

The Effect of Multiple Intelligence(s) on Academic Success: A Systematic Review and Meta-analysis

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ABSTRACT

Many thesis, dissertations, and articles have been written on whether the concept of multiple intelligence has achieved the expected success in educational environments that has been established in accordance with the multiple intelligence principle and whether such developments have had a positive influence on the attitudes of students towards their learning. In other words, what kind of results do these scientific reports show? The research conducted in this paper seeks to determine the answer to this question through a meta-analysis and to determine if the creation and implementation of learning and teaching activities based on multiple intelligence models have had a positive influence on the academic success of students and have engendered positive attitudes towards learning. Within the context of this research, the following moderating factors were incorporated into the research; the level of education with which the studies dealt, the lesson under discussion, and the geographical region in which the studies were conducted and the year of publication of the studies concerned. These moderating factors did not seem to create any divergence in the results of the research regarding academic success. With respect to moderating factors, while no differences existed regarding the level of education, differences were observed in the relationship with the lessons, the geographical region and the academic year under observation within the studies.

Keywords: multiple intelligence, academic achievement, success, meta-analysis, systematic review

INTRODUCTION

Although the predominate view has been that intelligence could be measured objectively and stated using a single measure called IQ (Hoerr, 2000), Gardner (1983), who introduced the concept of multiple intelligence in his book *Frames of Mind*, believed that intelligence could not be measured by a single metric. Theoreticians/academics such as Gardner who had approached the topic have emphasized that intelligence was actually a phenomenon comprising multiple or plural elements.

Garner defined intelligence as the capacity employed by an individual or group in one or more cultural environments to create products of value or to solve problems (Ersoy & Uysal, 2018; Gardner, 1983). In 1983, Gardner proposed the “multiple intelligence(s) theory” and brought about a new perspective for the issue of intelligence. According to Gardner (1993), intelligence encompasses many different abilities and has a multifaceted nature that cannot be expressed merely using a single number/measure or notion/concept. Gardner defined abilities that are found in different degrees in each individual as “intelligence areas” or “modalities”. He named those intelligence modalities as follows: verbal-linguistic intelligence, logical-mathematical intelligence, visual-spatial intelligence, musical-rhythmic and harmonic intelligence, bodily-kinesthetic intelligence, interpersonal intelligence, interpersonal intelligence and naturalistic intelligence. Although Gardner (1993) defined these eight intelligence areas, he noted that those eight areas of intelligence were insufficient to define fully the abilities of individuals and more areas of intelligence could be discovered in due course.

Contribution of this paper to the literature

- The structural relations in multiple Intelligences are synthesized meta-analytically.
- The concept of multiple intelligence has achieved the expected success in educational environments.
- The average effect size was calculated according to the random effect model.
- Moderating factors were observed in relationship with the lessons, the geographical region.
- Multiple Intelligence Theory influences academic success in a positive fashion.

Multiple Intelligence Theory represents the pluralist appearance of intelligence domains and the diversity of ways of expressing the skillfulness and skills of the individual within the scope of their own culture (Allen, 1997; Iyitoglu & Aydin, 2015). According to Hopper and Hurry (2000), the theory of multiple intelligences could be adopted as an educational approach for many reasons. According to them, the multiple intelligence theory:

1. Ensures the development of consciousness in line with the learning processes of students;
2. Individualizes the learning process for every student; and
3. Provides for active learning.

To transfer these developments into school environments, teachers must be informed of developments regarding the issue and then to adopt them to their own practices. Whatever the extent is to which modern theories and well-designed educational programs may be developed, the person who will put these into practice is the teacher himself or herself.

The primary school program the Turkish Ministry of Education put into effect from 2005 was based on principles that focused on the thematic, constructivist, student-centered and student-active aspects of education. These programs were designed to allow for the scope of modern approaches such as the provision of teaching methods that teachers could apply that are sensitive to multiple intelligences and the individual differences of students (Gömleksiz, 2005). In the appendix (ces) of the *Directive with Regard to the Planned Procedure of Education and Teaching* found in Issue 2551 of the *Educational Journal of Notifications/Announcements* published by the Turkish Ministry of Education in August 2005, two examples were provided of lessons to be conducted with regard to these principles. Alterations were requested to be made so as to integrate the principles of Multiple Intelligence Theory. Thus, the assertion that multiple intelligence applications have occupied a significant position within the Turkish educational system over the course of the last ten years can be made. Additionally, many scientific studies have also been conducted on Multiple Intelligence(s) Theory that have assumed a prominent position within the educational system in Turkey.

Similar scientific research questions may be approached by different researchers using varying sample groups and sizes. In such a way, the results of studies conducted on similar topics may show similarities from time to time and at other times may exhibit differences. In such situations, those involved with the topic have felt a pressing need to look at the studies already conducted from a perspective that is more than that of a single researcher or research itself to reach a more suitable overview. Thus, the argument can be made that a meta-analysis may address this need.

This current study developed a synthesis of studies hitherto conducted in Turkey about the effect of the application of activities based on the Multiple Intelligence Theory on the academic success of the students involved and the attitudes of the respective students to the lessons. This was done to find answers to the following questions:

1. What is the difference between the success levels in lessons and at school of students who have undergone a process of teaching and learning based on Multiple Intelligence Theory and those who have undergone processes of learning based on traditional learning and teaching processes?
2. What is the difference between the attitudes to the lessons by students who have undergone a process of teaching and learning based on Multiple Intelligence Theory and those who have undergone processes of learning based on traditional learning and teaching processes?
3. What is the difference between the success of students in lessons with respect to moderating factors such as the level of education, the subject matter of a lesson, the geographical region and the year of study?
4. What is the difference between the attitudes of students towards lessons about moderating factors such as the level of education, the subject matter of a lesson, the geographical region and the year of study?

METHOD

Research Design

This study employed a meta-analysis method. Meta-analysis may be defined as an analysis of empirical studies conducted on a particular topic or in similar fields that involve the grouping of the studies according to specific criteria and the combination of quantitative findings pertaining to these studies (Dincer, 2014; Erkuş, 2013; Hunter, Jackson, & Schmidt, 1991). According to Cohen, Manion, and Morrison (2007), meta-analysis is, in simple terms, the “analysis of analyses”. Glass and Petitti (2000) describe meta-analysis as the examination of effect sizes reported in study articles (as cited in Chambers, 2004). The application of meta-analysis offers the opportunity to create new models and theories that may present an overall perspective of studies already conducted in a particular academic field.

The Criteria Required for Studies to Be Included Within the Scope of the Research

The first stage when employing the meta-analysis method on academic studies that already have been conducted is to define clearly the criteria of selection for the studies to be included. The criteria and factors concerning whether studies should be incorporated in this current research are listed below. They are:

1. The inclusion of an experimental-control group design within the research study.
2. Deciding whether the individuals belonging to the experimental groups have undergone an educational process in a learning- and teaching-environment based on Multiple Intelligence Theory or supported by its principles.
3. Deciding whether those individuals found in the control group have undergone an educational process conducted in environments that could be described as traditional in nature.
4. Determining the definitions of the success and achievement of those belonging to the study group considered for the research.
5. Determining the definitions of attitudes towards the lessons of those belonging to the study group.
6. The recording of the final test results from the experimental and control groups.
7. The clarity of arithmetical averages, standard deviations and numbers of participants for both the experimental and control groups.
8. An article or thesis has been submitted at the end of the scientific research process of the study.
9. The study was conducted in Turkey.

Studies that did not satisfy the conditions these criteria were not included within the scope of the research. As a result, 66 theses and 30 articles that met the criteria listed were incorporated into the scope of the research. The above-mentioned 96 studies were all conducted between 2001 and 2014.

Data Collection

The studies included within the research were all taken from the ProQuest Citations, EBSCO, and the Higher Academic Council (YÖK) and the National Thesis Search System databases from June to September 2015.

Data Analysis

The data obtained from the studies that met the criteria defined above were all loaded into the Comprehensive Meta-Analysis (CMA) software program.

Meta-analysis employs the effect size as its basic unit of measurement/evaluation. The most important aspect in the calculation of effect size is the degree of precision. The following factors influence the degree of precision, including variance, standard error, confidence interval, the homogeneity of the sample, the size of the sample and the research models employed (Borenstein, Hedges, Higgins, & Rothstein, 2009). The most important question in this instance is: “What method was used to calculate the effect size?” These are: the fixed effect(s) model and the random effect(s) model.

In meta-analysis the goal defines the common/shared effect. Just as in all other statistical analyses the desire is that extreme values do affect the analysis. In meta-analysis an attempt is made to prevent extreme values from exerting a common effect on the results of research/studies. The fixed effect model assumes that the real effect size is the same for all studies included in the meta-analysis and that they share the same actual effect size (Borenstein, Hedges, Higgins, & Rothstein, 2009). In the fixed effect model, the most important assumption is that “for all studies included in the meta-analysis there exists only one actual effect size” (Borenstein, Hedges, Higgins, & Rothstein,

2009: 78-79). However, the random effect model is based on the principle that the real effect size of factors such as the age of participants, the educational level of participants or the size of the class may differ from study to study (Üstün & Eryılmaz, 2014). Because of the increase in the number of studies (with larger amounts of data), the contribution to the common/shared effect will not remain the same, and, therefore, the random effect model that aims to estimate the average of the distribution of the effect will not reach the same conclusion as that emanating from the fixed effect model. The random effect model, weights studies with small sample sizes in relationship to larger overall sample sizes, and, in such a way, that does not require a break from meta-analysis. Employing such a method allows for the provision of data about the common effects of other studies. In essence, such a state of affairs means that the random effect model is valid not merely for studies incorporating small sample sizes but for all types of academic studies (Aydin & Aslan, 2016; Borenstein, Hedges, Higgins, & Rothstein, 2009).

Another important statistical element that is used when choosing between a fixed and random effects model is that of the Q notation. In analysis of the statistical value of Q , a hypothesis test is carried out to discover whether the general effect of all studies is shared or not. On analysis of the results, if the critical value (p) is found to fall below the critical values, then this result may be interpreted in such a way that "all studies do not share the general values". In such a situation, differentiation exists between the studies (Borenstein, Hedges, Higgins, & Rothstein, 2009; Hedges & Olkin, 1985: 124-128). The I^2 statistical value then provides information regarding the degree of this variation.

The publication bias of the studies included in the research was then analyzed using a funnel plot. In situations, in which no publication bias exists, a symmetry should be observed. Furthermore, the accumulation of elements on the internal and upper parts of the graph demonstrates that the contribution of the effect size is high. According to Cooper, Hedges, and Valentine (2009), if publication bias exists, then this leads to the emergence of an asymmetrical shape on the graph, and one corner of the graph remains empty with respect to another. In such a situation, the studies that contribute least to the common effect fall into the empty spaces at the bottom corners of the graph.

Moderating analysis is a method of analysis that provides for the testing of differences between the average effect sizes of moderating factors and the type of differences between sub-groups (Littel, Corcoran, & Pillai, 2008; Ogurlu & Sevim, 2017). The statistical significance in the difference between moderating factors are tested using the Q statistical method that Hedge and Olkin (1985) develop. In this method, the Q statistical measure is divided into two Q_{between} (Q_b) and Q_{within} (Q_w); then, the analysis is then carried out using these two Q figures. While Q_w is used to test the homogeneity within the moderating factor itself, Q_b is used to test the homogeneity between the groups (Borenstein, Hedges, Higgins, & Rothstein 2009; Hedges & Olkin, 1985).

In this study, the differences between the moderating factors were observed using the value Q_b . Four moderating factors were defined as being thought to exert an important effect on effect size. These were: 1) the level of education, 2) the lesson under discussion, 3) the geographical region and 4) the year of the study published.

RESULTS

The research was based on the main topic of the effect of learning and teaching environments based on or supported by the Multiple Intelligence Theory on student success and achievements and attitudes towards lesson. The breakdown of studies regarding the success and achievement of studies accepted for the meta-analysis are displayed in [Table 1](#).

Table 1. Information Concerning the Studies Included for Research with Regard to Student Achievement

The number of studies included in the meta-analysis.		91
The size of the sample reached for the experimental group following analysis of all studies ($N_{Experimental}$)		3210
The size of the sample reached for the control group following analysis of all studies ($N_{Control}$)		3223
Distribution of studies according to level of education	<i>Primary</i>	13
	<i>Middle School</i>	50
	<i>Secondary</i>	23
	<i>Higher education</i>	5
Distribution of studies according to subject areas	<i>Language Lessons</i>	10
	<i>Numerical Disciplines (Science and Mathematics)</i>	59
	<i>Humanities</i>	18
	<i>Sports and Arts</i>	4
Distribution of Studies according to geographic area	<i>Eastern Anatolia</i>	6
	<i>Central Anatolia</i>	32
	<i>Mediterranean</i>	9
	<i>Aegean</i>	16
	<i>South-Eastern Anatolia</i>	4
	<i>Black Sea</i>	12
Distribution of studies according to year published	<i>Marmara</i>	12
	<i>2001–2007</i>	72
	<i>2008 and Later</i>	19

Table 2. Information on the Studies Concerning Attitudes Included Within the Research

The number of studies included in meta-analysis		28
The size of the sample reached for the experimental group following analysis of all studies ($N_{Experimental}$)		921
The size of the sample reached for the control group following analysis of all studies ($N_{Experimental}$)		849
The distribution of studies conducted according to level of education	<i>Primary</i>	
	<i>Middle School</i>	19
	<i>Secondary Education</i>	4
Distribution of studies according to subject areas	<i>Language Lessons</i>	3
	<i>Numerical Disciplines (Mathematics and Science)</i>	16
	<i>Humanities</i>	7
	<i>Sports and Arts</i>	2
Distribution of studies according to geographical region	<i>Central Anatolia</i>	10
	<i>Mediterranean</i>	1
	<i>Aegean</i>	8
	<i>South Eastern Anatolia</i>	3
	<i>Black Sea</i>	3
	<i>Marmara</i>	3
Distribution of studies according to year of publication	<i>2001–2007</i>	25
	<i>2008 and later</i>	3

In accordance with the criteria, 91 studies about success and achievement regarding multiple intelligence(s) were chosen for inclusion for analysis. These studies comprised 66 academic theses and 25 scientific articles. The number of studies conducted that focused on higher education was particularly limited. The studies were conducted predominantly in the field of the numerical and scientific disciplines (mathematics and science), were made in the Central Anatolian region, and were carried out between 2001 and 2007.

Yurt and Polat (2015) conducted a meta-analysis study comprising 66 theses and 7 scientific articles, concerning the effectiveness of multiple-intelligence applications on academic achievement. The section of this research study entitled Multiple Intelligence-The Effect on Achievement incorporates the studies forming part of the research that Yurt and Polat conducted. The general composition of the studies concerning attitudes that were included in the meta-analysis are shown in **Table 2**.

A total of 28 studies that satisfied the criteria specified were included in the research regarding attitudes of students. These studies were found predominantly to focus on numerical disciplines (science and mathematics), were in the main conducted in the Central Anatolian region and were carried out mostly between 2001 and 2007.

Saban (2009) found that taking 2007 as a starting point, 148 academic theses had been conducted on the topic of multiple intelligence in Turkey, with 27 of these (18.24%) being written in English, 2 (1.35%) in German, and the

Table 3. Findings Concerning the Effect Size of the Meta-Analysis Conducted According to the Random Effect Model. (The Effect of Multiple Intelligence on Achievement)

Number of Studies (N)	Size Effect (ES)	Standard Error	Z	With a confidence interval of 95%	
				Lower limit	Upper limit
91	1.200	0.098	12.210***	1.007	1.392

Note: *p<.05, **p<.01, and ***p<.001

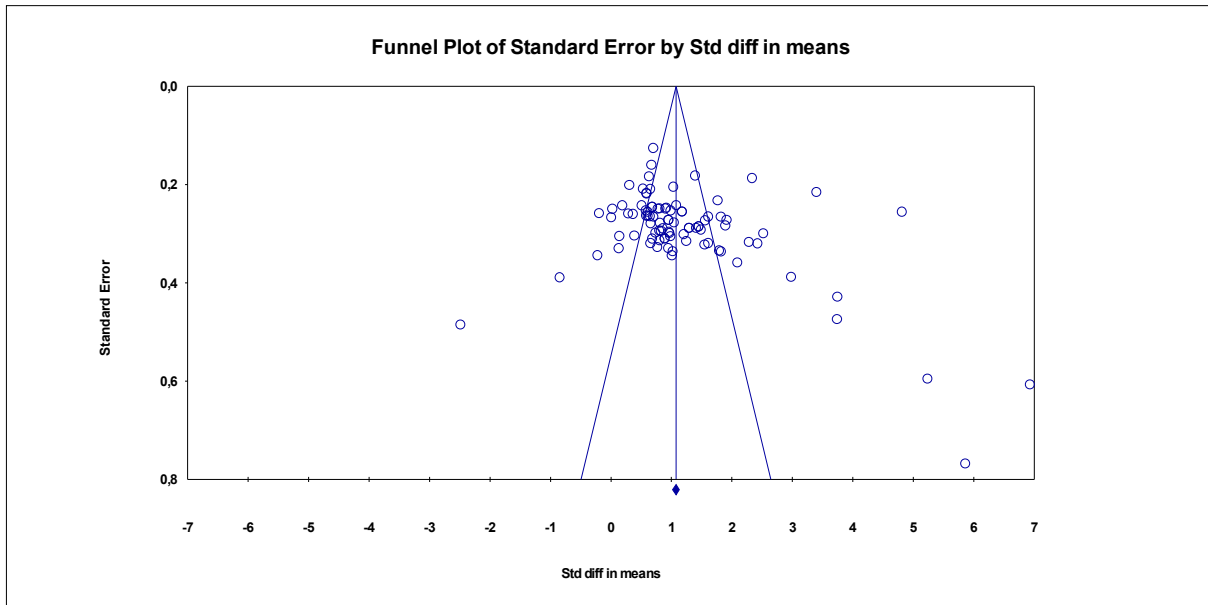


Figure 1. Funnel plot – meta-analysis for achievement

remaining 119 (80.40%) in Turkish. However, these numbers include several studies that had not actually reached completion. Between 1999 and 2007, a total of 18 articles had been written and published in Turkish on the topic.

The Effect of Activities Based on Multiple Intelligence Theory on Success and Achievement in Lessons

Using meta-analysis, the general effect and publication bias was tested. The level of differentiation of the studies was examined to decide whether the fixed or random effect model would be more suitable for this current research. Because of the analysis conducted, 91 studies were ($Q(90) = 1084,939, p < .05$) heterogeneous. The assumption of the H_1 value was that the Q value was significant, and so the fact that the studies differed from one another was confirmed. The degree of heterogeneity (differentiation) was found to be 92%. ($I^2 = \%91,705$). According to Cooper, Hedges, and Valentine (2009), in cases in which the I^2 value exceeds 75%, this means that the studies under observation are heterogeneous to a high degree.

In cases in which studies are found to be heterogeneous, the random effect model provides more effective results regarding the calculation of the common effect size in meta-analysis calculations. The breakdown of the results of the analysis conducted using the random effect model and the accompanying forest plot is provided in [Appendix 1](#). The results of the meta-analysis carried out in accordance with the random effect model are summarized in [Table 3](#).

According to the results of the analysis that was conducted in accordance with the random effect model, the value of the size effect was found to be significant ($Z = 12,210, p < .01$) with a confidence interval of 95%. The value of the average size effect was 1.200 and was found to be positive. Given such a case, the effect of the process could be said to be in favor of the experimental group. The success of individuals who had been educated in learning and teaching environments based on the Multiple Intelligence Theory was found to be higher than that of those who had not followed this approach.

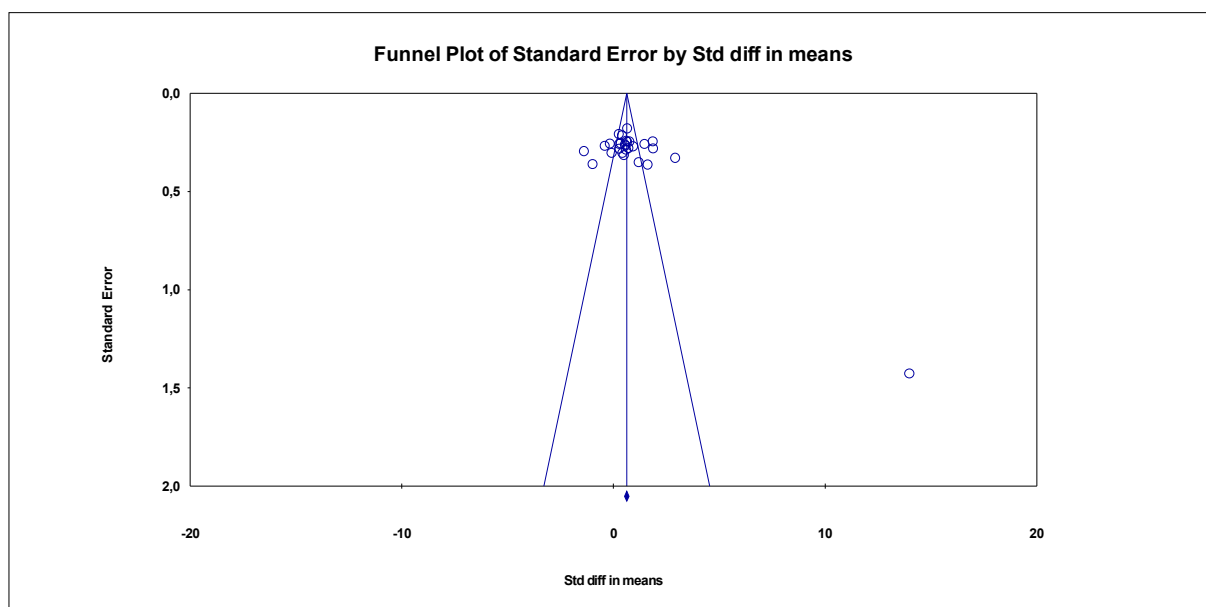
The degree to which publication bias is present may be examined through a funnel plot (graph). The graph highlighting the publication bias present in this study is shown in [Figure 1](#).

As can be seen in [Figure 1](#), the studies included for this research are congregated in the upper and internal parts of the graph. Furthermore, the studies do not appear in a symmetrical formation on both sides of the graph. Studies that spill over from (fall outside) the outline shape of the graph are those that have least effect for the effect size

Table 4. Findings Concerning the Effect Size of the Meta-Analysis Conducted According to the Random Effect Model (Multiple Intelligence-Effect on Attitude)

Number of Studies (N)	Effect Size (ES)	Standard Error (SE)	Z	Effect Size with Confidence Interval of 95%	
				Lower Limit	Upper Limit
28	0,770	0,176	4,382***	0,426	1,115

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

**Figure 2.** Funnel Plot Demonstrating the Degree of Publication Bias

and indicate deviation or bias. Deformation in the symmetry or shape of the graph represents an indication of publication bias.

To ascertain how many studies broke/distorted the symmetry of the graph, the Duval and Tweedie method was applied. According to this method, to achieve symmetry 23 studies had to be moved over to the right side of the graph. After carrying out this relocation of elements, the effect size was defined as 1.551. Thus, in a similar fashion to the meta-analysis research study that Yurt and Polat carried out in 2015, the studies included in this research were found to encompass a large degree of differentiation.

The Effect of Multiple Intelligence Theory on Attitudes towards Lessons

Using a meta-analysis method, the studies collected were analyzed for general effect and publication bias. Prior to deciding whether the fixed or random effect model would be chosen to analyse the data, the differentiation in the studies was analyzed. Because of the analysis conducted, 28 studies were found to be heterogeneous. In such a way, the H1 measure of assumption that the studies would differ from one another was confirmed as the Q variable was found to be significant. The degree of differentiation was found to be 91% ($I^2 = \%91,180$). Several scholars indicated that cases in which the I^2 variable exceeds 75% show that the sample is heterogeneous to a large degree (Cooper, Hedges, & Valentine, 2009; Karakus, 2018).

In cases in which the studies are found to be heterogeneous, meta-analysis conducted using the random effect model is seen to be more effective in providing reliable results regarding the calculation of the common effect size. The breakdown of the results of the analysis conducted using the random effect model and the accompanying forest plot are provided in [Appendix 2](#). The results of the meta-analysis carried out in accordance with the random effect model are summarized in [Table 4](#).

Because of analysis conducted according to the random effect model, the average effect size was found to be positive with a significant confidence interval of 95% ($Z = 4,382$, $p < .01$). In such a situation, the effect of the process can be said to be in favor of the experimental group. Thus, individuals who had undergone a process of education in learning and teaching environments that are based on Multiple Intelligence Theory were seen to be more positive in their attitudes towards lessons than those who had not been exposed to such an approach in their education.

The degree to which publication bias is present in the research can be examined using a funnel plot. The graph that demonstrates the publication bias in this research study is shown in [Figure 2](#).

Table 5. The Effect of Multiple Intelligence on Success and Achievement in Lessons with Regard to Moderating Factors

Moderating Factor	Degree of Moderating Factor	(N) Number of Studies	(ES) Effect Size	(SE) Standard Error	Z	Effect Size with Confidence Interval of 95%		Q _{between} (Q _b)	sd
						Lower Limit	Upper limit		
Distribution of Studies according to level of education	Primary	13	1.099	0.170	6.458***	0.766	1.433	1.018	3
	Middle School	50	1.220	0.144	8.444***	0.937	1.503		
	Secondary	23	1.278	0.210	6.076***	0.866	1.690		
	Higher Education	5	0.990	0.264	3.757***	0.473	1.508		
Distribution of studies according to fields of study	Dil Alanı Dersleri Language Lessons	10	1.315	0.292	4.496***	0.742	1.888	1.472	3
	Numerical Disciplines (mathematics and Science)	59	1.121	0.129	8.717***	0.869	1.373		
	Humanities	18	1.377	0.179	7.687***	1.026	1.729		
	Sports and Arts	4	1.195	0.518	2.310*	0.181	2.210		
Distribution of studies according to geographical region	Eastern Anatolia	6	1.254	0.356	3.524***	0.557	1.952	9.346	6
	Central Anatolia	32	0.917	0.118	7.772***	0.686	1.148		
	Mediterranean	9	1.774	0.317	5.595***	1.153	2.396		
	Aegean	16	1.286	0.254	5.067***	0.789	1.783		
	South-Eastern Anatolia	4	1.397	0.542	2.577*	0.334	2.460		
Distribution of studies according to year of publication	Black Sea	12	1.579	0.426	3.709***	0.745	2.414	0.016	1
	Marmara	12	1.011	0.255	3.968***	0.512	1.511		
	2001–2007	72	1.206	0.109	11.019***	0.991	1.420		
	2008 and later	19	1.174	0.230	5.109***	0.724	1.624		

Note: *p<.05, **p<.01, and ***p<.001

As can be seen in Figure 2, the great majority of studies included in the research are collected in the upper part, while all of them are congregated in the internal part of the graph. Furthermore, the graph is not symmetrical on both sides of the graph. A distortion or a break in the symmetry represents an indication of publication bias. To ascertain how studies may break the inherent symmetry, the Duval and Tweedie Method was employed. According to this method to ensure symmetry, 23 studies needed to be moved to the right side of the graph. After carrying out this alteration, the effect size was calculated at 1.173. Considering this adjustment as the classification method of Cohen, Manionm, and Morrison (2007) suggested, a result may be reached that indicates a greater effect size than the one hitherto measured.

Effect on Success and Achievement with Regard to Activities Based on Multiple Intelligence Theory and Attitudes to Lessons-Moderating Factors

The success and achievement of individuals who had undergone a process of learning based on Multiple Intelligence Theory was analyzed to ascertain whether differences existed with respect to the level of education, the lesson subject, the geographical region and/or the year of publication. The results are summarized in Table 5.

In an analogous manner, those individuals who had undergone a learning and teaching process based on Multiple Intelligence Theory were examined to see whether differences existed in terms of the level of education they had reached, lesson subjects, geographical region or year of study. The results are summarized in Table 6.

Table 6. The Effect of Multiple Intelligence on Attitudes towards Lessons in Accordance with Moderating Factors

Moderating factors	Degree of Moderating Factor	(N) Number of studies	(ES) Effect Size	(SE) Standard Error	Z	Confidence Interval of 95%		Q _{between} (Q _b)	sd
						Lower Limit	Upper Limit		
Distribution of studies with regard to level of education	Primary	5	0.652	0.311	2.096*	0.042	1.262	3.782	2
	Middle School	19	0.952	0.245	3.888***	0.472	1.432		
	Secondary	4	0.283	0.242	1.171	-0.191	0.758		
	Language lessons	3	-0.433	0.521	-0.830	-1.455	0.589		
Distribution of studies according to fields of study	Numerical disciplines (Science and Mathematics)	16	1.040	0.231	4.497***	0.587	1.493	9.789*	3
	Humanities	7	0.985	0.284	3.473**	0.429	1.541		
	Sports and Arts	2	-0.282	0.658	-0.428	-1.572	1.008		
	Central Anatolia	10	0.619	0.234	2.646**	0.160	1.077		
Distribution of studies according to Geographical Region	Aegean	8	0.532	0.243	2.186*	0.055	1.009	50.160***	5
	South-Eastern Anatolia	3	-0.041	0.622	-0.066	-1.259	1.177		
	Black Sea	3	0.747	0.391	1.909	-0.020	1.514		
	Marmara	3	4.015	1.205	3.331**	1.652	6.377		
Distribution of studies according to year of publication	2001–2007	25	0.899	0.176	5.099***	0.554	1.245	4.476*	1
	2008 and later	3	-0.372	0.575	-0.648	-1.499	0.754		

Note: *p<.05, **p<.01, and ***p<.001

On examining **Table 5**, the observation can be made that no significant difference in terms of moderating factors exists regarding the level of education, the lesson subject, the geographical region or the year of study of the publication of studies ($p>.05$). No difference can be ascertained between the success in lessons between those students who underwent a learning-teaching process based on Multiple Intelligence Theory and those who had experienced traditional learning-teaching processes in terms of level of education, lesson subject, geographical region or year of publication of the studies.

On analysis of **Table 6**, the observation can be made that the level of education did not, as a moderating factor, create a significant difference on educational performance ($p>.05$) while the lesson subject, the geographical region and the year of publication of the studies did render a significant difference as moderating factors ($p<.05$, $p<.01$, $p<.05$). The findings regarding the attitudes of those students who had experienced a process of learning-teaching based on Multiple Intelligence Theory and those who had undergone a more traditional learning-teaching process were:

1. Little difference was found between studies regarding the different levels of education.
2. A difference was found in the studies carried out regarding different lessons. While little difference was recorded regarding attitudes towards language lessons or sports or arts lessons, difference in attitudes were discovered in the fields of the sciences and humanities. These differences in attitudes were in favor of the experimental group.
3. Differences in the studies were recorded regarding different geographical regions. While no differences in attitudes were found in South-East Anatolia and the Black Sea regions, in studies carried out in the Central Anatolian, Aegean and Marmara regions, differences in attitudes were discovered. These differences were in favor of the experimental group.
4. The studies differed according to the years in which they were conducted. While those studies carried out in 2008 and afterwards did not demonstrate differences in attitudes, those conducted between 2001–2007 showed noticeable differences. These differences were in favor of the experimental group.

CONCLUSIONS AND RECOMMENDATIONS

Before carrying out the meta-analysis for this research, the criteria for which studies were to be included in the research were stipulated. The research was conducted using a total of 91 studies that satisfied the stipulated criteria, 91 of which addressed the factor of success and 28 that dealt with the factor of attitude. These studies were related to a particular focus on the level of secondary/middle school, predominantly were focused on mathematics and science lessons, and were carried out predominantly in the Central Anatolian Region between 2001 and 2007.

The average effect size was calculated according to the random effect model. The reason for this was the apparent heterogeneity (differentiation/variation) in the studies. On analysis of the results, learning and teaching techniques based on Multiple Intelligence Theories were seen to have an effect on success, and those students

subjected to such techniques were found to be more successful than those who had not undergone such a process with a confidence interval of 95%, $Z = 12,210$, $p < .01$. The value of the average effect size was calculated at 1.200 and found to be positive. Similar results were reached in the meta-analysis studies that Yurt and Polat (2005) conducted. The researchers determined that the academic success of the group that had been exposed to activities based on the Multiple Intelligence Theory was higher than that of the group for which traditional methods had been employed.

Applications based on Multiple Intelligence Theory were found to have an effect of a positive nature, and those students who had undergone such experiences were found to have more positive attitudes to learning than those who had not ($Z = 4,382$, $p < .01$ with a confidence interval of 95%). The value of the average effect size was calculated at 0.7770 and designated as positive.

The effect sizes were calculated as part of this research, which when arranged according to the principles of classification that Cohen, Manion, and Morrison (2007) set out, were found to be either moderate or strong in nature.

According to the findings of the research, Multiple Intelligence Theory influences academic success in a positive fashion. Methods based on the principles of Multiple Intelligence Theory have been applied since the start of the 2000s. However, an examination of the performance of students on a country-wide basis in national examinations (level placement examinations at middle school level or at high school level for university entrance) reveals that a steady decline in the number of questions answered correctly and overall marks at such vital tests can be observed. Such a state of affairs gives pause for thought. The carrying out of detailed studies on this phenomenon may serve to bring more clarity to the issue.

As regards the effect size, the studies on an individual basis that have shown the greatest effect in favor of the experimental group with regard to the success of the application of multiple intelligence have been those conducted by the following researchers: Akcin (2009), Altinsoy (2011), Alegre Ansuátegui, Moliner, Miravet, Lorenzo, Valentín, and Maroto, (2018), Azap (2012), Babacan, (2006), Balim, Sahin-Pekmez, and Ozacik-Erdem (2004), Basli (2006), Bumen (2001), Cepni (2010), Dogan (2004), Gok-Altun (2006), Isik (2007), Iflazoglu (2003), Karakoc (2006), Karakoc and Sezer (2007), Karatekin (2006), Korkmaz (2001), Korkmaz (2010), Koksai (2005), Koroglu and Yesildere (2004), Kurt and Temelli (2011), Kurt, Gumuş, and Gunay-Ermurat (2011), Kurtcuoglu (2007), Nacakci (2006), Ozacik-Erdem (2003), Saydam (2005), Sivrikaya and Kaya (2009), Sakir (2013), Sengül (2007), Tasezen (2005), Turkmen (2005), Turhan (2006), Uzunoz and Akbas (2011), Yagci (2006), Yavuz (2010), Yekrek (2006), Yildirim and Tarim (2008), Yildirim (2006), and Yildirim, Tarim, and İflazoglu (2006) . The effect sizes of these studies can be seen to be significant. Because of a meta-analysis, the studies that favored the control group were also determined. These were the studies that Durmus-Hepyasar (2006) and Elmaci (2010) completed.

When examining the effect size of each study, the studies that were most in support of the experimental group regarding the effect of multiple intelligence applications on attitudes were Bumen (2001), Gazioglu (2006), İflazoglu (2003), Korkmaz (2001), Tasezen (2005), Turhan (2006) and Yekrek (2006). Considering the meta-analysis, the studies that also underlined the significant effect sizes in favor of the control group were those of Epcacan (2013) and Gorucu (2007).

The studies included within the scope of the research were distributed around the upper and internal parts of the graph and were spread in a symmetrical fashion on both sides of the graph. Furthermore, the studies that had little effect on the common effect and those that showed (publication) bias were also determined.

Within this current study, the moderating factors were taken to be level of education, the lesson subject that the study dealt with, the type of publication, the geographical region and the year of publication. None of these moderating factors were found to have a great effect on the success of the applications based on the Multiple Intelligence Theory. In Yurt and Polat (2015) and Carothers and Parfitt (2017)'s study, the educational levels were designated as primary and secondary education, and they found that no significant difference was registered regarding level of education. A comparison was also made with reference to the type of lesson, and this also rendered no significant difference in the findings of the research. The researchers also employed a different approach that used the duration of the experiment and the type of publication as moderating factors. They did not find any differences regarding the type of publication but did establish differences concerning the length of application of the experiment. Success was seen to rise as the duration of the application of the experiment was increased.

This situation is different with respect to studies conducted into attitudes towards learning. In the studies conducted concerning attitudes to learning the moderating factor of educational level did not create any difference. While multiple intelligence applications did not exert any influence on language lessons or for sports and arts, they did create difference in attitudes towards numerical and humanities disciplines. In addition, while there were no differences recorded in studies conducted in the South-Eastern Anatolian or Black Sea regions, differences in attitudes were observed in the Central Anatolian, Aegean and Marmara regions. These differences were in favor of the experimental group.

Furthermore, no difference was recorded in attitudes in the studies in 2008 and later years, differences were found in the attitudes included in studies between 2001 and 2007. These differences were found to be in support of the experimental group. The years 2001 to 2007 were those in which applications based on the Multiple Intelligence Theory were first put into practice. In fact, from 2008 onward, applications have been based on the multiple intelligence system and/or the number of studies conducted after 2008 and that deal with this subject should easily be accessible for observation. This is because it is likely that, even within the group taken to be traditional learners, the group can be assumed on the part of those charged with putting new concepts into practice to have reached a certain maturity about exposure to applications based on Multiple Intelligence Theory. Moreover, the fact that an Educational Sciences Institute exists and that many master's/postgraduate students are accepted onto programs at universities situated in the Turkish capital of Ankara are also factors that influence the results of this research. This may be the reason why most of the studies included in this research have been conducted in the Central Anatolian region. The small number of studies carried out in the South-East Anatolian and the Black Sea regions may also be one reason why little significant differentiation is found between the studies in these regions.

A repetition or revision of this study may be suggested to enlarge its scope by including studies carried out abroad. Furthermore, this research could be conducted again taking into consideration only studies written in a thesis or an article format. In the case of such an endeavor being undertaken, it may also prove beneficial to revise the study, incorporating updates and developments from congresses and conferences.

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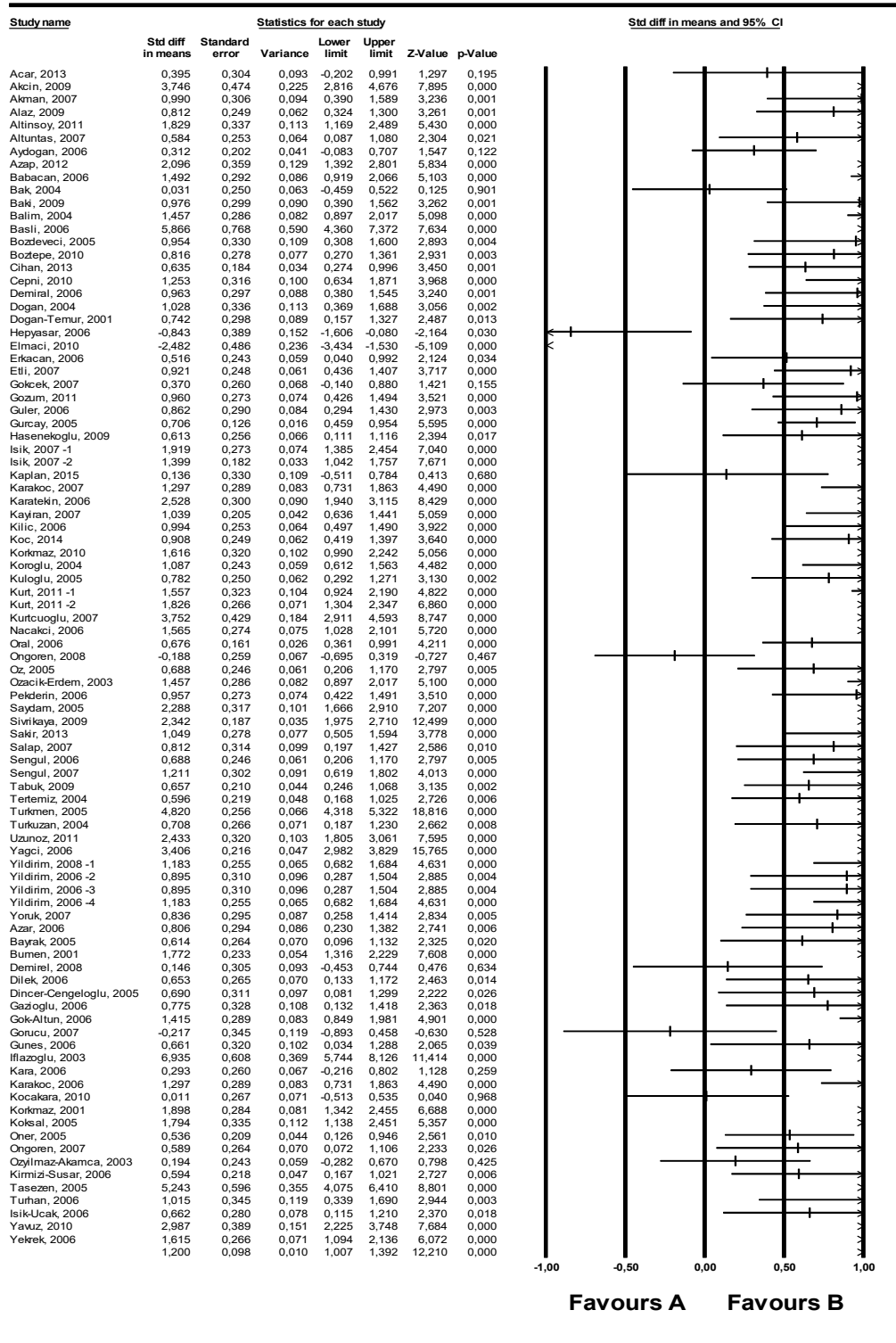
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APPENDIX 1

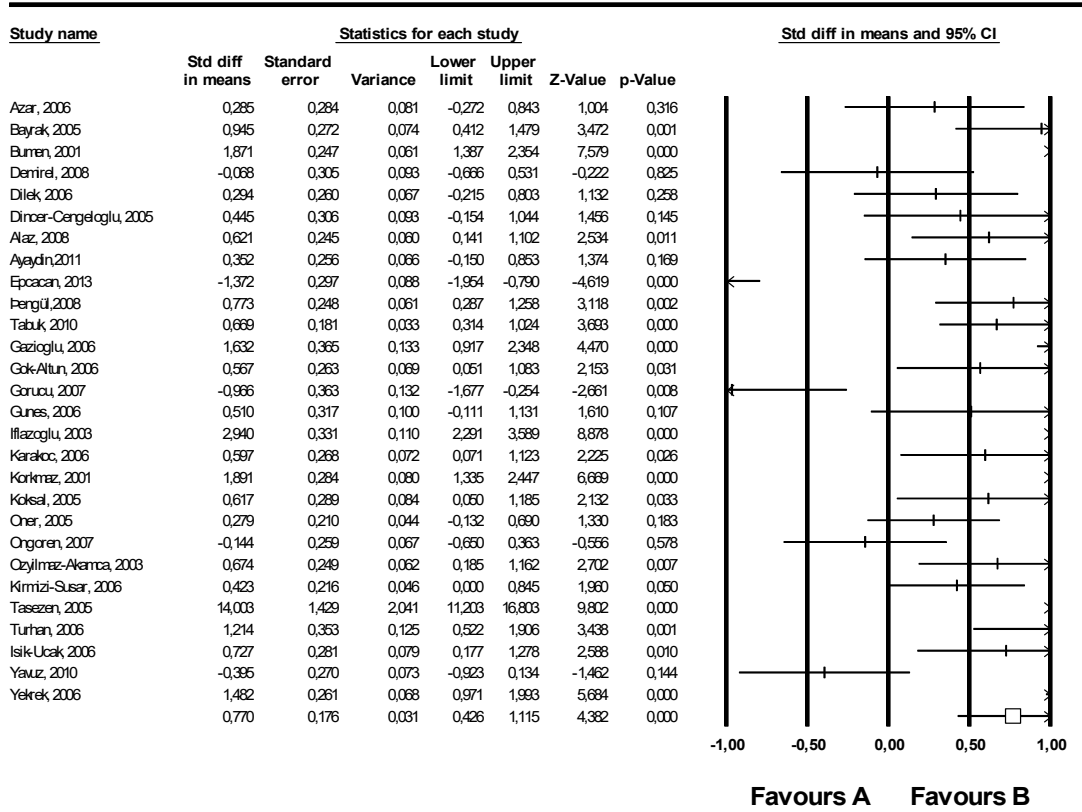
The Effect of Learning-Teaching Process Based on Multiple Intelligence Theory on Academic Success, Statistics for Each Study and Forest Plot



Meta Analysis

APPENDIX 2

The Effect of Learning-Teaching Process Based on Multiple Intelligence on Attitude, Statistics for Each Study and Forest Plot



Meta Analysis

<http://www.ejmste.com>