 Anthropologist, 21(1,2): 202-212 (2015)

A Meta-analysis into the Effectiveness of Doctoral Dissertations on Constructivist Learning

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KEYWORDS Academic Achievement.Effect Size. Level of Schooling. Random-effects Model. Type of Subject

ABSTRACT This paper aims to combine the results obtained by studies conducted independently of each other on constructivist learning in Turkey. The question the study seeks to answer is expressed as: "Does constructivist learning approach affect students' academic achievement?". In this context, the literature research was made between 2001 and 2013, and 27 doctoral dissertations written in Turkish about the effect of constructivist learning on students' academic achievement were included in the meta-analysis. In line with the determined criteria, the 27 doctoral dissertations conducted on the effect of constructivist learning in Turkey, it can be said that the applied constructivist education has an effect on academic achievement in the classification framework of Cohen and it is located in the wide interval which is the highest level. Following meta-analysis, it was concluded that constructivist learning approach was effective in terms of academic achievement in the positive direction.

INTRODUCTION

In line with the recent developments in the world, constructivist philosophy in education started to be applied in Turkish Education System and behaviorist approaches in education were replaced by progressivist approaches. Starting from the academic year of 2004-2005, the learning-teaching environment was shaped by this, accordingly. The teaching process that emerged has favored active physical and cognitive participation of the students instead of passive acquisition of information from their environment.

The constructivist learning is a process which establishes a dynamic link between human brain and its environment; it places the learner in the center, around which knowledge is constructed (Doganay and Tok 2007; Kazu and Aslan 2012; Koc 2007; Oguz 2005; Saban 2004; Yurdakul 2005). In this context, The Ministry of National Education defends that the current training programs are based more on constructivist approach than on behaviorist approach (Boydak 2009; Celik 2006; Demirel 2005; MEB 2005; Sunbul 2010; Turan 2006). For instance, an inspection of course books showed that there is at least one type of activity related to each learning objective (Gunay 2013). Further, the classes given at Faculties of Education incorporate contents which are prepared according to the new approach. Many post-graduate theses have focused and continue to focus on the effectiveness of constructivist learning. The studies that looked at constructivist learning often include notions such as the effectiveness of constructivist learning, its effect on student achievement, the success of the activities in practice, and teacher views (Demirdis et al. 2010; EARGED 2008; Isik et al. 2015; Kirikkaya and Bozkurt 2012; Ozgen and Alkan 2011; Ozsevgec 2006; Yalcin and Bayrakceken 2010). Accordingly, constructive approach is considered very important for the effective conduct of educational programs.

In the literature related to the effectiveness of constructive approach, there are research findings which indicate that constructive learning increase academic achievement in our country. (Aggul-Yalcin 2010; Ari 2008; Bulut 2009; Inan 2009; Koc 2002; Mant 2007; Mercan 2012; Pektas 2008; Savas 2006; Uredi 2015; Uredi and Akbasli, 2015; Yurdakul 2004). However, other than the independent variable, in experimental studies there may be some variables which influence the dependent variable. For instance, while investigating the effect of constructive learning on student achievement, the student's extra-curricular activities or the teacher's actions may have an effect on the outcome of learning. Therefore, the findings gleaned from experimental and mixed studies should be meticulously analyzed and interpreted.

The ever-increasing number of studies and the diversity of information make it increasingly

difficult to inspect the sources one by one, and reach the information which is sought for. Therefore, a research approach is required for more accurate interpretation of all findings and for guiding new research. With such abilities, meta-analysis is the right method to serve this purpose. Meta-analysis is a quantitative method that is used to combine research results. Scientists and academicians state that only one study or experiment does not provide the correct answer to the research question (Hedges and Pigott 2004). And due to insufficient amount of money, time, staff and expert researchers, it is not always possible, in many scientific disciplines, to conduct studies with larger samples representing the population. As a result, the studies are mostly conducted with small samples at different times (Wolf 2006). Upon inspection of the literature, the researchers see that there are similar studies with different samples; and after compiling these studies taking as basis certain criteria, the researchers see that they can give inconsistent results (Smith et al. 2006). However, with meta-analysis, it is possible to analyze summary statistics of quantities that belong to different studies, such as standardized effect sizes, correlation coefficients and p values. (Hunter and Schmidt 2004). The difference of meta-analysis from other literature research methods is that it collects and combines study findings and uses statistical methods in their analysis. (Glass et al. 2011). Meta-analysis studies employ all the effects in the statistical analysis in the calculation of the general effect, and help us discern the difference between real distribution and unreal distribution (Borenstein et al. 2011).

This paper aims to combine the results of studies conducted independently of each other on the effectiveness of constructivist learning. A more detailed and comprehensive approach is needed in the literature in order to classify and construe the contents of studies (Demirel 2005). It was established that meta-analysis could provide explanations for certain unexplainable situations due to the non-generalizability (external validity) of the studies on their own to the whole population (Hedges and Pigott 2004). In this context, this paper aimed to provide clarification to the doctoral dissertations made on constructivist learning in Turkey. What is more, the paper aimed to make a contribution to the literature by inspecting studies on constructivist learning at doctoral level in Turkey and show the "big picture" to the researchers.

Although there are numerous meta-analysis studies abroad, there are but few meta-analysis studies conducted in Turkey in the field of education (Camnalbur and Erdogan 2008; Cogaltay et al. 2014; Gozuyesil and Dikici 2014; Okursoy 2009; Ozcan and Bakioglu 2010; Sahin 2005; Topcu 2009). Tokgoz and Yildirim's (2011) study titled "Instructional Planning Research Studies: A Meta-Analysis Study" showed that the literature consisted mostly of quantitative publications and their results were analyzed descriptively. Ustun and Eryilmaz (2014) stated that meta-analysis both provided guidance to policy makers in education by giving scientific evidence and guided researchers in their reports by calculating inconsistent results in the literature with statistical methods. This paper supports the limited number of meta-analysis studies in the literature. Accordingly, the available meta-analysis research was extended to include the experimental studies conducted on the effectiveness of constructivist learning. Moving from this standpoint, the main objective of the paper is to attain the effect size of academic achievement in classes which were held with the constructivist learning approach. Twenty-seven studies were considered in order to comment on the effect of constructivist learning and the following research questions were constructed in the scope of the paper:

i. What is the effect of constructive learning on students' academic achievement?
ii. Is there a significant difference between the effect sizes of constructivist learning in terms ofstudents' level of schooling (primary, secondary, high school, university)?
iii. Is there a significant difference between the effect sizes of constructivist learning in terms of the type of subjects (Mathematic, Science and Technology, Child Development, social sciences, Turkish, Art) which the research covered?
iv. Is there a significant difference between the effect sizes of constructivist learning in terms of the cities where the research conducted?

METHODOLOGY

This paper employed the meta-analysis method in the analysis of data. Meta-analysis is the process of synthesis and interpretation of findings from individual studies (Buyukozturk et al. 2009; Glass et al. 2011). The method is realized in

three stages in general. These being: (i) Determining and sorting the related research, (ii) Coding the research data and calculation of their effect sizes, (iii) Statistical analysis of effect sizes and interpretation of data (Hoffler and Leutner 2007).

Collection of Data and Literature Research

In order to determine the effect of constructivist learning on academic achievement, in the scope of this research, the studies on constructivist learning conducted between 2001 and 2013 were inspected. The studies marked with an asterisk (*) in the references section of this research were included in the meta-analysis. The first study was accessed for the purpose on 28 February 2014 and the last was accessed on 30 April 2014. The following criteria were employed in the decision of what studies to include in the research:

1. In order to determine the level of effectiveness of doctoral dissertations on constructivist learning published between 2001 and 2013 in Turkey, only available studies were analyzed. The reason why this dates are included is that there are doctoral dissertations about constructivist learning only between 2001 and 2013 in Turkey.
2. Related studies include only the doctoral dissertations accessible from National Thesis Center, Council of Higher Education.
3. Studies with treatment and control group were included in the current research. Constructivist learning was applied in the treatment group, while the control group incorporated studies which constructive learning was not applied.
4. In studies where there were more than one test group, the group in which constructivist learning was applied was accepted as the treatment group.
5. In order to be able to calculate effect sizes, studies which lack arithmetic means, standard deviations, and participant numbers were discarded.
6. In studies where more than one test was applied, the data from a random test were analyzed.
7. To collect data, CoHE National Thesis Center was scanned for doctoral dissertations with the key words, "constructivism", "constructivist approach", "constructivist education", and "constructivist learning".
8. Initially, 89 studies were accessed. However, upon controls it was seen that some of these studies were qualitative and some lacked a control group, while some did not have the statistical data required for effect sizes.
9. Consequently, 27 experimental and semi-experimental studies that conformed to the criteria formed the samples in this research.

Coding of the Data

At first, an electronic form was created in which all studies were coded. The coding was in two phases. In the first phase studies were given an identity. To classify the studies on Microsoft Excel, the names of the authors, the year of the paper, level of schooling, type of subject, and the city where the study is conducted were determined. Every title was further divided into sub-titles and number coded. For example, the title "level of schooling" was divided into categories and these were coded with numbers as the following: "1= Pre-school, 2=Primary School, 3= Secondary School, 4= High School, 5= University". In the second phase, there are arithmetic means, standard deviations, and sample size values which were obtained from treated and control groups.

Variable

The effect sizes used in the studies were included in the meta-analysis. These were related to the effectiveness of constructivist learning and were defined as dependent variable. Effect size is defined as frequency of occurrence of a certain effect in a study or of a phenomenon in the society (Tarim 2003). Independent variables (study characteristics) used in the data analysis were the students' level of schooling, the year the studies were conducted, types of subjects, the cities where the study was conducted and number of samples.

Data Analysis

The effect sizes of the studies included in the meta-analysis were calculated. Model type was determined by looking at their effect size

and test of heterogeneity was applied. In the analysis of data, Procedural Effect meta-analysis method was applied. This method was used in the case of inspecting the difference between the groups and when the arithmetic means of dependent variables were obtained with different instruments. In this method, the difference between treatment and control groups was calculated using the formula, d= (Xe-Xc)/SD (Hunter and Schmidt 2004).

In the Procedural Effect meta-analysis method, standardized effect size values indicated by "d" and "g" were used. In the current study, "Hedges'd" was used in order to calculate the effect size. In the meta-analysis process, fixed-effects model was used in case of a homogeneous distribution of effect sizes, while random effect model was used in the case of a heterogeneous distribution (Ellis 2010). To conduct the analysis in this paper, the researchers employed SPSS 20.0, Comprehensive Meta Analysis and MetaWin Statistics programs.

FINDINGS

The effect sizes of 27 studies in this research were calculated using their sample sizes, standard deviations and arithmetical means. Data from a total of 2065 students were gathered in a total of 27 studies, 1044 of which were treated group and 1021 of which belonged to the control group. Table 1 shows the frequency and percentage information according to the variables, namely the year of the study, level of schooling, type of subject, and the city where the study was conducted.

A majority of the studies included in the research were conducted between 2007 and 2008 (25.93%). The distribution according to the cities in which the studies were conducted shows that there were 10 studies (37.04%) from Ankara and 4 studies (14.81%) from Izmir. Upon inspection of the levels of schooling used in the studies, the researchers see that the majority of dissertations were at the level of University (40.74%). These were followed by six dissertations focusing on Secondary school (22.22%) and High school (22.22%). In terms of the types of subjects the studies looked at, the researchers see that the majority is Science and Technology (18.52%) with 5 dissertations focusing on it.

On the other hand, the standard error and variance values of the studies were combined in a shared table. Figure 1 shows the respective confidence intervals, effect sizes of each of the

Table 1: Frequencies and percentages of the studies according to variables

Variable	*Frequency (f)*	*Percentage (%)*	*Variable*	*Frequency (f)*	*Percentage (%)*
Year of Study			*Level of Schooling*		
2001-2002	1	3.70	Pre-school	2	7.41
2002-2003	1	3.70	Primary school	2	7.41
2003-2004	1	3.70	Secondary school	6	22.22
2004-2005	2	7.41	High school	6	22.22
2005-2006	2	7.41	University	11	40.74
2006-2007	3	11.11	*Type of Subjects*		
2007-2008	7	25.93	Computer	1	3.70
2008-2009	2	7.41	Biology	3	11.11
2009-2010	3	11.11	Geography	1	3.70
2010-2011	2	7.41	Child Development	2	7.41
2011-2012	3	11.11	Religion and Moral Studies	1	3.70
City the Study was Conducted			Science and Technology	5	18.52
			Physics	1	3.70
Ankara	10	37.04	English	1	3.70
Bursa	1	3.70	Chemistry	1	3.70
Diyarbakir	1	3.70	Mathematics	2	7.41
Erzurum	3	11.11	Practicum Teaching	1	3.70
Istanbul	3	11.11	Art	2	7.41
Izmir	4	14.81	Social Sciences	2	7.41
Kastamonu	2	7.41	Agriculture (Elective)	1	3.70
Konya	1	3.70	Turkish	3	11.11
Kutahya	1	3.70			
Trabzon	1	3.70			

studies included in the meta-analysis as well as their weight on the total effect size.

In Figure 1, the researchers see the meta-analysis diagram (forest plot) that displays the effect sizes of doctoral dissertations which have not been combined yet. Effect sizes are depicted with squares; the longer the horizontal lines passing through them the wider is their confidence intervals. The arrows show confidence intervals which do not fit in the diagram. According to Figure 1, the widest confidence interval belongs to that of Pektas (2008). What's more, all 27 doctoral dissertations used in the research are seen to have positive effect sizes. Positive effect sizes indicate that the effect size favours the treatment group. Table 2 shows the homogeneous distribution value, average effect size, and confidence intervals of studies included in meta-analysis.

The effect of constructivist learning on academic achievement could be said to be in the positive direction with the effect size of 1.101 in fixed-effects model. The positive values of effect sizes show that the effect sizes of performances of this size favour treated group. If the result were negative, the effect size would favour control group (Wolf 2006: 26). Following the homogeneity test Q statistical value was found to be 361.830. From the Ch-square table 26 degrees of freedom were found to be 92.814 with a significance level of 95 percent. That is, as Q statistical value (361.830) exceeded the critical value of Chi-square distribution ($\chi^2_{(0.95)}$=92.814), the distribution of doctoral dissertations show heterogeneity according to fixed-effects model. If studies show heterogeneity according to Q statistical value, the studies are analyzed according to random-effects model with the aim to save the samples from heterogeneity.

On the other hand, in the current research, it was assumed that under the random-effects model, the real effects of the studies were the samples in real distribution. Therefore the data from the 27 studies in the meta-analysis were calculated according to random-effects model

Study Name	*Statistics for each study*							
	Hedges's g	*Standard error*	*Variance*	*Lower limit*	*Upper limit*	*Z-value*	*P-value*	*Hedges's g and 95% CI*
Acar (2008)	0.480	0.298	0.089	-0.104	1.064	1.612	0.107	
Altas (2012)	1.955	0.258	0.066	1.450	2.460	7.587	0.000	
Ari (2008)	0.721	0.187	0.035	0.354	1.089	3.852	0.000	
Aydin (2011)	1.374	0.296	0.088	0.793	1.955	4.636	0.000	
Bakir (2010)	1.210	0.201	0.040	0.816	1.603	6.019	0.000	
Bay (2008)	2.889	0.348	0.121	2.207	3.571	8.308	0.000	
Bulut (2009)	0.726	0.310	0.096	0.119	1.332	2.344	0.019	
Buyuktaskopu(2010)	2.935	0.321	0.103	2.306	3.564	9.150	0.000	
Erdem (2012)	3.185	0.415	0.172	2.372	3.998	7.676	0.000	
Hancer (2005)	0.893	0.272	0.074	0.359	1.426	3.282	0.001	
Hasiloglu (2009)	1.009	0.308	0.095	0.405	1.612	3.274	0.001	
Inan (2009)	1.600	0.227	0.052	1.154	2.045	7.037	0.000	
Kaya (2010)	2.608	0.323	0.104	1.974	3.241	8.069	0.000	
Kildan (2008)	0.592	0.153	0.024	0.291	0.892	3.858	0.500	
Kizilabdullah (2008)	0.182	0.270	0.073	-0.348	0.712	0.674	0.168	
Koc (2002)	0.205	0.149	0.022	-0.087	0.497	1.878	0.000	
Kucukavsar (2010)	1.222	0.262	0.069	0.709	1.736	4.670	0.001	
Mant (2007)	1.825	0.529	0.280	0.787	2.852	3.447	0.000	
Mercan (2012)	1.800	0.278	0.077	1.255	2.344	6.486	0.000	
Ozden (2012)	5.046	0.417	0.174	4.230	5.863	12.110	0.616	
Pektas (2008)	0.211	0.421	0.177	-0.613	1.036	0.502	0.000	
Savas (2006)	1.636	0.273	0.075	1.101	2.171	5.994	0.263	
Semenderoglu(2012)	0.364	0.325	0.105	-0.273	1.000	1.120	0.661	
Turgut (2005)	0.103	0.235	0.055	-0.358	0.564	0.439	0.000	
Yalcin (2010)	1.048	0.195	0.038	0.666	1.429	5.381	0.002	
Yurdakul (2004)	0.773	0.249	0.062	0.286	1.261	3.108	0.000	
Zor (2008)	2.240	0.303	0.092	1.647	2.834	7.397	0.000	
Fixed	1.116	0.049	0.002	1.020	1.212	22.776	0.000	

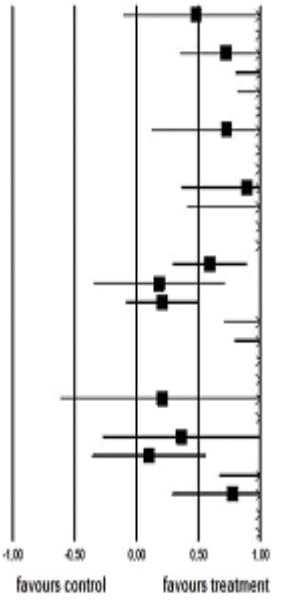

Fig. 1. Meta-analysis diagram showing the effect direction of the studies (Forest Plot)

Table 2: Homogeneity values and effect sizes of studies included in the meta-analysis according to their effect models

Model type	*N*	*Z*	*Average effect size (ES)*	*Total heterogeneity value (Q)*	*95% confidence interval for effect size*	
					Lower Limit	*Upper Limit*
Fixed-effects	27	22.244	1.101	361.830	1.004	1.198
Random-effects	27	7.377	1.391	361.830	1.022	1.761

and gave the following results; standard error was calculated to be 0.189, the lower limit of 95 percent confidence interval was 1.022, the upper limit was 1.761 and the effect size value was ES= 1.391. Upon z-test done in order to calculate statistical significance, z was found to be 7.377. Accordingly with p= 0.000, it can be said that the analysis was statistically significant. The effect size is in the wide interval according to Cohen's classification of effect size values, in other words, it can be said that constructive learning has a positive effect on academic achievement.

Effectiveness of Constructivist Learning According to Type of Subject

In order to determine whether the effect size of constructivist learning differs according to the subject type, 7 groups were determined including Mathematics, Biology, Child Development, Science and Technology, Social Sciences, Turkish, and Art. As there were not enough studies to demonstrate the effect size of other subjects, they were not given in Table 3. The analysis results of the 7 subjects given were shown in Table 3.

As per Table 3, the highest effect size according to the school type in which the studies were conducted belonged to Turkish with 2.338; and the lowest effect type belonged to Child Development with 0.398. Upon homogeneity test, Q statistical value was calculated as 4.236. From Chi-square Table, 6 degrees of freedom were found to be 8.581 at 95 percent significance. That means, as Q statistical value (4.236) was found to be lower than Chi-square critical distribution ($\chi^2_{(0.95)}$=8.581), the Subject Type distribution of doctoral dissertations showed homogeneity. That is, the distribution can be said to have a homogeneous structure. Therefore, it can be said that there is not a significant difference (Q_B = 4.236, p=0.498) in terms of the effect sizes between groups caused by the type of subject.

Effectiveness of Constructivist Learning According to Level of Schooling

In order to determine the effect of the level of schooling of the students acting as samples in doctoral dissertations on the combined effect size, the studies were divided into five different groups; namely, pre-school, primary, secondary, high school, and university. The analysis results according to 8these levels of schooling were given in Table 4.

As can be seen from the results of analysis given at Table 4, the highest effect size belongs to the Primary school group with 2.412, while the

Table 3: Homogeneity values and effects sizes according to school type the studies were conducted

Model type	*Effect size between groups (Q_B)*	*N*	*Effect size*	*95% confidence interval for effect size*	
				Lower limit	*Upper limit*
Type of Subject	4.236				
Mathematics		2	1.202	0.349	2.056
Biology		3	0.671	-0.015	1.358
Child development		2	0.398	0.018	0.779
Science and Technology		5	1.667	0.641	2.692
Social Sciences		2	1.211	0.356	2.065
Turkish		3	2.338	1.378	3.544
Art		2	2.182	1.657	2.708

Table 4: Homogeneity values and effect sizes of studies according to level of schooling

Model type	*Effect size between groups (Q_B)*	*N*	*Effect size*	*95% confidence interval for effect size*	
				Lower limit	*Upper limit*
Level of Schooling	2.489				
Pre-school		2	1.762	-0.560	4.083
Primary school		2	2.412	0.865	3.958
Secondary school		6	0.913	0.575	1.251
High school		6	1.122	0.721	1.523
University		11	1.685	0.903	2.468

lowest belongs to the Secondary school group with 0.913. However, homogeneity test between groups gave the value Q_B= 2.489. From the ChisquareTable, it was seen that at 95 percent significance level, 4 degrees of freedom were 6.052. That means, the distribution of level of schooling in doctoral dissertations is homogeneous according to the fixed-effects model as Q statistical value (2.489) was found to be lower than the critical value ($\chi^2_{(0.95)}$=6.052) of Chi-square distribution. Thus it can be said that the distribution has a homogeneous structure. Accordingly, the researchers can say that there is not a significant difference in terms of the effect sizes formed between groups due to levels of schooling.

The Effectiveness of Constructivist Learning According to the Cities the Studies Were Conducted

According to predetermined criteria, studies from five cities (cities in which at least 2 studies were conducted) were included in the meta-analysis. Thus, meta-analysis results for 5 groups representing Istanbul, Ankara, Izmir, Erzurum, and Kastamonu were shown in Table 5.

As can be seen from Table 5, the highest effect size (2.181) was in Erzurum, while the lowest (0.553) was in Kastamonu. The homogeneity test between the cities gave the value Q_B= 3.023. From the X^2 table, 4 degrees of freedom were found to be 5.589 at 95 percent significance level. That means, the distribution of doctoral dissertations in terms of the cities is homogeneous according to the fixed-effects model as Q statistical value (3.023) is lower than the critical value ($\chi^2_{(0,95)}$=5.589) of the Chi-square table. Thus it can be said that the distribution has a homogeneous structure. Accordingly, the researchers can say that there is not a significant difference in terms of effect sizes (Q_B = 3.023. p=0.687) between groups formed according to cities. In other words, the effectiveness of constructivist learning does not change according to cities.

DISCUSSION

According to the findings obtained from the paper, the effect size was found to be ES=1.391 in favour of constructivist learning. In line with the determined criteria, the 27 doctoral dissertations conducted on the effect of constructivist learning in Turkey, it can be said that the applied constructivist education has an effect on academic achievement in the classification framework of Cohen (1992) and it is located in the wide

Table 5: Homogeneity values and effect sizes as per cities where the studies were conducted

Model type	*Effect size between groups (Q_B)*	*N*	*Effect size*	*95% confidence interval for effect size*	
				Lower limit	*Upper limit*
City of study	3.023				
Ankara		10	1.240	0.718	1.761
Istanbul		3	1.938	-0.266	4.141
Izmir		4	0.991	0.358	1.623
Erzurum		3	2.181	0.900	3.462
Kastamonu		2	0.553	0.268	0.838

interval (1.10 < Cohen'*sd*< 1.45) which is the highest level. These results which are based on the doctoral dissertations made on constructivist learning in Turkey are consistent with many studies in the literature (Acar 2008; Bulut 2009; Hasiloglu 2009; Pektas 2008; Yalcin 2010; Yurdakul 2004). In the past, Schmidt et al. (2009) inspected via meta-analysis many studies made on this subject and found that constructivist learning was more effective in terms of learning than in cases where it was not used. On the other hand, the established heterogeneity of the data following homogeneity test shows that it cannot be generalized to the whole population. Consequently, sampling error, or size, or the existence of variables other than the researched variables could be the reasons that increase heterogeneity.

In the present meta-analysis research, it was also inspected whether effect sizes differed according to the types of subjects, levels of schooling, and the cities the studies were conducted in. When the data was analyzed in terms of the 7 different types of subject, namely, Mathematics, Biology, Child Development, Science and Technology, Social Sciences, Turkish and Art, it was seen that all subjects had positive effect size values. It was seen that the highest effect size belonged to Turkish, and the lowest effect size belonged to Chiled Development classes. It can be said that there is not a significant difference between effect sizes of groups (Q_B = 4.236, p=0.498) formed according to the subject type of the studies included in the meta-analysis. As a precise judgment cannot be reached since there were few studies that met the criteria on Mathematics, Child Development, Social Sciences, and Art, it is more plausible to say that these only gave information about the current situation. The data obtained related to the type of subjects give similar results with the studies by Batdi (2015), Gozuyesil and Dikici (2014) and Cogaltay et al. (2014). Similarly, no significance was observed in the meta-analysis study by Kablan et al. (2013) on the use of materials. On the other hand, there is no similarity with the findings from meta-analysis by Camnalbur and Erdogan (2008).

Upon meta-analysis on the levels of schooling of the samples; the results showed that the highest effect size belonged to primary school (2.414) level, and the lowest effect size was at secondary school (0.913) level. It can be said that there is not a significant difference (Q_B = 2.489, p=0.324) in terms of effect sizes between the groups formed by the levels of schooling in the studies included in the meta-analysis. Consequently, it can be said that there is no difference between the size effects of different levels of schooling and all inspected levels of schooling has high levels of contribution to the academic achievement. What is more, the effect sizes in terms of the levels of schooling are in adverse proportion with the number of studies. It was inquired if other meta-analyses conducted in Turkey showed significant differences in terms of levels of schooling. Accordingly, it was seen that effect sizes did not differ in terms of levels of schooling in meta-analyses by Okursoy (2009) on the studies on concept maps teaching strategies, by Sahin (2005) on internet-based education, and by Camnalbur and Erdogan (2008) on computer-assisted education. The findings in the present study are similar to the findings of other research inspected.

Following analysis according to the cities wherein the studies were conducted, the results showed that in terms of the effect sizes in cities where at least two studies were conducted, the highest effect size was in Erzurum with 2.181, and the lowest was in Kastamonu with 0.553. The researchers can say that there was no significant difference between the effect sizes of groups (Q_B = 3.023, p=0.687) formed according to the cities in the studies included in the meta-analysis. The reason why the effectiveness of constructivist learning is researched according to the cities in which studies were conducted is that meta-analysis is conducted with both significant and non-significant study samples, and it is sometimes witnessed that researchers construe the meaning of the effect seen only in one population and do not take other populations into consideration. Further, in determining the size of the real effect, accessing the whole of the observed distribution provides a diversity of samples and makes the result more generalizable (Borenstein et al. 2011). It must be noted that the cities where the studies were conducted belong to different regions in Turkey. This paper also made it possible to evaluate different cultures, values, and traditions together. Therefore, in the present study the effect sizes were studied according to the cities.

CONCLUSION

Based on the data obtained from meta-analysis, it was seen that constructivist learning approach has a considerably large effect on achievement. With random-effects model, not one effect was estimated by taking the mean of

effect distribution. Accordingly, it is recommendable to apply constructivist learning in educational settings by developing it further, as it attaches importance to learn how to learn, as it is based on progressivist education philosophy, and as it favours students' individual differences and progress; defends problem-solving, critical thinking, and entrepreneurship; treats the school as life itself and puts effective learning and guidance counselors on the foreground. It is expected that the present study will act as a guide to the researchers who study constructivist learning. In addition, it is promising that this learning approach is put into practice, incorporated in the system and gave its results in institutions that belong to The Ministry of National Education in Turkey. Consequently, it was concluded that constructivist learning approach was effective in terms of academic achievement in the positive direction, and that there was no difference in terms of the type of subject, levels of schooling and the cities the studies were conducted in.

RECOMMENDATIONS

In the light of the information above, the practicers are provided with some suggestions. The present paper of meta-analysis inspected the effect of constructivist learning only on students' academic achievement. Other researches who wish to conduct meta-analysis on this subject could look at the effect of constructivist learning on factors such as attitudes and motivation. They could even realize more comprehensive meta-analysis research. That is, besides doctoral dissertations, they could include master's theses, national and international articles and papers and compare meta-analysis results. Additionally, effect sizes could be calculated and compared between universities where these theses were prepared. Consequently, a more comprehensive result could be attained.

The relative scarcity of meta-analysis as a method employed in studies in the field of education in Turkey shows that the method is newly developing. Therefore, the use of other methods and models of meta-analysis in the prospective studies in the field will improve its usability. On the other hand, meta-analyses are readily being used in many other research disciplines. It could be used in pharmaceutical industry, criminology, psychology, and educational sciences for the diversity of causes; and it could not only be used in combining findings but also in supporting the use of these findings. It is the aim of meta-analysis to compare a study, after it is conducted, with others under normal conditions.

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