ULUSLARARASI SOSYAL ARAŞTIRMALAR DERGİSİ
THE JOURNAL OF INTERNATIONAL SOCIAL RESEARCH

Cilt: 13 Sayı: 69 Mart 2020 & Volume: 13 Issue: 69 March 2020
www.sosyalarastirmalar.com Issn: 1307-9581
Doi Number: http://dx.doi.org/10.17719/jisr.2020.4005

FARKLILAŞTIRILMIŞ ÖĞRETİM YAKLAŞIMININ ÖĞRENCİLERİN AKADEMİK BAŞARILARINA ETKİSİ: BİR META-ANALİZ ÇALIŞMASI*

THE EFFECT OF DIFFERENTIATED INSTRUCTION APPROACH ON ACADEMIC ACHIEVEMENT OF STUDENTS: A META-ANALYSIS STUDY

Şehide ARSLANHAN**
M. Akif SÖZER***

Öz

Bu araştırmada farklılaştırılmış öğretim yaklaşımına dayalı öğretimin öğrencilerin akademik başarıları üzerindeki etkisini inceleyen deneysel çalışmaların genel etki büyüklüğünü ve bu etki büyüklüğünün araştırmanın yayın türüne, ders türüne, öğretim kademesine, desen türüne ve örneklem büyüklüğüne göre anlamlı bir farklılık gösterip göstermediğini belirlemek amacıyla bir meta-analiz çalışması yapılmıştır. Bu amaçla Türkiye'de 2008-2018 yılları arasında yapılmış, araştırma problemine uygun ve meta-analiz çalışmasına dâhil edilebilecek istatistiksel verilere sahip toplam 19 yüksek lisans ve doktora tezi meta-analize dâhil edilmiştir. Bu çalışmada etki büyüklüğü hesaplamasında "Hedges' d" kullanılmıştır. Meta-analize dâhil edilen çalışmaların etki büyüklüğü yönüne bakıldığında; 19 çalışmanın tamamında pozitif etki büyüklüğü görülmektedir. Meta-analiz sonucunda farklılaştırılmış öğretim yaklaşımının öğrencilerin akademik başarılarına pozitif etkisi olduğu belirlenmiştir.

Anahtar Kelimeler: Farklılaştırılmış Öğretim, Farklılaştırma, Akademik Başarı, Meta-analiz.

Abstract

In this research, a meta-analysis study is conducted to determine the effect sizes of the quantitative studies that examined the effectiveness of the differentiated instruction on the academic achievements and whether this effect differs significantly from the pu¹blication type, course type, education level and sample size of the study. Therefore a literature survey is carry out in Turkey between 2008 and 2018. After the literature review, total 19 Master's and doctoral dissertation studies are include in meta-analysis with statistical data appropriate to the research problem related to the impact of differentiated instruction on the academic achievements of the students. In this study, "Hedges' d" was used in effect size. When looking at the effect size of the studies included in meta-analysis, positive effect size is observed in all 19 studies. As a result of the meta-analysis, it has been determined that the differentiated instruction has a positive effect on the academic achievement of the students.

Keywords: Differentiated Instruction, Differentiation, Academic Achievement, Meta-analysis.

---

* Bu çalışma 11.04.2018 ile 14.04.2018 tarihleri arasında Ankara'da düzenlenen 17. Uluslararası Sınıf Öğretmenliği Sempozyumunda sözlü bildiri olarak sunulmuştur.

** Gazi Üniversitesi, Eğitim Bilimleri Enstitüsü Sınıf Eğitimi Anabilim Dalı, Doktora Öğrencisi, sehidearslanhan83@gmail.com
*** Doç. Dr., Gazi Üniversitesi, Gazi Eğitim Fakültesi, İlköğretim Eğitimi, akifsozer@gmail.com

1.Introduction

In traditional classrooms in which students have individual differences in terms of prior knowledge, interests and motivations, as well as different past experiences, it is a must to restructure educational environments in order to adapt to different developmental needs and individual differences of students. It is the responsibility of teachers to take into account the individual differences of students and to create learning experiences that will respond to their learning needs. Thus, teachers seek new approaches and strategies for best educational practices that can be effective in reaching all students in a heterogeneous classroom environment.

In this context, differentiated teaching approach which provides an opportunity for students to plan teaching in line with their different developmental needs has been emphasized in recent years. Differentiated instruction is a learning experience in which the content, process or product of the curriculum elements is adapted by the teacher according to students'readiness, interests or learning profiles in accordance with their needs in order to discover the content of the program. (Tomlinson, 1995). The main priority of differentiated education is to plan the education systematically to satisfy the learning needs and maximize the learning capacities of students who are different in terms of intelligence levels, prior knowledge, interests, skills and learning styles as well as their past lives, sociocultural characteristics and economic environments. (Tomlinson, 1999; Tomlinson ve Eidson, 2003). The number of studies demonstrating that differentiated teaching (McTighe and Brown, 2005), which is a pedagogical approach built on studies on cognitive learning and development, provides effective learning in heterogeneous classes with intense individual differences is increasing day by day. (Chen, 2011; Çalıkoğlu, 2014; Demir, 2013; Karaduman, 2012; Kök, 2012).

There are various researches carried out in different levels and areas of education regarding differentiated teaching approach abroad. In some of the researches, it has been concluded that students' academic achievement increased in the learning environment with differentiated teaching method and that students reached high performance by discovering themselves and progressing at their own pace (Anderson, 2007; Hall, Strangman & Meyer, 2003; Lawrence-Brown, 2004). In addition, the number of studies showing that differentiated teaching provides effective learning in diversity classes is increasing day by day (Rock, Gregg, Ellis, and Gable, 2008; Tomlinson, 2005). It has been shown that differentiated instructional designs have positive effects on students' academic achievement as well as other variables that affect learning such as attitude and motivation (Ayers, 2008; Cheng, 2006). Although there are many studies on differentiated education abroad, it is seen that there are limited number of studies on differentiated education in our country and there is a big gap in this field (Atalay, 2014; Beler, 2010; Çam, 2013; Demir, 2013; Kaplan, 2016; Karadağ, 2010; Kök, 2012; Şaldırdak, 2012; Umar, 2014; Yabaş, 2008). Besides, two studies have been reached in which the researches conducted on differentiated teaching in Turkey are evaluated (Karadağ, 2014; Karip. 2016). Karadağ (2014), in his study examining differentiated teaching studies in Turkey and abroad, revealed that in the majority of studies on differentiated teaching, this approach was conducted to examine the effects of this approach on students' academic achievement. Karip (2016), in his research that he examined theses about differentiated teaching in Turkey, found that the studies were focused on mostly gifted individuals, mostly quantitative research methods were used and the effect of differentiated teaching on students' academic achievement was investigated. However, there has been mo research to determine the effect of differentiated teaching on academic achievement both in Turkey and abroad. In this respect, it is thought that this research will shed light on new researches about differentiated teaching and will contribute to new researches in the frame of research priority.

In this context, the aim of this reserach is to calculate the overall effect size by making meta-analysis of the experimental studies examining the effect of teaching based on the differentiated teaching approach on the students' academic achievement and to determine whether this effect size shows a significant difference according to the type of publication, type of course, teaching level, pattern type and sample size of the research. For this purpose, the following questions are sought:

1. What is the impact of the differentiated teaching approach on students' academic achievement?

2. Is there any effect of publication bias on the effect of differentiated teaching approach on students' academic achievement?

3. Does the effect of differentiated teaching approach on academic achievement differ between the type of publication, type of course, level of teaching, type of pattern and sample size?

2. Method

In this part; there are the topics of research model used in the research, data collection, inclusion criteria of the studies, coding of data, analysis and interpretation of the data.

2.1 Model of the Research

In the research, meta-analysis method was used to determine the effect of differentiated teaching approach on students' academic achievement. Meta-analysis is a literature search method used to synthesize and interpret individual studies. Meta-analysis is used to compare the findings of similar experimental studies in a field in a consistent and coherent way with statistical methods, and to calculate effect sizes (Büyüköztürk, Çakmak Kılıç, Akgün, Karadeniz ve Demirel, 2010; Cohen, Manion ve Morrison, 2007; Hunter ve Schmidt, 1990).

2.2 Collection of Data

The studies included in the study consist of both published and non-published master's and doctoral thesis on "Differentiated Instruction Approach" between 2008-2018 in Turkey. It is 2008 when the earliest study was conducted to determine the effect of differentiated teaching approach on academic achievement in the literature review process. For this reason, studies that were in accordance with the coding criteria between 2008 and 2018, the year of this research, were included in the meta-analysis. Within the scope of this study, the researches were obtained in Turkish and English by scanning the YÖK National Thesis Center, YÖKAKADEMİK and ULAKBİM databases. In sweeping out the publications "farklılaştırılmış öğretim", "farklılaştırılmış eğitim", "farklılaştırma", "farklılaştırılmış" words in Turkish and "Differentiated education"', "Differentiated instruction", "Differentiated" "differentiations" words in English were used as keywords.

According to results, there has been 20 articles published in the differentiated instruction in Turkey. 7 of these articles consist of experimental studies. However, since 7 articles were presented both as master's / doctorate thesis and as an article, more than these were included in the analysis and coded. As a result of the research, 32 master / doctorate theses within the borders of the research were determined. 24 of these studies consisted of experimental studies. Five of the experimental studies were excluded from this research since they did not contain the necessary numerical data for the meta-analysis. As a result of the studies, 19 master's / doctorate theses were examined in the meta-analysis study examining the effects of differentiated teaching on students' academic achievement in accordance with the research problem and inclusion criteria

In order to determine the effect size of differentiated teaching approach on academic achievement, experimental studies conducted between 2008-2018 were examined in the scope of the research. The criteria used for the studies included in the research are as follows:

- The study has to be conducted between 2008-2018 in Turkey.
- The study has to be a master's or doctoral dissertation article written in Turkish or English.
- Experimental pattern has to be pre-test-posttest weak and pre-test-posttest control group quasi-experimental design from experimental studies.
- The study has to have students' final test average (X) and standard deviation (SD) of their academic achievement and use parametric tests (t-test or F statistic).
- The study has to Show sample size of the studied groups.

2.3.Coding Data

There are 19 master's / doctoral thesis that examine the effect of differentiated teaching on students' academic achievement and include them in meta-analysis. The characteristics of the studies are presented in

Table 1: The characteristics of the studies

Author	Year of the Study	Type of Publication	Academic Level	Course	Design Type	Working Group
Akça Üşenti	2013	Doktorate	Primary School	Turkish	quasi-experimental	0-29
Akkaş	2014	Doktorate	Primary School	Maths	quasi-experimental	0-29
Atalay	2014	Doktorate	Primary School	Social Studies	quasi-experimental	0-29
Batdal Karaduman	2012	Doktorate	Secondary School	Maths	quasi-experimental	30 -
Camcı Erdoğan	2014	Doktorate	Secondary School	Science	quasi-experimental	0-29
Çalıkoğlu	2014	Doktorate	Secondary School	Science	quasi-experimental	0-29
Demir	2013	Doktorate	Secondary School	Science	quasi-experimental	30 -
Deringöl Karataş	2013	Doktorate	Secondary School	Maths	quasi-experimental	0-29
Ekinci	2017	Master	Primary School	Maths	quasi-experimental	30 -
Kaplan Sayı	2016	Doktorate	Secondary School	İngilizce	quasi-experimental	0-29
Kaplan	2013	Master	Secondary School	Science	Weak experimental	0-29
Karip	2016	Doktorate	Secondary School	Visual Arts	quasi-experimental	30 -
Korkut	2017	Master	Primary School	Maths	quasi-experimental	0-29
Kök	2012	Doktorate	Secondary School	Maths	quasi-experimental	30 -
Özyaprak	2012	Doktorate	Secondary School	Maths	quasi-experimental	0-29
Şaldırdak	2012	Master	Secondary School	Maths	quasi-experimental	30 -
Taş	2013	Master	Secondary School	Maths	quasi-experimental	30 -
Umar	2014	Doktorate	High School	Science	quasi-experimental	30 -
Yabaş	2008	Master	Secondary School	Maths	Weak experimental	0-29

Table 1 shows that most of the studies included in the meta-analysis consist of a doctoral thesis. It is seen that the studies are mostly used at the secondary school level by using quasi-experimental design and mathematics course is mostly preferred.

In order to make comparisons between the studies, a Coding Form was prepared in accordance with the purpose of the study. The information in the coding form was chosen to determine the general characteristics of the study. Some of the features found in the coding form are: Name of the study, author of the study, type of study, year of publication, educational level of the student group, statistical data in the study, effect size of the study.

In order to ensure the reliability of coding in meta-analysis, it is important to evaluate the studies by at least two experts (Açıkel, 2009). In this study, coding was done by two expert researchers. The analyzes of the first and second researchers were compared and the number of matching and non-matching codes were determined. To determine the reliability level, the number of codes matched is divided by the total number of codes (Card, 2012). The reliability of the codings was found to be 100% using the reliability level formula. 80% and more values obtained from this formula are sufficient for reliability (Miles and Huberman, 1994). Therefore, it can be said that the coding is reliable.

2.4 Analysis and Interpretation of Data

In this study, the Study Effect Meta-analysis method was used to analyze the data. In this method, d = (Xe-Xc) / SD formula, shown in the experimental studies to calculate the difference between the mean of the control and experimental groups is the main purpose (Hunter and Schmidt, 2004). With this statistical method, the data of independent studies used in multiple studies are converted into a common measurement system and the resulting effect sizes are compared (Schulze, 2004). Classifications are used to interpret the significance of the effect sizes obtained from the meta-analysis. According to Cohen et al., The effect size classification is as follows (2007):

- 0 ≤ Impact magnitude value ≤ 0.20 poor,
- 0.21 ≤ Effect size value ≤ is 0.50 modest,
- 0.51 ≤ Impact magnitude value ≤ 1.00 medium,
- ≤ The effect size value has a strong effect.

In this study, ges Hedges 'd" is used to calculate the effect size. The effect size "d" is the difference between the processes by the combined standard deviation of the two groups (Cooper, 1989). The meta-

analysis model to be used in bringing together different effect sizes becomes important. There are two types of meta-analysis models: fixed effects model and random effects model. The fixed effects model is based on the assumption that universe impact magnitudes do not change in the studies included in the meta-analysis. Therefore, the standard deviation of the universe effect magnitudes of all studies is equal to zero. In the random effects model, the universe effect magnitudes are assumed to vary from study to study (Ellis, 2010). After the effect size of each study was calculated, heterogeneity test was performed to determine which model (fixed or random effects model) would be included in the overall effect. It can be said that I2, which was developed as a complement to the Q statistic related to the heterogeneity of the studies, can give a more clear result regarding heterogeneity (Petticrew and Roberts, 2006). The result of I2 shows 25% low heterogeneity, 50% moderate heterogeneity and 75% high heterogeneity (Cooper, Hedges and Valentine, 2009). As a result of this test, Q, I2 and p values were obtained. The p value obtained was significant ($p < .05$). The fact that p value is not significant ($p > .05$) shows that the studies are homogeneous (Dinçer, 2014: 47).

In the study, 0.05 was chosen as the level of significance for all statistical calculations. Comprehensive Meta Analysis (CMA) and Statistical Package for the Social Sciences (SPSS) programs were used for statistical analysis of the data.

3.Findings

In this section, descriptive statistics of the studies included in the study and the results of the analysis obtained by combining the research problems with the meta-analysis method and their interpretations are given.

3.1 Descriptive Data of the Study

In this study, where the effect of differentiated teaching approach on students' academic achievement was determined by using the number of study groups, standard deviations and arithmetic means of the 19 studies, and descriptive statistics and effect sizes of the studies were determined. Only the immediate post-test results of the sample groups included in the study were included in the comparison.

Table 2 shows the percentages and frequencies of the studies included in the study according to the year of publication, type of publication, academic level, type of course, type of pattern and study group.

Table 2: The percentages and frequencies of the studies

Variable		Frequency	Percentage (%)
Publication Type	Master	6	31,6
	Doktorate	13	68,4
Academic Level	Primary School	5	26,3
	Secondary School	13	68,4
	High School	1	5,3
Course Type	Maths	10	52,6
	Science	5	26,3
	Visual Arts	1	5,3
	English	1	5,3
	Social Studies	1	5,3
	Turkish	1	5,3
Design Type	Weak Pattern	2	10,5
	Quasi-experimental Design	17	89,5
Sample Size	Between 0-29	11	57,9
	30 and Over	8	42,1

According to Table 2, the majority of the studies included in the research are doctoral theses (68.4%). When the type of educational level of the studies that meet the determined criteria is examined, it is seen that studies at the secondary school level (68.4%) are preferred the most. When the type of the courses are examined, it is seen that the maximum number of studies was carried out in mathematics course with 10 studies (52.6%). When the frequency and percentage data of the pattern type of the studies are examined, it is seen that the most semi-experimental design (89.5%) is studied. When the study group data were analyzed, it was seen that 11 (57.9%) of the researchers conducted experimental studies with a working group between 0 and 29 students.

3.2. Effect of Differentiated Teaching Approach on Students' Academic Success

The results of the meta-analysis of the studies examining the effect of differentiated teaching approach on students' academic achievement are given in Table 3.

Table 3: According to the impact model of studies, standard error, heterogeneity, effect size and confidence interval

Model Type	N	Standart Error	Heterogeneity					95% Confidence Intervals	
			Q	df	p	I²	Effect Size	Lower Limit	Upper Limit
Fixed Effect Models	19	0,082					1,183	1,023	1,343
			80,758	18	0,000	77,711			
Random Effects Model	19	0,183					1,502	1,143	1,861

According to Table 3, the heterogeneity test result was significant (p <0.05). These results show that the studies are heterogeneous. The I2 index in Table 3 shows a high level of heterogeneity with a value of 77.71%. In this case, since the actual effect will vary from study to study, an analysis should be made according to the random effects model.

Figure 1: Forest plot showing the distribution of effect size values

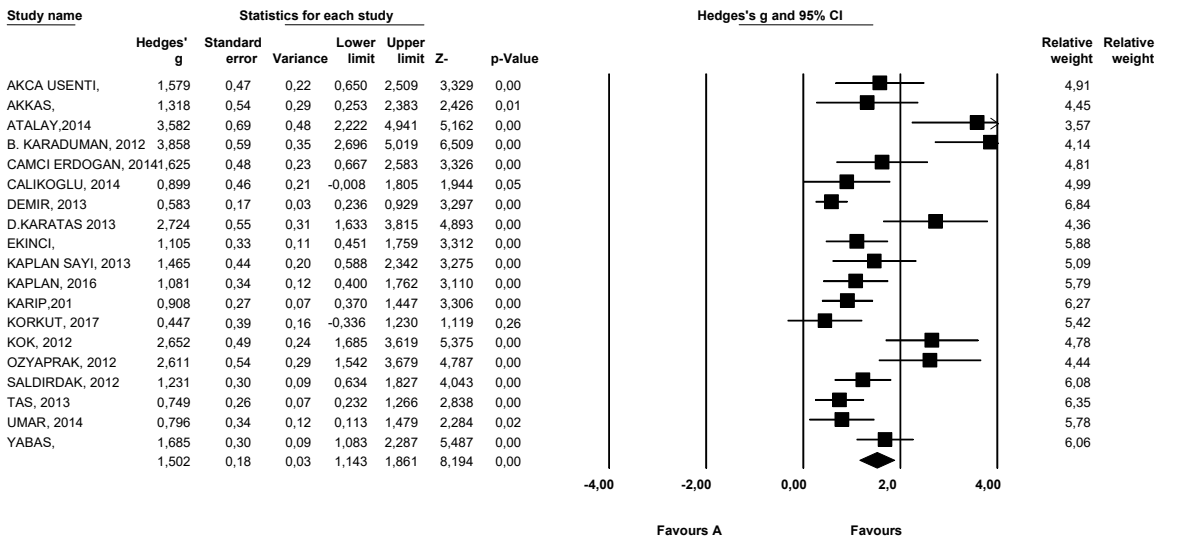


Figure 1 shows the effect size graph calculated according to the random effects model of the studies.According to Figure 1, when the effect sizes of the studies are examined, it is seen that the smallest effect size value (Korkut, 2017) is 0.447 and the maximum effect size value (Batdal Karaduman, 2012) is 3,858. When the significance values of the studies were examined in the 95% confidence interval, it was seen that the effect sizes of the two studies (Korkut, 2017; Çalıkoğlu, 2014) were not significant (p> 0.05).

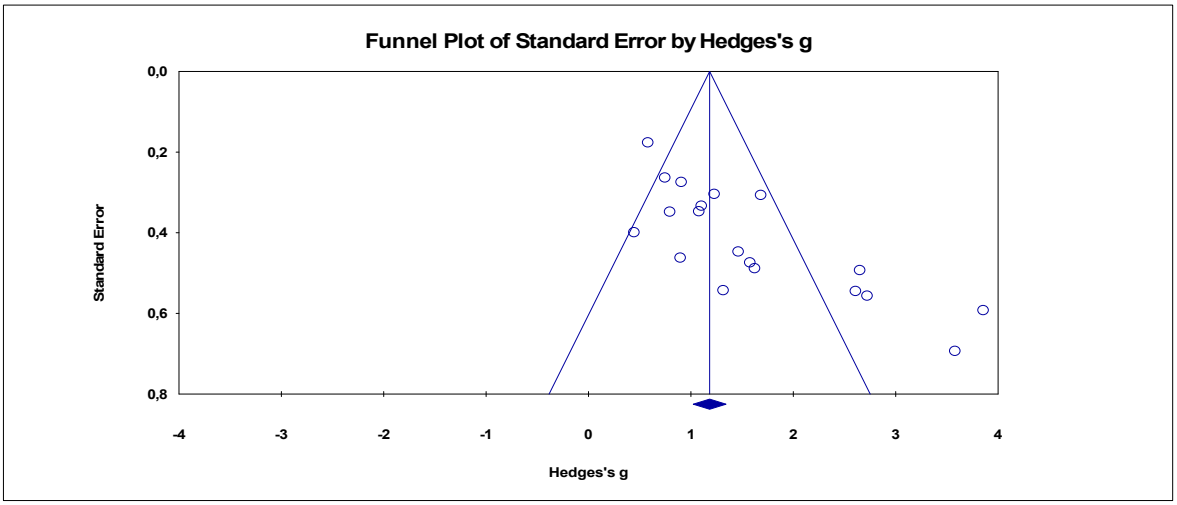
When the effect sizes of the 19 studies included in the study were combined according to the random effects model, the value of effect sizes was found to be 1.502 with 0.183 standard error. In the 95% confidence interval, the lower limit of effect size was calculated as 1,143 and the upper limit as 1,861. Statistical significance was found to be Z = 8,194 and p = 0,000. Accordingly, the result can be said to be statistically significant. A positive mean effect size value (+1,502) indicates that the process effect is in favor of the experimental group. Therefore, it can be said that the effect of differentiated teaching approach on students' academic achievement is positively more effective than traditional teaching methods. This effect is strong according to Cohen et al. (2007) classification.

3.3 The Effect of Publication Bias in Differentiated Teaching Method on Students' Academic Success

Publication bias is defined as the probability of publication of studies that do not find a statistically significant effect or that find a negative effect contrary to expectations (Card, 2012). In order to determine the effect of publication bias and the effect of the differentiated teaching approach on the results of the meta-analysis, the general effect size value (1.502) of the effect of students on academic achievement was found to be 1251 by using the Orwin method. Considering the fact that the number of studies is more than the

number of studies included in the meta-analysis, it can be said that the results obtained are reliable and publication bias is low. The funnel graph was also examined to determine whether the publication bias. In this graph, the studies are expected to distribute symmetrically around the overall effect size. Whether the publication bias can be interpreted with the help of Funnel Plot graph given in Figure 2.

Figure 2: Funnel Plot of Effect Sizes



In case of publication bias in the funnel plot, the effect sizes appear asymmetrically. In the absence of publication bias, they show a symmetrical distribution. When we look at Figure 2, it can be said that the effect sizes are spread to the graph close to a symmetry structure. A spread close to symmetry is one of the conditions that show that the bias is low.

Crop and fill statistics of Duval and Tweedie are used to determine whether or not the effect of bias on the overall effect size is significant. The main basis of this statistic is that if there were no publication bias in the study, the studies would be symmetrically distributed around the overall effect size ". For this purpose, the corrected overall effect size is calculated by including the missing data that will provide symmetry again in the analysis. If there is no significant difference between corrected effect size and observed effect size, it is concluded that there is no publication bias (Borenstein, Hedges, Higgins, and Rothstein, 2009). Table 4 shows the results of Duval and Tweedie's cropping and filling statistics according to models.

Table 4: The results of Duval and Tweedie's cropping and filling statistics

Value	Clip Studies	Random Effects Model		
		Effect Size	Lower Limit	Upper Limit
Observed Values	0	1,50173	1,14252	1,86094
Expected Values		1,50173	1,14252	1,86094

According to Table 4, there is no difference between observed values and expected values of effect size under random effects model. Therefore, the lack of difference between observed and expected effect sizes indicates that there is no publication bias.

3.4 The Effect of Differentiated Teaching Approach on Students' Academic Success in terms of publication type, level of study, course type and sample size

In terms of academic achievement; Table 5 shows the effect sizes of the studies.

Table 5: The effect sizes of the studies.

	Model Type		Heterogeneity				95% Confidence Intervals	
			Q	p	N	E.B.	Lower Limit	Upper Limit
	Fixed E.M.	Intra- Groups	79,56	0,000		1,183	1,023	1,343
Publication Type		Intergroup	1,194	0,275				
	Random E.M.	Intergroup	4,953	0,026	19	1,262	0,980	1,545
Master					6	1,069	0,740	1,399
Doktorate					13	1,795	1,247	2,342

According to Table 5, intra-group heterogeneity test results were found to be significant (p <.05) under the fixed effects model. This result shows that the studies within the groups do not share the same widespread effect. In this case, comments should be made according to the random effects model. According to the random effects model, the heterogeneity test between the groups was significant (p <.05). This result shows that there is a significant difference between the effect sizes of the groups formed according to the type of publication (master- doctorate) of the study. Under the random effects model, the overall effect size of the master's thesis type was 1.069 (0.740, 1.399), the overall effect size of the dissertation type studies was 1.795 (1.247, 2.342) and the overall effect size of the publication type was calculated as 1.262 (0.980, 1.545). According to these results, it can be said that the publication type of the studies has a strong effect on academic achievement and is in favor of the doctoral theses studied.

Analysis was conducted to determine the effect of the academic level (primary, secondary, and high school) on which academic studies were conducted; however, since there was only one study conducted at the high school level (Umar, 2014), the high school education level was not included in this analysis. The results of the analysis are given in Table 6.

Table 6: Heterogeneity test and effect sizes for the effect of academic level where the studies carried out on academic achievement

	Model Type		Heterogeneity				95% Confidence Intervals	
			Q	p	N	E.B.	Lower Limit	Upper Limit
	Fixed E.M.	Intra-Groups	79,371	0,000		1,205	1,041	1,370
Academic Level		Intergroup	0,086	0,770				
	Random E.M.	Intergroup	0,044	0,833		1,561	1,169	1,952
Primary School					5	1,483	0,606	2,301
Secondary School					13	1,584	1,138	2,030

According to Table 6, intra-group heterogeneity test results were found to be significant (p <.05) under the fixed effects model. This result shows that the studies within the groups do not share the same widespread effect. In this case, comments should be made according to the random effects model. According to the random effects model, the heterogeneity test between the groups was not significant (p> .05). This result shows that there is no significant difference between the effect sizes of the groups formed according to the educational level (primary-secondary). Under the random effects model, the overall effect size of the studies conducted in the primary school level was calculated as 1,483 (0.606, 2.301), the overall effect size of the studies conducted in the secondary school level was 1.584 (1.138, 2.030) and the overall effect size of the teaching level was calculated as 1.561 (1.169, 1.952). According to these results, although the overall effect size of the studies carried out in the secondary school level is larger than the studies conducted in the primary school level, it can be said that the teaching level in which the study was conducted had no effect on academic achievement.

Analysis was conducted to determine the effect of course types on academic achievement. While the course types were categorized, these four studies were examined under the other courses category, since

there were one study from Turkish, Social Studies, Visual Arts and English courses. Thus, three categories were formed: mathematics, science and other. The results of the analysis are given in Table 7.

Table 7: Heterogeneity test and effect sizes for the effect of course type where the studies carried out on academic achievement

	Model type		Heterogeneity				95% Confidence Intervals	
			Q	p	N	E.B.	Lower Limit	Upper Limit
	Fixed E.M.	Intra-Groups	66,079	0,000		1,183	1,023	1,343
Course Type		Intergroup	14,680	0,001				
	Random E.M.	Intergroup	9,199	0,010		1,116	0,850	1,383
Maths					10	1,746	1,175	2,318
Science					5	0,846	0.527	1,164
Others					4	1,735	0,818	2,651

According to Table 7, the intra-group heterogeneity test results were found to be significant (p <.05) under the fixed effects model. This result shows that the studies within the groups do not share the same widespread effect. In this case, comments should be made according to the random effects model. According to the random effects model, the heterogeneity test between the groups was significant (p <.05). This result shows that there is a significant difference between the effect sizes of the groups formed according to the type of course (mathematics-science-other). General effect size of mathematics course type studies under random effects model was 1.746 (1.175, 2.318), general effect size of science course type studies was 0.846 (0.527, 1.164) and other course type studies general effect size 1.735 (0.818, 2.651) The overall effect size of the species was calculated as 1.116 (0.850, 1.383). According to these results, it can be said that the course type has a strong effect on academic achievement and is in favor of mathematics course.

The results of the analysis to determine the effect of the pattern type (weak-quasi-experimental) used in the studies on academic achievement are given in Table 8.

Table 8: Heterogeneity test and effect sizes for the effect of design type where the studies carried out on academic achievement

	Model type		Heterogeneity		N	E.B.	95% Confidence Intervals	
			Q	p			Lower Limit	Upper Limit
	Fixed E.M.	Intra-Group	79,543	0,000				
						1,183	1,023	1,343
Design Type		Intergroup	1,217	0,270				
	Random E.M.	Intergroup	0,116	0,733	19	1,490	1,157	1,822
Weak					2	1,405	0,814	1,995
Quasi Experimental					17	1,529	1,126	1.932

According to Table 8, the intra-group heterogeneity test results were found to be significant (p <.05) under the fixed effects model. This result shows that the studies within the groups do not share the same widespread effect. In this case, comments should be made according to the random effects model. According to the random effects model, the heterogeneity test between the groups was not significant (p> .05). This result shows that there is no significant difference between the effect sizes of the groups formed according to the pattern type (weak-quasi-experimental) of the studies. Under the random effects model, the overall effect size of the studies carried out with weak patterns was calculated as 1.405 (0.814, 1.995), the overall effect size of the studies carried out with semi-experimental design was 1.529 (1.126, 1.932) and the overall effect size of the pattern type was 1.490 (1.157, 1.822). According to these results, although the overall effect size of the studies carried out according to the quasi-experimental design type is larger than the studies conducted according to the weak design type, it can be said that the pattern type which the study is conducted has no effect on academic achievement.

The results of the analysis to determine the effect of sample size (0-29, 30 and above) on academic achievement are given in Table 9.

Table 9: Heterogeneity test and effect sizes for the effect of sample size where the studies carried out on academic achievement

Model Type			Heterogeneity		N	E.B	95% Confidence Intervals	
			Q	p			Lower Limit	Upper Limit
	Fixed E.M.	Gruplar İçi	70,671	0,000				
						1,183	1,023	1,343
Sample Size		Gruplar Arası	10,088	0,001				
	Random E.M.	Gruplar Arası	0,690	0,406		1,505	1,159	1,851
Between 0-29					11	1,633	1,174	2,091
30 and over					8	1,337	0,809	1,864

According to Table 9, intra-group heterogeneity test results were found to be significant (p <.05) under the fixed effects model. This result shows that the studies within the groups do not share the same widespread effect. In this case, comments should be made according to the random effects model. According to the random effects model, the heterogeneity test between the groups was not significant (p> .05). This result shows that there is no significant difference between the effect sizes of the groups formed according to the sample size (0-29, 30 and above). The overall effect size of the studies carried out under the random effects model with a sample size between 0 and 29 was 1.633 (1.174.2.091), the overall effect size of the studies conducted with a sample size of 30 and above was 1.337 (0.809, 1.864) and the overall effect size of the sample size was 1.505 (1.159, 1.851). According to these results, although the overall effect size of the studies conducted with a sample size between 0 and 29 is larger than the studies conducted with a sample size of 30 and above, it can be said that the sample size in which the study is conducted has no effect on academic achievement.

4. Discussion, Conclusion And Suggestions

In this research, in order to determine the effect of differentiated teaching approaches on students' academic success, the findings of the experimental studies in Turkey between 2008 and 2018 have been collected numerically and effect size between variables have been pointed out. In order to determine the effect of differentiated teaching on academic achievement, 24 master's / doctorate theses have been identified. Of these studies, only the pretest-posttest weak experimental pattern and the pretest-posttest control group quasi-experimental pattern model and all the data required for the calculation of the effect size were included in the meta-analysis process. In this context, 19 studies, which included criteria for inclusion, were combined with meta-analysis.

Considering the 19 studies included in the meta-analysis; the types of publications in which the studies were conducted, it was seen that the highest number of studies consisted of 13 studies (68.4%). According to the teaching level, the highest number of studies was done in 13 studies (68.4%) at secondary school level. 89,5) semi-experimental design and according to the data of the study group, 11 studies (57.9%) were conducted between 0 and 29 students with a study group.

When the effect size of the studies included in the meta-analysis is considered; positive effect size was observed in all 19 studies (100%). The fact that the effect size values are positive shows that the academic achievement value in these studies is in favor of the experimental group. When impact sizes were classified according to Cohen et al. (2007) classification, it was found that 1 study (5.3%) had a small effect level, 5 studies (26.4%) had a moderate level and 13 studies (68.4%) had a strong effect size for academic achievement. .

As a result of the analyzes performed according to the fixed effects model on the data in 19 studies included in the meta-analysis, the effect size was found to be + 1.183 within the 95% confidence interval. The effect size for academic achievement shows that the situation is in favor of a differentiated teaching approach. However, the heterogeneity of the studies after the homogeneity test exceeded the critical value of the Q statistic value showed that the data could not be generalized to the whole universe. Therefore, data were analyzed again according to random effects model. As a result of this analysis, 0.183 standard errors

and 95% confidence interval upper limit was calculated as 1.861 and lower limit was 1.143 and effect size value was calculated as 1.502. This value is a strong, positive and significant effect size according to Cohen et al. (2007) classification.

The findings of the present study show that differentiated teaching approach is more successful than the traditional teaching method on students' academic achievement. The results obtained are consistent with the individual research conducted in Turkey and abroad in different years (Battal karaduman, 2012; Camcı Erdoğan, 2012; Cummings, 2011; Deringöl Krataş, 2013; Etienne, 2011; Gilbert, 2011; Kaplan Issue; 2013; Root, 2012; Özyaprak, 2012; Shaldırdak, 2012; Williams, 2012; Yabaş, 2008). The consistency of the results obtained with this study with domestic and international research supports the positive effects of differentiated teaching approach on students' academic achievement.

When the 19 studies included in the meta-analysis were analyzed according to independent variables, the heterogeneity test between groups was significant ($p < 0.05$). This result shows that there is a significant difference between the effect sizes of the groups formed according to the type of publication (master- doctorate) of the study. The overall effect size of the master's thesis type was 1.069, the overall effect size of the doctoral thesis type was 1,795 and the overall effect size of the publication type was calculated as 1.262. According to these results, it can be said that the publication type of the studies has a strong effect on academic achievement and is in favor of the doctoral theses studied. It is thought that this situation may be caused by other variables such as student group or course and duration. The heterogeneity test between the groups was not significant ($p > .05$) under the random effects model according to the education level in which the studies were applied. This result shows that there is no significant difference between the effect sizes of the groups formed according to the educational level (primary-secondary). According to these results, academic achievement does not change depending on the teaching levels of students in the studies conducted with differentiated teaching approach. In other words, it is seen that differentiated teaching approach increases the academic success either in primary or secondary school.

The heterogeneity test between the groups was significant ($p < .05$) according to the random effects model according to the course types applied to the studies included in the meta-analysis. This result shows that there is a significant difference between the effect sizes of the groups formed according to the type of course (mathematics-science-other). Under the random effects model, the overall effect size of the studies in mathematics was 1.746, the overall effect size of the studies in the field of science was 0.846 and the overall effect size of the studies in other fields was 1.735 and the overall effect size of the course type was 1.116. According to these results, it is seen that the course type has a strong effect on academic achievement and is in favor of mathematics course. The heterogeneity test between the groups was not significant ($p > .05$) under random effects model according to the pattern type and sample size to which the studies were applied. This result shows that there is no significant difference between the effect sizes of the groups formed according to the type of design (weak, quasi-experimental) and sample size (between 0-29, 30 and above). According to these results, academic achievement does not change depending on the type of sample or sample size.

When the literature is examined, it is seen that differentiated teaching approach generally has a positive effect on students' academic achievement. The studies included in the meta-analysis also reached this finding. When designing the research, it is seen that differentiated teaching creates different effect sizes in terms of the selected course type, teaching level and application time variables. This result shows that if differentiated teaching approach is applied in the right subject areas, teaching level and during the application, it will provide a broad benefit.

As a result of this study where the effect of learning environments prepared according to differentiated teaching approach on academic achievement is examined, the following suggestions can be made:

- Differentiated teaching approach was found to be more effective than traditional methods in increasing academic success. Therefore, in accordance with the principles of differentiated teaching approach of teachers, studies can be done in order to organize students' learning experiences.
- The effect of differentiated teaching approach on academic achievement did not differ significantly according to teaching level. Therefore, teachers can increase academic achievement by using this model in primary and secondary schools.
- It is seen that differentiated teaching approach is mostly applied in mathematics course. Further studies can be done on the application of the approach in different courses.

REFERENCES

Açıkel, C. (2009). Meta analiz ve kanıta dayalı tıptaki yeri. *Klinik Psikofarmoloji Bülteni, 19*(2), 164-172.
Anderson, K. M. (2007). Tips for teaching: Differentiating instruction to include all students. *Preventing School Failure, 51* (3), 49-54.
Atalay, Z., Ö. (2014). *Farklılaştırılmış sosyal bilgiler öğretiminin üstün zekalı öğrencilerin akademik başarı, tutum, eleştirel düşünme ve yaratıcılıklarına etkisi.* Doktora Tezi, İstanbul Üniversitesi, Eğitim Bilimleri Enstitüsü, İstanbul.
Ayers, D. J. (2008). *The effect of teacher attitudes on differentiated instruction in two rural elementary schools monroe county, Georgia.* Doctoral Dissertation,
Beler, Y. (2010). *Farklılaştırılmış öğretim ortamının sınıf yönetimine ve öğrencilerin akademik başarısına etkisi.* Yayınlanmamış Yüksek Lisans Tezi, Maltepe Üniversitesi, Sosyal Bilimler Enstitüsü. İstanbul.
Büyüköztürk, Ş., Çakmak Kılıç E., Akgün, Ö. E., Karadeniz, Ş. ve Demirel, F. (2010). *Bilimsel araştırma yöntemleri.* Ankara: Pegem A Yayıncılık.
Card, N.A. (2012). *Applied meta-analysis for social science research*. Newyork, London: GuilfordPress.
Chen, W.R. (2011). *Differentation in the art education: exploring two art teachers'responsive pedegogy in an elementary school in taiwan*. Doctoral Dissertation, Elementary Education in the Graduate College of the University of Illinois at Urbana- Champaign. Urbana.
Cohen, L., Manion, L.& Morrison, K. (2007). *Research methods in education (6th Edition)*. New York: Routledge.
Cooper, H. M. (1989). *Integrating research: A guide for literature reviews*. Newbury Park, CA: Sage.
Cooper, H., Hedges, L. V. & Valentine, J. C. (2009). *The handbook of research synthesis and meta-analysis (2nd edition).* New York: Russell Sage Publication.
Cummings, P. L. (2011). *A comparative analysis of the impact of differentiated instructional strategies and traditional basal instruction on the reading achievement of selected fourth grade students*. Doctoral Dissertation. Capella University. UMI Number: 3449381.
Çalıkoğlu, B. S. (2014). *Üstün zekalı ve yetenekli öğrencilerde derinlik ve karmaşıklığa göre farklılaştırılmış fen öğretiminin başarı bilimsel süreç becerileri ve tutuma etkisi*. Doktora Tezi, İstanbul Üniversitesi Eğitim Bilimleri Enstitüsü, İstanbul.
Çam, Ş. S. (2013). *Öğretmenlerin farklılaştırılmış öğretim yaklaşımını uygulama ve buna ilişkin yetkinlik düzeyleri*, Yüksek lisans tezi. Osmangazi Üniversitesi, Eskişehir.
Demir, S. (2013). *Farklılaştırılmış öğretim yöntemlerinin öğrencilerin akademik başarıları öğrenme yaklaşımları ve kalıcılık puanları üzerindeki etkisi*. Doktora Tezi, Yıldız Teknik Üniversitesi Sosyal Bilimler Enstitüsü, İstanbul.
Dinçer, S. (2014). *Eğitim Bilimlerinde Uygulamalı Meta-Analiz(1.Baskı)*. Ankara: Pegem Akademi.
Ellis, P. (2010). *The essentials of effect sizes.* New York: Cambridge University Press.
Etienne, J. S. (2011). A grounded theory approach to use of differentiated instruction to improve students' outcomes in mathematics. Doctoral Study Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Education. Walden University.
Gilbert, D. L. (2011). *Effects of differentiated instruction on student achievement in reading.* Doctoral Study Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Education Administrator Leadership for Teaching and Learning. Walden University. UMI Number: 3489353.
Hall, T., Vue, G., Strangman, N., & Meyer, A. (2003). Differentiated instruction and implications for UDL implementation. *Wakefield, MA: National Center on Accessing the General Curriculum.*
Hunter, J. E. & Schmidt, F. L. (1990). *Methods of meta-analysis: Correcting error and bias in research findings.* London: Sage Publications.
Kaplan, M. (2016). *Farklılaştırılmış öğretim yöntemi ile işlenen fen bilimleri dersi 7.sınıf kuvvet ve hareket ünitesinin öğrencilerin kavramsal anlamalarına, bilimsel süreç becerilerine ve akademik başarılarına etkisi*, Yayımlanmamış yüksek lisans tezi. Dokuz Eylül Üniversitesi, İzmir.
Karadağ, R. (2010). *İlköğretim Türkçe dersinde farklılaştırılmış öğretim yaklaşımının uygulanması: Bir eylem araştırması.* Yayımlanmamış Doktora tezi, Anadolu Üniversitesi Eğitim Bilimleri Enstitüsü, Eskişehir.
Karadağ R (2014). Dünyada ve Türkiye'de farklılaştırılmış öğretimle ilgili yapılmış çalışmaların değerlendirilmesi, *Kastamonu Eğitim Dergisi 22*(3):1301-1322.
Karaduman, G.B. (2012). *İlköğretim 5. sınıf üstün yetenekli öğrenciler için farklılaştırılmış Geometri öğretiminin yaratıcı düşünme uzamsal yetenek düzeyi ve erişiye etkisi.* Doktora Tezi, İstanbul Üniversitesi Sosyal Bilimler Enstitüsü. İstanbul.
Karip, F. (2016). Analyzing the dissertations about differentiated instruction in terms of their contents in Turkey. *Educational Research and Rewievs, 11*(16), 1590-1597
Kök, B. (2012). *Üstün zekalı ve yetenekli öğrencilerde farklılaştırılmış Geometriöğretiminin yaratıcılığa uzamsal yeteneğe ve başarıya etkisi*. Doktora Tezi, İstanbul Üniversitesi Sosyal Bilimler Enstitüsü, İstanbul.
Lawrence Brown, D. (2004). Differentiated instruction: Inclusive strategies for standards-based learning. *American Secondary Education, 32* (3), 34-62.
McTighe, J., & Brown, J. L. (2005). *Differentiated instruction and educational standards: Is détente possible? Theory Into Practice, 44*(3), 234–244.
Miles, M.B. & Huberman, A.M. (1994). *Qualitative data analysis* (2nd ed.).ThousandOak, CA: Sage. p.69.
Petticrew, M. & Roberts, H. (2006). *Systematic reviews in the social sciences.* MA-USA: Blackwell Publishers Ltd.
Rock, M., Gregg, M., Ellis, E., & Gable, R. A. (2008). REACH: A framework for differentiating classroom instruction. *Preventing School Failure, 52*(2), 31–47.
Schulze, R. (2004). *Meta-analysis a comparison of approaches.* Göttingen: Hogrefe And Huber Publishers.
Şaldırdak, B. (2012). *Farklılaştırılmış öğretim uygulamalarının matematik başarısına etkisi.* Yayımlanmamış Yüksek Lisans Tezi, Ankara Üniversitesi Eğitim Bilimleri Enstitüsü, Ankara.
Tomlinson, C. A. (1995). *How to differentiate instruction in mixed-ability clasrooms. USA, Alexandria,* VA: Association for Supervision and Curriculum Development.
Tomlinson, C. A. (1999). *The differentiated classroom: Responding to the needs of all learners.* Alexandria, VA: Association for Supervision and Curriculum Development.
Tomlinson, C. A., & Eidson C. C. (2003). *Differentiation in practice: A resource guide for differentiating curriculum.* Alexandria, VA: Association for Supervision and Curriculum Development.
Tomlinson, C. A. (2005). *The differentiated classroom: responding to the need of all learners*. ABD: Pearson Merrill Prentice Hall.
Umar, Ç. N. (2014). *Karma öğrenme yöntemi ile farklılaştırılmış öğretim ortamının üstün zekâlı ve yetenekli öğrencilerin akademik başarılarına, eleştirel düşünme becerilerine ve yaratıcılıklarına etkisi*. Yayımlanmamış Doktora Tezi, İstanbul Üniversitesi Eğitim Bilimleri Enstitüsü, İstanbul.
Williams, T. (2012). Differentiated mathematics instruction for students in grades 3 and 4 in a rural school district. Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy K-12 Educational Leadership Walden University. UMI Number: 3518519.
Yabaş, D. (2008). *Farklılaştırılmış öğretim tasarımının öğrencilerin özyeterlik algıları, bilişüstü becerileri ve akademik başarılarına etkisinin incelenmesi.* Yayımlanmamış Yüksek Lisans Tezi, Yıldız Teknik Üniversitesi Sosyal Bilimler Enstitüsü, İstanbul.