RESEARCH ON EDUCATION AND PSYCHOLOGY (REP)

Received: March 13, 2020
Accepted: April 27, 2020
http://dergipark.org.tr/rep

e-ISSN: 2602-3733

April 2020 ◆ 4(Specila Issue) ◆ 88-106

Research Article

Effect of Station Technique in Classroom Teaching: A Meta-Analysis Study

Füsun Gülderen Alacapınar[1]
Necmettin Erbakan University

Hatice Uysal[2]
Ministry of Education

Abstract

By applying meta-analysis method, the present article examines academic theses based on experimental design related to the station technique conducted in the period 2007-2019 and accepted by universities. Meta-analysis covered 15 postgraduate theses that are fit for the problem of the present study and have sufficient statistical data. Treatment effectiveness meta-analysis was used in data analysis. The effect of station technique on students' cognitive achievement, attitude and retention scores was examined. After meta-analysis calculations, station technique was found to have the effect size value of 0.865 on students' cognitive achievement/success scores, of -0.006 on attitude scores, and of 0.961 on retention scores. These values obtained from meta-analysis suggest that the effect size is large in achievement/success and retention, but negative and negligible in the case of attitude. Findings confirm that the use of station technique in class teaching has its positive effect, relative to the present teaching method, on both cognitive achievement/success and retention.

Key Words

Attitude • Cognitive achievement • Effect value • Station technique • Success

[1] **Correspondance to:** Füsun Gülderen Alacapınar (PhD), Department of Curriculum and Instruction, Necmettin Erbakan University, Faculty of Ahmet Kelesoglu Education, Konya, Turkey. Email: fusunmireli@yahoo.com **ORCID:** 0000-0001-7515-3851
[2] Ministry of Education, Konya, Turkey. Email: h.uysalll@hotmail.com **ORCID:** 0000-0003-3935-5899

Citation: Alacapınar, F. G., & Uysal, H. (2020). Effect of station technique in classroom teaching: A meta-analysis study. *Research on Education and Psychology (REP), 4*(Specila Issue), 88-106.

It is observed that the concept of learning in our times is shifting from behaviourist theories to cognitive theories. The basis of cognitive theories is more advanced behaviourist approach by reflecting individual's interaction with his environment and subjective interpretation of it (Başbay, 2005). The roles of teacher and student have changed along with the concept of constructivism adopted nationwide in Turkey starting from the academic year of 2005-2006. As an approach placing student at the centre, constructivism aims to establish a strong tie between the environment and human brain (Şaşan, 2002).

An interesting feature of the concept of learning based on constructivist approach is the change in education environments. In this approach, education environment is arranged in a way to motivate students to learning and attract their interest to the course. In constructivist class environments, approaches to learning such as cooperative learning and problem-based learning which allow for more interaction and make students more active in the process are utilized (Şaşan, 2002). Vygostky (1978) considers peer interaction in class as one of the most effective instruments in learning. Also, the importance of peer interaction is stressed particularly in learning concepts and acquiring general culture information. According to Vygostky, oral communication among students contributes them much in expressing themselves better and internalizing ideas that are hard to learn (Yılmaz, 2001).

Active Learning – Cooperative Learning

Active learning and cooperative learning are two concepts that supplement each other (Koç, 2000). The basic factor of active learning, which is an extension of student-centred education (Demirörs, 2007) is student activity and participation to the process of learning (Prince, 2004). Cooperative learning, in turn, is the key strategy to switch the role of the student from passive to active in the process (Johnson & Johnson, 2008). Cooperative learning is the name given to classroom techniques in which students work on learning activities in small groups and awarded or recognized according to the performance of their groups (Slavin, 1980). Student-student interaction cannot be ensured just by having students sit side by side. The essence is the quality of interaction (Yılmaz, 2001). In this learning technique students in groups are expected to share their ideas with each other, help others in solving their problems, discuss issues intellectually to reach a consensus and to contribute to group work to reach the objective (Johnson & Johnson, 2008).

Cooperative learning provides a natural environment for improving interpersonal skills (Prince, 2004). Among primary school children in particular, the positive effect of cooperative learning on academic performance derives from two characteristics: group objectives and individual responsibility (Slavin, 1989). Examining studies on cooperative learning, we find that students perform better in cooperative learning than in competitive and individual learning, grow more positive feelings towards each other and subjects and build their academic self-respect stronger (Johnson & Johnson, 1989, cited in Johnson & Johnson, 2008).

Station Technique

The station technique which is one of the techniques of active learning and also considered in the context of cooperative learning methods (Öztürk, 2019) is an important one providing for peer interaction. We see learning stations as a method that is recently used particularly in Europe. Learning at stations is a form of course where students work on a selected topic or topic is broken into its parts depending on the case and then parts are brought together (Demirörs, 2007).

Whatever may the subject be, it is important to take the bases as cooperative learning, active learning and student-centred teaching while developing "learning stations" since students take active roles in learning stations. It is a modern way of covering a course which, while allowing students to work independently, also gives them the chance of using tools and instruments, saving them from the monotony of just listening while on their desks, and serving to the retention of what has been learned thanks to its visual aspects (Demirörs, 2007). Conventional classes, on the other hand, where students remain silent and spend most of their time in school just sitting may prevent students' active participation and undertaking responsibility for their behaviour (Bottini & Grossman, 2005).

Station technique is a teaching-learning activity that proceeds by passing through specific phases in a topic and continues with activities that have been left incomplete (Alacapınar, 2009). Also called as "learning centres", station technique is defined by McClay (1996) as special spaces in class where students can work independently on in small groups to develop a concept, explore a subject or to improve a skill. While Köksal and Atalay (2017: 216) defines the technique as a *"student-centred method, teaching how to carry further what a prior group has done by ensuring the contribution of the whole class to each stage in the process"* Koca (2018: 12) maintains that station technique *"is a teaching technique which actually embodies many techniques in indirect ways and applied as a group to start something, to contribute to what has been started or to complete a process."*

Station technique makes interrelation of all courses possible and thus helps students to relate a specific topic to other courses, which encourages students to take a holistic and multi-dimensional look to life (Alacapınar, 2009). This technique making classes student-centred instead of teacher-centred is the way of responding to academic, social, emotional and physical needs of primary education students (McClay, 1996). Through learning stations, students learn by doing/experiencing and acquire fundamental practical skills and information. Learning stations heightens students' interest in courses facilitates the learning of complex issues in particular (Demirörs, 2007). Besides, student performance gets higher as their interaction reaches higher levels (Johnson & Johnson, 2008). These stations provide students opportunities to make choices, work in cooperation with others, participate to application exercises and to actively take part in learning (Bottini & Grossman, 2005). On the other hand, limitations of learning stations include considerable consumption of work and time and chaotic class situations which may arise if students are not appropriately guided about what they are supposed to do (Demirörs, 2007).

Examining findings in studies from the field literature we find that the advantages of this technique vis-à-vis students include the following: students finding the technique as pleasing (Abasız Tercan, 20019; Mergen, 2011; Sönmez, 2015); higher interest of students in the course (Alacapınar, 2009); noticing the importance of individual differences (Batdı & Semerci, 2012); stations' contribution to learning (Albayrak, 2016; Öztürk, 2019; Yüksel, 2017); beneficial in terms of ensuring students' learning from each other (Alacapınar, 2009; Güneş, 2009), enhancing students' self-confidence (Mergen, 2011; Yüksel, 2017); developing original ideas (Batdı & Semerci, 2012). There are also some negative aspects and limitations of the technique, however, which include: problems in group communication (Arslan, 2017; Demir, 2008; Mergen, 2011); noisy environment emerging in the process of application (Abasız Tercan, 20019; Arslan, 2017; Çakmak, 2018; Öztürk, 2019;

Sönmez, 2015); confusion while changing tables (Bozpolat & Arslan, 2017); exclusion of some students from the group (Çakmak, 2018); and timing problems at stations (Avcı, 2015; Batdı & Semerci, 2012).

Station technique helps teachers in clarifying concepts easier (Bulunuz & Jarrett, 2010). Still, this method requires serious planning. The aspects of the technique which may pose disadvantages to teachers include relatively long time necessary for preparing activities and possible deviation from the purpose when good planning is not made (Güç, Korkmaz, Çakır, & Bacanak, 2016).

Objective of the Study

With dozers of themes, there is rapid increase in the literature related to education. This is an indicator of the need for meta-analyses. For example, while ten studies may be sufficient to analyse a subject in biology, ten studies on computer supported teaching or reading may not yield the same outcome. It is because findings in education are much more fragile and variable depending upon too many factors (Glass, 1976).

The basic objective of the study along this line is to examine the outcomes of experimental academic theses on station technique in Turkey by using meta-analysis and to see the comparative effects of the station technique and existing teaching methods on student's cognitive achievement/success, attitude and retention scores. It was sought, through this meta-analysis, to bring together experimental theses with station technique and to reach a general conclusion. It is expected that this study will provide an overall picture of academic theses on station technique.

Problem Statement

In academic theses conducted in Turkey in the period 2007-2019 comparing groups with which station technique is applied and not applied, is there any significant difference in students' cognitive achievement/ success, attitude and retention scores?

Sub-problems

1. Is there any significant difference in students' cognitive achievement/ success scores according to meta-analysis of studies using/not using station technique based learning?
2. Is there any significant difference in students' attitude scores according to meta-analysis of studies using/not using station technique based learning?
3. Is there any significant difference in students' retention scores according to meta-analysis of studies using/not using station technique?

Literature Survey

In their study, Aydoğmuş and Şentürk (2019) sought to identify the effect of station technique on academic performance. The present study conducted with meta-analysis method covered 13 studies conducted in the period 2000 – 2018 to investigate the relationship between station technique and academic performance. The study found the effect of station technique on academic performance with the value of .84. This result suggests that station technique is much more effective than conventional teaching methods. The study also investigated the levels of effect of teaching practices with respect to teaching stage, duration of application, type of study and type of course. In this context, significant difference in effect size values could be found only with respect to

course type and teaching stage. While largest effect sizes are observed in sciences, technology, social studies and Turkish language, the lowest ones are in general chemistry and mathematics. Station technique has large, medium and small effect sizes, respectively, at primary secondary and higher education stages.

In their study, Aksoy and Aydın (2019) examined the effect of applying station technique to grade 5 sciences course on the academic performance of students. This study with pre/post-test control groups and semi-experimental design was conducted in the school year 2017-2018 with 28 students attending grade 5 in a state secondary school. The study shows that the application of station technique improved the academic performance of experimental group students in unit force and motion in sciences course and contributed positively to learning.

The study by Karacalı (2018) sought to collate studies on the use of learning stations technique in sciences teaching in Turkish schools and to describe how the technique is used in courses. The surveying reached 6 theses, 9 articles and 2 presentations which were examined with respect to their objectives, methodologies, conclusions and suggestions. Studies focusing on the use of learning stations technique in sciences teaching have been conducted by using combined methodology to determine the academic performance of students, performance in using the technique in courses, and the effect of the opinions of students and candidate teachers. The literature survey suggests that sciences teaching based on learning stations encourages group work, imparts notion of responsibility, supports the retention of knowledge and affects students' academic performance and attitude to station technique positively.

Güç et. al. (2016) investigated the effect of station technique on students' academic performance in mathematics and their opinion about the technique. The group studied consisted of 47 students attending a secondary school at central Giresun province in the school year 2015-2016. The study showed that the average level of performance of students with whom station technique was used was higher than others; but this different was not found as statistically significant. Interviews conducted later suggest that students' opinions on teaching mathematics with station technique are positive in general.

Batdı and Semerci (2012) investigated outcomes obtained from the reflective inquiry on station technique application; characteristics of the technique observed at the beginning of the course, during and after, suggestions made on the basis of observed shortcomings, negative and positive aspects of the technique and its potential in teaching. Descriptive analysis in the context of case study was also used in this research which was qualitative in nature. Outcomes suggest that station technique contributes to motivation in class, re-structure knowledge and ensure retention in learning.

Ocak (2010) sought to assess the effect of station technique in sciences and technology teaching on academic performance and retention levels of students. According to outcomes of the study which used pre and post-tests and control group, academic performance and retention scores of experimental group students were significantly higher that the control group.

In her study, Alacapınar (2009) sought to explore what station technique gives primary school 5th grade students in affective area and what kind of affective, cognitive and motional behaviour changes it brings along. According to survey findings students enjoy station technique in their class and find if different than other methods; the technique also supports communication, cooperative work, sharing and creativity and improves thinking skills.

Hall and Zentall (2000) examined the effect of station technique on mathematics homework completion and accuracy of secondary school students with homework problems. The participants were a math teacher and three students. The survey showed that students working with station technique improved in their homework submission and accuracy. Meta-analysis surveying technique is used in this study. Since it is based on numerical data, meta-analysis is a quantitative method differing from other literature surveying methods (Demiray, 2013). Meta-analysis means "analysis of analyses" (Glass, 1976). In other words, formulas used in meta-analysis are extensions of formulas used in studies covered by meta-analysis (Dinçer, 2014). In this method, a group work on a specific topic is systematically summarized with the help of statistical methods (Göçmen, 2004). It makes it possible to reach a single generalized comment on the basis of data obtained instead of interpreting the outcomes of meta-analysis one by one (Ekemen, 2017). Dinçer (2014) lists the steps in meta-analysis as follows: identification of the topic; literature search; identification of criteria and themes; formulation of survey questions; coding; analysis; calculation of effect size; heterogeneity test; model selection; assessment of overall effect and interpretation.

Data Collection Process

Theses covered by the study for the purpose of analysis consist of experimental surveys that aim to assess the effect of station technique in class teaching. The search of postgraduate theses asserted in Turkey was conducted on the internet site of YÖK National Thesis Centre in Turkish language (https://tez.yok.gov.tr/UlusalTezMerkezi/). Meta-analysis covers all experimental station technique theses that were conducted before January 2020. In addition, the meta-analysis include post-test control model theses. 19 such postgraduate theses were found and 15 of these were included in the study. The literature research did not include any doctoral thesis on station technique. All academic theses included in the study are experimental surveys comparing groups with which station technique was applied or not.

Data Analysis

In the statistical analysis of data, the meta-analysis method known as "Treatment Effectiveness" was used. The essence of this method is to compare the outcomes of many different and independent meta-analyses by transforming them into a common measurement unit and to reach a general conclusion by calculating an overall effect size (Topan, 2013). Effect size gives information about the degree to which an independent variable in a survey affects a dependent variable either positively or negatively (Dinçer, 2014). In fact, meta-analysis requires the expression of survey outcomes as degree of effect. Effect size is the transformation of analyses from studies with different individuals and groups into the same common unit (Sönmez & Alacapınar, 2014). In effect size calculation in this study "Hedges' g" was used and results obtained were interpreted according to Cohen's d. Cohen (1988) defines effect sizes as "small" when in the interval 0.2-0.50, "medium" in 0.5-0.80, and "large" if it is 0.80 and over. Also used in interpreting survey findings is the effect size classification made by Thalheimer and Cook (2002). Thalheimer and Cook (2002) classify effect sizes (ES) as follows on the basis of averages: $-0.15 \leq ES < 0.15$ "negligible", $0.15 \leq ES < 0.40$ "small", $0.40 \leq ES < 0.75$ "medium", $0.75 \leq ES < 1.10$ "large", $1.10 \leq ES < 1.45$ "very large" and $1.45 \leq ES$ "extremely large". The level of significance in this study is 95%.

Findings

Findings reached as a result of data analysis are given below.

Findings Related to the First Sub-problem

The first sub-problem of the study is whether there is significant difference in students' cognitive achievements according to the meta-analysis of studies covering groups in which station technique is applied or not applied. Homogenous distribution values, average effect sizes and confidence intervals of 20 outcomes in total covered by meta-analysis are given in Table 1 below.

Table 1

Homogeneous and Heterogeneous Distribution Values, Average Effect Sizes and Confidence Intervals of Studies on Cognitive Achievement/Success of Students Included in Meta-Analysis

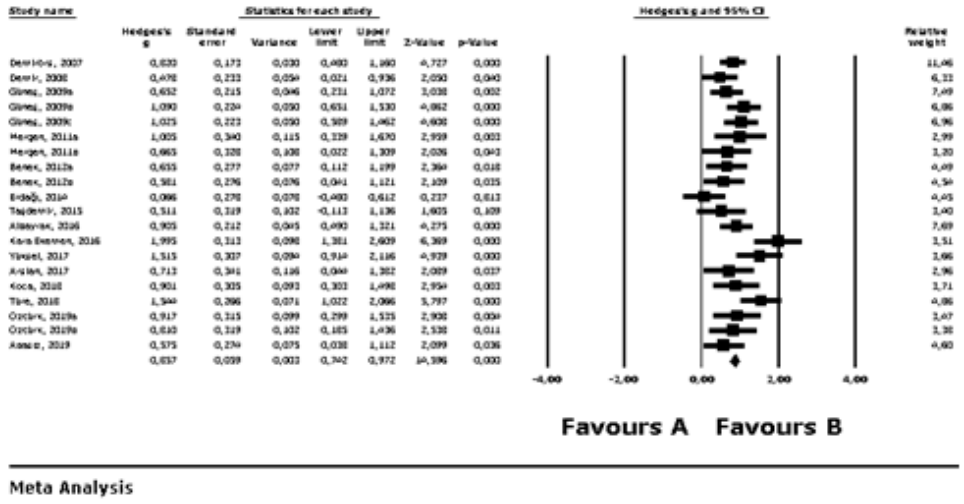
Model Type	Average effect size (ES)	Degree of freedom (df)	Homogeneity value (Q)	Chi square table value	Standard error (SE)	I2	95% Confidence interval for effect size	
							Lower limit	Upper limit
Fixed Effects Model	0.857	19	42.373	30.144	0.059	55.161	0.742	0.972
Random Effects Model	0.865	19	42.373	30.144	0.090		0.689	1.040

According to Table 1, the effect of station technique used in teaching environment on student achievement/ success can be said to be positive with the effect size value of 0.857 in the fixed effects model. Homogeneity test yields statistical value Q as 42.373. In chi-square table, the critical value is considered as about 30.144 at significance level of 95% and with degree of freedom of 19. Since 42.373, the statistical value Q calculated in this study is greater than 30.144 as critical value, it can be said that the distribution of effect sizes has a heterogeneous nature. Having 55.161 as calculated I^2 may be accepted as showing that effect size at heterogeneous level is high.

Since the distribution in the study has heterogeneous character, it was sought to avoid illusions deriving from this heterogeneous character of the sample by conducting analyses in line with random effects model (Çelebi Yıldız, 2002). On this basis, the effectiveness of teaching with or without station technique is compared according to random effects model. According to random effects model, meta-analysis of data from 20 studies gives the effect size as ES= 1.223 with standard error of 0.090 in 95% confidence interval with upper and lower limits as 1.040 and 0.689, respectively. It can be said that effect size value is in the category "large" according to Cohen's (2007), which suggests that the use of station technique in class teaching have its positive effect on cognitive achievement/ success. These suggest that average achievement/ success scores in groups where station technique is used are significantly higher than in other groups where station technique is not used.

Findings related to effect size of studies are given in Figure 1.

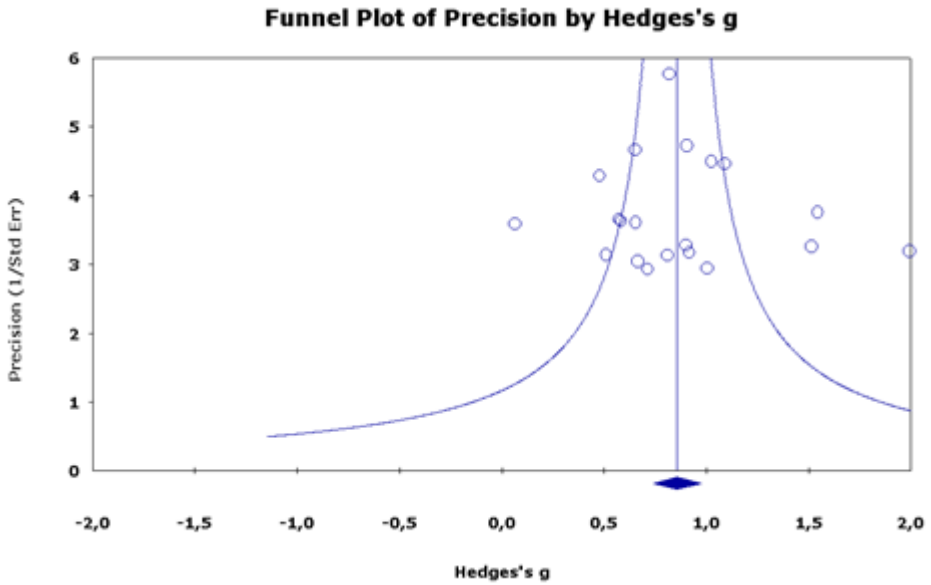
Figure 1. Effect Size Related to Academic Success



As can be seen in Figure 1 lines on both sides of squares show the lower and upper limits of effect sizes in 95% confidence interval while the rhomb shows the overall effect size of studies. Taking a look we see 0.478, as the smallest and 1.995 as the largest effect size.

Figure 2 gives the distribution of effect sizes of studies according to Hedges's as funnel chart (Funnel plot of precision).

Figure 2. Distribution of Effect Sizes of Studies According to Hedges's g (Funnel Chart)



The funnel in the graphic is delimited by a ± slope. According to this graphic some studies remain out of the slope curve which makes it possible to say that the group is heterogeneous. It may not yield sound results if assessment is made solely by taking a look at the funnel graphic. More reliable outcome can be obtained if Q or p values are also considered (Dinçer, 2014: 81).

Findings Related to the Second Sub-problem

The second sub-problem of the study is whether there is significant difference in students' attitude scores according to the meta-analysis of studies covering groups in which station technique is applied or not applied. Homogenous distribution values, average effect sizes and confidence intervals of 12 outcomes in total covered by meta-analysis are given in Table 2 below according to statistical models related to students' attitude scores.

Table 2

Homogeneous and Heterogeneous Distribution Values, Average Effect Sizes and Confidence Intervals of Studies on Attitude Scores of Students Included in Meta-Analysis according to Effect Models

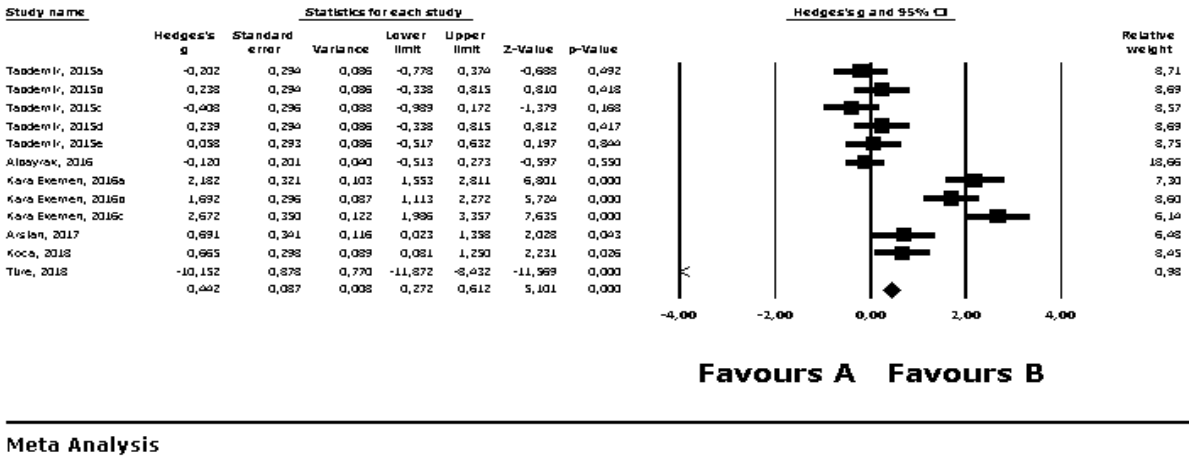
Model Type	Average effect size (ES)	Degree of freedom (df)	Homogeneity value (Q)	Chi square table value	Standard error (SE)	I2	95% Confidence interval for effect size	
							Lower limit	Upper limit
Fixed Effects Model	0.442	11	258.302	19.675	0.087	95.741	0.272	0.612
Random Effects Model	-0.006	11	258.302	19.675	0.428		-0.845	0.833

According to Table 2, the effect of station technique used in teaching environment on students' attitude scores can be said to be positive with the effect size value of 0.442 in the fixed effects model. Homogeneity test yields statistical value Q as 258.302. In chi-square table, the critical value is considered as about 19.675 at significance level of 95% and with degree of freedom of 11. Since 258.302, the statistical value Q calculated in this study is greater than 19.675 as critical value, it can be said that the distribution of effect sizes has a **heterogeneous** nature. Having 95.741 as calculated I^2 may be accepted as showing that effect size at heterogeneous level is high.

Since the distribution in the study has heterogeneous character, it was sought to avoid illusions deriving from this heterogeneous character of the sample by conducting analyses in line with random effects model (Çelebi Yıldız, 2002). On this basis, the effectiveness of teaching with or without station technique is compared according to random effects model. According to random effects model, meta-analysis of data from 12 studies gives the effect size as ES= 0.006 with standard error of 0.428 in 95% confidence interval with upper and lower limits as 0.833 and - 0.845, respectively. Since effect size value remains in insignificance interval according to effect size classification by Thalheimer and Cook (2002), it can be said that the effect of using station technique in class on attitude scores is negligible in negative direction.

Findings related to effect size of studies are given in Figure 3.

Figure 3. Effect Size Related to Attitude Scores



As can be seen in Figure 3 lines on both sides of squares show the lower and upper limits of effect sizes in 95% confidence interval while the rhomb shows the overall effect size of studies. Taking a look at effect sizes we see 0.058 as the smallest and -10.152 as the largest effect size.

Figure 4 gives the distribution of effect sizes of studies according to Hedges's as funnel chart (Funnel plot of precision).

Figure 4. Distribution of Effect Sizes of Studies According to Hedges's g (Funnel Chart)

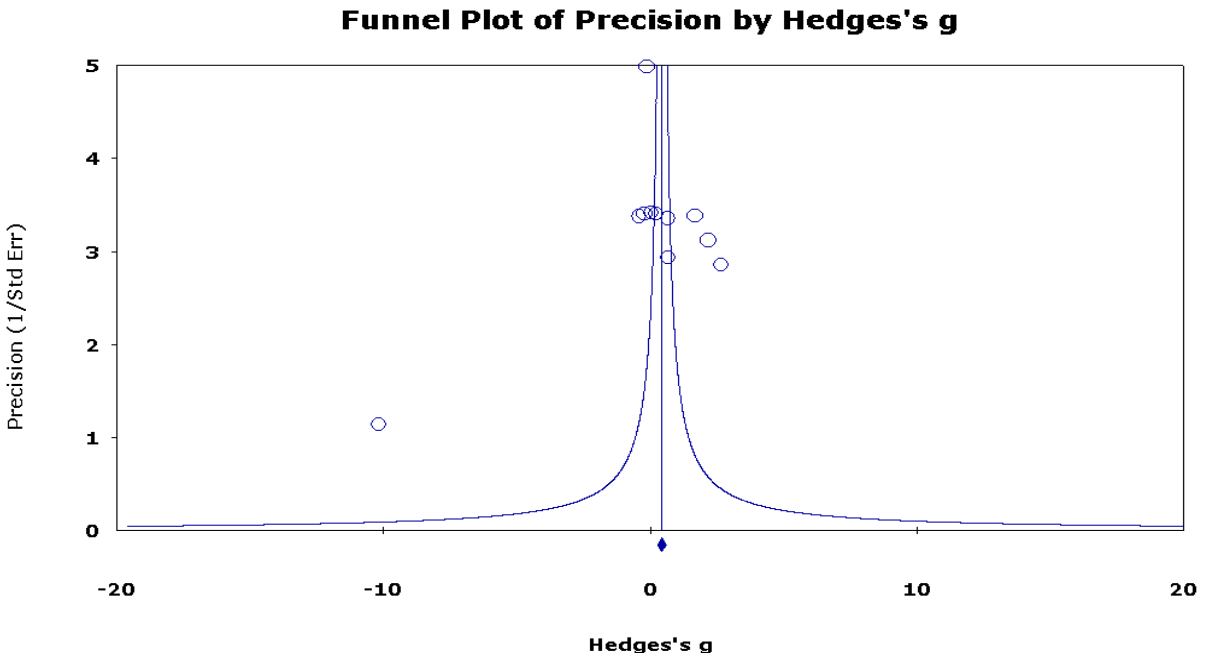


Figure 4 gives the funnel chart showing the distribution of effect size in studies. The funnel in the graphic is delimited by a ± slope. According to this graphic some studies remain out of the slope curve which makes it possible to say that the group is heterogeneous. It may not yield sound results if assessment is made solely by taking a look at the funnel graphic. More reliable outcome can be obtained if Q or p values are also considered (Dinçer, 2014: 81).

Findings Related to the Third Sub-problem

The third sub-problem of the study is whether there is significant difference in students' retention scores according to the meta-analysis of studies covering groups in which station technique is applied or not applied. Homogenous distribution values, average effect sizes and confidence intervals of 9 outcomes in total covered by meta-analysis are given in Table 3 below according to statistical models related to students' retention scores.

Table 3

Homogeneous and Heterogeneous Distribution Values, Average Effect Sizes and Confidence Intervals of Studies on Retention Scores of Students Included in Meta-Analysis according to Effect Models

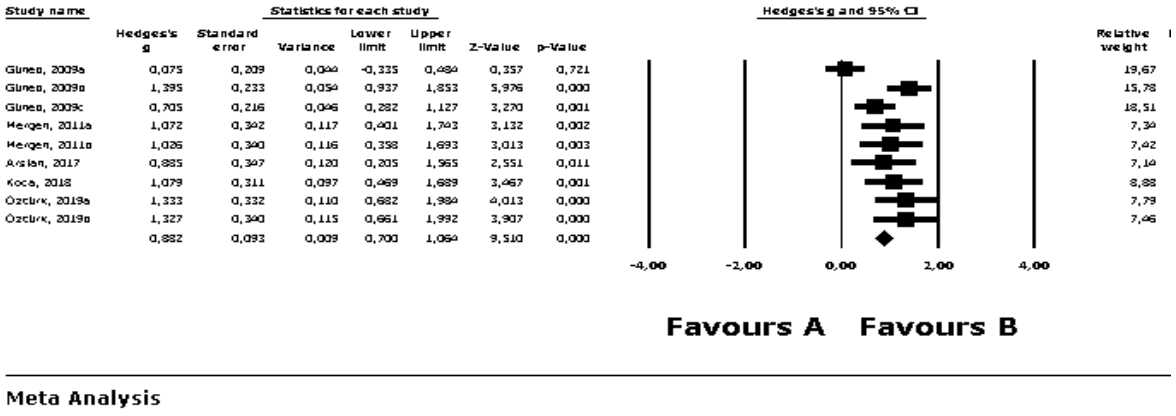
Model Type	Average effect size (ES)	Degree of freedom (df)	Homogeneity value (Q)	Chi square table value	Standard error (SE)	I2	95% Confidence interval for effect size	
							Lower limit	Upper limit
Fixed Effects Model	0.882	8	24.682	15.5073	0.128	67.822	0.700	1.064
Random Effects Model	0.961	8	24.682	15.5073	0.128		0.631	1.290

According to Table 3, the effect of station technique used in teaching environment on students' retention score can be said to be positive with the effect size value of 0.882 in the fixed effects model. Homogeneity test yields statistical value Q as 24.682. In chi-square table, the critical value is considered as about 15.5073 at significance level of 95% and with degree of freedom of 8. Since 24.682, the statistical value Q calculated in this study is greater than 15.5073 as critical value, it can be said that the distribution of effect sizes has a **heterogeneous** nature. Having 67.882 as calculated I^2 may be accepted as showing that effect size at heterogeneous level is high.

Since the distribution in the study has heterogeneous character, it was sought to avoid illusions deriving from this heterogeneous character of the sample by conducting analyses in line with random effects model (Çelebi Yıldız, 2002). On this basis, the effectiveness of teaching with or without station technique is compared according to random effects model. According to random effects model, meta-analysis of data from 9 studies gives the effect size value as ES= 0.961 with standard error of 0.128 in 95% confidence interval with upper and lower limits as 1.290 and 0.631, respectively. It can be said that effect size value is in the category "large" according to Cohen's (2007), which suggests that the use of station technique in class teaching have its positive effect on students' retention scores. These suggest that average retention scores in groups where station technique is used are significantly higher than in other groups where station technique is not used.

Findings related to the effect size of studies are given in Figure 5.

Figure 5. Effect Size Related to Retention Scores



As can be seen in Figure 5 lines on both sides of squares show the lower and upper limits of effect sizes in 95% confidence interval while the rhomb shows the overall effect size of studies. Taking a look at effect sizes we see 0.075 as the smallest and 1.395 as the largest effect size.

Figure 6 gives the distribution of effect sizes of studies according to Hedges's as funnel chart (Funnel plot of precision) .

Figure 6. Distribution of Effect Sizes of Studies According to Hedges's g (Funnel Chart)

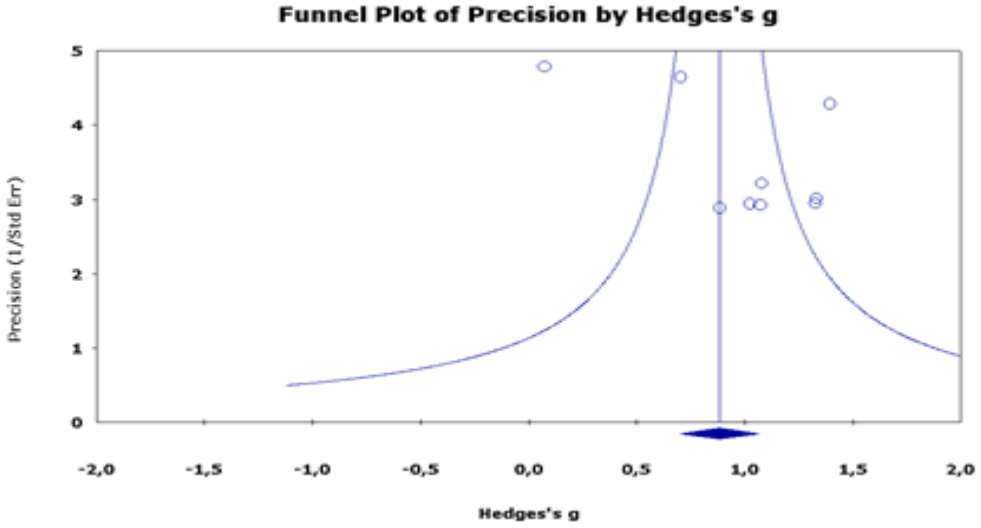


Figure 6 gives a funnel chart showing the distribution of effect sizes of studies. The funnel in the graphic is delimited by a ± slope. According to this graphic some studies remain out of the slope curve which makes it possible to say that the group is heterogeneous. It may not yield sound results if assessment is made solely by taking a look at the funnel graphic. More reliable outcome can be obtained if Q or p values are also considered (Dinçer, 2014: 81).

Discussion

Data from 15 postgraduate studies conducted in Turkey show that teaching through station technique has its positive effect on academic achievement/success and this effect is in the interval "large" which is the highest one in Cohen's (2007) effect size classification. The relevant literature also confirms that station technique has its

significant effect on student performance and retention (Arslan, 2017; Koca, 2018; Mergen, 2011; Öztürk, 2019). Another meta-analysis work conducted on station technique similarly suggests that teaching practices based on station technique are more effective of student performance relative to conventional methods of teaching (Aydoğmuş & Şentürk, 2019).

There are many variables that affect learning outputs and one of these is student's active participation to education environment. Student learns more easily as he debates, acts and teaches what he has learnt to others in education environments. In this way students retain what has been learned and enjoy learning.

In station technique, students listen, discuss, communicate, do things and teach others. Active participation is the result of all these activities. Here, active participation takes place in mental, affective and motional terms. When an individual is presented a content for him to learn, he learns and keeps in his mind 10% of that content by reading only, 20% by listening, 30% by seeing, 50% by listening and seeing, 30% by discussing with others, 70% by doing and demonstrating, and 90% by teaching others (Çilenti 1988; Budak, 1999; Kinder, 1973; Sönmez 2005). In an education environment where all these are in place the student does not forget what he has learnt, may enjoy the process of learning and learning activities, and join the process on his own choice. This is most likely to facilitate students' cognitive, affective, motional and intuitive learning and keep what is learnt fresh in their memory.

Individuals in station technique groups work together and cooperate in this context. They can exchange information, feelings, skills and intuition and contribute to each other. What is missing, incorrect or unknown may be remedied for, corrected or learnt and these improvements may facilitate learning in new and succeeding course units. (Bloom,1976). This technique may make it easier for students to reach higher levels in their learning achievements. As a matter of fact, a study by Abasız Tercan (2019) found that station technique is effective in imparting in students high level cognitive skills. The fact is that in station technique students can easily pass through the informative and conceptual steps of the cognitive domain and reach practice, analysis and in some cases even synthesis and evaluation steps. Indeed, learning outcomes demonstrated are at the step of practice at least. If a student is at the step of practice in this context, it may well be assumed that the student has already attained preliminary knowledge level, targets at informative and conceptual steps. If a student has reached that step, it is not likely for him to lose what has been gained abs knowledge, skills, affection and intuition and is able to use these when needed. These are the factors behind the possible success of groups using station technique relative to others.

While going through a course with station technique students can use their left and right brain hemispheres separately or together. Left hemisphere can be taken as the centre of language, discourse, communication, logic, mathematical operations, analysis, abstraction and problem solving by employing methods. It is important in this hemisphere to examine not the whole but details; rational, logical approach is dominant here. The main function of the right hemisphere is, on the other hand, is to synthetize our perceptions and experiences as images; it looks at what is general. Intuition and image are its two main functions. This way, the individual synthesize relations between objects so as to constitute a whole. The guide is intuition rather than reason (Chalvin, 1991). While working together to respond to what is asked of them in relation to a given situation, students can discuss the issue and make their suggestions. They can both conduct analyses through reasoning and reach syntheses after having identified relations. This effective use of both left and right hemispheres by students may positively affect the acquisition and retention of cognitive, affective, motional and intuitive skills in learning.

Students work together at stations. Students may supply each other with hints, feedback, correction and reinforcement which are effective variables ensuring learning (Bloom, 1976). These variables may have their share in the outcome that cognitive and affective achievements of and retention in groups working with station technique are better than other groups. While working with this technique students may enjoy their working environments. Engaging in different and attractive activities, racing with time and complementing what others have done after learning about them keep students away from getting bored. Learning-teaching activities may proceed as if a game. Their state of not getting bored, nobody preventing what they want to do, adoption and retention of what they have done by others and creation of multiple products may motivate students from both within and without. All these may significantly and positively affect learning, retention and attitude.

This meta-analysis work suggests that the effect of teaching based on station technique on attitude to the course is negligible according to the classification made by Thalheimer and Cook (2002). It can therefore be concluded that the use of station technique in teaching has no effect on attitude to the course. The absence of a meaningful effect on attitude may be related to the application period of the theses included in the research or may be related with high attitude scores. Also, as stated by Kablan, Topan and Erkan (2013) in their meta-analysis, this may be the result of limited number of related experimental surveys. In experimental surveys, there is the possibility that dependent variable is affected by some variables that cannot be controlled other than a specific independent variable. Indeed, one can come across diverging outcomes examining surveys on the effect of station technique on attitude. For instance, a study by Güç et. al. (2016) found that station technique facilitates students' development of positive attitude to mathematics course. Similarly, Koca (2018) also concludes that students in an experimental group to which station technique is applied have developed positive attitude to the course concerned. Contrary to these findings Avcı (2015) finds that the use of station technique has no effect on student attitude to English language course while Taşdemir (2015) reaches the same conclusion for social studies course. These diverging results may derive from the stubborn nature of attitudes (Savaş, Taş, & Duru, 2010).

In the light of what has been explained above, the following can be suggested to researchers and practitioners:

- This study is limited to experimental theses only. More extensive studies can be done, including both theses and articles.
- They can conduct meta-analysis on studies made on this topic in Turkey and abroad.
- There may be meta-analysis of studies on station techniques used in different courses and school levels.
- There may be orientation to new learning-teaching theories on the basis of outcomes of these meta-analyses.
- There may be research to conduct in-depth analysis of the effect of station technique on attitude.
- Teachers may give wider place to station technique which is more effective than existing teaching programmes with respect to achievement and retention.

References

Studies marked with asterisk (*) were included in the meta-analysis

Abasız Tercan, M. (2019). *Matematik dersi üst düzey bilişsel becerileri kazandırmada istasyon tekniğinin etkisi* [The effect of the station technique in the acquisition of high-level cognitive skills in mathematics] (Master's thesis, Necmettin Erbakan University, Konya, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ *

Alacapınar, F. G. (2009). İstasyon tekniği ile ders işlemeye yönelik öğrenci görüşleri [Students' views on studying lessons with station technique]. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi* [Abant İzzet Baysal University Faculty of Education], *9*(1), 137-147.

Arslan, A. (2017). *Türkçe öğretiminde istasyon tekniği kullanımının öğrencilerde akademik başarıya, tutuma ve kalıcılığa etkisi* [The effect of station technique on academic success, attitude, and retention in Turkish language teaching] (Master's thesis, Cumhuriyet University, Sivas, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ *

Aksoy, İ., & Aydın, A. (2019, April). *Fen bilimleri dersinde istasyon tekniğinin öğrencilerin akademik başarılarına etkisi* [The effect of the station method on students' academic achievement in science lesson]. Paper presented at the The International Virtual Symposium of Innovations in Education and Social Sciences, Ankara, Turkey.

Albayrak, H. (2016). *Astronomi konularında istasyon tekniğinin öğrencilerin akademik başarısına ve astronomiye karşı tutumuna etkisi* [The effect of the station technique to students' academic achievement in astronomy topics and students' attitudes to astronomy] (Master's thesis, Erzincan University, Erzincan, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ *

Avcı, H. (2015). *İngilizce öğretiminde istasyon tekniği kullanımının akademik başarıya, tutumlara ve kalıcılığa etkisi* [The effect of the usage of station technique on academic achievement, attitudes and retention in teaching English] (Master's thesis, Fırat University, Elazığ, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/

Aydoğmuş, M., & Şentürk, C. (2019). The effects of learning stations technique on academic achievement: A meta-analytıc study. *Research in Pedagogy, 9*(1), 1-15.

Başbay, A. (2005). Basamaklı öğretim programı [Layered curriculum]. In Ö. Demirel (Ed.), *Eğitimde yeni yönelimler* [New trends in education] (2nd edition) (pp. 241-252). Ankara, Turkey: Pegem Akademi.

Batdı, V., & Semerci, Ç. (2012). Derslerde istasyon tekniği uygulamasının yansıtıcı sorgulaması [Reflective inquiry of the station teaching method in lessons]. *Bartın Üniversitesi Eğitim Fakültesi Dergisi* [Bartın University Journal of Faculty of Education], *1*(1), 190-203.

Benek, İ. (2012). *İstasyonlarda öğrenme tekniğinin ilköğretim 7. sınıf öğrencilerinin fen ve teknoloji dersindeki başarılarına etkisi* [Effect of the learning in stations technique on 7th grade secondary school students' achievement on science and technology course] (Master's thesis, Yüzüncü Yıl University, Van, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ *

Bloom, B. S. (1976). *Human characteristics and school learning*. New York: McGraw-Hill.

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2013). *Meta-analize giriş* [Introduction to meta-analysis] (S. Dinçer, Trans.). Ankara, Turkey: Anı Yayıncılık.

Bottini, M., & Grossman, S. (2005). Center-based teaching and children's learning: the effects of learning centers on young children's growth and development. *Childhood Education, 81*(5), 274-277.

Bozpolat, E., & Arslan, A. (2018). Türkçe öğretiminde istasyon tekniği kullanımına ilişkin nitel bir çalışma [A qualitative study on the use of station technique in Turkish teaching]. *Balıkesir University The Journal of Social Sciences Institute, 21*(39), 55-97.

Budak, Y. (1999). Eğitim sürecinde öğrencinin tüm beynini kullanmasını sağlamanın yolları [Ways to ensure that the student uses his entire brain during the education process]. *Kuram ve Uygulamada Eğitim Yönetimi* [Educational Administration: Theory and Practice], *18*, 283-302.

Bulunuz, N., & Jarrett, O. (2010). The effects of hands-on learning stations on building American elementary teachers' understanding about earth and space science concepts. *Eurasia Journal of Mathematics, Science & Technology Education, 6*(2), 85-99.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education* (6th ed.). New York: Routledge.

Çakmak, M. (2018). *İstasyon tekniğinin 6. sınıf madde ve ısı ünitesindeki öğrenci başarısına etkisi ve öğrencilerin tekniğe ilişkin görüşleri* [The effect of station-based teaching method on the success of 6th grade students in matter and heat unit and students' opinions on the method] (Master's thesis, Dicle University, Diyarbakır, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/

Çelebi Yıldız, N. (2002). *Verilerin değerlendirilmesinde meta analiz* [Meta analysis method in data evaluation] (Master's thesis, Marmara University, İstanbul, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/

Çilenti, K. (1988). *Eğitim teknolojisi ve öğretim* [Educational technology and teaching]. Ankara, Turkey: Kadıoğlu Matbaası.

Chalvin, D. (1991). *Utiliser tout son cerveau*. Paris: ESF Editeur.

Demir, M. R. (2008). *İstasyonlarda öğrenme modelinin hayat bilgisi dersindeki üst düzey beceri erişisine etkisi* [The effect of learning station (center) model to the achievements of high level skills in life studies lessons] (Master's thesis, Hacettepe University, Ankara, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ *

Demiray, P. (2013). *Proje tabanlı öğrenme modelinin etkililiği: Bir meta analiz çalışması* [*The effect of project based learning method: A meta analytic study*] (Master's thesis, Ankara University, Ankara, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/

Demirörs, F. (2007). *Lise I. sınıf öğrencileri için ohm yasası konusunda öğrenme istasyonları'nın geliştirilmesi ve uygulanması* [The development and application of learning stations on ohm law for the first year highschool students] (Master's thesis, Hacettepe University, Ankara, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ *

Dinçer, S. (2014). *Eğitim bilimlerinde uygulamalı meta-analiz* [Applied meta-analysis in education sciences]. Ankara, Turkey: Pegem Akademi.

Ekemen, H. (2017). *Beyin temelli öğrenmenin akademik başarı ve öğrenci tutumu üzerindeki etkisi: Bir meta-analiz çalışması* [*The effect of brain based learning on academic success and student's attitude: A meta analytic study*] (Master's thesis, Necmettin Erbakan University, Konya, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/

Erdağı, S. (2014). *İstasyon tekniğinin fen ve teknoloji dersinin akademik başarısına etkisi* [The influence of station technique on the academic success of science and technology lesson] (Master's thesis, Kafkas University, Kars, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ *

Glass, G. V. (1976). Primary, secondary, and meta-analysis of research. *Educational Researcher*, *5*(10), 3-8.

Göçmen, G. (2004). Meta-analizin genel bir değerlendirmesi [A general assessment of meta-analysis]. *Sakarya Üniversitesi Eğitim Fakültesi Dergisi* [Sakarya University Journal of Faculty of Education], *7*, 186-192.

Güç, F., Korkmaz, Ö., Çakır, R., & Bacanak, A. (2016). İstasyon Tekniğinin Matematik Dersi Akademik Başarısına Etkisi ve Öğrenci Görüşleri [The effect of station technique on students' academic achievement in mathematics and students' views]. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi* [Mehmet Akif Ersoy University Journal of Education Faculty], *40*, 171-190.

Güneş, E. (2009). *Fen ve teknoloji dersinde istasyon tekniği ile yapılan öğretimin erişiye ve kalıcılığa etkisi* [*The effect of learning stations instruction on gain score and retention in science and technology lesson*] (Master's thesis, Hacettepe University, Ankara, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ *

Hall, A. M., & Zentall, S. S. (2000). The effects of a learning station on the completion and accuracy of math homework for middle school students. *Journal of Behavioral Education*, *10*(2/3), 123-137.

Johnson, R. T., & Johnson, D. W. (2008). Active learning: cooperation in the classroom. *The Annual Report of Educational Psychology in Japan*, *47*(0), 29-30.

Kablan, Z., Topan, B., & Erkan, B. (2013). Sınıf içi öğretimde materyal kullanımının etkililik düzeyi: Bir meta-analiz çalışması [The effectiveness level of material use in classroom instruction: A meta-analysis study]. *Kuram ve Uygulamada Eğitim Bilimleri* [Educational Sciences: Theory & Practice], *13*(3), 1638-1644.

Kara Ekemen, D. (2017). *Biyolojik çeşitlilik ve korunması konusunun öğretilmesinde istasyon tekniği kullanımının 9. sınıf öğrencilerinin akademik başarıları ve tutumları üzerine etkisi* [The effect of using station technique in biodiversity and conservation subject to 9th grade students' academic achievement

and attitudes] (Master's thesis, Gazi University, Ankara, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ *

Karacalı, K. (2018). Fen öğretiminde öğrenme istasyonları konusunda Türkiye'de yapılan çalışmalardan bir derleme [A review of studies conducted in learning stations in Turkish science teaching]. *ESTÜDAM Eğitim Dergisi* [Journal of Education in Eskisehir Osmangazi University Turkic World Apply and Research Center], *3*(2), 59-77.

Kinder, J.S. (1973). *Using instructional media*. New York: HarperCollins College Publisher.

Koca, M. (2018). *Altıncı sınıf fen bilimleri dersi hücre konusunun öğretiminde istasyon tekniği uygulamasının öğrencilerin akademik başarısına, kalıcılığına ve tutumlarına etkisi* [The effect of the application of station technique in teaching the 6th grade science lesson cell topic on the academic achievement of students, permanence and attitudes] (Master's thesis, Fırat University, Elazığ, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ *

Koç, G. (2000). Etkin öğrenme yaklaşımının eğitim ortamlarında kullanılması [Using active learning approach in educational environment]. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi* [Hacettepe University Journal of Education], *19*, 220-226.

Köksal, O., & Atalay, B. (2017). *Öğretim ilke ve yöntemleri (Çeşitli uygulamalarla yöntem ve teknikler)* [Teaching principles and methods (Methods and techniques with various applications)]. Konya: Eğitim Yayınevi.

McClay, J. L. (1996). *Learning centers. Professional's Guide.* Westminster: Teacher Created Materials.

Mergen, H. H. (2011). *İlköğretim 5. Sınıf sosyal bilgiler dersinde öğrenme istasyonları uygulamasının akademik başarıya ve kalıcılığa etkisi* [The effects of learning stations technic on academic success and permanence in social sciences lesson in 5th classes of primary school] (Master's thesis, Afyon Kocatepe University, Afyonkarahisar, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ *

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education, 93*(3), 223-231.

Ocak, G. (2010). The effect of learning stations on the level of academic success and retention of elementary school students. *The New Educational Review, 21*(2), 146-156.

Öztürk, F. (2019). *İstasyon tekniğinin 11. sınıf coğrafya dersinde akademik başarıya etkisi ve tekniğe yönelik öğrenci görüşleri* [The effect of station technique at 11th grade geography lessons on academic achievement and opinions of students about this technique] (Master's thesis, Atatürk University, Erzurum, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ *

Savaş, E., Taş, S., & Duru, A. (2010). Matematikte öğrenci başarısını etkileyen faktörler [Factors affecting students' achievement in mathematics]. *İnönü Üniversitesi Eğitim Fakültesi Dergisi* [Inonu University Journal of The Faculty of Education], *11*(1), 113-132.

Slavin, R. E. (1980). Cooperative learning. *Review of Educational Research, 50*(2), 315-342.

Slavin, R. E. (1989). Cooperative learning and student achievement. In R. E. Slavin (Ed.), *School and Classroom Organization* (pp. 129-156). Hillsdale, NJ: Lawrence Erlbaum Associates.

Sönmez, V. (2005). *Hayat ve sosyal bilgiler öğretimi* [Life and social studies teaching]. Ankara, Turkey: Anı Yayıncılık.

Sönmez, V. (2015). *Program geliştirmede öğretmen elkitabı* [Teacher handbook in curriculum development]. Ankara, Turkey: Anı Yayıncılık.

Sönmez, V., & Alacapınar, F. G. (2014). *Örneklendirilmiş bilimsel araştırma yöntemleri* [Sampled scientific research methods]. Ankara, Turkey: Anı Yayıncılık.

Şaşan, H. H. (2002). Yapılandırmacı öğrenme [Constructivist learning]. *Yaşadıkça Eğitim* [Journal of Education for Life], *74-75*, 49-52.

Taşdemir, D. (2015). *Sosyal bilgiler dersi 6. sınıf ülkemizin kaynakları ünitesinin istasyon tekniği ile öğretiminin öğrencilerin akademik başarısı ve derse karşı tutumuna etkisi* [The effect of teaching 6th grades social studies "the resources of country unit" with station technique on students' academic success and their attitude towards the lesson] (Master's thesis, Fırat University, Elazığ, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ *

Thalheimer, W., & Cook, S. (2002). How to calculate effect sizes from published research: A simplified methodology. *Work-Learning Research*, *1*, 1-9.

Topan, B. (2013). *Matematik öğretiminde öğrenci merkezli yöntemlerin akademik başarı ve derse yönelik tutum üzerindeki etkililiği: bir meta-analiz çalışması* [*Effects of student-centered methods on academic achievement and attitude towards the subject: A meta-analysis study*] (Master's thesis, Kocaeli University, Kocaeli, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/

Türe, Z. G. (2018). *Örnek olay destekli istasyon tekniğinin sosyobilimsel konuların öğretimi üzerine etkisi* [Teaching of socioscientific issues with case-based supported station technique] (Master's thesis, Erzincan Binali Yıldırım University, Erzincan, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ *

Vygostky, L. (1978). *Mind in society: The development of higher psychological process.* Cambridge, MA: Harvard University Press.

Yılmaz, A. (2001). Sınıf içi öğrenci - öğrenci etkileşiminin öğrenme ve sosyal gelişim üzerindeki etkileri [In-class student - effects of student interaction on learning and social development]. *Kuram ve Uygulamada Eğitim Yönetimi* [Educational Administration: Theory and Practice], *25*, 147-158.

Yüksel, Ö. (2017). *"Evsel atıklar ve geri dönüşüm - kimya endüstrisi" konularında istasyon tekniğinin öğrencilerin akademik başarısına ve görüşlerine etkisi* [The effect of station techiıque on students' academic achievement and opinions in the teaching of "household waste and recycling-chemical industry" subjects] (Master's thesis, Ordu University, Ordu, Turkey). Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ *