher evaluation. The information process was considered especially when preparing scoring rubrics for the projects. Students were provided feedback by the researchers through watching them again from the video recordings of the presentations and they were asked to re-organize their projects.

During the process phase of the designed model, at the point which requires research skills, that is, especially when students need to prepare projects, 'The Information Process' among the skills which are included within the scope of research skills in the process phase of Kaplan model was called as Stages for Preparing Projects (Student Instructions) after editing by the researcher and the lecturer. Students were asked to prepare project reports by considering these stages. While evaluating students' projects which were prepared by depending on the differentiation approach developed within the scope of this study, an evaluation form prepared by depending on the 'information skills' part of the Information Process was used. Students were informed about the effect of each stage on the overall evaluation of the project. Thus, it became easier to determine the stages that students needed to concentrate more.

With the help of the activities based on the differentiation approach developed within the scope of this study, students develop self-confidence and positive risk-taking behaviours through situations such as making a selection among project topics addressing their dominant intelligence domains, deciding on the proper presentation method, facing with critiques and criticising friends as a result of peer assessment, advocating his/her opinions and projects to others against the questions, planning the project, preparing a work plan and be able to work according to this plan, distributing tasks, taking responsibilities, being responsible from both their own and their friends' learning, cooperating, presenting their work, having positive feedbacks for their efforts.

Data analysis

Statistical analyses were made through collecting achievement pre-post test, Torrance creative thinking (figural-verbal) pre-post test, Divergent Feeling (Creativity Test) pre-post test and Multiple-Intelligence Inventory data which were carried out with gifted students. When calculating scores, the numbers rounded up according to first digit after comma. All the analyses were made in 95 % confidence interval and $p<0,05$ values were accepted as statistically significant.

According to achievement test scores, control and experimental group were determined. There weren't any significant difference between achievement test scores of the groups. That's why, in the determination of the groups was taken into consideration the mean rank scores. The group whose mean rank score was smaller than the other was chosen as experimental group. When analysing pilot studies of the achievement tests, scores were taken as the number of questions answered correctly. However, when determining control and experimental groups, scores were calculated by converting them into 100-scale grading system in the analyses of the achievement tests. The Item remaining, item discrimination and item-total indices were calculated by conducting item analysis to achievement tests after pilot study and accepting the significance level as 0,05. The equivalence of the scores obtained from Torrance verbal and figural forms, Williams' creativity (Divergent Feeling Test) and "how creative are you" creativity scale over 100 was calculated and analyses were conducted according to these scores.

As the number of students in the class is less, non-parametric tests were used in data analysis of the conducted studies (The number of data is less than 30 (Kalaycı, 2009; Baydur, 2012; URL-3; URL-4; URL-5)). In the cases, when control and experimental are needed to be compared generally, Mann Whitney U test and in the analysis of just control group or experimental group's pre-test and post-test data analysis Wilcoxon signed ranks test was used. The data collected by using multiple intelligence inventory, were analyzed, the intelligences that got a score between 32 and 40 were accepted as 'highly developed' and the distribution of dominant intelligence domains of the classes were given in tables by displaying their percentage frequency values.

RESULTS

Torrance Creativity Analysis (5th Grade)

In Table 1, there was shown wilcoxon signed ranks test comparison regarding creativity components scores of students in control and experimental groups before and after implementation.

According to the table, there is a significant difference

Table 1. Wilcoxon signed ranks test comparison regarding creativity components scores of students in control and experimental groups before and after implementation.

Group	Score	Post-test-Pre-test	N	Mean Rank	Rank Sum	z	p
Control	Post-Fluency-Pre-Fluency	Negative Rank	5	6,60	33,00	-0,473	0,636
		Positive Rank	7	6,43	45,00		
		Equal	2				
	Post-Flexibility-Pre-Flexibility	Negative Rank	10	6,00	60,00	-2,408	0,016
		Positive Rank	1	6,00	6,00		
		Equal	3				
	Post-originality Pre-originality	Negative Rank	10	6,60	66,00	-1,441	0,150
		Positive Rank	3	8,33	25,00		
		Equal	1				
	Post-elaboration-Pre-elaboration	Negative Rank	0	0,00	0,00	-2,264	0,024
		Positive Rank	6	3,50	21,00		
		Equal	8				
	Post-Overall Pre-Overall	Negative Rank	8	5,88	47,00	-1,270	0,204
		Positive Rank	3	6,33	19,00		
		Equal	3				
Experimental	Post-Fluency-Pre-Fluency	Negative Rank	0	0,00	0,00	-3,065	0,002
		Positive Rank	12	6,50	78,00		
		Equal	1				
	Post-Flexibility-Pre-Flexibility	Negative Rank	0	0,00	0,00	-3,198	0,001
		Positive Rank	13	7,00	91,00		
		Equal	0				
	Post-originality Pre-originality	Negative Rank	0	0,00	0,00	-3,182	0,001
		Positive Rank	13	7,00	91,00		
		Equal	0				
	Post-elaboration-Pre-elaboration	Negative Rank	0	0,00	0,00	-2,070	0,038
		Positive Rank	5	3,00	15,00		
		Equal	8				
	Post-Overall Pre-Overall	Negative Rank	0	0,00	0,00	-3,187	0,001
		Positive Rank	13	7,00	91,00		
		Equal	0				

between the flexibility (z=-2,408, p=0,016<0,05) and elaboration (z=-2,264, p=0,024<0,05) scores of the gifted students in control group before and after implementation. When the rank sum of the difference scores are considered, it is seen that the observed difference is in favour of negative ranks (pre-test) for the flexibility and positive ranks (post-test) for the elaboration. However, there is not a significant difference between fluency (z=-0,473, p=0,636>0,05), originality (z=-1,441, p=0,150) and overall (z=-1,270, p=0,204) scores before and after implementation. There is a significant difference between the fluency (z=-3,065, p=0,002<0,05), flexibility (z=-3,198, p=0,001<0,05), originality (z=-3,182, p=0,001<0,05), elaboration (z=-2,070, p=0,038<0,05) and overall (z=-3,187, p=0,001<0,05) scores of the gifted students in experimental group before and after implementation. When the rank sum of the difference scores is considered, it is seen that the observed difference is in favour of positive ranks (post-test). According to these results, there was an increase in the creativity and creativity components of the experimental group students.

In Table 2 there was shown Mann Whitney-u test comparison regarding the creativity test scores (fluency-flexibility- originality- elaboration- overall) of the gifted students in control and experimental groups before and after implementation.

According to the table, there is a significant difference in favour of experimental group between the fluency-post (U=42,000, p=0,017<0,05), flexibility-post (U=6,500, p=0,000<0,05), originality-post (U=19,000, p=0,000<0,05) and overall-post (U=28,00, p=0,002<0,05) scores of the gifted students in control and experimental groups before and after implementation. However, there is not a significant difference between fluency-pre (U=88,00, p=0,884>0,05), flexibility-pre (U=69,00, p=0,285>0,05), originality-pre (U=81,00, p=0,626>0,05), elaboration-pre

Table 2. Mann Whitney-U test comparison regarding the creativity test scores (fluency- flexibility- originality- elaboration- overall) of the gifted students in control and experimental groups before and after implementation.

Score	Group	N	Mean Rank	Rank Sum	U	P
Fluency-pre	Control	14	14,21	199,00	88,000	0,884
	Experimental	13	13,77	179,00		
Fluency-post	Control	14	10,50	147,00	42,000	0,017
	Experimental	13	17,77	231,00		
Flexibility-pre	Control	14	12,43	174,00	69,000	0,285
	Experimental	13	15,69	204,00		
Flexibility-post	Control	14	7,96	111,50	6,500	0,000
	Experimental	13	20,50	266,50		
Originality-pre	Control	14	14,71	206,00	81,000	0,626
	Experimental	13	13,23	172,00		
Originality-post	Control	14	8,86	124,00	19,000	0,000
	Experimental	13	19,54	254,00		
Elaboration-pre	Control	14	12,75	178,50	73,500	0,393
	Experimental	13	15,35	199,50		
Elaboration-post	Control	14	12,75	178,50	73,500	0,393
	Experimental	13	15,35	199,50		
Overall-pre	Control	14	13,00	182,00	77,00	0,496
	Experimental	13	15,08	196,00		
Overall-post	Control	14	9,50	133,00	28,00	0,002
	Experimental	13	18,85	245,00		

(U=73,500, p=0,393>0,05), elaboration-post (U=73,500, p=0,393>0,05) and overall-pre (U=77,00, p=0,496>0,05) scores of gifted students in control and experimental groups. On the other hand, when mean ranks are analyzed, the mean rank of the experimental group is higher than control group even though there is not a significant difference between groups for elaboration-post.

Torrance Creativity Analysis (Sixth Grade)

In Table 3, there was shown wilcoxon signed ranks test comparison regarding creativity components scores of students in control and experimental groups before and after implementation.

According to the table, there is a significant difference between the flexibility (z=-2,557, p=0,011<0,05), elaboration (z=-3,157, p=0,002<0,05) and overall (z=-2,966, p=0,003<0,05) scores of the gifted students in control group before and after implementation. When the rank sums of the difference scores are considered, it is seen that the observed difference is in favour of negative ranks (pre-test) for the flexibility, elaboration and overall scores. However, there is not a significant difference between fluency (z=-0,370, p=0,711>0,05) and originality (z=-1,445, p=0,148>0,05) scores before and after implementation. There is a significant difference between the fluency (z=-3,415, p=0,001<0,05), flexibility (z=-3,414, p=0,001<0,05), originality (z=-3,413, p=0,001<0,05), elaboration (z=-3,084, p=0,002<0,05) and overall (z=-3,422, p=0,001<0,05) scores of the gifted students in experimental group before and after implementation. When the rank sums and mean rank of the difference scores are considered, it is seen that the observed difference is in favour of positive ranks (post-test).

In Table 4, there was shown Mann Whitney-u test comparison regarding the creativity test scores (fluency-flexibility- originality- elaboration- overall) of the gifted students in control and experimental groups before and after implementation.

According to the table, there is a significant difference between the fluency-post (U=38,500, p=0,002<0,05), flexibility-post (U=12,000, p=0,000<0,05), originality-post (U=25,500, p=0,000<0,05), elaboration-post (U=12,000, p=0,000<0,05) and overall-post (U=4,500, p=0,000<0,05) scores of the gifted students in control and experimental groups. However, there is not a significant difference between fluency-pre (U=88,00, p=0,884>0,05), flexibility-pre (U=69,00, p=0,285>0,05), originality-pre (U=81,00, p=0,626>0,05), elaboration-pre (U=73,500, p=0,393> 0,05), and overall-pre (U=77,00, p=0,496>0,05) scores of gifted students in control and experimental groups.

Williams' Creativity Analysis (Fifth Grade)

In Table 5, there was shown Mann Whitney-u test comparison regarding creativity test scores of gifted students in control and experimental groups.

According to the table, there is not a significant difference between the creativity-pre scores (U=79,000,

Table 3. Wilcoxon signed ranks test comparison regarding creativity components scores of students in control and experimental groups before and after implementation.

Group	Score	Pre-Test-Post-Test	N	Mean Rank	Rank Sum	Z	p
Control	Post-Fluency- Pre-Fluency	Negative Rank	8	8,31	66,50	-0,370	0,711
		Positive Rank	7	7,64	53,50		
		Equal	0				
	Post-Flexibility- Pre-Flexibility	Negative Rank	11	7,45	82,00	-2,557	0,011
		Positive Rank	2	4,50	9,00		
		Equal	2				
	Post-originality Pre-originality	Negative Rank	10	7,55	75,50	-1,445	0,148
		Positive Rank	4	7,38	29,50		
		Equal	1				
	Post-elaboration- Pre-elaboration	Negative Rank	14	8,25	115,50	-3,157	0,002
		Positive Rank	1	4,50	4,50		
		Equal	0				
	Post-Overall Pre-Overall	Negative Rank	14	8,00	112,00	-2,966	0,003
		Positive Rank	1	8,00	8,00		
		Equal	0				
Experimental	Post-Fluency- Pre-Fluency	Negative Rank	0	0,00	0,00	-3,415	0,001
		Positive Rank	15	8,00	120,00		
		Equal	0				
	Post-Flexibility- Pre-Flexibility	Negative Rank	0	0,00	0,00	-3,414	0,001
		Positive Rank	15	8,00	120,00		
		Equal	0				
	Post-originality Pre-originality	Negative Rank	0	0,00	0,00	-3,413	0,001
		Positive Rank	15	8,00	120,00		
		Equal	0				
	Post-elaboration- Pre-elaboration	Negative Rank	0	0,00	0,00	-3,084	0,002
		Positive Rank	12	6,50	78,00		
		Equal	3				
	Post-Overall Pre-Overall	Negative Rank	0	0,00	0,00	-3,422	0,001
		Positive Rank	15	8,00	120,00		
		Equal	0				

p=0,559>0,05) of the gifted students in control and experimental groups. However, there is a significant difference between the creativity-post scores (U=3,000, p=0,000<0,05) of gifted students in control and experimental groups. When mean ranks are considered, the mean rank of the experimental group is higher than the mean rank of the control group for creativity-post.

In Table 6, there was shown wilcoxon signed ranks test comparison regarding the creativity test scores of gifted students in control and experimental groups.

According to the table, there is a significant difference between creativity sores before and after implementation (z=-3,300, p=0,001<0,05) of gifted students in control group and creativity sores before and after implementation (z=-3,183, p=0,001<0,05) of gifted students in experimental group. When rank sums of the difference scores are considered, it is seen that the observed difference is in favour of negative ranks (pre-test) for the control group and positive ranks (post-test) for the experimental group.

Williams' creativity analysis (Sixth Grade)

In Table 7, there was shown Mann Whitney-u test comparison regarding the creativity test scores of gifted students in control and experimental groups.

According to the table, there is not a significant difference between creativity-pre scores (U=97,000, p=0,519>0,05) of gifted students in control and experimental groups. However, there is a significant difference between creativity-post scores (U=36,500, p=0,002<0,05) of gifted students in control and experimental groups. When mean ranks are considered, the mean rank of the experimental group is higher than control group's mean rank for creativity-post. In this case, the difference is in favour of experimental group.

Table 4. Mann Whitney-U test comparison regarding the creativity test scores (fluency- flexibility- originality- elaboration- overall) of the gifted students in control and experimental groups before and after implementation.

Score	Group	N	Mean Rank	Rank Sum	U	p
Fluency-pre	Control	14	13,70	205,50	85,500	0,262
	Experimental	13	17,30	259,50		
Fluency-post	Control	14	10,57	158,50	38,500	0,002
	Experimental	13	20,43	306,50		
Flexibility-pre	Control	14	14,73	221,00	101,000	0,633
	Experimental	13	16,27	244,00		
Flexibility-post	Control	14	8,80	132,00	12,000	0,000
	Experimental	13	22,20	333,00		
Originality-pre	Control	14	13,80	207,00	87,000	0,289
	Experimental	13	17,20	258,00		
Originality-post	Control	14	9,70	145,50	25,500	0,000
	Experimental	13	21,30	319,50		
Elaboration-pre	Control	14	13,33	200,00	80,000	0,174
	Experimental	13	17,67	265,00		
Elaboration-post	Control	14	8,00	120,00	0,000	0,000
	Experimental	13	23,00	345,00		
Overall-pre	Control	14	13,40	201,00	81,00	0,190
	Experimental	13	17,60	264,00		
Overall-post	Control	14	8,30	124,50	4,500	0,000
	Experimental	13	22,70	340,50		

Table 5. Mann Whitney-U test comparison regarding creativity test scores of gifted students in control and experimental groups.

Score	Group	N	Mean Rank	Rank Sum	U	p
Creativity -Pre	Control	14	14,86	208,00	79,00	0,559
	Experimental	13	13,08	170,00		
Creativity- Post	Control	14	7,71	108,00	3,000	0,000
	Experimental	13	20,77	270,00		

Table 6. Wilcoxon signed ranks test comparison regarding the creativity test scores of gifted students in control and experimental groups

Group	Score	Post-Test-Pre-Test	N	Mean Rank	Rank Sum	z	p
Control	Creativity-Pre-Creativity-Post	Negative Rank	14	7,50	105,00	-3,300	0,001
		Positive Rank	0	0,00	0,00		
		Equal	0				
Experimental	Creativity-Pre-Creativity-Post	Negative Rank	0	0,00	0,00	-3,183	0,001
		Positive Rank	13	7,00	91,00		
		Equal	0				

In Table 8, there was shown Wilcoxon signed ranks test comparison regarding creativity test scores of gifted students in control and experimental groups.

According to the table, there is a significant difference between creativity scores (z=-2,899, p=0,004<0,05) of gifted students in control group before and after implementation and creativity scores (z=-3,412, p=0,001<0,05) of gifted students in experimental group before and after implementation. When the rank sums of the difference scores are considered, it is seen that the observed difference is in favour of negative ranks (pre-test) for control group and positive ranks (post-test) for

Table 7. Mann Whitney-U test comparison regarding the creativity test scores of gifted students in control and experimental groups.

Score	Group	N	Mean Rank	Rank Sum	U	p
Creativity-Pre	Control	15	16,53	248,00	97,00	0,519
	Experimental	15	14,47	217,00		
Creativity-Post	Control	15	10,43	156,50	36,500	0,002
	Experimental	15	20,57	308,50		

Table 8. Wilcoxon signed ranks test comparison regarding creativity test scores of gifted students in control and experimental groups.

Group	Score	Post-test-Pre-test	N	Mean Rank	Rank Sum	z	p
Control	Creativity-Post Creativity-Pre	Negative Rank	14	7,93	111,00	-2,899	0,004
		Positive Rank	1	9,00	9,00		
		Equal	0				
Experimental	Creativity-Post Creativity-Pre	Negative Rank	0	0,00	0,00	-3,412	0,001
		Positive Rank	15	8,00	120,00		
		Equal	0				

experimental group.

DISCUSSION, CONCLUSION AND SUGGESTIONS

The conclusion regarding torrance creativity test

In the study carried out with the students studying at 5th grade (Tables and Graphics), it is observed that the flexibility scores of gifted students in control group decreased after implementation and their elaboration scores increased. However, after implementation, any difference in fluency, originality and overall scores is not observed. There has been an increase in fluency, flexibility, originality, elaboration and overall scores of gifted students in experimental groups after implementation. While a difference is not observed in fluency, flexibility, originality, elaboration and overall scores of control and experimental groups before implementation, there is a significant difference between fluency, flexibility, originality, elaboration and overall scores in favour of experimental group. Although there is not a significant difference between groups for elaboration score after implementation, the elaboration score of experimental group is higher than control group.

In the study carried out with the students studying at 6th grade (Ratio-Proportion) it is seen that there is a decrease in flexibility, elaboration and overall scores of the gifted students in the control group. However, any difference in their fluency and originality scores is not being observed. There was an increase in the fluency, flexibility, originality, elaboration and overall scores of the gifted students in experimental group after implementation. While there is not a significant difference between fluency, flexibility, originality, elaboration and overall scores of the gifted students in control and experimental groups before implementation, after implementation there is significant difference in favour of experimental group in fluency, flexibility, originality, elaboration and overall scores.

There was a significant increase after implementation in creative thinking skills of experimental group students with whom the activities designed according to differentiation approach developed within the scope of this study when it is compared with control group. This shows that elaborated, creative thinking based, project based activities depending on dominant intelligences increase creative thinking skills of students. In addition to that, it is seen that the changes in content, process and learning environments which are based on creative strategies improve students' creative thinking skills.

The conclusion regarding with Williams' divergent feeling activities

In the study carried out with the students studying at 5th grade and 6th grade, while a difference is not observed between creativity pre-test scores of gifted students in control group and experimental group, after implementation there is a difference between groups in favour of experimental group. While the creativity scores of gifted students in control group decreased after implementation, there was an increase in the creativity scores of students in experimental group.

The differentiation approach developed within the scope of this study increased students' calculated risk taking, imagination, complexity and curiosity-based

creativity levels. Risk taking, imagination, complexity and curiosity are consisted of the affected creation factors of the creativity. In this case, it was determined that developed differentiation approach improved the creativity of the students.

All the implementation in accordance with the results fit with the studies of Scott et al. (2004), Karatas Öztürk (2007), Kadayıfçı (2008), Özcan (2009), Karataş and Özcan (2010), Kök (2012), Kurtuluş (2012) due to giving place to teaching applications based on creative thinking and with Kök (2012) due to differentiating depending on a teaching model, with Korkmaz (2002), Yılmaz (2006), Yıldız (2012) and Çeliker (2012) due to depending on project-based learning and with Memmert (2006), Nogueira (2006), Garcia-Cepero (2008), Aljughaiman and Ayoub (2012) due to depending on elaboration activities.

Suggestions

1. It is suggested to use and practise the developed differentiation approach with other subjects in mathematics lessons and with other lessons in addition to grade levels and subjects in other grades stated in this study.
2. Project topics designed according to the developed differentiation approach can be re-designed by considering different process changes and different creativity strategies.
3. It is suggested for teachers and students to use developed differentiation approach periodically for having some experience.
4. It is suggested to obtain an overall or a respective creativity score by considering all the sub-dimensions stated in the original evaluation of the Torrance creativity test.
5. It is suggested to collect data by practicing differentiation method trough determining nationwide pilot schools.
6. It is suggested generally to inform all teachers across the country about how they will guide the process of preparing projects and all students about how they will prepare projects.
7. It is suggested to conduct seminars to teachers and prospective teachers for teaching and implementing the differentiation approach developed for the gifted students within the scope of this study and various approaches and models that their effectiveness on this students were proved.
8. It is suggested that the sample be increased and the effect of the differentiation approach on creativity be searched.

Conflict of Interests

The author(s) have not declared any conflict of interests.

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