

The Effect of the Developed Differentiation Approach on the Achievements of the Students

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Suggested Citation:

Altıntaş, E., & Özdemir, A. Ş. (2015). The effect of developed differentiation approach on the achievements of the students. *Eurasian Journal of Educational Research*, 61, 199-216 <http://dx.doi.org/10.14689/ejer.2015.61.11>

Abstract

Problem Statement: The present study is of importance for designing a differentiation approach, which enables gifted students to use their present potential in mathematics effectively and enables them to develop their achievement, while looking at the effect of the approach on both gifted and non-gifted students. Within the scope of the developed differentiation approach concerning mathematics education of gifted students, the present study is one of the limited studies with such a focus, which is why it is thought that it will contribute to the literature. By the results of the study, it is of great importance.

Purpose of the Study: The purpose of this research is to determine the effect of a newly-developed differentiation approach for the mathematics education of gifted middle school students on the achievements of both gifted and non-gifted students.

Method: Within the scope of this current study, the model with pre-test and post-test control group among real research models in accordance with quantitative research method was used. The sample of the study was composed of 57 gifted and 60 non-gifted 5th and 6th grade students from a public school and a private school in Maltepe and Cekmekoy districts of Istanbul. Convenience and purposeful sampling were conducted within the scope of quantitative sampling in this study. 'Mathematics Achievement Test' and 'Multiple-Intelligences Domains Inventory' were used within the scope of this study. The lessons carried out using activities stated in the National Education curriculum about the related subjects were compared with lessons carried out with the activities designed

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according to the differentiation approach developed in three implementations conducted.

Findings: The research made in private school showed that there is a significant difference between current-enriched and overall scores of gifted students in control and experimental groups after the application on behalf of the experimental group. The research made in the state school showed that there is a significant difference between current-enriched and overall scores of non-gifted students in control and experimental groups after the application on behalf of the experimental group.

Conclusion and Recommendations: There was a significant increase in the achievement scores of experimental group students, where the activities designed according to differentiation approach developed within the scope of this study, when compared with the control group students during all of the implementations. This situation shows that activities and curriculum differentiation studies, which are based on elaboration, creative thinking, and multiple intelligences increase students' academic achievements. Besides, it is seen that the changes based on creativity strategies on the content, process, product, and learning environments increase students' academic achievements. The effectiveness of the developed differentiation approach should be researched with different grade levels, on different topics. It is suggested to use developed differentiation approach periodically for teachers and students to gain experience. It is further suggested to inform generally all teachers across the country about how they will guide the process of preparing projects and for teachers to inform their students about how they will prepare projects.

Keywords: Giftedness, teaching mathematics, differentiation, multiple intelligence

Introduction

There exists negative motivation in learning academic lessons in addition to the deficiency of students' attention, without the enrichment and differentiation approaches that are aimed at adding richness and differences to academic lessons, with regard to mathematics education, especially for gifted students (GS). Accordingly, the educational needs not being met truthfully in GS give rise to the atrophy of their potential. In the scope of recent research, a differentiation approach with regard to the mathematics education of GS was developed, with the intention that this differentiation approach would increase the achievement of both GS and non-gifted students (NGS) by adding richness and differences to the mathematics lessons.

The presence of the GS is as old as the human history. However, the education provided for these children is quite new. The stimulus, tools, and equipment that are consciously selected and the teaching and learning environments that are consciously

organized support these children salubriously and provide them with the ability to use their potentials at a top level (MEGEP, 2007). There is not a generally accepted definition for giftedness. While unidirectional approaches classify giftedness only on the basis of high intelligence, multi-directional approaches classify mental abilities as a factor among many others, including intelligence domains or skill profiles and a different type of mental giftedness or creativity (Preckel, Holling, & Wiese, 2006). The important thing is that gifted students need to be taken care of, by getting an education appropriate to their needs, which meets their social and psychological needs as well.

Usiskin was the first person who referred to “improving students’ skills to more advanced levels”. The core of being gifted can be improved in suitable circumstances. However, these kinds of circumstances should be created (Karp, 2011). Teachers need to do differentiation for fulfilling cognitive and emotional needs of the GS and they need to provide mathematical opportunities for their students (Leikin & Stanger, 2011; Hunt & Seney, 2009). Children and young people should not be forced to fit into certain stereotypes and individuals should not be prevented from reaching their potentials (Mattsson & Bengmark, 2011). The important thing is that there should be prepared approaches and models in proper to the needs, talents, and intelligences of children.

Enrichment has a structure that encompasses all children—not only for GS, but for all the children to take advantage of this application—regardless of their level of abilities (MEGEP, 2007). The general objective of an enrichment method is to increase the quality and level of learning experiences for all students in any and every part of the curriculum (Renzulli & Reis, 2008a). The basic objective of teaching enrichment is to provide independent and effective learning instead of dependent and passive learning (Renzulli & Reis, 2008b). For all students, it is important to provide enrichment to present different teaching experiences in the classes.

Differentiation encompasses the teacher’s effort to address the different students in the classroom. Differentiation means making teaching suitable for fulfilling individual needs (Tomlinson, 2000). Differentiation can be defined through the target audience and their needs, interests, and abilities; the content and attainments of the teaching subject; how the pedagogy will be use to teach content, attainments, and both, and where the teaching will be carried out in order to apply the curriculum effectively (Kaplan, 2009). In the view of differentiation, teachers can encompass different students and by enriching lessons, the quality of education can be increased.

In recent years, various studies have been conducted to reorganise teaching-learning environments and to realise the modern education principles. Project-based teaching is the approach that recently attracts much attention and provides opportunities to use many discipline areas and teaching-learning approaches together (Korkmaz & Kaptan, 2002). Project-based learning, which includes various approaches, puts the students at the centre and enables them to access information, solve problems, make connections with real life, and to learn by doing. This learning

approach also provides students the ability to study in process-based, interdisciplinary, and cooperative learning environments (Atici & Polat, 2010). The multiple-intelligences approach is used in establishing new schools, defining individual differences, planning and developing curriculum, and evaluating educational strategies. It is widely used in terms of its practicability to various students, subject areas, and grade levels (VanTassel-Baska & Brown, 2009). Creativity is defined as the people's natural survival or adapting response in a constantly changing environment. Psychologist Sternberg defines creativity as a useful and adaptive, unexpected, and original working and production skill. The other definitions, such as the one stated by Torrance, also generally includes the necessity of improvements, changes, and exceptions of a response provided for a problem to the creativity (Juter & Sriraman, 2011). By including in project activities adjusted to their multiple intelligences, students can have an advantage of producing different products and developing their creativity.

The purpose of this research is to develop a differentiation approach for the mathematics education of GS in middle school and determine the effect of the developed differentiation approach on the achievements of both GS and NGS. In this regard, this study is important in terms of designing a differentiation approach for improving the achievement levels of GS and for enabling them to use their existing potentials in the most effective way in mathematics lessons. Furthermore, it is also important in terms of investigating the effects of the developed differentiation approach on both GS and NGS.

The problem statement can be expressed as the following by moving from these explanations: 'Is there an effect of the differentiation approach, which was developed for the mathematics education of the GS on the achievements of GS and NGS?'. In accordance with the purpose of this study, which was applied to both GS and NGS, the answers of the following sub-problem were searched: Is there a significant difference between the achievement pre-test and post-test results of the GS and NGS in control and experimental groups?

Method

Research Design

In this study, pre-test post-test with control group model among real experiment models was used in accordance with the quantitative research methods.

Research Sample

The universe of the study is composed of 5th and 6th grade GS and NGS who are studying at middle schools in Maltepe and Cekmeköy districts of Istanbul. The sample of the study consists of 68 GS and 60 NGS in the 5th and 6th grade who are studying at a public and a private school in Maltepe and Cekmeköy districts of Istanbul. In this current study, convenience sampling was made in terms of determining the schools where the study was carried out with the help of familiar

teachers and administrators who are known by the researcher for practical reasons, such as getting permission, ease of transportation, performing applications carefully, and having convenient communication in addition to purposive sampling being made since the study was carried out with both GS and NGS in order to reveal the effect differentiation method developed for GS on NGS.

Research Instrument and Procedure

The data collection instruments, which were used within the scope of this study are: Mathematics Achievement Test; and Multiple-Intelligences Inventory. The study was carried out with GS and NGS who are studying at the 5th and 6th grade levels. The implementation was conducted on different subjects at different grade levels in this study, which was carried out in a public and a private school. Achievement pre-tests and post-tests were prepared differently in order to prevent students from remembering the questions. The pre-test and post-test were composed of entirely different but parallel questions in each implementation. The teaching practice were carried out for the 'Tables and Graphics' subject for GS who are studying in 5th grade, the 'Ratio and Proportion' subject for the GS who are studying in the 6th grade, and the 'Tables and Graphics' subject for the NGS.

While preparing the achievement tests for the study, questions used in the online or written publications or course books, which were approved by Ministry of Education and in various nationwide examinations (such as High School Placement Exams-Public Boarding Schools and Scholarship Exams), were used in the same way or by making various changes by the researchers by considering the acquisitions stated about the subjects in the National Education curriculum. The achievement tests were created by using these questions. The draft achievement tests were checked in terms of suitability of the tests to the related acquisition and grade levels by the researcher, an academician, and three mathematics teachers. The draft achievement test was carried out with students studying in one higher grade level than the grade level of the related subject in different primary schools (one class each and a small sample size) and final control of the tests were made by deciding on the time needed to be allocated for the tests. In the next level, item analysis (item-total, item-remaining, itemdiscrimination) of the tests were made according to the obtained data by having pilot implementation (big sample of approximately 200 persons) with students who are studying in one upper grade level than the grade level of the related subject. As a result of the item analysis, Cronbach alpha values (pre-test and post-test were composed of different but parallel questions) of the achievement tests were changed between 0.760 and 0.858.

First, the dominant intelligences of the students were determined within the scope of the current study and the lessons were carried on the basis of projects by determining project themes suitable to creativity strategies and according to intelligence domains of the students. The 'Multiple-Intelligences Inventory' as prepared by Saban (2005) was used for determining the dominant intelligence domains of the students. The inventory was in Likert type and composed of ten

sections and 80 questions. 'Multiple-Intelligences Inventory Evaluation Profile' also provided by Saban (2005) was used for the evaluation of the inventory scores.

Teaching Material

The Topic-based Differentiation Approach for Mathematics Education of GS

In terms of developing a curriculum differentiation model, some changes were made in content, process, product, and learning environment of a subject, which was chosen from the National Education mathematics curriculum. The purpose of the differentiation approach developed within the scope of this study is to ensure that teaching is carried out in accordance with the different intelligence domains, skills and interests of students, that students are responsible from their own learning, interact with each other, can make peer evaluations, create connections with real life, fulfil their responsibilities, learn to cooperate with others, have chances to improve both their creative thinking and communication skills, and have opportunities to have high-level of acquisition. In this regard, the learning environment was organized as project-based by using interdisciplinary developed project topics according to creative thinking strategies and in accordance with the interests and skills of the students by considering dominant intelligence domains of students and high level acquisitions. While designing the differentiation model, the models of Williams, Maker, Kaplan, Autonomous Learner, Maker Matrix, and multiple intelligences of Gardner were used. All of these models were developed for GS and they have been used all over the world for designing lessons for GS. In the developed differentiation approach, students were faced with different, exciting project topics, which were suitable to their skills and interests and addressing extra acquisitions.

Data Analysis

Statistical analyses were made by collecting achievement pre-post test and Multiple Intelligence Inventory data, which were carried out with GS and NGS. While calculating scores, rounding was made according to the two digits after coma. All the analyses were made in 95% confidence interval and $p < 0.05$ values were accepted as statistically significant. While analysing the pilot studies of the achievement tests, the scores were accepted as the number of true questions. But in pre-post test analysis, scores were calculated by changing them into the 100-scoring system. The item-remaining, item-discrimination, and item-total indices were calculated by conducting item analysis to achievement tests after pilot practice and accepting the significance level as 0.05. In conclusion, the final versions of the tests were decided. The reliability of the tests differs between 0.780 and 0.854. In determining control and experimental groups, the overall scores of the test were taken into account without looking at the current, attainment, and enrichment scores in pre-achievement test. The activities based on the differentiation approach within the scope of the study were compared with the activities stated in the National Education curriculum for the related subject. Since there are questions for both current grade level acquisitions and enriched acquisitions in achievement tests, current acquisition score, enriched acquisition score, and overall scores (current acquisition score+ enriched acquisition score) were calculated.

Non-parametric tests were used in less-populated classrooms (the number of data is less than 30) for analysing the data. In studies where the classrooms were crowded (the number of data is more than 30), descriptive statistics were examined for analysing the normality of the data and Shapiro-Wilk normality test was used since the number of data was less than 50. In this sense, dependent group t-test and independent group t-test (parametric tests) were used for the analyses of the scores that fulfilled the conditions of normality and Mann Whitney-U and Wilcoxon Signed Ranks Test (non-parametric tests) were used for the analysis of the scores that could not fulfil the conditions of normality. The collected data were analysed by using Multiple Intelligences Inventory and the intelligences that scored between 30 and 40 in the inventory were accepted as 'highly developed'.

Results

Findings Regarding the Mathematics Achievement Test and Interpretations

In this part, the analysis of the achievement pre-post tests, which were carried out in public and private schools, were given.

Private School Achievement Test Analysis (Fifth Grade: Tables and Graphics)

An achievement test was carried out in order to determine the control and experimental groups before the implementation and it was determined that there was not a significant difference between groups according to Mann Whitney-U test results ($U=69.00$, $p=0.28>0.05$). But from the groups, the one with a smaller mean rank was selected as the experimental group (12.31), and the one with a bigger mean rank was selected as the control group (15.57).

Mann Whitney-U Test comparison regarding achievement test scores of GS in control and experimental groups before and after implementation were given in Table 1.

Table 1.

Mann Whitney-U Test Comparison Regarding Achievement Test Scores of GS in Control and Experimental Groups before and after Implementation

Score	Group	N	Mean Rank	Mean Sum	U
Pre-Overall	Control	14	15.57	160.00	69.00
	Experimental	13	12.31	218.00	
Post-Overall	Control	14	7.89	110.50	5.50
	Experimental	13	20.58	267.50	
Pre-Current	Control	14	19.43	272.00	15.00
	Experimental	13	8.15	106.00	
Post-Current	Control	14	7.50	105.00	0.00
	Experimental	13	21.00	273.00	
Pre-Enriched	Control	14	15.07	211.00	76.00
	Experimental	13	12.85	167.00	
Post-Enriched	Control	14	10.25	143.50	38.50
	Experimental	13	18.04	234.50	

According to Table 1, there is not a significant difference between enriched ($U=76.00, p=0.45>0.05$) acquisition scores and overall ($U=69.00, p=0.28>0.05$) scores of GS in control and experimental groups before the teaching practice. There is a significant difference in favour of control group between the current scores ($U=15.00, p=0.00<0.05$) of the groups before the implementation. However, there is significant difference in favour of the experimental group between the overall ($U=5.50, p=0.00<0.05$), current ($U=0.00, p=0.00<0.05$), and enriched ($U=38.50, p=0.01<0.05$) acquisition scores of the groups after implementation.

Private School Achievement Test Analysis (Sixth Grade: Tables and Graphics)

Achievement test was carried out in order to determine the control and experimental groups before the implementation and it was determined that there was not a significant difference between groups according to Mann Whitney-U test results ($U=102.00, p=0.66>0.05$). But from the groups, the one with a smaller mean rank was selected as the experimental group (14.80), and the one with a bigger mean rank was selected as the control group (16.20).

Mann Whitney-U Test comparison regarding the achievement test scores of GS in the control and experimental groups before and after implementation were given in Table 2.

Table 2.

Mann Whitney-U Test Comparison Regarding Achievement Test Scores of GS in Control and Experimental Groups before and after Implementation

Score	Group	N	Mean Rank	Mean Sum	U
Pre-Overall	Control	15	14.80	222.00	102.00
	Experimental	15	16.20	243.00	
Post-Overall	Control	15	8.00	120.00	0.00
	Experimental	15	23.00	345.00	
Pre-Current	Control	15	14.20	213.00	93.00
	Experimental	15	16.80	252.00	
Post-Current	Control	15	10.77	161.50	41.50
	Experimental	15	20.23	303.50	
Pre-Enriched	Control	15	16.80	252.00	93.00
	Experimental	15	14.20	213.00	
Post-Enriched	Control	15	8.00	120.00	0.00
	Experimental	15	23.00	345.00	

According to Table 2, there is not a significant difference between pre-overall ($U=102.00$, $p=0.66>0.05$), pre-current ($U=93.00$, $p=0.41>0.05$), and pre-enriched ($U=93.00$, $p=0.40>0.05$) scores of GS in the control and experimental groups. But, there is a significant difference in favour of the experimental group between the post-overall ($U=0.00$, $p=0.00<0.05$), post-current ($U=41.50$, $p=0.03<0.05$), and post-enriched ($U=0.00$, $p=0.00<0.05$) scores of GS in the control and experimental groups.

Primary School 2 Achievement Test Analysis (Sixth Grade: Tables and Graphics)

Achievement test was carried out in order to determine the control and experimental groups before the implementation and it was determined that there was not a significant difference between groups according to independent group t-test results ($t_{(58)} = 0,84$, $p=0.40>0.05$). But from the groups, the one with a smaller mean rank was selected as the experimental group (27.21), and the one with a bigger mean rank was selected as the control group (28.68).

Mann Whitney-U Test comparison regarding the achievement test scores of NGS in control and experimental groups were given in Table 3.

Table 3.

Mann Whitney-U Test Comparison Regarding Achievement Test Scores of NGS in Control and Experimental Groups

Score	Group	N	Mean Rank	Mean Sum	U
Pre-Current	Control	32	30.09	963.00	435.00
	Experimental	28	30.96	867.00	
Post-Current	Control	32	16.53	529.00	1.00
	Experimental	28	46.46	1301.00	
Pre-Enriched	Control	32	33.88	1084.00	340.00
	Experimental	28	26.64	746.00	
Post-enriched	Control	32	16.52	528.50	0.50
	Experimental	28	46.48	1301.50	

According to Table 3, there is not a significant difference between pre-current ($U=435.00$, $p=0.84>0.05$) and pre-enriched ($U=340.00$, $p=0.10>0.05$) scores of NGS in the control and experimental groups. But, there is a significant difference in favour of the experimental group between the current ($U=1.00$, $p=0.00<0.05$) and enriched ($U=0.50$, $p=0.01<0.05$) scores of NGS in the control and experimental groups after implementation.

Independent Group t-test comparison regarding the achievement test scores of NGS in the control and experimental groups were given in Table 4.

Table 4.

Independent Group t-test Comparison Regarding Achievement Test Scores of NGS in Control and Experimental Groups

Score	Group	N	Mean	SS	sd	t
Pre-Overall	Control	32	28.68	5.57	58	0.84
	Experimental	28	27.21	7.86		
Post-Overall	Control	32	27.00	7.24	58	-23.26
	Experimental	28	67.53	6.09		

According to Table 4, there is not a significant difference between the pre-overall ($t_{(58)} = 0.84$, $p=0.40>0.05$) scores of the experimental and control groups. But, there is a significant difference in favour of the experimental group between the post-overall ($t_{(58)} = -23.26$, $p=0.00<0.05$) scores of the experimental and control groups.

Conclusion, Discussion, and Suggestions

The research made in private school showed that there is a significant difference between current-enriched and overall scores of gifted students in the control and experimental groups after the application on behalf of the experimental group.

The research made in the state school showed that there is a significant difference between current-enriched and overall scores of non-gifted students in the control and experimental groups after the application on behalf of the experimental group.

All of the implementations carried out within the scope of this study fit with the following studies: with Kok (2012) and Kurtulus (2012), since the study included the teaching practices based on creative thinking; with Kok (2012) in addition to creativity making differentiation by relying on a teaching model; with Poonpon (2011), Denis Celiker (2012), Kasarcı (2013), and Yılmaz (2015) since the study was based on project-based learning; with Tabuk (2009), Bas and Beyhan (2010) since the multiple intelligences method was used in project-based and cooperative teaching; with Adodo and Agbayewa (2011), since skill grouping and homogeneous groupings were made; with Altınsoy (2011), Uzunoğlu and Akbaş (2011), Yalmanlı and Gozum (2013), and Kaplan and Yılmaz (2015) since the study was based on multiple intelligences theory; with Luehmann (2009), Fakolade and Adeniyi (2010), Al-Zoub (2011), and Singh (2013), since the lessons were carried out according to enriched activities; and with Simpkins, Mastropieri and Scruggs (2009), Kadum-Bošnjak and Buršić-Križanac (2010), Reis, McCoach, Little, Muller ve Kaniskan (2011), Gorman (2011), and McCoach, Gubbins, Foreman, Rubenstein, and Rambo-Hernandez (2014), since curriculum differentiation was conducted.

There was a significant increase in the achievement scores of the experimental group of students where the activities designed according to differentiation approach developed within the scope of this study, when compared with the control group of students during all of the implementations. This situation shows that activities and curriculum differentiation studies, which are based on elaboration, creative thinking, and multiple intelligences increase students' academic achievements. Besides, it is seen that the changes based on creativity strategies on the content, process, product, and learning environments increase students' academic achievements.

Recommendations

It is suggested to use the developed differentiation approach with other grade levels in addition to the grade levels from this study, with other topics in mathematics lessons, and with other lessons. Thus, the effectiveness of the developed differentiation approach can be researched with different grade levels, and on different topics. Project topics designed according to the developed differentiation approach can be re-designed by considering different process changes and different creativity strategies. Thus, teachers can make different enrichments. It is suggested to use the developed differentiation approach periodically for teachers and students to gain experience. Thus, it can be easy to use the developed differentiation approach in lessons and teachers can enrich the lessons for clarifying. It is further suggested to

collect data by practicing the differentiation method by determining nationwide pilot schools. It is suggested to inform generally all teachers across the country about how they will guide the process of preparing projects and for teachers to inform their students about how they will prepare projects. During the lessons, which were carried out with activities based on the developed differentiation approach, the subjects of which acquisitions would continue in the next grade were covered. It is suggested to analyse the effectiveness of the developed differentiation method by determining the acquisitions that will not be used in the next grades and then conduct studies where these acquisitions are enriched profoundly, in less crowded classrooms individually and in crowded classrooms in groups with the help of an interdisciplinary consultant.

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Geliştirilen Farklılaştırma Yaklaşımının Öğrencilerin Başarıları Üzerindeki Etkisi

Atıf:

Altıntaş, E., & Özdemir, A. Ş. (2015). The effect of developed differentiation approach on the achievements of the students. *Eurasian Journal of Educational Research*, 61, 199-216. <http://dx.doi.org/10.14689/ejer.2015.61.11>

Özet

Problem Durumu: Araştırmanın problem cümlesini şöyle ifade edebiliriz: “Ortaokula gitmekte olan üstün zekalı öğrencilerin matematik eğitimine yönelik geliştirilen farklılaştırma yaklaşımının, üstün zekalı öğrencilerin ve üstün zekalı olmayan öğrencilerin başarıları üzerinde bir etkisi var mıdır?”

Araştırmada şu alt probleme cevap aranmıştır: Kontrol ve deney grubundaki üstün zekalı öğrencilerin ve üstün zekalı olmayan öğrencilerin başarı öntest ve sontest sonuçları arasında anlamlı bir farklılık var mıdır?

Araştırma üstün zekalıların matematik dersinde var olan potansiyellerini en etkili şekilde kullanabilmelerine, başarı düzeylerini arttırabilmelerine yönelik bir farklılaştırma yaklaşımı tasarlanması bakımından ve geliştirilen farklılaştırma yaklaşımının hem üstün zekalı öğrencilerin hem de üstün zekalı olmayan öğrenciler üzerindeki etkisine bakılması bakımından önem taşımaktadır. Bunun için de ileride örnek teşkil edecek ve üstün zekalılarına eğitim veren öğretmenlerin de yararlanabileceği bir farklılaştırma yaklaşımı ve bu yaklaşıma dayalı derslerin tasarlanması planlanmıştır.

Araştırmanın Amacı: Bu araştırmanın amacı ortaokula gitmekte olan üstün zekalı öğrencilerin matematik eğitimi için yeni geliştirilmiş bir farklılaştırma yaklaşımının hem üstün zekalı hem de üstün zekalı olmayan öğrencilerin başarıları üzerindeki etkisini tespit etmektir.

Araştırmanın Yöntemi: Mevcut araştırma kapsamında, nicel araştırma deseni kapsamında gerçek araştırma modellerinden ön test son test kontrol gruplu model kullanılmıştır. 2012-2013 eğitim öğretim yılı güz yarıyılında gerçekleştirilen bu çalışmanın evrenini İstanbul ili Maltepe ve Çekmeköy ilçelerinde yer alan ortaokullarda 5. ve 6. sınıflarda eğitim görmekte olan üstün zekalı öğrenciler ve üstün zekalı olmayan öğrenciler, örneklemini ise İstanbul ili Maltepe ve Çekmeköy ilçelerinde bulunan bir devlet okulu ve bir özel okulun 5. ve 6. sınıflarında eğitim görmekte olan toplam 57 üstün zekalı öğrenci, 60 üstün zekalı olmayan öğrenci oluşturmaktadır.

Mevcut araştırmada izin alma problemleri, ulaşım kolaylığı, uygulamaların gerekli titizlikle yürütülmesi ve rahat iletişim sağlanabilmesi gibi pratik nedenlerle araştırmacının tanıdığı idareciler ve öğretmenler vasıtasıyla uygulama okullarının belirlenmesi sebebiyle uygun örnekleme, bununla birlikte üstün zekalı öğrencilere yönelik olarak geliştirilen farklılaştırma yaklaşımının üstün zekalı olmayan öğrenciler üzerindeki etkisini de ortaya koyabilmek amacıyla hem üstün zekalı hem

de üstün zekalı olmayan öğrencilerle çalışılması sebebiyle de amaçlı örnekleme yapılmıştır.

Araştırmanın Bulguları: Özel okulda yapılan çalışmada (5. Sınıf) kontrol ve deney gruplarındaki üstün zekalı öğrencilerin uygulama öncesi zenginleştirilmiş kazanım ve genel puanları arasında anlamlı bir farklılık bulunmazken, mevcut puanları arasında kontrol grubu lehine anlamlı bir farklılık vardır. Ancak uygulama sonrası mevcut kazanım, zenginleştirilmiş kazanım ve genel puanları arasında deney grubu lehine anlamlı bir farklılık vardır. Kontrol grubundaki öğrencilerin uygulama öncesi ve sonrası mevcut kazanım, zenginleştirilmiş kazanım ve genel puanlarında düşüş gözlenirken, deney grubundaki öğrencilerin uygulama öncesi ve sonrası mevcut kazanım, zenginleştirilmiş kazanım ve genel puanlarında artış olmuştur. Kontrol ve deney gruplarındaki üstün zekalı öğrencilerin uygulama öncesi başarıları arasında anlamlı bir farklılık bulunmazken, uygulama sonrası başarı puanları arasında deney grubu lehine anlamlı bir farklılık vardır.

Özel okulda yapılan çalışmada (6. Sınıf) kontrol ve deney gruplarındaki üstün zekalı öğrencilerin uygulama öncesi mevcut kazanım, zenginleştirilmiş kazanım ve genel puanları arasında anlamlı bir farklılık bulunmazken uygulama sonrası mevcut kazanım, zenginleştirilmiş kazanım ve genel puanları arasında deney grubu lehine anlamlı bir farklılık vardır. Kontrol grubundaki öğrencilerin uygulama öncesi ve sonrası genel ve mevcut puanlarında bir artış gözlenirken, uygulama öncesi ve sonrası zenginleştirme puanları arasında anlamlı bir farklılık bulunmamaktadır. Deney grubu öğrencilerinde ise uygulama sonrası genel, mevcut ve zenginleştirme puanlarında artış olmuştur.

Devlet Okulun'da yapılan çalışmada (6. Sınıf) kontrol grubundaki üstün zekalı olmayan öğrencilerin uygulama sonrası mevcut puanlarında artış, zenginleştirme puanlarında ise azalma gözlenmektedir. Uygulama öncesi ve sonrası genel başarı puanları arasında ise anlamlı bir farklılık bulunmamaktadır. Deney grubundaki üstün zekalı olmayan öğrencilerin uygulama sonrası mevcut, zenginleştirme ve genel puanlarında artış gözlenmektedir. Kontrol ve deney gruplarının uygulama öncesi mevcut, zenginleştirme ve genel puanları arasında anlamlı bir farklılık bulunmazken uygulama sonrası mevcut, zenginleştirme ve genel puanları arasında deney grubu lehine anlamlı bir farklılık bulunmaktadır.

Araştırmanın Sonuçları ve Önerileri: Yapılan araştırma kapsamında geliştirilen farklılaştırma yaklaşımına yönelik olarak tasarlanan derslerin yapıldığı deney grubu öğrencilerinin kontrol grubu ile kıyaslandığında uygulama sonrası başarı puanlarında anlamlı bir artış olmuştur. Bu durum da göstermektedir ki; zenginleştirilmiş, yaratıcı düşünme temelli, proje tabanlı, baskın zekaları baz alan aktiviteler ve müfredat farklılaştırma çalışmaları öğrencilerin akademik başarılarını arttırmaktadır. Ayrıca yaratıcılık stratejileri temel alınarak yapılan içerik, süreç, ürün ve öğrenme çevresi değişikliklerinin öğrencilerin akademik başarılarını arttırdığı görülmektedir.

Geliştirilen farklılaştırma yaklaşımının araştırma kapsamında uygulanan sınıf seviyelerine ek olarak diğer sınıflarda da uygulamalarının yapılması önerilir. Geliştirilen farklılaştırma yaklaşımının araştırma kapsamında uygulanan konulara ek

olarak matematik dersindeki diğer konularda da uygulamalarının yapılması önerilir. Geliştirilen farklılaştırma yaklaşımının farklı derslerde de uygulamalarının yapılması önerilir. Geliştirilen farklılaştırma yaklaşımına dayalı olarak tasarlanan proje konuları farklı süreç değişiklikleri ve farklı yaratıcılık stratejileri gözönünde bulundurularak yeniden dizayn edilebilir. Öğretmenlerin ve öğrencilerin deneyim kazanabilmeleri için, belirli zaman aralıklarında geliştirilen farklılaştırma yaklaşımının kullanılması önerilir. Ülke çapında pilot okullar belirlenerek geliştirilen farklılaştırma yaklaşımının uygulamalarının yapılarak veriler toplanması önerilir. Genel anlamda ülke çapında tüm öğretmenlerin proje hazırlama sürecine nasıl rehberlik edecekleri ve öğrencilerin de nasıl proje hazırlayacakları konusunda bilgilendirilmeleri önerilir.

Anahtar Kelimeler: Üstün zekalılık, matematik öğretimi, farklılaştırma, çoklu zeka