

*Full Length Research Paper*

# **The effect of cooperative learning on the academic achievement and attitude of students in Mathematics class**

**Yalçın Karali\* and Hasan Aydemir**

Basic Education Department, Institute of Educational Sciences, İnönü University, Malatya, Turkey.

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In the axis of basic skills and values, students' enjoyment of mathematics lesson and the realization of learning by taking a certain distance depend on the appreciation of the effort of the individual. Cooperative learning provides this requirement with a great deal of reward and success. Success increases individual's self-confidence and making him/her more powerful and positive in mathematical learning. By developing an individual's positive attitude, mathematical barriers that may adversely affect his/her success in social interaction with friends might be removed. An individual can also help his/her friends in learning and reinforce his belief and self-esteem. This study aims to reveal the effect of cooperative learning method on students' academic achievement and attitudes towards mathematics in primary school fourth grade math class. The study was carried out with "pre-test -post-test control group experimental design". This pattern allows for the comparison of the success of the cooperative method used in the mathematics course to improve students' achievement and positive attitude towards mathematics. "Team Play Tournament Supported Student Teams and Achievement Divisions" (TPT supported STAD) technique, which combined the application of Student Teams Achievement Divisions (STAD) and "Team Play Tournament" (TPT) techniques from the cooperative learning applications, was applied to the test group. In the control group, the lessons were taught using the instructions in the Ministry of National Education (MoNE) 4th grade Mathematics Teacher's Guide Book. 4th grade primary school students in Malatya Battalgazi during the 2015-2016 academic year were the study participants. They were 40 students (20 in test group and 20 in control group). "Mathematics Attitude Scale" developed by Baykuland "Mathematics Achievement Test" developed by the researcher were applied to the test and control groups as pre-test and post-test. TPT supported STAD technique is more effective in increasing the academic achievement of the students in mathematics course compared to the teacher-centred teaching; however, it is less effective than teacher-centred teaching in their mathematics attitudes.

**Keywords:** Cooperative learning, teaching mathematics, mathematics attitude, academic achievement.

## **INTRODUCTION**

Human beings can be organized as a group in order to reach a general purpose in modern life and thus they can be successful in realizing any purpose in business life,

sport and military fields. Cooperative activities, one of the most important human activities (Slavin, 1981), aim to work together to achieve the same goals. Collaborative

work is based on the idea of creating a common solution to a problem by combining the power and abilities of individuals with different abilities, which are related to the problems of each of the individuals in a group or the solution of a general problem concerning a group. Cooperative learning is a way for students to help each other in learning academic content by working together in small groups (Slavin, 1980). In Turkey, where the constant transformation taking place in the field of education, schools is not sufficiently effective in the training of the type of people required by age. The education system needs to be renewed in the light of scientific developments in accordance with the paradigms that can build the future (Açıköz, 2009). In recent years observable corruption has invaded humanitarian values such as social interaction, sharing, cooperation, empathy and devotion. Corporate training has also been affected by these negative developments; the format of the teacher-student relationship has changed; with the rapid changes in technology and other areas of life, education has entered a path of change that educators have to keep up with (Üre, 2008). The targeted student type has changed. Depending on this, instead of a person who is uninformed, powerless, incomplete, directed, accepting and obedient, a person with less experienced, asking, curious, with the potential of learning, critical thinking who can make his or her own decisions independently was brought to the agenda (Cüceloğlu and Erdoğan, 2015).

Theorists, looking at the rooted education approach from a critical perspective, have suggested that knowledge has a social formation and that the world in which we live is symbolically created by the brain through social interaction with other beings (McLaren, 2011; Charles, 2003). In the understanding of constructivism, which constitutes the theoretical basis of the understanding that directs Turkish Education System, it is assumed that information is structured both in an individual and social context through continuous and communicative experiences. The individual structuring occurs with individual experience; whereas in social structuring the experiences of the individual, who is a part of the community, take place based on interacting with the environment. This importance given to communication within the group emphasizes the impact of social relations on learning and building knowledge (Atay, 2003). Nevertheless, the interaction of students, which is the basic dynamic of development, is neglected. A great majority of teaching time is dedicated to the proper regulation of interaction between students and teaching materials. While some time is spared for the interaction between teacher and student, the way students interact

with each other is relatively ignored (Johnson and Johnson, 2009). In solving this problem, there are critical tasks that fall to the share of the trainers in the creation of classroom environments in which knowledge is supported within the interaction. Since the students have different nature, teachers should undergo diversity of understanding by changing their perspective from "How will we teach?" to "How will students learn?" The classes, where social relations are emphasized and students are taken to the centre and encouraged to cooperate on the basis of scientific values, are one of the most needed learning environments for today's society. Only in this case, important concrete steps will be taken in developing students' thinking skills and the permanence of learning (Mısır and Çalışkan, 2007).

Problems in teaching mathematics can be shown in one of the most obvious signs of the Turkish Education System not being based on a scientific understanding. Mathematics, the center of positive sciences from the past to the present, is the common language of the age of science. This is because numbers are the basis of all kinds of information technology. Many jobs of computer technologies that make lives easier in every area are products put forth based on mathematical operations. The accounts of giant organizations require a great deal of mathematics activity. The basis of many quantitative and qualitative activities such as classification, sorting, appraisal, reasoning realized in the human mind are in the field of mathematics. In this sense, a life independent of mathematics and targeted social development without taking mathematics into account are a thought distant from scientific facts.

In the past, various projects and trials were conducted on how mathematics teaching should be done in Turkey. The opinion that the students' level of achievement in mathematics plays a more decisive role than the achievement in other courses is common in a large part of society (Karaçay, 1985). However, in addition to that, due to transforming experiences obtained with senses into a structure that works only with abstractions, instead of the physical world, mathematics is often perceived as a metaphysical science. This intangible feature of mathematics also gave rise to its eerie appearance in the eyes of society (Başkan, 1985). Another important problem is the belief that mathematics is an innate skill. Such a belief leads to the fact that people, who appear as ordinary, are not expected to understand what is desired, and negative attitude towards mathematics occurs (Bruning et al., 2014). With the understanding of the direct contributions of the fields of science, which are directed by mathematics, to the economy, the importance

\*Corresponding author. E-mail: yalcinkarali@hotmail.com.

of the methods adopted in mathematics teaching has also gained a new dimension. Depending on the transfer of the scientific content entering a rapid development process during the 20th century to new generations; the development of new and more effective methods and techniques, rather than traditional methods and techniques, has been generally accepted. In this sense, it is understood that mathematics is not just a discipline for making calculations; it also includes the skills of problem solving in new and different situations (Aptik, 1985).

It is not surprising that mathematics teaching is more at the forefront compared to other problems in the education system. It is because math, which transforms the human mind into an unlimited tool of calculation, has always kept its importance and priority due to their contribution to scientific developments as well as facilitating people's daily life. However, new job and career opportunities that emerge depending on the information and communication technologies have become a situation that requires mathematical skills. Therefore, mathematics is the key to problem solving and to bringing a way of thinking that deals with events in this understanding in addition to the knowledge and skills required by daily life (Altun, 2013). From past to present, starting from pre-school it has become one of the most important criteria of the success for the individual in his/her education life in the eyes of society. Although it goes unnoticed in the flow of daily life, steady behaviour of natural assets and events and the fact that this determination can only be explained on the basis of mathematics is another important aspect that brings mathematics its importance. Especially, the fact that problem solving improves the thinking and reasoning of the person and increases the quality of cognitive structures is one of the other important features that makes mathematics valuable (Altun, 2006). The need for abstraction has always been accepted in transforming the experiences gained through experience into knowledge and providing permanence. Conceptualization of sensory codes of a real experience or directly conceptual thinking require abstraction. This is an indication of the importance of mathematics built on abstraction in the development of human cognitive structure (Çüçen and Ertürk, 2008).

Mathematical anxiety, which makes academic life difficult for many students, is defined as feelings of anxiety and tension that prevent the solution of problems in many different areas of school life and daily life and that interferes with the processing of numerical data. This can cause loss of self-confidence in students. Cooperative learning structures enable students to be active learners, take more responsibility for learning and participate more in the course in overcoming these and similar challenges (Panitz, 2010).

Especially, monotonous teaching disconnected from life, one-way traditional approaches used in measurement and evaluation prevent students from reaching the

desired level of achievement and lead to cultivating individuals with negative attitudes towards mathematics (Umay, 1996). Exam-oriented education in schools due to the selection exams can be shown among the reasons of the problem that become apparent. This system, based on elimination and categorization instead of development and cultivation, has made learning perceived as a preparation for exams, has brought the exams into the state of aim and education to the state of means (Işık et al., 2005).

In terms of human beings trying to explain life through certain rules, the fact that the "concept of absolute right" has lost its seat pushed the education to go beyond teaching the right and useful (Çağlar, 2010). If the students, who need to adapt to today's world which gains a more complex feature each day, cannot use critical thinking, reasoning and problem solving skills in interaction with others, what kind of benefits such skills might have is an important question to be answered. To provide appropriate models of social behaviour, cooperative learning is an important practice in bringing together students by creating environments similar to adults, engraining reasoning behaviours of the adult world in them (Borich, 2014). In the schools surrounded by one-way test-oriented understanding, teaching-oriented approaches that restrict the interaction of students among themselves are inadequate in providing academic and socially expected development. Therefore, researchers and teachers have to focus on learning approaches that support the social development of the individual that increase the persistence of learning and students enjoy learning. Cooperative learning, among learning methods that can meet these needs and expectations, draws attention as an important option. It is because cooperation exists in the nature of human beings (Efe et al., 2008).

In the schools that push social development into the background, that are focused on academic achievement, cooperation and collaboration culture are damaged only with activities related to teaching. In works with collaboration, helping others is not in the form of bringing the helper into an awkward state; on the contrary, it helps the individual to release his or her skills. The contribution of student studies provides qualitative and group success rather than quantitative, ensuring that education is organized in a surrounding and social basis (Dewey, 2010). Moreover, it is important that the child cooperates with friends in affecting cognitive development. When individuals work together in collaboration with others, it feeds cognitive development. In other words, cognitive development shows a progress towards self-regulated behaviours from behaviours organized by others (Senemoğlu, 2012).

Modern life imposes an individualistic and competitive personality structure to people. This understanding manifests itself by classifying learners as winners and

losers in educational environments. However, a modern basic education process should promote socializing values such as peace, solidarity, cooperation and sharing among students and the classes should be far from transforming the classes into a destructive competition environment (Ural, 2014). The basic skills are emphasized in the classes, which are far from meeting the educational expectations of the age. Teachers expect students to answer questions correctly while dictating knowledge to them. Evaluation of what students learn is usually done with tests and they are often encouraged to work alone (Schunk, 2014). Although the school is a community, it is common that students are kept separately at their own desks to prevent them from causing problem. This understanding reveals that positive effect of cooperation among students in schools is ignored. However, in promising education, it is essential to create meaningful activities for students that they will have to work on problems with others. It is because the key to real learning is cooperative, purposeful activities in social environments (Philips and Soltis, 2004).

In order to improve students' academic achievements by improving their positive attitudes towards mathematics, there are many research oriented methods. Among them, to achieve a positive result in mathematics teaching, researches, supported by different methods such as music (Yağışan, et al., 2015; Koçoğlu, 2015), computer (Aşıcı, 2014), narration (Coşkun, 2013), impersonation (Şengül and Ekinözü, 2004), visualization (Koğ and Başer, 2012), multiple intelligence (Kuloğlu, 2005), were carried out.

Institutionalized educational practices are sensitive and irreversible, time-limited activities aiming to create a happy school life and future using the moment experienced. Therefore, the renewability and repetition of learning experiences in the classroom environment is quite difficult and costly. In this sense, as a requirement of efficient use of time in teaching applications, recording of the knowledge and experiences obtained by teachers to ensure maximum efficiency from planned learning experiences in schools is important for the formation of an important scientific knowledge.

Learning and teaching are dynamic processes that occasionally require controlled and scientific interventions. It is essential that guidance and interventions by trainers in the teaching process increase the quality of learning and the students develop positive attitudes towards classes. In this context in making lessons interesting for students, the method-techniques chosen by the teachers, who are in the position of guides in education-teaching, are critical factors in the process. It is important that this is tried by a specific research method and transformed into theoretical knowledge. Information based on experimental applications in classroom environments will often provide theoretical support to practical learning environments.

In this context, the aim of the study; cooperative learning method in primary school fourth grade mathematics course reveal students' academic achievements and their impact on mathematics attitudes. The study is limited to the "calculation of the environmental lengths" in the 4th grade mathematics course and 23 course hours.

### **Problem clause**

What are the effects of the cooperative learning method on students' academic achievements and attitudes in mathematics?

### **Sub-Problems**

In accordance with the aim of the study, the following sub-questions were sought:

Is there a significant difference between the academic gain of the test and control groups in the mathematics course?

Is there a significant difference between the attitude gain of the test and control group students towards mathematics?

### **METHODS**

Many studies conducted in education are based on quasi-experimental design. The design contains running multiple instances in a specific time period. In this sense, it has a relatively low level of validity compared to classical experimental designs (Can, 2014). In the design of this research, pre-test-post-test control group design (PPCD), which is a mixed design often used in the field of social sciences, was used. This pattern gives the opportunity to compare the success of the collaborative method used in the research in the mathematics course to improve student achievement and positive attitude towards mathematics. In this pattern, the participants are measured in relation to the experimental procedure before and after the test procedure. PPCD is a related pattern because the same persons are measured twice on the dependent variable. However, it is also an unrelated pattern because it allows comparison of the measurements of the test and control groups composed of different subjects. Therefore, this pattern can be characterized as a mixed design (Büyüköztürk, 2014). Information on the procedures to be carried out to the test and control groups during the stages of this study is presented in Table 1.

The study group of this research consists of students studying in the 4th grade in the Battalgazi district of Malatya connected to the Ministry of National Education in the spring semester of 2015-2016. In order to make an appropriate comparison, the students were selected from the same environment as the socio-cultural sample. Although the test group participating in the study was designated as the class that the researcher worked, the control group was determined according to the pre-test results. The students continued their learning process in their classrooms. The characteristics of the test and control groups are presented in Table 2.

Table 2 shows the distribution of test and control groups, a

**Table 1.** Experimental Design Processes.

Group	Pre-test	Subject Field	Experimental Process	Post-test
Test	Achievement test	6th Unit: Calculating Perimeter Lengths	Cooperative Learning Method (TPT supported STAD technique)	Achievement test
Control	Achievement test	6th Unit: Calculating Perimeter Lengths	Teaching activities conducted in accordance with the guidelines in the mathematics teacher's manual	Achievement test

**Table 2.** Characteristics of the study group.

Group	Gender		Total
	Female	Male	
Test Group	10	10	20
Control Group	10	10	20
Total	20	20	40

numerically equivalent distribution is observed both in groups and between groups in terms of gender. Depending on this situation, in the creation of study teams, which are important factors of cooperative learning, numerical equality could be achieved in terms of gender. Also based on the study findings, in the comparison of test and control groups, numerical equality is important in terms of gender. In the study, t-test was used for unrelated samples to determine the similarity of test and control groups in terms of academic achievement. According to the analysis results, the arithmetic mean of the students related to pre-test scores showed no significant difference according to the group they were in [ $t_{(38)}=0,15$   $p>.05$ ]. These findings can be interpreted as the test and control groups were similar in terms of their academic achievement according to pre-test scores.

#### Data collection tools

Mathematics achievement test and mathematics attitude scale were used in collecting the data of this study. To determine and compare the mathematical attitude of the study group, mathematics attitude scale, developed by Baykul, (1990) was used. The mathematics achievement test developed by the researchers was used to determine and compare academic achievement.

#### Data analysis

The data collected within the scope of the study were analysed by coding in the SPSS program. In the scope of the study, the progress points series have been created by calculating the difference between the pre-test and post-test points of the students in both groups; later these gains, which are indicators of the progress of the test and control groups, were compared with the t-test for unrelated samples (Can, 2014). In the context of study, it was measured whether the difference between the pre-test and post-test scores in the test group, where the collaboration learning approach practices were conducted, was significantly higher than the difference between the pre-test and post-test scores in the control group, where the teacher-centred teaching methods were conducted.

#### Test process steps

In the first phase of the study, a test of achievement and attitude scale, related to the subjects to be covered in the research process, were applied to the students in the test and control groups as pre-test. The pre-test findings obtained in the test group were taken as the basic score and 5 cooperative learning groups of 4 persons were formed by considering gender differences. In the test group, warm-up activities were carried out to ensure that the students were prepared for cooperative learning. Work sheets and monitoring tests with activities to maximize the interaction between students were prepared and reproduced in sufficient numbers. The "Team Play Tournament supported Student Teams and Achievement Divisions" (TPT-supported STAD) technique, containing the implementation of techniques "Student Teams Achievement Divisions" (STAD) and "Team Play Tournament" (TPT), which are among the cooperative learning applications, was applied in the test group. At the evaluation stage, a total of 11 tournaments were conducted during the survey, one for each gain. Three questions were asked to each level group in the tournaments and competitors received 10 points for each correct answer. In this case, each competitor was able to collect a maximum of 30 points for his or her team on the tournament table. In addition, 11 monitoring tests were performed in order to measure each gain. Team scores were calculated by adding monitoring tests and individual scores obtained in the tournament. As a result of monitoring tests and tournaments, the students who earned 30 points for their team were awarded with blue certificate; students who earned 20 points were awarded with a red certificate; those who earned 10 points were awarded with a green certificate. This application was also made for the teams. The teams with a total score of 200 or more were presented an award of star team certificate; a score between 150-200 was awarded with bees' team certificate; the teams under 150 points were awarded with ants team certificate.

#### FINDINGS

In this experimental study, which examines the effect of cooperative learning method on learning in primary

**Table 3.** Pre-test and post-test averages for mathematics achievement test.

Group	Pre-test			Post-test		
	N	$\bar{X}$	ss	N	$\bar{X}$	ss
Test	20	55.20	19.34	20	71.10	20.38
Control	20	55.29	18.82	20	64.66	18.84

**Table 4.** T-test results For Academic Success Gain Points

Group	N	$\bar{X}$	ss	sd	t	p
Experimental	20	15.91	11.27	38	2.03	<b>0.049</b>
Control	20	9.37	8.95			

**Table 5.** Pre-test post-test means related to the mathematics attitude.

Group	Pre-test			Post-test		
	N	$\bar{X}$	ss	N	$\bar{X}$	ss
Test	20	3.52	0.702	20	3.65	0.730
Control	20	3.73	0.914	20	3.65	1.01

school 4th grade mathematics course, tests were applied before and at the end of the unit to a group of 20 people, whose mathematics lessons are taught according to cooperative learning method, and to the same number of other group where lessons are taught according to teacher-centered teaching. The averages for the test results are presented in Table 3.

As seen in Table 3, while the average score of pre-trial mathematics achievement test of the students who study according to the cooperative learning method is 55.20, this value was 71.10 after the trial. While the mean score of pre-trial mathematics achievement test of the students who were educated according to teacher-centred teaching method was 55.29, it was 64.66 after the trial. According to these values, it is seen that there is an increase in the mathematics achievement of the students who study according to both cooperative method and teacher-centred teaching methods. However, post-test averages in the experimental group increased more. The descriptive statistics of this increase and the t-test results for unrelated samples are given in Table 4.

It is seen that after the trial, the mean progress scores in the test group where cooperative learning method is applied ( $\bar{X}_{\text{test}}=15,91$ ) is significantly different [ $t_{(38)}=2.03$ ,  $p<0.05$ ] than the mean progress scores in the control group where the traditional method ( $\bar{X}_{\text{control}}=9,37$ ) is applied. This situation can be interpreted as the cooperative learning method is significantly more effective than the traditional method on student success

in mathematics lesson in 'calculating perimeter length' unit. Although, the t-test for unrelated samples gives an idea of whether there is a significant difference between the means, it does not give clear information about the extent of this difference. Therefore, it is important to calculate the effect size as well as statistical significance. The effect size in T-test is calculated with *Cohen d* formula. The effect size calculated on the effect of the method on mathematics achievement is found as " $d=.642$ ". Based on the classifications in the literature, it can be said that the effect of the cooperative learning method applied in this experimental research on the mathematics achievement is between medium and large effect sizes (Can, 2016).

In order to obtain finding related to the second sub-problem that examines the effect of cooperative learning method on students' attitude towards mathematics, mathematics attitude scale was applied to the test and control groups before the unit starts and at the end of the unit. The means related to the test results are given in Table 5.

While the mean score of the mathematics attitude scale of the students, who are studying according to cooperative learning method, before the experimental process  $\bar{X}_{\text{test}} = 3.52$ , this value was  $\bar{X}_{\text{test}} = 3.65$  after the trial. While the mean score of the mathematics attitude scale of the students, studying according to teacher-centred teaching method, before the test process was  $\bar{X}_{\text{control}} = 3.73$ , it was  $\bar{X}_{\text{control}} = 3.65$  after the trial.

**Table 6.** T-Test results for mathematics attitude scale gain scores.

Group	N	$\bar{X}$	ss	sd	t	p
Experimental	20	0.124	0.515	38	1.006	0.546
Control	20	-0.78	0.737			

According to these values, while the mathematical attitude scale mean of the experimental group, in which the cooperative learning method was adopted and increased after the test process; the mathematical attitude scale of the control group, where the traditional method was applied, decreased. The descriptive statistics of the resulting gain scores concerning pre-test - post-test means and t-test results for unrelated samples are given in Table 6.

When the changes in the mathematical attitude scale of the students in the test and control groups after the test process are compared with t-test for unrelated samples, it is seen that the mean of the attitude gain scores in the test group, in which the cooperative learning method is applied ( $\bar{X}_{\text{test}}=0.124$ ), is higher than the average of the attitude gain scores of the control group in which the traditional method is applied ( $\bar{X}_{\text{control}}=-0.78$ ). However, according to the results of the analysis, this difference between the test and control groups was not found to be significant [ $t_{(38)}=1.006$ ,  $p>0.05$ ].

## DISCUSSION

Direct instruction, the most widely used method in the Turkish Education System, takes part at the end of the list about the persistence and recall of learning. However, the permanence and recall of knowledge is directly proportional to the degree to which the student is involved in the learning process. Cooperative learning, which is subject to the study, and teaching techniques in learning groups organized according to this approach have been known for many years. From the 70s, researchers working on education, examined small group activities and the interaction of students within the group. Such research has made significant contributions to the development and becoming widespread of cooperative learning techniques (Erden, 1988). When the course in question is mathematics, prejudices and negative attitudes of the students take precedence over the course content. At this point, learning-teaching methods and activities are the most critical factors. When we look at it in terms of the age group of the students, there is a need for instant help in developmentally necessary points in education activities in primary school years. In this critical period of development, provision of the support children need by their classmates, teachers, and learning

environment without them being aware is a situation that naturally supports the positive learning environment.

In the experimental practice within the context of the study which lasted for five weeks, it was concluded that the TDT-supported STAD technique was more effective in increasing the academic achievement of students compared to the traditional method in the 4th grade math class "Calculation of Perimeter Lengths" subject where the gains for the implementation step of the cognitive dimension are predominant. In his study conducted with meta-analysis method taking into account 31 researches, Tarim (2003) found the overall effect size of cooperative learning on academic achievement as " $d = 0.82$ ". As a result of his meta-analysis on 26 studies, Özdemirli (2011) determined the effect size of cooperative learning on academic achievement in mathematics course as  $D = 0.59$ ". In a meta-analysis study consisting of multinational students from 11 countries which included comparison of traditional methods of cooperative learning and 148 studies, significant findings have been reached in favour of cooperative learning in academic achievement and positive peer relations (Roseth, Johnson and Johnson, 2008). Research results showed that cooperation is more effective than interpersonal competition and individual studies; also cooperation provided by sustaining inter-group competition is more effective than individual competition and studies (Johnson et al., 1979). Along with that, in meta-analysis on 122 research, results were obtained in favour of cooperative learning; there was no significant differences found between the interpersonal competition and individual studies. The results have been consistent in concept learning, problem solving, classifying and reasoning in age and all subject areas including language, reading, science, art, physical education and mathematics (Johnson et al., 1981). Cooperative learning has been widely used and researched worldwide since the 70s (Vaughan, 2002). It has been confirmed by research findings that cooperative learning in terms of academic achievement is more effective in acquiring cognitive behaviours especially at the level of knowledge, comprehension and application; positively affect the relationships between students; increase their confidence; students have a more positive attitude towards school and lessons (Slavin, 1980). In addition, cooperative learning techniques are considered as a contemporary method of improving students' emotional and social aspects as well as cognitive aspects (Erden, 1988). It has been supported that cooperative

learning is more effective than traditional methods in increasing students' academic achievement in mathematics (Erçelebi, 1995; Yıldız, 1998; Bozkurt, 1999; Deane, 2001; Yıldız, 2001; Vaughan, 2002; Kramarski and Mevarech, 2003; Tarım, 2003; Araz, 2004; Bosfield, 2004; Carlan et al., 2005; Ural, 2007; Karagöz, 2007; Özdoğan, 2008; Akbuğa, 2009; Conring, 2009; Özsarı, 2009; Zakaria et al., 2010; Özdemirli, 2011; Yıldırım, 2011; Sofeme, 2012; Torchia, 2012; Johnson, 2013; Kabuk, 2014; Koç, 2015; Titsankaew, 2015; Pesen and Bakır, 2016; Egüz et al., 2018). It increases their oral exam achievements (Bozkurt, 1999), persistency (Arısoy, 2011; Ünlü and Aydın, 2011), problem solving skills (Posluoğlu, 2002; Bernero, 2000) and geometric learning (Bilgin, 2004; Çırakoğlu, 2009; Torun, 2009; Marangoz, 2010; Gülsar, 2014; Dirlikli, 2015). A wide range of positive effects of cooperative learning based on academic achievement on mathematical learning were revealed by many different experimental studies. These positive findings cover different characteristics various study groups. For example; it has been determined that the cooperative learning environment is more effective than traditional learning approaches on students' mathematical calculation skills (Bosfield, 2004). More successful results have been achieved in cooperative learning groups than traditional methods (Erçelebi, 1995). Collaboration has been shown to support students' development of mathematics and social skills (Yıldız V., 1998; Koç, 2015). While making mathematics lessons more fun for students and teachers, (Gülsar, 2014) it has shown improving effects on self-esteem of students (Bernero, 2000), self-efficacy perception (Tuğran, 2015) and interaction skills (Deane, 2001). It was observed that there was an intense exchange of information between the students during teamwork and because of this, the students learned more solution strategies and realized their deficiencies by reinforcing their knowledge (Ural, 2007). Ensuring that teachers are more aware of the mathematical skills of their students (Carlan et al., 2005), increase in the interest of the students to the course, their being better motivated are among the positive results achieved (Arısoy, 2011). Students' being more engaged in problem solving, transition from competition to collaboration, exploring different solutions of problems can be counted among the other positive effects (Carlan, et al., 2005). The cooperative learning process has had positive effects on students' timid, dependent and competitive learning styles (Vega and Hederich, 2015; Tunç, 2016; Koçoğlu, 2017). Considering the large number of positive results, it can be predicted that the academic success of the students will increase due to the increase in the frequency of the use of cooperative learning method in primary school mathematics classes.

Cooperative learning techniques can be used to achieve academic and social goals at the same time and place, without sacrificing one to another (Slavin, 1981).

Teachers who used cooperative techniques in their classes stated that they believed that cooperative learning would provide many benefits in terms of academic, social and psychological aspects such as students' development of positive attitude towards mathematics; increasing success, sharing, interaction, self-confidence, motivation; development of awareness of responsibility (Macit, 2013). Based on the data provided by a large number of studies, it is necessary to use the concept in the right course and the age range by making appropriate determinations instead of questioning the contribution of cooperative methods and techniques to success or attitude (Türkmen, 2016). A lot of research has been done in recent years to evaluate the effectiveness of cooperative methods and techniques. Most of these studies have validated that cooperative methods and techniques are more effective than traditional competitive methods and techniques in increasing students' achievement. Perhaps more importantly, these studies showed that cooperative learning strategies significantly increase the motivation of students at low and middle achievement levels. Moreover, it is understood that cooperative learning strategies do not only increase academic achievement but also seed the values of help and cooperation and is highly effective in ensuring social development. Thus, it is thought that cooperative learning method can help not only cognitive development but also affective competencies.

In one or more stages of cooperative learning or any activity, working together in small groups is an important part of learning (Eurydice, 2011). One of the primary benefits of cooperative learning, to increase the self-esteem attitude that motivates students to participate in the learning process. Cooperative based efforts shaped in this way result in the success of the participants. Students help each other to improve the performance of their teams, where friends from all levels are in (Panitz, 1999). Researches have proven that cooperative learning can be highly effective developing positive attitudes towards school and encouraging student interaction (Vaughan, 2002). Researches also indicate that the cooperative approach has positive effects on students' attitude towards mathematics (Vaughan, 2002; Gelici and Bilgin, 2011; Özdoğan, 2008; Andersen, 2009; Ural and veArgün, 2010; Efe, 2011; Çapar and Tarım, 2015; Titsankaew, 2015; Akman and Koçoğlu, 2016). In traditional learning environments, as the students are not sufficiently aware of each other, the attitude that may arise as a result of the interaction does not develop positively; in teamwork, it is possible to develop positive attitudes about mathematics based on interaction and common success. For example, 45% negative attitude towards mathematics prior to cooperative learning practices were identified at 90% positive level at the end of the practices (Bernero, 2000). It has been seen that



cooperative learning experiences in mathematics lessons increase students' confidence and to develop positive attitudes related to the ability to work on mathematics (Brush, 1997). Providing the skills and requirements needed for learning in cooperative practices requires time and practice for students and teachers (Harding and Fletcher, 1994). The scientific fact that needs to be taken into account is that the reason why the test procedure applied in this study did not provide a statistically significant expected development of students' attitude towards mathematics can be caused by the uncontrolled variables in the context of study conditions, duration, limitations and possibilities. Based on the results, the following suggestions are given.

Primary school teachers should be encouraged to use strategies and techniques that involve collaborative team work by raising awareness of the benefits of cooperative learning.

In mathematics teachers' guidebooks, activities organized according to cooperative learning methods and tools such as work sheets, monitoring tests and certificates that will enable these activities to be carried out in a practical way should be readily available.

Cooperative learning practices in mathematics courses should be started in early classes and students should benefit from each other. Thus, it is thought that students will be able to develop more positive attitudes towards mathematics by increasing their academic success.

Similarly, in experimental studies, longitudinal studies should be carried out which include intermediate measurements that can be used to evaluate the process by keeping the experimental application time longer. Thus, it is thought that cooperative learning process may have more positive effects on attitude.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

## REFERENCES

- Açıkgöz KÜ (2009). Active Learning İzmir: Biliş Publishing House.
- Akbuğa S (2009). The effects of the Structured Group Activities according to Cooperative Learning Principles in Primary School 4th Class Mathematics Lessons on Student Gains and Attitudes. İzmir: Dokuz Eylül University Institute of Educational Sciences, Approved Master Thesis.
- Akman Ö, Koçoğlu E (2016). Investigation 8th Grade Students Secondary School Cognitive Structure about Principles of Atatürk through Word Association Test. *Journal of Education and Training Studies* 4(11):151-162.
- Altun M (2006). Developments In Mathematics Teaching. *Uludağ University Journal of Faculty of Education* 223-238.
- Altun M (2013). Teaching Mathematics in Secondary School. Bursa: Aktüel Publishing House.
- Andersen T (2009). Using Cooperative Learning In A Sixth Grade Math Classroom. University of Nebraska - Lincoln: Math in the Middle Institute Partnership Action Research Project Report.
- Aptik A (1985). Method in Mathematics Teaching. Mathematics Teaching and Problems in Secondary Education Institutions(s. 175-186). Ankara: TürkEğitimDerneği Publishing House.
- Araz SG (2004). The Effect of In Teaching the Decimal Representation of Fractions Subject in the Classroom The Effect of cooperative Learning Method on Student Success Compared to the Traditional Method. İzmir: DokuzEylül University / Institute of Educational Sciences / Department of Primary Education.
- Arisoy B (2011). The Effect of Cooperative Learning Method STAD and TPT Techniques on Academic Achievement, Persistency and Social Skills Levels on 6th Grade Students' Mathematics Course on Statistics and Probability. Adana: Çukurova University /Institute of Social Sciences / Department of Primary Education.
- Aşıcı F (2014).The Effect of Teaching Elementary 6th Grade Mathematics Lessons by Using Excel Academic Achievements and Attitudes of Students. Ankara: Gazi University Institute of Educational Sciences.
- Atay DY (2003). The Changing Face of Teacher Education. Ankara: Nobel Publishing Distribution.
- Başkan T (1985). Contemporary Approaches In The Teaching of Mathematics. Teaching Mathematics and Problems in Secondary Education Institutions (s. 99-127). Ankara: TürkEğitimDerneği Publications.
- Baykul Y (1990). Changes in attitudes towards mathematics and science courses From Primary School Fifth Grade to the Last Class of High School and Equivalent Schools and Some Factors Considered to Be Related With Success in Student Selection Examination. Ankara: ÖSYM Publications.
- Bernero J (2000). Motivating Students in Math Using Cooperative Learning. Chicago, Illinois: Master of Arts Action Research Project, Saint Xavier University and Skylight Professional Development.
- Bilgin T (2004). Use of Student Teams Achievement Divisions Technique in Primary Education Seventh Grade Math Lessons (On the subject of polygons) and Application Results. *Uludağ University Faculty of Education Journal* pp. 19-28.
- Borich GD (2014). Effective Teaching Methods Research Based Application. Ankara: Nobel Academic Publishing.
- Bosfield GF (2004). A Comparison of Traditional Mathematical Learning and Cooperative Mathematical Learning. Los Angeles: Faculty of California State University.
- Bozkurt Y (1999). The Effect of Different Measurement Techniques Used at the End of Cooperative Learning in Primary School 4th Grade Math Lessons. Ankara: Hacettepe University Institute of Social Sciences, Approved Master Thesis.
- Bruning RH, Schraw GJ, Norby MM (2014). Cognitive Psychology and Instruction. (D. Çölkesen, Çev.) Ankara: Nobel Academic Consultancy.
- Brush T (1997). The Effects Of Student Achievement And Attitudes When Using Integrated Learning Systems With Cooperative Pairs. *Educational Technology Research and Development* pp. 51-64.
- Büyükoztürk Ş (2014). Experimental Designs. Ankara: Pegem Academy Publishing House.
- Çağlar A (2010). The Changing Role of School in the 21th Century and Some Optimistic Predictions on New Trends. The Education and Turkish Education System in 21st Century. Inside Ankara: Pegem Academy Publishing House. pp. 57-68.
- Can A (2014). Quantitative Data Analysis in Scientific Research Process with SPSS. Ankara: Pegem Academy Publishing House.
- Can A (2016). Quantitative Data Analysis in Scientific Research Process with SPSS. Ankara: Pegem Academy Publishing House.
- Çapar G, Tarım K (2015). Efficacy of the Cooperative Learning Method on Mathematics Achievement and Attitude: A Meta-Analysis Research. *Educational Sciences: Theory ve Practice* pp. 553-559.
- Carlan VG, Rubin R, Morgan BM (2005). Cooperative Learning, Mathematical Problem Solving, and Latinos. Brownsville: Cvel Department, School of Education.
- Charles CM (2003). Piaget Principles for Teachers. Ankara: Nobel Publishing Distribution.
- Çırakoğlu C (2009). The Effect of Cooperative Learning Method and Traditional Teaching Approach on the Academic Achievements of 6th

- Grade Students in Geometry Course. Ankara: Gazi University Institute of Educational Sciences, Approved Master's Thesis.
- Conring JM (2009). *The Effects of Cooperative Learning on Mathematic Achievement in Second Graders*. Minneapolis, Washington: Walden University College of Education.
- Coşkun M (2013). *The Effect of Narration Method on Attitude and Success in Teaching Mathematics Concepts*. Kırşehir: AhiEvrân University Institute of Social Sciences.
- Cüceloğlu D, Erdoğan İ (2015). *Öğretmen Olmak Bir Can'a Dokunmak. (Being a Teacher, Touching a Life)* İstanbul: Final Kültür Sanat Publishing House.
- Çüçen K, Ertürk E (2008). *The Place of Logic and Mathematics Knowledge in Abstract Thinking* Uludağ University Journal of Philosophy pp. 247-268.
- Deane JA (2001). *The Influence of Cooperative Learning on Students' Understanding of Mathematics and Literacy Content*. Boston: Boston College The Graduate School of Education Department of Teacher Education, Special Education, and Curriculum and Instruction Program of Curriculum and Instruction.
- Dewey J (2010). *School and Society*. Ankara: Pegem Academy Publishing House.
- Dirlikli M (2015). *The Effect of Cooperative Learning Methods on Academic Achievement and Retention in Analytical Examination of the Circle and its Reflections in the Class*. Erzurum: Atatürk University Institute of Educational Sciences, Approved Doctorate Thesis.
- Efe M (2011). *Cooperative Learning Method, Student Teams Success Sections and Clustered Assisted Individualization Techniques Mathematics Course "Achievements in Statistics and Probability" Unit, Effects on Attitudes and Motivations*. Hatay: Mustafa Kemal University Social Sciences Institute.
- Efe R, Hevedanlı M, Ketani Ş, Çakmak Ö, Efe HA (2008). *Cooperative learning theory and Practice*. Ankara: Eflâton Publishing House.
- Egüz Ş, Öztürk C, Kesten A (2018). "A Global Education Application in Turkey A Product Marketing Activity," *Universal Journal of Educational Research* 6(4):638-646.
- Erçelebi E (1995). *The Effects of Traditional Teaching Methods and Cooperative Learning Method on Mathematics Teaching*. İzmir: Dokuz Eylül University /Institute of Social Sciences.
- Erden M (1988). *Teaching Techniques Based on Collaboration Among Students*. Education and science pp. 57-60.
- Eurydice (2011). *Mathematics Education in Europe: Basic Challenges and National Policies*. Ankara: Education, Audiovisual and Culture Executive Agency.
- Gelici Ö, Bilgin İ (2011). *Introduction of Cooperative Learning Techniques and Examination of Student Views*. Adıyaman University Journal of Science pp. 40-70.
- Gülsar A (2014). *The Effect of Cooperative Learning on Mathematics Success and Student Opinions Regarding This Method*. Bursa: Uludağ University Educational Sciences Institute, Approved Master's Thesis.
- Harding FR, Fletcher RK (1994). *Effectiveness of Variations in Cooperative Cooperative Learning in RDS Mathematics Classes*. Nashville: Paper presented at the Annual Meeting of the Tennessee Academy of Science.
- Işık C, Albayrak M, İpek SA (2005). *Self Realization in Mathematics Teaching*. Kastamonu Education Journal pp. 129-138.
- Johnson DW, Johnson RT (2009). *An Overview Of Cooperative Learning*. Retrieved on 1 10, 2016 from <http://www.co-operation.org/>: <http://www.cooperation.org/what-is-cooperative-learning/>
- Johnson DW, Maruyama G, Johnson R, Deborah N, Skon L (1981). *Effects of cooperative, competitive, and individualistic goal structures on achievement: A meta-analysis*. Psychological Bulletin pp. 47-62.
- Johnson RT, Johnson DW, Tauer M (1979). *The Effects of Cooperative, Competitive, and Individualistic Goal Structures on Students' Attitudes and Achievement*. The Journal of Psychology pp. 191-198.
- Johnson SL (2013). *The impact of cooperative and traditional learning on the academic achievement of third grade students in selected rural school districts in northeast, South Carolina*. Orangeburg, South Carolina: Faculty of South Carolina State University.
- Kabuk Ö (2014). *A Review on The Effect of Cooperative Learning Techniques on Students' Mathematical Achievement* Burdur: Mehmet Akif Ersoy University Institute of Educational Sciences, Approved Master's Thesis.
- Karaçay T (1985). *Current Status and Evaluation of Mathematics Teaching*. Teaching Mathematics in Secondary Education Institutions and its Problems. Ankara: TürkEğitimDerneği Publishing House pp. 1-26.
- Karagöz DI (2007). *The Effect of Multiple Intelligence Theory Supported Cooperative Learning Method on the Academic Achievements and Persistency in Mathematics Course of Elementary Education Fourth Grade Students*. Adana: Cukurova University/Social Sciences Institute / Department of Primary Education.
- Koç B (2015). *The Effect of Cooperative Learning Method on Gain, Persistency and Social Skills in Mathematics Lesson*. Aydın: Adnan Menderes University Social Sciences Institute, Approved Master's Thesis.
- Koçoğlu E (2015). *Social Studies Teachers Perspective of Religion Education in Turkey*. International Online Journal of Educational Sciences 7(3):192-206.
- Koçoğlu E (2017). *Perceptions of teacher candidates about social network usage levels in Turkey*. Educational Research and Reviews 12(4):230-238.
- Koş OU, Başer N (2012). *The Role of Visualization Approach in Attitude towards Mathematics and Success Elementary Education Online* pp. 945-957.
- Kramarski B, Mevarech ZR (2003). *Enhancing Mathematical Reasoning in the Classroom: The Effects of Cooperative Learning and Metacognitive Training*. American Educational Research Journal pp. 281-310.
- Kuloğlu S (2005). *The Effect of Multiple Intelligence Theory on Student Success in Mathematics Teaching in Elementary Education Eighth Grade*. Balıkesir: Balıkesir University Science Institute.
- Macit E (2013). *Teacher Opinions on the Use of Cooperative Learning Method in Elementary Education Second Level Mathematics Lessons*. Malatya: İnönü University Institute of Educational Sciences.
- Marangoz İ (2010). *The Effect of the Cooperative Learning Method on Student Success and Attitudes Elementary 6th Grade Mathematics Course Geometry Learning Area*. Ankara: Gazi University Institute of Educational Sciences, Approved Master's Thesis.
- McLaren P (2011). *Life in Schools, Introduction to Critical Pedagogy*. (M. Y. Eryaman, and H. Arslan, Trans.) Ankara: Anı Publishing House.
- Mısır ZE, Çalışkan N (2007). *Conditions to be Considered in Constructivist Learning*. Ankara: Kök Publishing House.
- Özdemirli G (2011). *The Effectiveness of Cooperative Learning Method on Students' Math Achievement and Their Attitude towards Mathematics: A Meta-Analysis Study*. Adana: Çukurova University / Institute of Social Sciences / Primary Education Department.
- Özdoğan E (2008). *The Effect of Cooperative Learning Method on Student Attitude and Success in Primary School 4th Grade Mathematics Teaching: Computer Assisted Cooperative Learning And Cluster Assisted Individualization Technique*. İzmir: Ege Social Sciences Institute, Approved Master's Thesis.
- Özşarı T (2009). *Effect of Cooperative Learning on Mathematical Achievement of Elementary 4th Grade Students: Problem Based Learning (PBL) and Student Teams- Achievement Divisions (STAD)*. İzmir: Ege University Institute of Social Sciences, Approved Master's Thesis.
- Panitz T (1999). *The Motivational Benefits of Cooperative Learning*. New Directions For Teaching And Learning pp. 59-67.
- Panitz T (2010). *Cooperative Learning Structures Help College Students Reduce Math Anxiety and Succeed in Developmental Courses*. Cooperative Learning in Higher Education (s. 57-68). in Sterling, Virginia: Stylus Publishing, LLC.
- Pesen A, Bakır B (2016). *The Effect of Collaborative Learning Approach on 6th Grade Students' Achievements in Mathematics Course*. Adana: 3rd International Congress on Curriculum and Education.
- Philips DC, Soltis FJ (2004). *Learning: Perspectives*. Ankara: Nobel Publishing Distribution.
- Posluoğlu ZY (2002). *The Effectiveness of Cooperative Learning*

- Approach on Gaining Problem Solving Skills in Primary Mathematics Course. Ankara: Gazi University Institute of Educational Sciences, Approved Master's Thesis.
- Roseth CJ, Johnson DW, Johnson RT (2008). Promoting Early Adolescents' Achievement and Peer Relationships: The Effects of Cooperative, Competitive, and Individualistic Goal Structures. *Psychological Bulletin* pp. 223-246.
- Schunk D (2014). *Learning Theories*. Ankara: Nobel Publishing House.
- Senemoğlu N (2012). *From Development, Learning and Teaching - Theory to Application*. Ankara: Pegem A Academy.
- Şengül S, Ekinözü İ (2004). The Effect of Animation Method in Mathematics Class on Perceived Benefits of Mathematics and Student Attitude. Malatya: XIII. National Educational Sciences Congress İnönü University Faculty of Education.
- Slavin RE (1980). Cooperative Learning. *Review of Educational Research* pp. 315-342.
- Slavin RE (1981). Synthesis of Research on Cooperative Learning. *Research Information Service* pp. 655-660.
- Sofeme JR (2012). Impact of Cooperative Learning Approach on Senior Secondary School Students Performance in Mathematics. *Ife Psychologia* pp. 107-112.
- Tarım K (2003). Effectiveness of Cooperative Learning Method in Mathematics Teaching and A Meta-Analysis Study on the Cooperative Learning Method. Adana: Çukurova University / ScienceInstitute / Department of Mathematics.
- Titsankaew P (2015). The Effects of using Cooperative Learning on Student's Achievement and Attitude toward Mathematics. *Mathematics Education Program, International College*.
- Torchia SP (2012). Cooperative learning and its effect on fourth-grade mathematics students' achievement, motivation, and self-efficacy. Minneapolis, Minnesota: Capella University.
- Torun Ö (2009). The Effect of Multiple Intelligence Assisted Cooperative Learning Method on the Achievement and Persistency of Elementary 7th Grade Students in Mathematics Course 'Geometric Objects' subject. Ankara: Gazi University/Institute Of Education Sciences/ Department Of Elementary Education/Elementary Mathematics Education Department/ Elementary Mathematics Teaching Department.
- Tuğran Z (2015). The Effects of Cooperative Learning on Mathematics Self-Efficacy Perception and Success of High School Students. Çanakkale: Çanakkale Onsekiz Mart University Institute of Educational Sciences.
- Tunç M (2016). Effect of Cooperative Learning on Learning Styles. Rize: Recep Tayyip Erdogan University Institute of Social Sciences.
- Türkmen H (2016). Teacher Perspectives on Cooperative Learning Process and Evaluation of Teacher Guiding. *Journal of European Education* pp. 60-72.
- Umay A (1996). Mathematics Education and Its Measurement. *Journal of Hacettepe University Faculty of Education* pp.145-149.
- Ünlü M, Aydın S (2011). The Effects of Cooperative Learning Method on Academic Success and Retention Levels of 8th Grade Students in Mathematics Course on Permutation and Probability AhiEvan University Faculty of Education *Journal* pp. 1-16.
- Ural A (2007). The Effect of Cooperative Learning on Academic Success in Mathematics, Persistency, Perception of Mathematics Self-Efficacy and Attitude towards Mathematics. Ankara: Gazi University Institute Of Education Sciences.
- Ural A (2014). Legitimizing the elitist education: Staging Education Based on Conditional Transition *Journal of Policy Analysis in Education* pp. 45-56.
- Ural A, veArgün Z (2010). The Effect of Cooperative Learning on Success and Attitude in Mathematics. *TürkEğitimBilimleri Journal* pp. 489-516.
- Üre Ö (2008). *21st Century Teacher. New Views on Education* (pp. 17-21). Konya: Education Book House Publication.
- Vaughan W (2002). Effects of Cooperative Learning on Achievement and Attitude among Students of Color. *The Journal of Educational Research* pp. 359-364.
- Vega ML, Hederich CM (2015). The Impact of a Cooperative Learning Program on the Academic Achievement in Mathematics and Language in Fourth Grade Students and its Relation to Cognitive Style. *New Approaches in Educational Research* pp. 84-90.
- Yağışan N, Köksal O, Karaca H (2014). The Effect of Music Assisted Education on Success, Attitude and Persistency in Primary School Mathematics Lessons. *İdil Journal* pp. 1-26.
- Yıldırım Z (2011). The Effect of Cooperative Learning Method Cluster Assisted Individualization Technique on the Mathematics Achievements and Attitudes of the 6th Grade Students. Erzurum: Atatürk University/ Institute of Educational Sciences / Elementary Education Division /Department of Elementary Education /Elementary Mathematics Teacher Education.
- Yıldız N (2001). The Effect of Cooperative Learning Method on Student Success in Elementary 7th Grade Mathematics Teaching. Balıkesir: Balıkesir University / Science Institute/ Department of Mathematics Education.
- Yıldız V (1998). The Effects of Cooperative Learning and Traditional Teaching on Basic Mathematics Achievements of Preschool Children and Teachers' Views on Existing Practices. İzmir: DokuzEylül University Social Sciences Institute, Approved Doctorate Thesis.
- Zakaria E, Chin LC, Daud Y (2010). The Effects of Cooperative Learning on Students' Mathematics Achievement and Attitude towards Mathematics. *Journal of Social Sciences* pp. 272-275.