Research Article

The Effect of Cooperative Learning on Academic Success Levels of 8th Grade Students in the Subject of Triangles *

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Abstract

This study aims to research the effect of cooperative learning on the academic success of 8th grade students in the subject of triangles in mathematics. The study, in which the Mixed Method was used, was carried out on a total of 84 students studying two classes of a secondary school affiliated to the Ministry of National Education in the spring semester of 2017-2018 academic year. The study includes an experiment group and a control group. During the period of the four-week application process, the lessons are introduced using the cooperative learning method in the experiment group and using the traditional learning method in the control group. "Mathematical Success Test" developed by the researchers is held for experiment and control groups as pre-test and post-test in order to collect data. Furthermore, an open-ended semi-structured interview form is used at the end of the process to collect the opinions of students on the cooperative learning method. The data were analysed using SPSS.24 statistics program. Statistical analyses such as dependent and independent t-test, arithmetic mean, standard deviation, frequency and percentages were used to analyse the data. The collected data were tested at a significance level of 0,05. As a result of the study, a significant difference was determined in favour of the experiment group in terms of the post-test success levels. At the end of the study, experiment group students stated that they found the cooperative learning method beneficial and it helped improve sharing, communication, responsibility, and feelings of belonging and confidence.

Keywords: Cooperative learning, triangles, academic success, student opinions

1. INTRODUCTION

In the wake of an exponential increase in knowledge in parallel with the rapid progress in science and technology, societal expectations from education have changed. In this process, the society has begun to care about raising individuals who can learn to learn, produce and process information, work in cooperation, play an active role in social and economic activities, and interact positively with their environment. To ensure that Turkey reaches the level of contemporary civilization, it is essential to raise generations that have cognitive, social, and personal skills such as using communication technologies effectively, possessing advanced high-level thinking skills, being curious about questioning and research and sociable, being able to empathize and lead, and possessing a high sense of self-efficacy and problem solving (Atav, Akkoyunlu & Sağlam 2006).

Studies have shown that the Traditional Teaching Method (TTM) has failed to satisfy the expectations of the society and has led students to memorize information instead of thinking freely and scientifically, resulting in consumer individuals rather than productive individuals with limited problem solving ability, who focus on the result rather than the process in the face of events and have no ability to use information and communication tools effectively (Çelen & Seferoğlu, 2016). As a

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result of these inadequicies, taking into consideration the unsuccessful results in tests such as the Program for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS) organized internationally (Türkmen, 2016); the Ministry of National Education (MoNE) has adopted a constructivist education approach by changing its understanding of education. This approach, which advocates that the student is the organizer, interpreter, and reconstructor of knowledge, has put forward five basic assumptions by considering the cognitive, affective, and physical development of individuals; 1) Knowledge is obtained through personal contribution; 2) Knowledge is formed as a result of adaptation; 3) Knowledge is the individual interpretation of what is seen or felt; 4) Conceptual progress emerges from the sharing of different perspectives; 5) Information should be organized in a rational way (Pehlivan, 2010).

There are a myriad of courses taught to improve students' cognitive, affective, and motor skills. One of the most important of these courses is mathematics. Mathematics is usually described as a science that investigates abstract structures that it created itself by logical definitions using logic for their properties and patterns (Ziegler & Loss, 2017). It is known that thousands of students in Turkey and around the world do not like mathematics, have anxiety about mathematics or are afraid of mathematics (Katipoğlu & Öncü, 2015). It has been demonstrated by many studies (Dursun & Bindak, 2011; Ünlü & Aydıntan, 2011) that mathematical knowledge is quickly forgotten, causing prejudice, fear, and anxiety.

The interests and abilities of the students in the schools are different, but their goals are common. One of the difficult tasks of teachers is to predict which teaching method is suitable for students to achieve shared goals (Johnsen, 2009). Using a teaching method suitable for the subject facilitates the reconciliation of concepts, process steps, and results, increases success and interest, and develops a positive attitude (Aktepe, Tahiroğlu, & Acer, 2015). In addition, it reduces fear and anxiety and makes learning permanent by saving effort and time. One of the most preferred teaching methods in today's contemporary education system is the Cooperative Learning Method (CoP). CoP is a teaching method that involves students working together in groups of 2-6 people for a certain period of time in order to achieve shared learning goals and complete certain tasks and assignments together (Johnson, Johnson, & Holubec, 2008). CoP is a contemporary form of teaching that increases students' sense of responsibility, improves their social interactions, and is heterogeneous in terms of factors such as academic achievement, gender, and ability, in which small groups work together to achieve a shared goal (Slavin, 1990). CoP is a teaching strategy that encourages students to assist each other in a small group to achieve a common goal (Chan & Noraini, 2017).

A review on the national and international literature reveals that CoP is used in mathematics education as in many other fields. Examining the effect of CoP on mathematics success and permenance, Yıldız (2001) found that CoP has a significant effect on 7th-grade students' mathematics achievement. Bilgin (2004) used CoP on "polygons" and concluded that CoP was significantly effective in the experimental group. Kuzucuoğlu (2006) found that CoP is significantly effective on 5^{th}-grade students' mathematics achievement. Zakaria, Chin, and Daud (2010) found that CoP positively affects 6^{th}-grade students' mathematics successand attitudes towards mathematics. Efe (2011) used CoP in the 7^{th}-grade "statistics and probability" unit, concluding that CoP is effective on achievement, attitude, and motivation. Ünlü and Aydıntan (2011) used CoP on 8^{th}-grade "permutation and probability", concluding that CoP has a positive effect on achievement and permanence as a result of the study. Timayi, Bolaji, and Kajuru (2015) used CoP in secondary school geometry subjects and found that CoP is effective on achievement. Pesen and Bakır (2016) used CoP in the 6^{th}-grade subject of "field", concluding that CoP increases success and helps students understand the importance of cooperation with friends and activities such as tournaments are exciting and fun. Çiftçi (2018) identified 22 difficulties in a study designed to identify learning difficulties on "triangles" and to

examine technology-supported CoP environments, concluding that such difficulties are likely to be reduced with technology-supported CoP.

Triangles, the first sub-learning area in the field of geometry and measurement learning, include algebraic symbols as well as visual elements such as line, line segment, angle, side length, and height. 8th-grade students, who have difficulties in abstract thinking in terms of age range, have difficulty in establishing a relationship between these two and have problems in later geometry subjects. The main purpose of this study is to investigate the effect of studying the triangles subject with CoP on academic success so that students can overcome these problems and avoid experiencing any negative feelings towards mathematics in their later education life. It is expected that determining the effectiveness of CoP in teaching different subjects of mathematics will guide the studies in the literature and the teachers of mathematics lessons.

For this purpose, the following questions were addressed:

1. Is there a significant difference between the academic success scores of the experimental group, in which CoP was used and the control group in which TTM was used?
2. What are the opinions of the students in the experimental group about CoP?

2. METHOD

2.1. Research Design

Combining qualitative and quantitative methods in a study helps to provide a holistic understanding, create well-structured education policies, and explain various aspects of the researched subject (Baki & Gökçek, 2012). Based on this assumption, a mixed method was used in this research with a combination of quantitative and qualitative data. The mixed method involves collecting, analyzing, and interpreting quantitative and qualitative data in a single study or in a series of studies (Leech & Onwuegbuzie, 2009). To test the hypotheses in this method, firstly, quantitative data are collected and analyzed, then qualitative data are collected to make these data more meaningful and interpretations are made by using both types of data together (Büyüköztürk, Kılıç-Çakmak, Akgün, Karadeniz, & Demirel, 2016). In addition, since quantitative data will be insufficient to reveal individual differences among students, the use of qualitative data allows more detailed information to be collected.

A quasi-experimental design with a pretest-posttest control group was used to collect the quantitative data of the study. The design used in the study is given in Table 1.

Table 1. Research design

Groups	Pre-test	Experimental Study	Post-test
Experimental	Mathematics Success Test	X	Mathematics Success Test
Control	Mathematics Success Test		Mathematics Success Test

In addition, the semi-structured interview technique was used to determine the opinions and thoughts of the students on CoP. Due to the flexibility of semi-structured interviews; it removes the limitations of writing and filling-based tests and questionnaires and helps to gain in-depth information on a specific subject (Yıldırım & Şimşek, 2006).

2.2. Study Group

The study group consists of 8th-grade students who continue their education in a public school in the city center of Siirt which in Turkey during the 2017-2018 academic year. In the research, 8/B branch was determined as the experimental group and 8/A branch was determined as the control group

by simple random sampling method. The chances of choosing the research units are equal to each other in the simple random sampling method (Kılıç, 2013). The frequencies and percentages of the students included in the study group are shown in Table 2.

Table 2. Frequency and percentage table of student numbers

Groups	Classes	Frequency	%
Experimental	8/B	42	50
Control	8/A	42	50

Table 2 highlights that 42 students are avialble in both classes and their frequency is 50%.

Before the application started, the results of the independent groups t-test regarding the pre-test scores were examined to understand whether the experimental and control groups were equivalent to each other. The results obtained are shown in Table 3.

Table 3. Independent groups t-test pre-test scores of experimental and control groups

Groups	Tests	N	$\bar{X}$	SD	df	t	p
Experimental	Pre-test	42	5,10	2,31	82	- 1,23	0,22
Control	Pre-test	42	5,95	3,87			

Table 3 highlights that there is no significant difference (p>0,05) between the pre-test mean score of the experimental group ($\bar{X}$=5,10) and the pre-test mean score of the control group ($\bar{X}$=5,95). According to this finding, it can be inferred that the experimental and control groups were academically equivalent to each other prior to the study.

2.3. Data Collection Tools

2.3.1. Mathematics Success Test

Taking into account the annual plan of the 8th grade mathematics course of the 2017-2018 academic year, which includes units, a draft success test of 30 questions was prepared on triangles. In order to ensure the content validity of the Draft Test, a table of specifications (target-content chart) was prepared. Displaying the test content on a two-dimensional chart with the target successes in a test is called a table of specifications (Demirel, 2006). Before the draft success test was used, it was applied to 92 9th-grade students at two different high schools in Siirt city center for preliminary evaluation. After the application, item analysis was performed on the items separately and as a result of the analysis, the items with an item difficulty (p) 0,40 and the item's discrimination power coefficient (r) 0,30 were included in the test without changing, while those ranging between 0,20-0,30 were developed and corrected in line with the option analysis and expert opinions and included in the success test. Thus, a mathematics success test consisting of 22 items with a high item difficulty and item discrimination power was created. For the reliability of the final version of the test, it was applied to 50 9th-grade students at another high school in the city center of Siirt, and the KR-20 reliability coefficient of the test was calculated as 0,87. Since this coefficient is over 0,80, it indicates that the test is highly reliable (Özdamar, 1999).

2.3.2. Interview Form

The interview form was developed by the researchers to determine the opinions, thoughts, and suggestions of the students in the experimental group about CoP. While developing the form, a comprehensive field search was made on the subject, and the draft form was presented to the opinion of two instructors who are experts in the field. As a result of the feedback received from the experts, a draft interview form consisting of nine semi-structured open-ended questions was developed. The draft form was applied to eight students for preliminary evaluation, and as a result of the application, necessary examinations were made with two instructors and three questions were removed from the form. The final interview form, which was created with the remaining six questions, was applied only to the experimental group students. The students were asked to evaluate the positive and negative aspects of CoP, the effect of working with the group on active participation and retention in the lesson, and the activities performed.

2.4. Data Analysis

The quantitative and qualitative data of the study were analyzed in two parts. The quantitative data of the study were analyzed with the Statical Package for the Social Sciences 24.0 (SPSS) package program, the results were analyzed at the 0,05 significance level, and descriptive statistics, t-test, were used. To reveal the change in the success of the students after the application, the difference between the pre-test and post-test of the mathematics success test is shown with This difference facilitated the analysis and interpretation of the data.

Demographics was analyzed via frequency and percentage values, and after the pre-application of the mathematics success test, item difficulty index (p), item discrimination power index (r), mean, standard deviation, and internal consistency reliability coefficient were calculated. Five categories were determined for the educational status of parents in the interview form. However, in practice, due to the fact that the frequencies of some categories were very low, the category was combined, and the educational status of the father was analysed in three categories and the educational status of the mother in two categories.

The qualitative data of the study were analyzed with the classical content analysis method. In classical content analysis, coding categories derived directly or inductively are used to make intercorrelated inferences about the content of the textual document in the theoretical framework (Berg & Lune, 2015). In direct quotation, the criteria of being striking (different opinion), expository (suitability to the theme), and diverse were taken into consideration (Ünver, Bümen & Başbay, 2010). It has been stated that volunteering is essential in filling out the interview form, the opinions received will be strictly confidential, and the collected data will not affect their grades and will only be used for scientific research.

2.5. Aplication Process

The study, which lasted for 4 weeks in accordance with the annual plan of the mathematics course including units, was carried out with the "Student Teams Success Sections (STSS)" technique of CoP. While Küçükilhan (2013) emphasized that the STSS technique is easy to implement in crowded classrooms, Bilgin (2004) stated that the team rewards obtained by the team members when they reach the intended achievements ensure cooperation, teamwork, and acting in unison. In the study, the researchers did not intervene in the course and guided the course teacher who would carry out the applications. Before the application, the course teacher was interviewed one-on-one, and information was given about the planned study and his opinion was taken. In line with the positive opinion of the teacher, details such as how the application would be carried out, the basic aspects of the STAD technique to be used, the activities and materials to be used, the creation of groups, and the

evaluation were shared with him. In addition, the STAD handbook, which was prepared separately for teachers and students, was given to him following a literature review. The materials of the activities to be done prior to the course were prepared and their applications were made by the researchers and the teacher, and not only preliminary preparations were made for the course but also potential problems were prevented. At the end of the course, monitoring tests were applied to the students and the data obtained were transferred to the case summary sheets and evaluated. As a result of the evaluation, the first team of the week was rewarded and the team's name was announced on the class board. After all the acquirements were completed, the final test was applied and the team reward was given according to this test.

3. FINDINGS

Findings related to the sub-problems of the study are given under the headings of findings related to quantitative and qualitative data.

3.1. Findings related to Quantitative Data

As part of the first sub-problem of the study, whether CoP significantly differs on students' mathematics success was examined with the dependent group t-test. The results are shown in Table 4.

Table 4. Dependent groups t-test results of mathematics success scores of experimental and control groups

Groups	Tests	N	$\overline{X}$	SD	df	t	p
Experimental	Pre-test	42	5,10	2,31	41	-8,99	0,00
	Post-test		12,48	4,86			
Control	Pre-test	42	5,95	3,87	41	-3,91	0,00
	Post-test		9,62	5,54			

Table 4 highlights that the pretest mean score of the experimental group was ($\overline{X}$=5,10) and the posttest mean score was ($\overline{X}$=12,48). While the pretest mean score of the control group was ($\overline{X}$=5,95) and the posttest mean score was ($\overline{X}$=9,62). Besides, a significant difference ($p<0,05$) was observed between the pretest-posttest mean scores of the groups.

To understand the difference between the success of the experimental and control groups after the application, the independent group t-test was conducted between the scores of the groups in the post-tests. The results are shown in Table 5.

Table 5. Independent groups t-test results of post-test success scores of experimental and control groups

Groups	Test	N	$\overline{X}$	SD	df	t	p
Experimental	Post-test	42	12,48	4,86	82	2,512	0,014
Control	Post-test	42	9,62	3,87			

Table 5 highlights that a significant difference ($p<0,05$) was observed between the posttest mean score of the experimental group ($\overline{X}$=12,48) and the posttest mean score of the control group ($\overline{X}$=9,62). This indicates that the students in the experimental group learned the subject of triangles better than the students in the control group with higher mathematics success and more effective results of CoP.

3.2. Findings Related to Qualitative Data

Six questions in the interview form were asked to understand the opinions of the students on CoP. Main and sub-themes related to CoP were created. The data are shown in Table 6 below.

Table 6. Main and sub-themes in students' opinions on CoP

Main Themes	Sub-themes	F	%
Working with a group	Allows face-to-face communication	9	21
	Creates student teams	19	45
	Creates an obligation to work together	29	69
	Allows sharing and communication	17	40
	Allows ingroup communication	13	30
	Provides opportunity for striving for a shared goal	16	38
	Activities are held with materials and materials	26	62
	Improves intergroup competition	8	19
Effect on learning	Provides quick feedback	8	19
	Allows students to learn from each other	14	33
	Provides a huge amount of knowledge with little effort	23	54
	Provides active participation in the course	28	66
	Provides permenant learning	32	76
Motivation	Increases interest in the course	10	23
	Increases course success	24	57
	Provides cooperation, solidarity, self-confidence, communication, and socialization	32	76
	Allows class participation	23	55
	Makes the course fun	24	57
	Gives a sense of accomplishment together	30	71
	Develops a sense of responsibility	18	42
	Helps build positive relationships	17	40
	Sometimes causes noise in the class	8	19

Table 6 highlights that three main themes were formed as "*working with a group*", "*effect on learning*", and "*motivation*". In the main theme of "working with a group", 69% of the students state that CoP creates an obligation to work together and 62% of them state that courses are held with activities while 19% of them state that it creates intergroup competition. In the main theme of "*effect on learning*", 72% of the students state that CoP provides permanent learning and 66% of them state that it provides active participation in the course while 19% of them state that it provides quick feedback. Finally, in the main theme of "*motivation*", 76% of the students state that CoP provides cooperation, solidarity, self-confidence, communication, and socialization and 71% of them state that it gives them a sense of accomplishment together while 23% of them state that it increases their interest in the course.

The students stated that working with the group facilitates communication, encourages cooperation, and the lesson is taught with different materials. Some of the students' opinions that can be evaluated within the framework of the "*group work*" theme are as follows:

> *I think we can get immediate help from our friends because we have face to face communication with the team in the seating arrangement (S33).*

When we work as a team, my friends help me to correct my mistakes and learn better. While we only benefit from our teacher in our regular courses, we also get help from our team in cooperative learning (S14).

Teams do different activities with their own materials. Courses are held using different tools such as scissors, compasses, rulers, cardboard and interactive whiteboard (S17).

The students stated that CoP increased their participation in the course, provided permanent learning, and was effective in their learning by improving the sense of belonging. Some of the students' opinions that can be evaluated within the framework of the "*effect on learning*" theme are as follows:

Working with a group enhances my desire for participation in the course as my friends in the group make some points clear for me if I fail to understand to make sure I fully understand those points (S33).

I think it is good to have exams at short intervals. We both work regularly and find out what we have missed (S8).

I ask for help from my friedns when I have no idea about a topic. It is also very nice to choose the team name and team motto. Also, I am very happy that we were the best team of the second week (S6).

With this method, I had the opportunity to ask my friends questions that I did not understand. My grades increased slightly (S28).

Students stated that CoP contributed to the development of sense of responsibility, sharing, active participation, permanent learning, and self-confidence. Some of the students' opinions that can be evaluated within the framework of the "*Motivation*" theme are as follows:

While working with a group, everyone is trying to learn the subject. That's why courses are effective. I follow the course until the end without getting bored (S39).

I also help my teammates because I love helping people. I realized that I learned very well myself after explaining some topics to my friends. That's why, even when I work alone, I imagine that there is someone in front of me and I begin to explain the subject to that someone. Thus, permenant learning occurs (S23).

Normally I get bored with math quickly. But since my friends in the gorup are studying hard, this makes me study, too. If I fail to study, this is kind of being unfair to my friends (S12).

I think working with a group would be both more fun and more educational. One can get bored of studying alone, but teamwork helps students get rid of boringness and cooperate with each other (S40).

Some of the students stated that working in groups was not good for them as it caused noise in the classroom, and changing the classroom seating arrangement was not good for them. Some student opinions that can be evaluated in this context are as follows:

I didn't like working with a group at all. I didn't even understand the triangle thing at all. I study better myself. There is a lot of noise. Nobody is listening to others. I didn't want to come to class at all because there were people in my team that I didn't like (S41).

It was nice that everyone worked hard for the team to be successful. The noise in the class and the change of place were not good (S5).

Considering the students' opinions, it was observed that CoP increases the interest and success in the course, reinforces the feelings of cooperation, solidarity, active participation, belonging, responsibility, communication, and self-confidence, which are considered as positive aspects. However, some students mention about negative aspects such as overcrowded classes, the constant change in the seating arrangement, disagreements among the team members, and noise.

4. DISCUSSION and CONCLUSION

Throughout the application, the students' general knowledge levels before the application, their progress during the application, and their general knowledge levels after the application were

measured. The results based on the quantitative and qualitative data obtained from the tests and forms applied before, during, and after the study are discussed below. The data obtained from the pre-test of the study showed that the readiness levels of the groups were equal. In order for the results to be reliable, it is important that the prior knowledge of the groups is close.

At the end of the application, a significant difference was found between the post-test scores applied to the experimental and control groups as a result of the independent group t-test. This result shows that CoP is more effective in increasing students' mathematics success than TTM. While this result is in line with the results obtained in the studies of Efe (2011), Timayi, Bolaji and Kajuru (2015), Pesen and Bakır (2016) and Çiftçi (2018), it conflicts with the results in the studies of Gelici (2008). Studies revealing that CoP does not make a significant difference compared to TTM (Tanışlı & Sağlam, 2006) have shown that cooperative learning practices are more effective in providing permanent learning. From this point of view, it can be inferred that cooperative learning affects success positively, but it cannot be concluded that it provides this effect in all cases. This may be due to the large class size, the inconvenience of the subject, or the teacher's lack of experience in applying this method.

Experimental group students state that CoP increases the interest and success in the course, provides cooperation, solidarity, and socialization and ensures active participation in the course for everyone while claiming that it is also useful to use this method in different courses and toğics. This result overlaps with the studies of Ural and Argün (2010), Macit and Aslaner (2019), The positive perceptions of the students about CoP may arise from factors such as being included in a team, studying on the subject in depth and by understanding the logic behind it, and creating an environment where team members could easily express their every definite opinion, with motivating suggestions and immediate feedback. Students' feeling of belonging to a team and the sense of confidence that this feeling gives improve motivation, success, creativity, and understanding in students (Angell, 2014).

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5. REFERENCES

Aktepe, V., Tahiroğlu, M., & Acer, T. (2015). Matematik öğretiminde kullanılan öğretim yöntemlerine ilişkin öğrenci görüşleri [Student opinions on methods used in mathematics education]. *Nevşehir Hacı Bektaş Veli University Journal of Social Sciences 4*(2015), 127-143.

Angell, C. (2014). *Cooperative learning in the classroom*. The Graduate Faculty and the College of Education, Eastern Oregon University.

Atav, E., Akkoyunlu, B., & Sağlam, N. (2006). Öğretmen adaylarının internete erişim olanakları ve kullanım amaçları [Prospective teachers' internet access facilities and their internet usage]. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 30*(30), 37-44.

Baki, A., & Gökçek, T. (2012). Karma yöntem araştırmalarına genel bir bakış [A general overview of mixed method researches]. *Electronic Journal of Social Sciences, 11*(42), 1-21.

Berg, L. B. & Lune, H. (2011). *Qualitative research methods for the social sciences*, Boston, USA.

Bilgin, T. (2004). İlköğretim yedinci sinif matematik dersinde (çokgenler konusunda) öğrenci takimlari başari bölümleri tekniğinin kullanimi ve uygulama sonuçlari [Use of student teams and success sections (STAV) technique in seventh grade mathematics lesson (on polygons) and application results]. *Uludağ Üniversitesi Eğitim Fakültesi Dergisi*, *17*(1), 19-28.

Büyüköztürk, Ş., Kılıç-Çakmak, E., Akgün, Ö. E., Karadeniz, Ş. & Demirel, F. (2016). *Bilimsel araştırma yöntemleri [Scientific research methods]*. Ankara: Pegem Akademi Publishing.

Chan, L. L., & Noraini, İ. (2017). Cooperative learning in mathematics education. *International Journal of Academic Research in Business and Social Sciences, 7*(3), 539-553.

Çelen, F.K. & Seferoğlu, S.S. (2016). Bilgi ve iletişim teknolojilerinin kullanımı ve etik olmayan davranışlar: sorunlar, araştırmalar ve değerlendirmeler. *Journal of Computer and Education Research, 4* (8), 124-153. https://doi.org/10.18009/jcer.37546

Çiftçi, O. (2018). *Üçgenler konusundaki öğrenme güçlüklerinin belirlenerek önlenmesine yönelik tasarlanan teknoloji destekli işbirlikli öğrenme ortamının incelenmesi [The investıgation of the technology supported cooperative* learning environment designed for the prevention of learning dıfficulties in triangles]. Doktora Tezi, Atatürk Üniversitesi, Erzurum [Doctoral dissertation, Atatürk University, Erzurum, Turkey].

Demirel, Ö., (2006). *Eğitimde program geliştirme [Programme development in education]*. Ankara: Pegem Akademi Yayınları [Ankara: Pegem Akademi Publishing].

Dursun, Ş. & Bindak, R. (2011). İlköğretim II. kademe öğrencilerinin matematik kaygılarının incelenmesi [The investigation of elementary school students' mathematics anxiety]. *Cumhuriyet Üniversitesi, Edebiyat Fakültesi Sosyal Bilimler Dergisi, 35* (1), 18-21.

Efe, M. (2011). *İşbirlikli öğrenme yönteminin ilköğretim 7. sınıf öğrencilerinin matematik dersi "istatistik ve olasılık" ünitesindeki başarılarına, tutumlarına ve motivasyonlarına etkisi* [The effects of cooperative learning method of students? teams- achievement divisions and team assisted individualization instructions on students? attitudes, achievement and motivation at primary 7th grade `statistics and probability? units on mathematics course]. (Master's thesis, Mustafa Kemal University, Hatay, Turkey).

Gelici, Ö. (2008). *İşbirlikli öğrenme tekniklerinin ilköğretim 7. sınıf öğrencilerinin matematik dersi cebir öğrenme alanındaki başarı, tutum ve eleştirel düşünme becerilerine etkileri* [The effects of cooperative learning techniques on the stidents' achievement in algebra learning, their attitudes, and on their critical thinking skills]. *(*Master's thesis, Mustafa Kemal University, Hatay, Turkey).

Johnsen, S. (2009). *Improving achievement and attitude through cooperative learning in math class action research projects*, Lincoln Unıversty, Nebraska, USA.

Johnson, D. W., Johnson, R. T. & Holubec, E. J. (2008). *Cooperation in the classroom* (8th Ed.). Edina, MN: Interaction Book Company.

Katipoğlu, M., & Öncü, B. (2015). Sosyal bilgiler öğretmeni adaylarına göre matematik dersinin neden zor algılandığına yönelik öğrenci görüşleri [Students' views towards the reason why mathematics is hardly being perceived according to social studies teacher candidates]. *International Journal of Social Sciences and Education Research. 1*(4), 1120-1131.

Kılıç, S. (2013). Örnekleme yöntemleri [sampling methods], *Journal of Mood Disorders*, *3*(1), 44-46.

Küçükilhan, S. (2013). *ÖTBB tekniğinin sosyal bilgiler dersindeki akademik başarıya ve kalıcılığa etkisi [The effects of students teams-achievement divisions method on academic success and permanence in social sciences les]*. (Master's thesis, Afyon Kocatepe University, Turkey).

Kuzucuoğlu, G. (2006). *İşbirlikli öğrenme yönteminin ilköğretim beşinci sınıf öğrencilerinin matematik dersindeki başarılarına etkisi [The effect of cooperative learning methods on the success of the 5th class's students in primary school in the mathematic lesson]*. (Master's thesis, Afyon Kocatepe University, Afyonkarahisar, Turkey).

Leech, N. L., & Onwuegbuzie, A. J. (2009). A typology of mixed methods research designs. *Qual Quant, 43,* 265–275.

Macit, E. & Aslaner, R. (2019). Ortaokul matematik derslerinde işbirlikli öğrenmenin kullanılmasına ilişkin öğretmen görüşleri [Views of teacher on using cooperative learning in math lessons at primary school]. *Journal of Science, Mathematics, Entrepreneurship and Technology Education*, *2*(2), 134-157.

Özdamar, K. (1999). *Paket programlar ile istatistiksel veri analizi 1 [Data analysis I with package programs]*, Eskişehir: Kaan Kitabevi, [Eskişehir: Kaan Publishing].

Pehlivan, H., (2010, May). *Eğitimde yapılandırmacı yaklaşım [Constructivist approach in education],* 1. Ulusal Eğitim Programları ve Öğretim Kongresi,13-15 Mayıs, Balıkesir.

Pesen, A. & Bakır, B. (2016). İşbirliğine dayalı öğrenme yaklaşımının 6. sınıf öğrencilerinin matematik dersi alan konusundaki başarılarına etkisi [The effect of cooperative learning approach on 6th grade students' success in the 'field' subject in mathematics]. *Uluslararası Eğitim Programları ve Öğretim Çalışmaları Dergisi, 6*(11), 71-84.

Slavin, R. E. (1990). *Comprehensive cooperative learning methods: embedding cooperative learning in the curriculum and school, cooperative learning*, In S. Sahran (Ed.), NY: Theory and Research Slavin.

Tanışlı, D., & Sağlam, M. (2006). Matematik öğretiminde işbirlikli öğrenmede bilgi değişme tekniğinin etkililiği [Effectiveness of the exchange of knowledge method ın cooperative learning in mathematics teaching]. *Journal of Theory and Practice in Education, 2*(2), 47-67.

Timayi, J. M., Bolaji, C., & Kajuru, Y. K. (2015). Effects of jigsaw IV cooperative learning strategy (J4CLS) on academic performance of secondary school students in geometry. *International Journal of Mathematics Trends and Technology, 28*(1), 12-18.

Türkmen, H. (2016). İşbirlikli öğrenme sürecinde öğretmen bakış açıları ve öğretmen yönlendirmelerinin değerlendirilmesi, [Assessment of teacher perspectives and directions on the collaborative learning process]. *Journal of European Education, 6*(1), 60-72.

Ünlü, M., & Aydıntan, S. (2011). İşbirlikli öğrenme yönteminin 8. sınıf öğrencilerinin matematik dersi "permütasyon ve olasılık" konusunda akademik başarı ve kalıcılık düzeylerine etkisi [The effect of cooperative learning method on the student's success and recall levels of the 8 th grade students learning in permutation and probability subject]. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi,12*(3), 1-16.

Ünver, G., Bümen, N. T., & Başbay, M. (2010). Ortaöğretim alan öğretmenliği tezsiz yüksek lisans derslerine öğretim elemanı bakışı: Ege üniversitesi örneği [Faculty members' perspectives towards secondary teacher education graduate courses at Ege university]. *Eğitim ve Bilim Dergisi, 155* (35), 63-77.

Ural, A., & Argün, Z. (2010). İşbirlikli öğrenmenin matematik mantığı ve tutuma etkisi [The effect of cooperative learning on mathematics achievement and attitudes]. *Türk Eğitim Bilimleri Dergisi, 8*(2), 489-516.

Yıldırım, A. & Şimşek, H., (2006*). Sosyal bilimlerde nitel araştırma yöntemleri [Qualitative research methods in the social sciences]*. Ankara: Seçkin Yayıncılık [Ankara: Seçkin Publishing].

Yıldız, N. (2001). *İşbirlikli öğrenme yönteminin ilköğretim 7. sınıf matematik öğretiminde öğrenci başarısı üzerine etkisi [The effect of learning method on student achievement in mathematics teaching of primary school 7th class]. (*Master's thesis, Balıkesir University, Turkey).

Zakaria, E., Chin, L. C., & Daud, Y. (2010). The effects of cooperative learning on students' mathematics success and attitude towards mathematics. *Journal of Social Sciences, 6*(2), 272-275.

Ziegler, G. M., & Loss, A. (2017). "What is mathematics?" and why we should ask, where one should experience and learn that, and how to teach it, *Proceedings of the 13th International Congress on Mathematical Education,* 63-77, Hamburg, Germany.