Journal of Education and e-Learning Research
Vol. 6, No. 2, 52-60, 2019
ISSN(E) 2410-9991/ISSN(P) 2518-0169
DOI: 10.20448/journal.509.2019.62.52.60

The Effect of Using Mathematical Games on Primary School 4th Grade Students' Attitudes towards Mathematics Course and Their Visual Metaphorical Perceptions

Zeynep Doğan[1]
Damla Sönmez[2]

[1]*Yildiz Technical University, Faculty of Education, Istanbul, Turkey*
Email: zeynepyildiz.2005@hotmail.com Tel: 00902123834856
[2]*Uludag University PhD Student, Bursa, Turkey*
Email: damlasonmez91@hotmail.com Tel: 00902123834856

(✉ Corresponding Author)

Abstract

The purpose of the study was to examine the effects of using mathematical games on 4th grade students' attitudes towards mathematics course and their visual metaphoric perceptions. The study was conducted with 101 students in a public school in Istanbul. Mixed method research design was used in the study. The attitude scale prepared by Baykul (1990) was applied as pre-test and post-test to the students in the experimental and control groups. At the same time, the metaphoric perception form which was formed to understand the visual metaphoric perceptions of the students was applied as pre-test and post-test to the experimental group students. According to the findings, it was seen that the mathematical games which were applied did not make a significant difference on students' attitudes. However, significant differences were found in visual metaphors created by students. As a result of the detailed analysis of the elements in visual metaphors, it was observed that the use of mathematical games generally affected the metaphorical perceptions of students about mathematics positively.

Keywords: Mathematics education, Mathematical games, Attitude, Metaphorical perception, Primary school students, Visuals.

Citation | Zeynep Doğan; Damla Sönmez (2019). The Effect of Using Mathematical Games on Primary School 4th Grade Students' Attitudes towards Mathematics Course and Their Visual Metaphorical Perceptions. Journal of Education and e-Learning Research, 6(2): 52-60.
History:
Received: 5 November 2018
Revised: 10 December 2018
Accepted: 23 January 2019
Published: 15 March 2019

Publisher: Asian Online Journal Publishing Group

Contribution/Acknowledgement: Both authors contributed to the conception and design of the study.
Funding: This study received no specific financial support.
Competing Interests: The authors declare that they have no conflict of interests.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study was reported; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained.
Ethical: This study follows all ethical practices during writing.

Contents

Contribution of this paper to the literature

This study contributes to the existing literature by investigating the effects of using mathematical games on 4th grade students' attitudes towards mathematics course and their visual metaphoric perceptions.

1. Introduction

The game word has many different defined forms. According to TLA (Turkish Language Association) (1998) game is an entertainment applied based on certain rules in order to spend time. The main purpose of the games is not to win or lose the players, but to get pleasure and enjoy (Er, 2008).

As the word meaning includes the meaning of instructiveness, instead of the word "game", the term "educational game" is widely used in both educational applications and researches for education. Educational game can be defined as all of the activities that positively affect the physical, mental and spiritual development of the child, that stimulate the child's feelings of joy and pleasure, and help the child gain good manners and habits (Varışoğlu *et al*., 2013). The main purpose of education is to produce science and technology by helping people develop their creativity (Cetin, 2016). From this point of view, it can be said that the education system aims to advance the thinking structures of individuals, use their minds in different ways, and raise individuals who can create new things without repeating the ones that have been done before (Oztürk, 2004). There are few studies on educational games in Turkey and the use of these educational games has an important role in mathematics education. Mathematical knowledge and problem solving related activities should be placed in the games in order to gain the targeted skills (Cetin, 2016). The benefits of educational mathematics games are as follows; create meaningful situations for learning, becomes a source of motivation for participation in class, helps students reduce their fears of failing and making mistakes, in this way, it creates the necessary opportunities for students to develop self-confidence and positive attitude towards mathematics, the courses taught with games provide more learning compared to the courses taught in a traditional way, creates an opportunity to test intuitive ideas and problem solving strategies through increased interactions between children, allows students to learn at different levels (Davis, 1995).

Teaching mathematics with educational games can be effective in changing the attitude towards the course positively (Erşen, 2014). Therefore, it is thought that it is important to reveal the attitudes of the students towards mathematics course.

According to TLA (1998) the attitude word is expressed as behavior. Students can change their attitudes about mathematics by gaining the necessary knowledge and skills. A student who has a positive attitude towards mathematics will be more successful in this course than a student with a negative attitude (Gürel, 2012). In the first years of primary education, all students who encounter mathematics course do not have the same attitude towards this course. Students developing the idea that they cannot be successful in mathematics course start not to show interest in mathematics course. As a result of this, they have a negative attitude towards the course. As a consequence of the negative attitude they developed, their love for mathematics class begins to disappear (Yenilmez and Özbey, 2006).

Revealing the attitudes of the students about mathematics course is seen important to change their attitudes towards math. It is thought that after revealing the attitudes, the use of metaphor in the education of mathematics course, which is an abstract course, will make it easier for students to understand concepts.

Metaphors are also used in teaching mathematics. The use of metaphor is an important tool that helps in the concretization of abstract concepts. The human memory has difficulty in giving meaning to the abstract data by itself, a concept perceived as abstract is embodied in a way that the brain knows precisely (Kutluay, 2009). The word 'metaphor' was formed by the combination of the words 'meta'(on) and 'phrein' (to carry) in ancient Greek. It describes the individual mental/ linguistic processes in which something through its various perspectives carries or transmits to another. Metaphors help to reveal something that is wanted to be told more effectively by using fewer words (Girmen, 2007). The transformation of abstract concepts that are difficult to understand through analogy into concrete concepts that have already been encountered is carried out with the help of metaphors (Geçit and Gencer, 2011). Metaphors may be useful in concretizing abstract concepts that students do not encounter in the daily life and the students have difficulty in understanding. Metaphors are frequently used in education, especially with the concept of learning (Cengiz, 2016). Metaphors are used in educational fields as well as in cognitive and literary fields. Metaphors as a useful teaching material, help students to understand and define scientific concepts more easily. The metaphors used for teaching are useful in linking a conceptual situation to another conceptual situation and also have a very important place in finding the solution of many problems (Sanchez *et al*., 2000).

Considering all of these, it is thought that it is important to reveal the implementation of educational games in education, the students' attitudes towards mathematics course and the metaphors they create. Therefore, the aim of this study was to investigate the effects of the use of mathematical games on primary school 4th grade students' attitudes towards mathematics course and their visual metaphorical perceptions. Problem statement of the study was determined as 'What is the effect of the use of mathematical games on primary school 4th grade students' attitudes towards mathematics course and their visual metaphorical perceptions?'.

2. Method

2.1. Research Design

This research was designed as a mixed method research in which both quantitative and qualitative methods were used. Balci (2018) described the mixed method research design as a mixture of both qualitative and quantitative research approaches during one or more phases of a research. In this research, an exploratory sequential mixed method was used from mixed method models. In this method, quantitative studies are carried out at the beginning stage of the research and the results are analyzed and then the results are restructured in order to detail the results with qualitative studies (Creswell, 2013). In the quantitative part of the study, experimental design with pretest-posttest-control group design was used. In order to provide more detailed information about

the results of the experimental application, visual metaphors created by the students in the experimental group before and after the application were investigated through qualitative research.

2.2. Participants

The participants of the study were the 4th grade students attending in a public school in Istanbul during the 2017-2018 academic year. In this school, there were four 4th grade classrooms and there were 101 students as 4th graders in total. These students were chosen based on the purposive sampling principle. The purposive sampling is the selection of situations that are rich in knowledge in accordance with the objectives of the study done in order to conduct a deep research (Buyukozturk *et al*., 2012). As a result of interviews with primary school 4th grade teachers working in the school, the academic success levels of the classes were found to be close to each other. In this respect, randomly two classes were selected and were determined as the control group and the remaining two groups were chosen as the experimental group. Table 1 shows the distribution of the students in the experimental and control groups by gender.

Table-1. Distribution of the students in the sample by gender.

	Girl		Boy		Total	
	N	%	N	%	N	%
Experimental Group	23	46	27	54	50	100
Control Group	27	53	24	47	51	100
Total	50	49	51	51	101	100

Source: Research data.

2.3. Data Collection Tools

In order to measure the attitudes of the students in the experimental and control groups towards mathematics course, the Likert-type attitude scale developed by Baykul (1990) that involves a 30-item, one-dimensional and five-point was used. 15 items in the scale are positive, 15 items are negative. The lowest score that can be taken from the attitude scale is 30 and the highest score is 150. When scoring the scale, the option of "Completely agree" is rated as 5 points and the option of "Completely disagree" is rated as 1 point in positive items. In negative items, the option of "Completely agree" is rated as 1 point whereas the option of "Completely disagree" is scored as 5 points. The Cronbach alpha coefficient of the attitude scale was found to be 0.96 (Gürel, 2012). Besides, a metaphorical perception form was prepared to reveal the students' ideas towards mathematics. There is an instruction of 'When math course is mentioned, draw the first thing that comes to your mind' and under this directive there is also a section where the appropriate gap is available for students to create their visuals in the form.

2.4. Data Analysis

Mathematics attitude scale was applied in order to determine the effect of the use of mathematical games on students' attitudes towards mathematics course. Pretest-posttest control group experimental design was used in one part of the study. The scores obtained from the attitude scale of the students in the experimental and control groups were analyzed by statistical methods. Since Mathematics Attitude Scale was applied as a pre-test and post-test in experimental and control groups, statistical analyzes were performed with SPSS program in order to determine whether there was a significant difference in the mean scores. For this part of the study, since the number of participants was 50, Shapiro-Wilk W Test was applied to the normality tests which were applied in order to understand whether the data showed normal distribution. It was also used to determine which test to analyze the difference between the mean scores. Wilcoxon signed rank test was used for the statistical analysis of the data which were found not to have normal distribution. As the mean score analysis was performed between the different groups in the pretest and posttest applied in both experimental and control groups, Mann Whitney U test was used.

In the analysis of qualitative data, the visual metaphors formed by the experimental group students in metaphoric perception forms were examined and analyzed in detail. The implementations with the use of mathematical games were performed only in the experimental group. Therefore, the metaphorical perception form was applied as a pre-test and post-test only to the experimental group students in order to examine the effect of mathematical game usage on visual metaphoric perception. In the analysis of visual metaphors, students were divided into three levels as low, medium and high based on the score they obtained from the attitude scale. Then, the metaphors created by the students that were from different levels were examined separately and the metaphors they created before and after the implementation were compared by 2 field experts. The results of the analysis were formed based on the points where the field experts agreed. In cases where field experts did not agree, a third field expert was consulted and the opinions of the third field expert were taken. In this respect, the reliability of the analyzes related to visual metaphors was ensured.

3. Findings

3.1. Sub-Problem 1: What is the Relationship Between Experimental and Control Groups' Mathematics Course Attitude Scale Pre-Test Mean Scores?

The pre-test attitude scale scores of the students in the experimental and control groups were used in order to compare the attitude levels towards mathematics course before the application. Mann Whitney U test was applied to determine whether the experimental and control groups were equivalent to each other before the application. The results were shown in Table 2.

Table-2. Analysis of the difference between the Math Attitude Scale Pre-test Scores of the Students in the experimental and Control Group.

Group	N	$\overline{X}$	S	p
Experimental Group	50	111.14	28.09	.497
Control Group	50	116.60	21,35	

Source: Research data.

When the results were examined, it was seen that there was a 5-point difference between the pre-test mean scores of the students in the experimental and control groups. An analysis was made to understand this 5-point difference whether it was a significant difference. However, it was found that there was no significant difference between these two score averages (p>0.05). Based on these results, it was understood that the students in the experimental and control groups received similar scores from the mathematics course attitude scales before the application. As a result of the findings, it was seen that the classes selected as experimental and control groups were equivalent in terms of attitudes towards mathematics course.

3.2. Sub-Problem 2: What is the Relationship between the Experimental Group Students' Mathematics Course Attitude Scale Pre-Test and Posttest Mean Scores?

The Shapiro-Wilk test was used to examine the normality distributions of mathematics course attitude scores of the students in the experimental group before and after the application. Due to the fact that the data did not have a normal distribution, Wilcoxon test was performed to determine whether there was a significant difference in the pre-test and post test results of the students in the experiment group. Table 3 shows the results of the Wilcoxon test.

Table-3. Comparison of Pretest-Posttest Mean Scores of Experimental Group Students with Wilcoxon Test.

Group	Test	N	P
Control Group	Pre-test	50	.629
	Post-test	50	

Source: Research data.

According to the results, it was seen that there was no significant difference between the pretest and posttest mean scores of the students in the experimental group since it was p> 0.05. There was no significant difference between the mean scores of the experimental group students who were implemented mathematical games before and after the application.

3.3. Sub-Problem 3: What Is The Relationship between the Control Group Students' Mathematics Course Attitude Scale Pre-Test And Posttest Mean Scores?

The Shapiro-Wilk test was used to examine the normality distributions of mathematics course attitude scores of the students in the control group before and after the application. Due to the fact that the data did not have a normal distribution, Wilcoxon test was performed to determine whether there was a significant difference in the pre-test and post-test results of the students in the control group. Table 4 shows the results of the Wilcoxon test.

Table-4. Comparison of Pretest-Posttest Mean Scores of Control Group Students with Wilcoxon Test.

Group	Test	N	P
Control Group	Pre-test	50	.301
	Post-test	50	

Source: Research data.

According to the results, it was seen that there was no significant difference between the pretest and posttest mean scores of the students in the control group since it was p> 0.05. Accordingly, there was no significant difference between the mathematics attitude scores of the control group students who were exposed to the traditional method before and after the application.

3.4. Sub-Problem 4: What is the Relationship between Math Lesson Attitude Scale Post-Test Mean Scores of Experimental and Control Groups?

The post-test attitude scale scores of the students in the experimental and control groups were compared in order to examine the attitude levels towards the mathematics course after the application. Mann Whitney U test was applied for this purpose. The results were shown in Table 5.

Table-5. Analysis of the difference between the Math Attitude Scale Post-test Scores of the Students in the Experimental and Control Group.

Group	N	$\overline{X}$	S	P
Experimental Group	50	113.70	24.73	.931
Control Group	50	115.40	23.99	

Source: Research data.

When the results were examined, it was seen that there was a 2-point difference between the post-test scores of the students in the experiment and control groups. An analysis was made to understand this 2-point difference whether it was a significant difference. However, it was found that there was no significant difference between these two score averages (p>0.05). Based on these results, it was seen that the students in the experimental and control groups received similar scores from the mathematics lesson attitude scales after the application. As a result

of the findings, mathematics education performed in the experimental group using mathematical games did not make a significant difference on the attitude scores of the students.

3.5. Sub-Problem 5: Considering The Attitude Levels of Students Towards Mathematics Course, How Do the Metaphors Which Experimental Group Students Created Before and After the Application Change?

At this stage of the study, the attitude levels of the students in the experimental group were investigated by taking into consideration the pre-test data of the mathematics course attitude scale. Students were categorized into three levels of attitudes according to their scores. These categories were ranged as low, medium and high level attitude. The metaphors created by the students related to mathematics course before and after the application which was carried out with the use of the mathematical games were examined based on the attitude levels of the students. For this purpose, 2 students from low and medium mathematical attitude level, 3 students from high mathematical attitude level were randomly chosen. Table 6 shows the attitude levels of the students based on the attitude test scores of the students.

Table-6. The Frequency and Percentage of Students' Attitude Levels.

Score Interval	f	%
42-77 (Low Mathematical Attitude Level)	12	%12
78-112 (Medium Mathematical Attitude Level)	22	%22
113-148 (High Mathematical Attitude Level)	66	%66
Total	100	%100

Source: Research data.

3.5.1. Comparison of Pre-Test and Post-Test Metaphors of Students with Low Mathematical Attitude Level

Figure 1 shows the drawings of the student P13 chosen from low mathematical attitude level before and after the application.

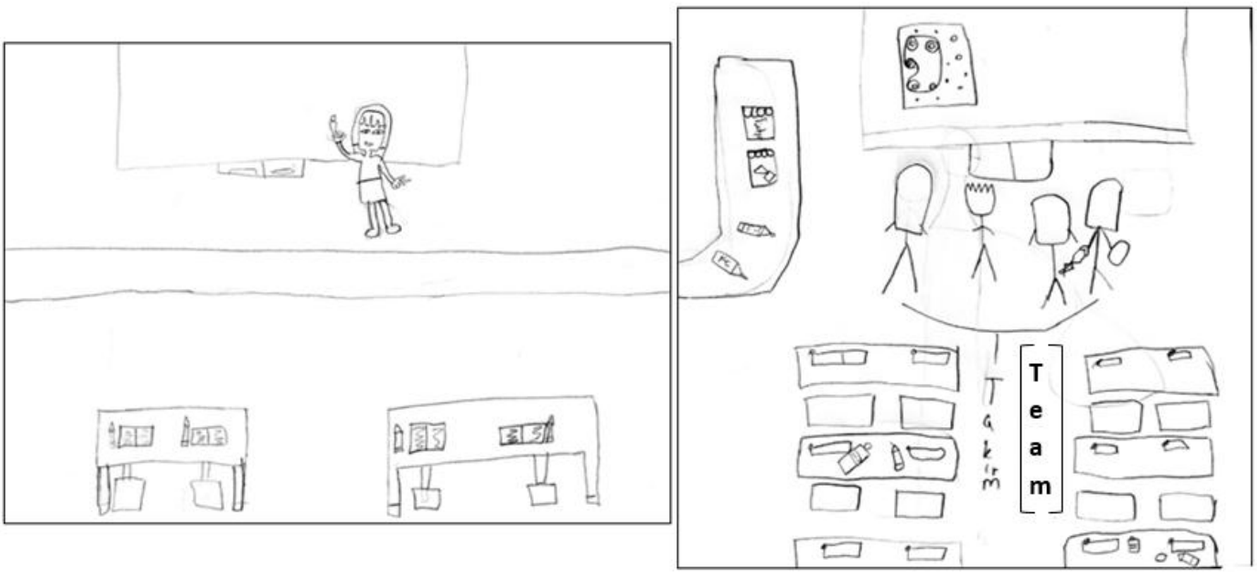

Figure-1. The drawings created by the student P13 with low mathematical attitude level before and after the application.

When examining the drawing of the student P13 which was created before the mathematical games application, it was thought that the student considered the process of mathematics course as a classical classroom environment. The image depicted an environment in which teachers were teaching in a classroom by using the blackboard, and in which there were notebooks and pens on the desks. When the visual image of the same student after the application was examined, it was seen that the image contained much more detail and elements. It was found that while there were no students in the first image, the second image showed a group of 4 people under the name of "team". It also drew attention to the fact that there were tools other than notebooks and pens on the desks. In addition, objects similar to equipment or activity materials were drawn on a separate table. Based on these findings, it was seen that the student created a classroom environment in which individual learning took place before the application, students formed a classroom environment in which the student was actively involved in the learning environment as groups after the application. In fact, this classroom environment represented a memory of the application process in the research. It is thought that the reason why the student's attitude towards mathematics is low is due to the fact that he sees the mathematics lesson as a lesson in which the teacher tells the subject, and the student sits and listens to the teacher during the course.

Figure 2 shows the drawings of the student P43 from low mathematical attitude level before and after the mathematical games.

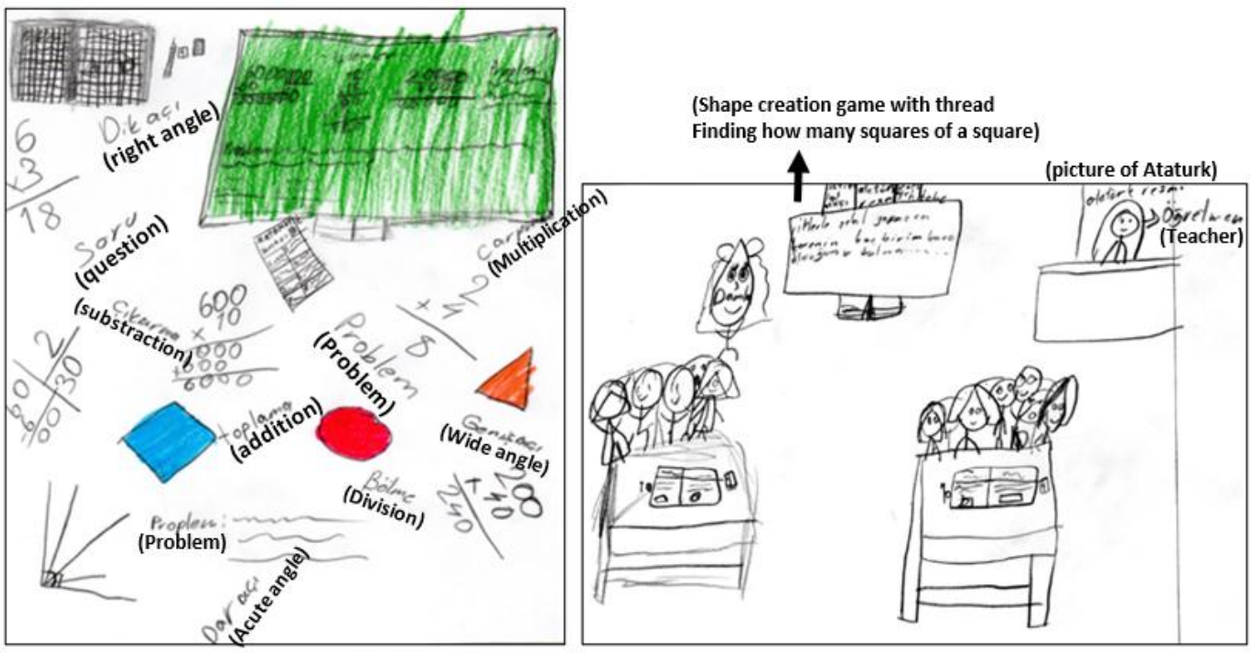

Figure-2. The Drawings of the student P43 with low mathematical attitude level before and after the application.

When analyzing the drawings of the student P43 which was created before the application, it was seen that the student had complex thoughts about mathematics course. In the first visual created by the student, it was seen that there were drawings such as a blackboard with written mathematics problems, various images and names of mathematical concepts, the word 'problem' and four operations exercises depending on the themes seen in mathematics course. In other words, it was thought that this student considered mathematics course as only a course consisting of concepts and operations. However, considering the intensity of the mathematical operations in the image, it was observed that this student thought mathematics course as exam oriented. When the visual of the same student after mathematical games was examined, it was seen that there was a change in the student's perspective about the mathematics course. Because, in the second image, mathematical concepts and operational expressions were replaced by group work or peer learning. In this respect, it can be said that the applied mathematical games enable the student to look at the course from a different perspective. In the second image, the student drew his classroom, his friends in the class and his teachers and this can be interpreted as a sign that he sees mathematics in a different way. Another detail about the second visual was that the faces of the teachers and students in the image were laughing. This can be interpreted that the student is happier in the mathematics class and he sees his teacher and his friends happy.

3.5.2. Comparison of Pre-Test and Post-Test Metaphors of the Students with Medium Mathematical Attitude Level

Figure 3 shows the drawings of the student P1 with medium mathematical attitude level before and after the mathematical games.

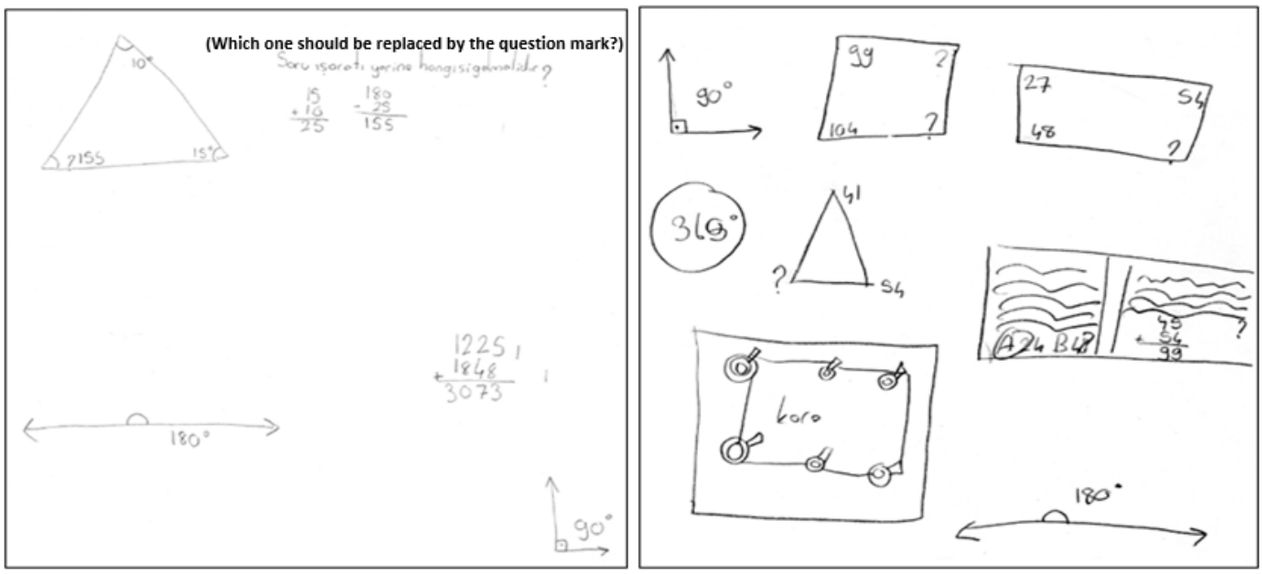

Figure-3. The drawings of the student P1 with medium mathematical attitude level before and after the application.

When examining the drawing created by the student P1 before the mathematical games application, it was seen that there were mathematical concepts such as triangles, angles, and four operations exercises. From this point of view, it can be thought that the student does not have any other ideas about mathematics other than what he learned in the mathematics course, and it can be said that he has no connection with the places in his daily life where he uses mathematics. However, it can be said that the mathematics course for this student consists of only

the questions asked and the solutions to these questions. When the drawing of the student after the application was examined, geometric shapes, angles and four operations were seen as in the previous drawing. Unlike the first drawing, it was seen that he drew one of the mathematical games performed in the classroom after the application. Even though it is not enough to comment as a positive or negative effect on the student's attitude towards mathematics, this can be interpreted that the student is influenced by mathematical games and developed the idea that mathematics can be used in other fields.

Figure 4 shows the drawings of the student P49 having the medium level mathematical attitude before and after the mathematical games.

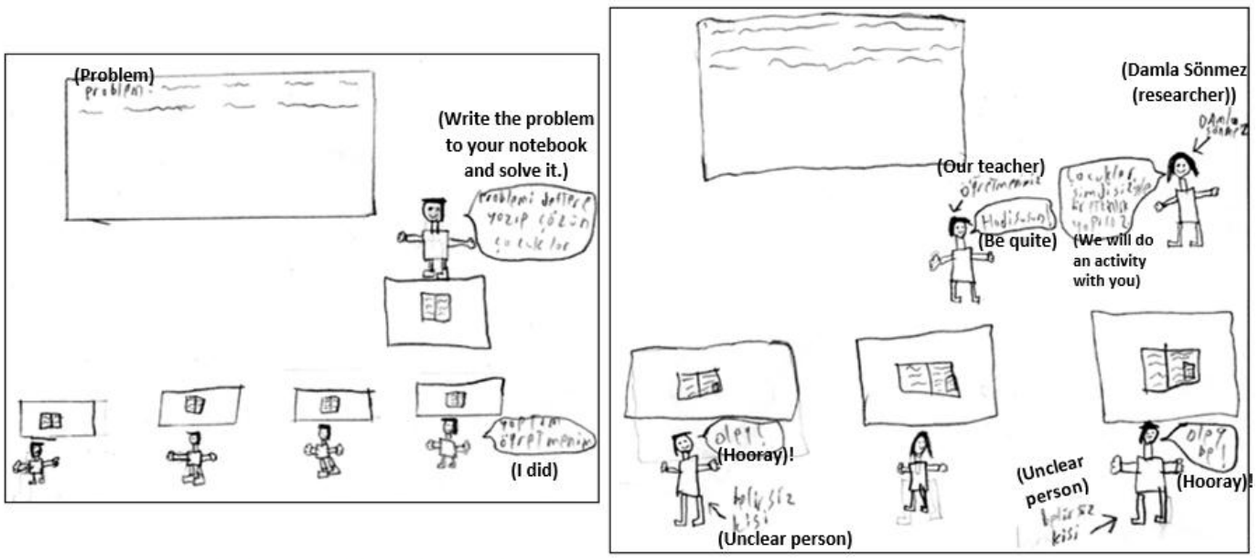

Figure-4. The drawings of the student P49 having medium level mathematical attitude before and after application.

When looking at the drawing created by the student P49 before mathematical games, the classroom environment, teachers, students and the problem on the board stood out at first. It was noticed that there was a teacher who asked questions and a student who solved the question. It can be said that this student considers mathematics as learning the math themes in the classroom and solving the question.

When the drawing of the student after the application was examined, it was observed that teachers, students, classroom environment and board were drawn again. However, the word "problem" which was written on the board in the previous drawing was not seen on the board in the second drawing. It can be said that the meaning of the mathematics course, which is perceived as only problem solving, has changed in the student's mind after the mathematical games. Again, it was observed that this student was more positively influenced by mathematical games. Because it was seen that the dialogue in the second image showed an environment where the students reacted to a situation as 'hooray' when the students were told that they would perform an activity. This may be interpreted as an indication that the emotional state in the classroom environment in which the mathematics course is being studied is positively affected.

3.5.3. The Comparison of Pre-Test and Post-Test Metaphors of Students with High Mathematical Attitude Level

Figure 5 shows the drawings created by the student with the high mathematical attitude level before and after the application.

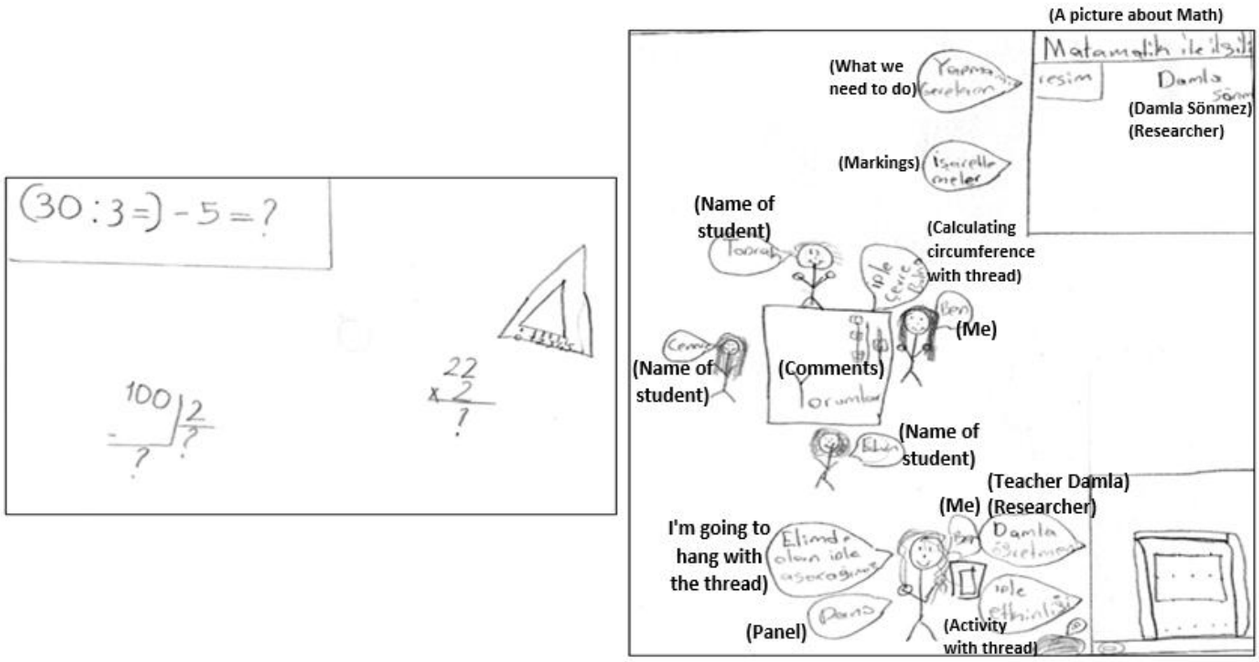

Figure-5. The drawings created by the student P5 with the high mathematical attitude level before and after the application.

Considering the drawing of the student P5 which was drawn before the mathematical games, it was thought that the mathematics lesson made no sense in this student since there were not many elements in the image. Since the student only drew four operations and miter, it was assumed that he only associated mathematics with them. Considering the drawing of this student after the application, it was seen that the perception of the student about the mathematics course changed. In particular, it can be said that the student is affected a lot by the mathematical games in the application process, and that he understands that mathematics is no longer to be just a tool. Because, in the picture, the group work performed in the classroom environment was remarked. Also, based on the drawing of the student, it is possible to say that this student developed positive emotions about mathematics because of drawing the faces of their friends as happy.

Figure 6 shows the drawings of the student P42 with high mathematical attitude level before and after the application.

Figure-6. The drawings of the student P42 with the high mathematical attitude level before and after the application.

Considering the drawings of the student P42 before the mathematical games application, it was understood that problems were the first things that came to the student's mind about mathematics. In addition, it was seen that when the student thought about mathematics, he established a connection between the classroom environment, the teacher and the tools he used for mathematics course. Considering the drawings of the student P42 after the mathematical games application, it was seen that students participating in various activities was drawn. The students in the pictures were all happy. Therefore, it was observed that this student did not see mathematics as only paper-pencil work after the application, and he perceived mathematics as a course which students were more active, participated in activities together and they were happy in this process.

4. Conclusion and Discussion

When the mathematics course attitude scale was applied as a pre-test to the students in the experimental and control groups, no significant difference was found between the two groups according to the mean scores. Hence, it was seen that the attitudes of the students in the experimental and control groups towards the mathematics course are equivalent. In the study conducted by Aydın (2011) it was revealed that the success levels of the experimental and control groups were the same in the activities based on active learning. When the scores of the mathematics course attitude scale applied to the experimental and control groups before and after the application in the research process were evaluated, no significant difference was found between the pre-test and post-test mean scores of both groups. In this process, although the attitude mean scores of the students in experiment group increased in favor of the post test, the increase in this score was not found statistically significant. There was no significant difference between the experimental and control groups' pre-test post-test in the study which had active learning based activities conducted by Aslan (2018). The result of this study shows that the use of mathematical games in mathematics course does not change the attitudes towards mathematics course in terms of the content and conditions of this research. However, especially considering the application process in the experimental group, it was observed that students were much more active and had fun in learning. In addition, informal interviews with students also showed that students had positive feelings and thoughts. However, it is thought that with the mathematics course attitude scale which is a quantitative scale, the reason why this result is not supported may be due to the fact that primary school students who are still in the concrete process period may not be able to fully internalize the scale items. Scale items are created with a language and expression style that students can easily understand. In spite of this, it is anticipated that more concrete expressions should be used in the scale of attitudes applied to the students in this period, and that explaining the situation mentioned with examples will provide

healthier information about the attitudes of the students. In this respect, it is thought that developing an attitude scale with these qualifications may be more applicable and useful for studies examining the attitudes of primary school students.

When the previous studies were examined, there was no study on the effect of using the game method on the students' attitude towards the course. However, in the study conducted by Biriktir (2008) it was seen that the success level of the students was increased with education performed by the game method.

Visual metaphorical perception form was applied to the students in the experimental group before and after the application in order to examine the effects of the applications carried out in the research on the visual metaphorical perceptions of the students about mathematics course. When the visual metaphors formed by the students about the perceptions of mathematics were examined in general, the first visual representations of the students were mostly related to the classroom environment, mathematical operations and mathematical concepts/symbols. It was observed that the visual metaphors created by the students after the application were generally more active in the classroom environment, they performed group work, they performed activities, and they mostly portrayed faces of students and teachers as happy. In the study based on cooperative teaching method conducted by Ozdogan (2008) it was observed that the attitudes of the students in the experimental group changed positively. It was observed that almost all of these students mentioned mathematical games in their drawings. This shows that the activities in the application process influence the students' perceptions about the mathematics course.

When the results obtained in the research are evaluated in general, it is predicted that increasing the use of mathematical games in mathematics courses will be beneficial for both student attitude and academic achievement. It is important that activities such as mathematical games which students are more active and have a positive effect on their attitudes towards mathematics course are implemented as long-term and regular. Researchers can apply mathematical games in classrooms for a longer period of time and observe the results, while mathematical games can be made a part of the course, and mathematical games can be included in the curriculum. In this way, it is thought that students' perspectives on mathematics lessons can be more positive.

References

Aslan, N., 2018. The effect of activity - based teaching on expectations of attitudes towards mathematics academic attitude, attitude and anxiety level. Unpublished Master's Thesis. Balikesir University Institute of Science and Technology.

Aydın, Z., 2011. The effect of active learning-based activities used in primary school 6th grade math lesson on students' attitudes towards mathematics course, academic success and creative thinking levels. Unpublished Master's Thesis. Gaziantep University Institute of Social Sciences.

Balci, A., 2018. Research methods, techniques and principles in social sciences. 13th Edn., Ankara: Pegem Academy.

Baykul, Y., 1990. Changes in attitudes towards mathematics and science courses from the fifth grade to the last grade of high school and equivalent schools, and some factors that are thought to be related to success in the student placement examination. Ankara: ÖSYM Publications.

Biriktir, A., 2008. Influence of game method on the accession of geometry subjects in grade 5 mathematics. Unpublished Master's Thesis. Selcuk University Social Sciences Institute.

Buyukozturk, S., E.K. Cakmak, O.E. Akgun, S. Karadeniz and F. Demirel, 2012. Scientific research methods. 11th Edn., Ankara: Pegem Academy.

Cengiz, İ., 2016. Metaphors and visual images of pre-service biology teachers. Unpublished Master's Thesis. Gazi University. Institute of Educational Sciences.

Cetin, Ö., 2016. The effect of secondary school students' mathematical game development process on success, attitude and problem solving strategies. Unpublished PhD Thesis. Necmettin Erbakan University Institute of Educational Sciences.

Creswell, J.W., 2013. Research design. Translation Editor. Ankara: View Selçuk's Full Profile.

Davis, B., 1995. Why teach mathematics? Mathematics education and enactivist theory. For the Learning of Mathematics, 15(2): 2-9.

Er, A., 2008. Use of games as a classroom activity for children in foreign language teaching. Journal of Faculty of Education, 17: 301-310.

Erşen, A.N., 2014. The effect of material supported mathematics teaching on grade 6 grade students' success, attitude, anxiety and retention of learning. Unpublished Master's Thesis. Firat University Institute of Educational Sciences.

Geçit, Y. and G. Gencer, 2011. Determination of geography perceptions of primary school class 1 students by metaphor (Rize University Case). Marmara Journal of Geography, 23: 1-19.

Girmen, P., 2007. The use of metaphors in the speaking and writing process of primary school students. Unpublished PhD Thesis. Anadolu University Institute of Educational Sciences.

Gürel, N., 2012. Effect of performance tasks on students' mathematical achievement and attitude. Unpublished Master's Thesis Mehmet Akif Ersoy University, Institute of Educational Sciences.

Kutluay, F., 2009. Metaphor in Utopias. Unpublished Master's Thesis Yuzuncu Yil University, Institute of Educational Sciences.

Ozdogan, E., 2008. The effect of cooperative learning method on student attitude and success in 4th grade mathematics teaching: Computer assisted cooperative learning and cluster supported individualization technique. Unpublished Master's Thesis. Ege University Institute of Social Sciences.

Oztürk, Ş., 2004. Creative thinking in education. Ondokuz Mayis University Journal of Education Faculty, 18: 77-84.

Sanchez, A., J.M. Barreiro and V. Maojo, 2000. Design of virtual reality systems for education: A cognitive approach. Education and Information Technologies, 4(5): 345–362.

TLA (Turkish Language Association), 1998. Turkish dictionary. C. 2. 9. Bs. Ankara: Turkish Historical Society Printing House.

Varışoğlu, B., İ. Seref, M. Gedik and İ. Yılmaz, 2013. Attitude scale for educational games applied in Turkish course: Validity and reliability study. Adiyaman University Journal of the Institute of Social Sciences, 11: 1059-1081.

Yenilmez, K. and N. Özbey, 2006. A research on mathematics anxiety levels of private school and public school students. Uludag University Faculty of Education Journal, 2(19): 431-448.