

ULUSLARARASI SOSYAL ARAŞTIRMALAR DERGİSİ THE JOURNAL OF INTERNATIONAL SOCIAL RESEARCH

Cilt: 12 Sayı: 67 Yıl: 2019
www.sosyalarastirmalar.com
Issn: 1307-9581



Volume: 12 Issue: 67 Year: 2019
www.sosyalarastirmalar.com
Issn: 1307-9581

Doi Number:
<http://dx.doi.org/10.17719/jisr.2019.3754>

THE EFFECT OF MULTIPLE INTELLIGENCE THEORY BASED TEACHING ON STUDENTS' ACADEMIC ACHIEVEMENT IN MATHEMATICS TEACHING: A META-ANALYSIS STUDY

Yeliz ÇELEN*

Abstract

Intelligence is the ability to comprehend the relationships between objects with the help of concepts and perceptions, to judge events and situations and to use these mental functions in a harmonious way for a purpose. The aim of the study is to conduct an impact analysis on the effects of multiple intelligence theory based teaching on the academic achievement of students in mathematics teaching. In mathematics teaching in this study between the years 2010-2017 the students to learn the theory of multiple intelligences in order to determine the impact on academic achievement in the field of mathematics education in Turkey it made regarding the impact on students' academic achievement of learning through multiple intelligences theory and quantitative studies were examined. According to the results of the meta-analysis, it was observed that the difference between the pre-test and post-test averages of the experimental group was statistically significant and not in the control group.

Keywords: Intelligence, The Theory of Multiple Intelligence, Meta Analysis.

Introduction

Intelligence, in the most general sense, is the ability to comprehend relationships between objects with the help of concepts and perceptions, to reconsider events and situations and to compatible use of mental functions directed to a purpose. While Gardner (1983) defines intelligence as "The ability of a person to reveal a product in one or more cultures and the ability to effectively and efficiently solve a problem encountered in his/her daily or professional life" Bümen (2002, 5) described it as the ability to shape or solve a shape or product in one or more cultural structures. Although there are different definitions of intelligence, most of the theories related to intelligence are combined on the fact that intelligence is a congenital capacity or potential inherent in the individual, hand it down from generation to generation and is a compound shaped by learning and environmental influences involving the central nervous system.

According to multiple intelligence theory, the purpose of education is not only to increase students' academic achievements. It is to reveal multiple intelligence potentials in students and improve them with providing appropriate learning environments that sensuous and provide that they feel more active (Armstrong, 1988). Multiple Intelligence Theory draws attention to individual differences and is a student-

*Dr. Öğr. Üyesi, Amasya Üniversitesi, Eğitim Fakültesi, Amasya, yeliz.celen@meb.gov.tr



centered teaching approach rather than a teacher-centered teaching approach (Saban, 2001). Talu (1999) states that Gardner's multiple intelligence theory is not an educational objective and that intelligence areas are strong means in achieving educational objectives. Gardner indicates the importance of observing children's interests and abilities by teachers and parents and reflecting this teaching processes and emphasizes that intelligence areas are means that serve education by teacher's different usages (Akt.San and Güleriyüz, 2004).

Mathematics teaching must help them to understand conceptual knowledge of mathematics, procedural knowledge of mathematics and make connections between conceptual and procedural knowledge. These three purpose are called relational understanding (Van de Wella, 1989, 6).

In order to realize the proper teaching of mathematics to its structure, it is necessary to know that mathematics is not a discipline that finished and contains definite truths, but a field that includes trial and error method and open for new search, discoveries and inventions. This structure of mathematics overlap the most important principle of multiple intelligence theory and the ability of intelligence to have a constant developmental dynamism. Mathematics is not a pile of different subjects, processes and rules, but a method of thinking based on some basic principles and concepts, a broader problem solving, finding and evidence activity. While providing mathematics education through multiple intelligence theory, it is possible to carry out activities to different fields of intelligence such as reasoning, thinking through inductive and deductive techniques, paintings and imagery, musical perception of an event and its order, and constructing a model. In this respect, it has become a necessity to investigate the effect of teaching of multiple intelligences on students' academic achievement in mathematics teaching.

There are several studies indicating that the Multiple Intelligence Theory constitutes a significant difference in the academic achievement of students (Campbell and Campbell, 1999; Patterson, 2002). In the studies that investigated the effect of multiple intelligence theory on students' mathematics achievement, it has been concluded that teaching in learning environment has effects such as facilitating understanding and providing permanent learning.

In the study which was conducted by Kuloğlu (2005) and tried to identify the effects of multiple intelligence theory on the success of students in mathematics teaching in the eighth grade students, it was concluded that the learning methods based on multiple intelligence theory affect the students' mathematical attitudes and that they have a positive difference in terms of academic achievement compared to traditional teaching methods. In the study conducted by Çoşkungönüllü (1998), the effects of multiple intelligences theory on the achievement of 5th grade students in mathematics lesson were investigated and the opinions of the students who participated in the process were taken. As a result of these interviews, the students were happy with the multiple intelligence theory methods applied in mathematics courses and they found that the lessons learned were more fun, colorful and interesting than the other methods.

Campell (1999, Aktaran, Talu) Multiple Intelligence theory of classroom applications, many studies have been done however, the most accurate of these cannot determined; teacher's classroom environment, goals and to choose appropriate methods by looking at society. After the study of multiple intelligence theory in mathematics courses it has been determined that benefiting from students has a positive effect on student achievement (Köroğlu, Yeşildere; 2004). According to Azar (2006), there was a significant difference in the favor of the experimental group between the achievement levels, recall levels and cognitive process skills of the students in the classroom where the multiple intelligence theory based activities were applied and the students in the classroom where the traditional method was applied.

In our country, international studies on mathematics teaching have fallen far behind other countries and in both TIMSS and PISA studies, it was seen that the majority of Turkish students were defined at a very simple level, they did not have the skills to solve even the mathematical problems, where all the information for the solution was given and the instructions for the problem were clearly defined. In the field of mathematical literacy in PISA application made in 2015, while average of Turkey is 428, it is seen that the average of other countries is 461. Turkey took place in the average score points this class which is below the statistical average for the OECD countries. It is thought that the addition of various applications based on multiple intelligence theory to the mathematics teaching processes may cause this difference and contribute to the student development and professional development of the teachers mentioned in the said report. In the light of the above mentioned explanations, it is thought that a meta-analysis study for the studies in this field will contribute to the literature.



Method

Meta analysis method was used to calculate the effect size of Multiple Intelligence Theory Based Teaching on the students' academic achievement. Meta analysis is a method of statistical analysis of the numerical data obtained from multiple studies which are independent of each other in specific subjects and concluding on the results of these studies (Glass, 1976; Johnson, Johnson and Stanne, 2000; Lipsey and Wilson 2001, Sağlam and Yüksel, 2007). Glass (1976; 3) describes the meta-analysis as a statistical analysis of a large set of compiled analysis obtained from individual studies to combine the findings. Meta analysis can be defined as the statistical analysis of the common results of the studies conducted under the same heading. Meta-analysis can increase the validity of these studies due to it combines the findings of individual studies with similar findings.

In mathematics teaching in this study between the years 2010-2017 the students to learn the multiple intelligences theory in order to determine the impact on academic achievement in the field of mathematics education in Turkey it made regarding the impact on students' academic achievement of learning through multiple intelligences theory and quantitative studies were examined. While the study has been conducted, it was benefited from all postgraduate thesis and doctoral thesis which are published and unpublished in the field of learning with multiple intelligence in mathematics teaching, thesis catalog of council of higher education, electronic catalogs of university libraries in Turkey and conference presentations. In order to collect data, publications were assigned by using "learning with multiple intelligence theory", "multiple intelligence theory in mathematics teaching ", " the effect of multiple intelligence theory on students' academic achievements" keywords.

The meta-analysis was carried out in the following steps:

- 1) First of all, appropriate studies were detected and these studies were included in the study. In the meta-analysis study, as experimental or semi-experimental studies were encountered in the literature search, non-experimental studies were excluded from the study due to insufficient data for the effect size calculation. In mathematics teaching, studies that did not measure the effect of learning with multiple intelligences on students' academic achievement were excluded from the study field. Among, both postgraduate/doctoral theses and papers which were presented as assertions, theses are included in the analysis and coded in this study rather than others. Some of the experimental studies searched were excluded due to they did not contain the numerical data required for meta-analysis. As a result, the sample of the study was published and 6 studies were conducted. In the studies included in the meta-analysis, the control and experiment groups were included, and in the experiment group, mathematics teaching was applied with multiple intelligence theory and sufficient numerical data (standard deviation, mean, sample size etc.) were sought.
- 2) In order to carry out the statistical analysis of the meta-analysis study in a healthy way, it is necessary to provide an integrity between the researches examined. For this purpose, the studies need to be coded and classified. In order to perform these procedures, the variables to be used in the study were determined. The effect sizes used in studies included meta analysis and effectiveness of multiple intelligence theory in mathematics teaching on students' academic achievements will be dependent variables. Impact sizes are standardized values for different measurement tools for each study and are derived from numerical or statistical data included in the studies (Bernard et al., 2004). The most important benefit of using effect size is that all studies can be interpreted using the same criterion. The effect size obtained allows to comment on the level of effectiveness of the independent variable on the dependent variable. While giving information about whether the hypothesis tests have relationship or difference, the effect size gives information about this difference or relationship. In order to evaluate the relationships between the independent variables and their effect sizes, the educational level of the students who participated in the experiment as an independent variable and the number of samples in the studies were used as explanatory variables in the data analysis.

The aim of the study was to use the multiple intelligence theory based mathematics teaching in our country, which has been published and published in our country. The terms " mathematics achievement ", " multiple intelligence theory " and " mathematics teaching " were used both in Turkish and English.

Findings

As a result of the surveys conducted by the researcher, 44 research studies were conducted and 5 of these studies were conducted on an effectiveness study that only fits the selection criteria of the researcher.

The studies are summarized in Table 1 according to the dependent and independent variables, the research design, the data collection tool used, the sample group and the results.



Table 1: Overview of Research

Author	Year	Name	Dependent Variable	Pattern	Mean	Sample Group	Result
Köroğlu- Yeşildere	2004	Primary Seventh Grade Math Lesson Effect of Multiple Intelligences Theory in Integers Unit on Student Success	Student Achievement	Search-Post test model with control group	Achievement test	39 students and 39 students in the control group	It was stated that students obtained majority of behaviors that necessary to gain in whole numbers unit in application period and there is significant difference in countenance experiment group among students' mathematics achievements in control and experiment group within the scope of whole numbers unit.
Yıldırım-Tarım	2008	Using Multiple Intelligence Activities and Cooperative Groups to Improve Academic Achievement and Retention	Academic achievement and level of retention	Search-Pre-test-posttest control group model	Mathematics Achievement Test-Interview Form-Personal Information Form		Cooperative learning supported by multiple intelligence theory was found to be more effective in increasing academic achievement than traditional teaching method.
Şengül-Altuntaş	2011	Effect of Teaching with Multiple Intelligence Theory on 7th Grade Students' Mathematics Achievements	Mathematics Achievements	Search-Pre-test-posttest control group model	Mathematics Achievement Test-Multiple Intelligence Determination Survey	65 7th Grade Students	It was found that the lessons made with the Multiple Intelligence Theory have more effect on students' mathematics achievement than the traditional method.
Şengül-Öz	2006	Primary School 6th Grade The Effect of the Teaching of Multiple Intelligences in the Fractions Unit on Mathematics Achievement and Retention	Mathematics achievement test consisting of The Ministry of National Education questions	Search-Pre-test-posttest control group model	Mathematics Achievement Test-Multiple Intelligence Determination Survey	70 6th Grade Students	It was determined that there was a significant difference in favor of the experiment group in which the Multiple Intelligence Theory was applied between the two groups according to the pre-test, post-test achievement scores and t-test findings of the control group using the traditional lesson processing method and the experimental group prepared in accordance with the Multiple Intelligence Theory.
Köroğlu, Yeşildere and Günhan		Primary School 6th Grade Teaching Mathematics According to Multiple Intelligences Theory in Teaching Dimension Measures	Achievement test	Search-Pre-test-posttest control group model	Achievement test	269 students	It was concluded that mathematics teaching based on multiple intelligence theory was significantly effective on student achievement.

Four studies which are overlap with the pattern of these studies, are included in the meta-analysis. According to the results of the impact analysis, the results of the pre-test-post-test meta-analysis for the experiment group are given in Table 2.



Table 2: Experiment Group Pre-test - Post-test Meta Analysis Results

Study Subgroups	Pre-test		Post-test		Weight	Std. Mean Difference	Year
	Mean (SD)	N	Mean (SD)	N			
Experiment							
Şengül-Altuntaş	26,88 (10,65)	33	50,27 (17,51)	33	32,04	-1,60 [-2,15 -1,04]	2011
Yıldırım-Tarım	12,97 (4,07)	36	18,53 (5,93)	36	33,07	-1,08 [-1,58 -0,58]	2008
Köroğlu-Yeşildere		39	35,25 (4,44)	39			
Şengül-Öz	43,54 (16,05)	35	51,71 (18,15)	35	34,26	-0,47 [-0,95 0,01]	2006
Total		104		104	100,00	-1,04 [-1,67 -0,40]	

Heterogeneity Test $Q=9,48$, $sd=2$ ($P=0,009$), $I^2=\%78,9$

Test Overall Impact $t=-6,47$ ($P=0,001$)

In the experiment group, Pre-test - Final Test Meta analysis graph is given below.

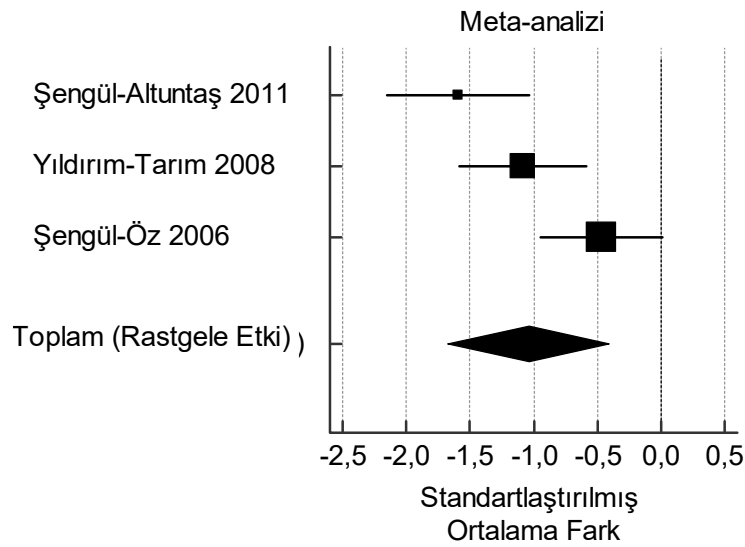


Figure 1: Pretest-Posttest Meta Analysis Graph in Experiment Group

There was a statistically significant heterogeneity in terms of the mean of pre-test and post-test effect size among the studies in the experiment group ($P=0,009$, $I^2=\%78,9$). Since there was heterogeneity between studies, random effect was used in the estimation. The standardized mean difference was $-1,04$ ($\%95$ GA = $-1,67$; $-0,40$, $p=0,001$) for the experiment group. It was observed that the standardized mean confidence interval contained the value of zero and the meta analysis graph do not contact the 0 point of the diamond point. According to the results of Meta analysis, the difference between the pre-test and post-test means of the experiment group was statistically significant.

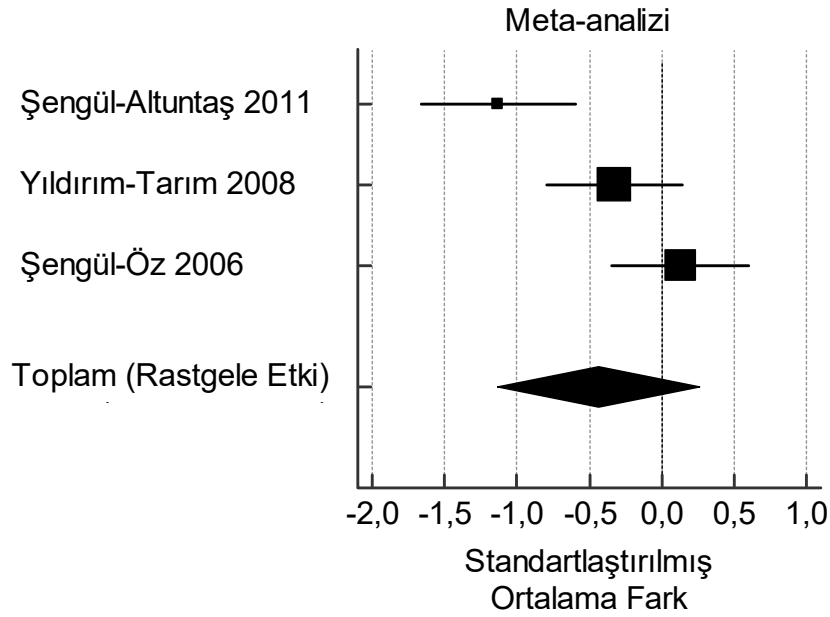
According to the results of the impact analysis, the results of the pre-test-post-test meta-analysis for the control group are given in Table 3.

Table 3. Control Group Pre-test - Post-test Meta Analysis Results

Study Subgroups	Pre-test		Post-test		Weight	Std. Mean Difference	Year
	Mean (SD)	N	Mean (SD)	N			
Control							
Şengül-Altuntaş	25,56 (9,84)	32	40,56 (15,69)	32	32,44	-1,13 [-1,66 -0,60]	2011
Yıldırım-Tarım	10,52 (3,39)	36	11,97 (5,13)	36	33,82	-0,33 [-0,80 -0,14]	2008
Köroğlu-Yeşildere		39	30,53 (4,24)	39			
Şengül-Öz	42,86 (15,93)	35	41,00 (12,47)	35	33,74	-0,39 [-0,67 0,11]	2006
Total		103		103	100,00	-0,44 [-1,14 0,27]	

Heterogeneity Test $Q=12,61$, $sd=2$ ($P=0,002$), $I^2=\%84,1$

Test Overall Impact $t=-1,22$ ($P=0,223$)



There was a statistically significant heterogeneity in terms of the mean of pre-test and post-test effect size among the studies in the control group ($P=0,002$, $I^2=\%84,1$). Since there was heterogeneity between studies, random effect was used in the estimation. The standardized mean difference was $-0,44$ ($95\% \text{ CI} = -1,14; -0,27$, $p = 0,223$) for the control group. It was observed that the standardized mean confidence interval contained the value of zero and the meta analysis graph contacted the 0 point of the diamond point. According to these results, it was observed that the difference between pre-test and post-test mean of the control group was not statistically significant.

Discussion and Conclusion

According to the findings obtained from the study, it is said that mathematics teaching with multiple intelligence theory has a positive effect on academic achievement and this effect is at the highest level. According to the results of this research carried out at the national level, the level of effectiveness of the mathematics teaching carried out with the multiple intelligence theory in the learning processes is high in terms of the students' academic achievement.

This high level of effectiveness can be interpreted as the increase in academic achievement of students with mathematics teaching performed by multiple intelligence theory. Although there are no other meta-analysis studies conducted in this field, there are studies stating that information is very effective in terms of teaching conceptions of multiple intelligence in primary and lower education levels (Köksal, 2006). In this context, it is recommended that multiple intelligence theory based teaching practices should be disseminated in mathematics teaching, and material studies should be increased and further studies should be conducted to investigate the effectiveness of these studies.

REFERENCES

- Armstrong, T. (1994). *Multiple intelligences in the classroom*. Alexandria: ASCD.
- Azar, A., Presley, A., Balkaya, Ö. (2006), Çoklu Zeka Kuramına Dayalı Öğretimin Öğrencilerin Başarı, Tutum, Hatırlama ve Bilişsel Sürec Becerilerine Etkisi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 30, 45-54
- Bernard RM, Abrami PC, Lou Y, Borokhovski E, Wade A, Wozney L, Walset M ve Huang B (2004). How does distance education compare with classroom instruction? A meta-analysis of the empirical literature. *Review of Educational Research*, 74(3): 349-361.
- Bümen, N. (2001). *Gözden geçirme stratejisi ile desteklenmiş çoklu zekâ kuramı uygulamalarının erişiş, tutum ve kalıcılığa etkisi*. Yayınlanmamış doktora tezi, Hacettepe Üniversitesi Sosyal Bilimler Enstitüsü, Ankara.
- Coşkungönüllü, R. (1998). Çoklu zekâ kuramı'nın 5. sınıf öğrencilerinin matematik erişişine etkisi. *Eğitim 97- 98 Dergisi*, TED Ankara Koleji, 1,1: 26, 30, Ekim.
- Campbell, L. & Campbell, B. (1999). *Multiple Intelligences and Student Achievement: Success Stories From Six Schools*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Gardner, H. (1993) *Multiple Intelligences: Theory in Practice*. New York Basic Books.
- Glass, G. V. (1976). *Primary, secondary, and meta-analysis of research*. *Educational Researcher*, 5(10), 3- 8.
- Johnson, D.W., Johnson, R.T., & Stanne M.B. (2000). *Cooperative Learning Methods: A Metaanalysis*. Web: <http://www.ccsstl.com/sites/default/files/cooperative%20learning%20research%20.pdf>. Accessed 11 March 2014
- Köksal, M.S. (2006). Kavram Öğretimi ve Çoklu Zekâ Teorisi. *Kastamonu Eğitim Dergisi*, Ekim 2006, Cilt :14



- Köroğlu, H, Yeşildere, S. (2004), İlköğretim Yedinci Sınıf Matematik Dersi Tamsayılar Ünitesinde Çoklu Zeka Teorisi Tabanlı Öğretimin Öğrenci Başarısına Etkisi. *Gazi Eğitim Fakültesi Dergisi*, 24 (82), 25-41.
- Kuloğlu, S. (2005). *Çoklu Zekâ Kuramının İlköğretim Sekizinci Sınıflarda Matematik Öğretiminde Öğrenci Başarısına Etkisi*. Yüksek Lisans Tez, Balıkesir Üniversitesi, Fen Bilimleri Enstitüsü.
- Lipsey, M. W., & Wilson, D. B. (2001). *Practical meta-analysis*. California: Sage Publications
- Patterson, C. (2002). Understanding The Multiple Intelligences Approach to Learning. [Online]: http://www.ucalgary.ca/~distance%20/cll_institute/connie_patterson.pdf, 10.06.2005.
- Saban, A. (2001). *Çoklu zekâ teorisi ve eğitim*. Ankara, Nobel Yayın Dağıtım.
- Sağlam, M. ve Yüksel, İ. (2007). Program değerlendirmede meta-analiz ve meta-değerlendirme yöntemleri. *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi*, 18, 175-188.
- San, İ. ve Güler, H. (2004). *Yaratıcı eğitim ve çoklu zekâ uygulamaları*. Ankara: Artım Yayınları.
- Talu, N. (1999). Çoklu zekâ kuramı ve eğitime yansımaları. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 15, 164-172.
- Van de Wella, J. E. (1989). *Elementary School Mathematics*. Virginia Commonwealth University.