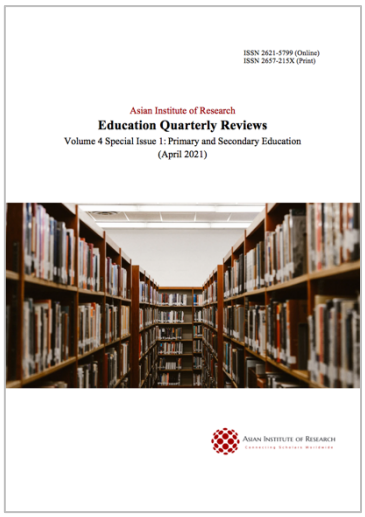

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Middle School Students' Problem Posing Processes

Mustafa Zeki Aydoğdu[1] & Elif Türnüklü[2]

[1] Dokuz Eylul University, İzmir, Turkey. ORCID: 0000-0003-1163-2890
[2] Dokuz Eylul University, İzmir, Turkey. ORCID: 0000-0003-4002-5432

Correspondence: Mustafa Zeki Aydoğdu, Toki Avrupa Konutları Middle School, İstanbul, Turkey. Email address: mustafazeki20@hotmail.com

Abstract
Problem posing has an important place in mathematics education curriculum in many countries. There are a few studies in the literature that reveal students' problem posing processes. The purpose of this research is to examine the problem posing processes of middle school students in geometry. The Research was carried out with 160 students who are in 5th-8th grades (aged 11-14). When the findings obtained in the study were examined, it was understood that the students followed some certain ways while posing problems, identified in the research. The processes followed by the students while they are posing problems are classified into 5 steps. It has been observed that the students do not go through all steps in problem posing processes; while some students use all of these steps, the others use some of them. The students are divided into four different types according to the way they used in their problem posing processes.

Keywords: Geometry, Middle School Students, Problem Posing

1. Introduction

Problem posing is a process of creating a new problem from a situation given to us or from an experience we have had. (NCTM, 2000). Silver (1994) explained problem posing as creating new problems and revising and revealing a problem in the problem solving process in order to understand the mathematical situation given in depth. In the definitions made about problem posing, it is emphasized that problem posing is a new problem generation process in accordance with the given situation.

Problem posing is closely related to problem solving skills and contributes to the development of problem solving skills. (Cai ve Hwang, 2002; Cankoy ve Darbaz, 2010; Silver ve Cai, 1996). Silver and Cai (1996: 522) stated that "As well as contributing to problem solving skills, the problem posing approach also draws attention to enabling to observe students' conceptual perceptions, attitudes, and ways of thinking. In addition to this, problem posing; a way to help students understand math and become autonomous learners". (In the meantime, the problem posing approach is a cognitive activity suitable for the constructivist approach. (Rosli, Mary, Goldsby, Gonzales, Onwuegbuzie and Capraro, 2015). In our country, Turkey, as in many countries in recent years, is forming education programs based on constructivist approach has included the problem posing in

mathematics education curriculum. Many researchers have said that problem posing is a key component in mathematics teaching programs such as problem solving, so problem posing should be at the center of mathematical activities. (Crespo, 2003; NCTM, 2000; Osana ve Pelczer, 2015). It is revealed in the literature that problem-posing activities carried out in the classroom environment affect students' learning positively and provide them a range of learning opportunities. (Crespo and Sinclair, 2008). For this reason, many researchers state that problem posing activities should be included in the classes. (Leung and Silver, 1997; Kılıç, 2013).

However, problem posing activities is included very little in mathematics teaching of students studying in middle school and students are rarely asked to create their own problems. Yaman and Dede (2005), stated that teachers do not want to bring problem posing into the classroom environment due to the limited time or the intensity of the curriculum. They also stated that problem posing activities would enable students to understand the problem itself rather than seeing their mistakes and solving the problem. English (1997a) stated that problem posing activities develop students' flexible and different thinking skills and help them understand concepts and processes. On the other hand, according to Kojima, Miwa and Matsui (2009), the individual who learns to pose problems can present different thoughts from their peers thanks to the different ways they have acquired. It is also obvious that problem posing is an activity that enables students to take responsibility in their own learning processes (Cunningham, 2004).

Since problem posing has a very important place in mathematics education, it is also very important how is the process the students go through while problem posing. Examining students' problem posing processes is important as it will reveal how students pursue cognitively in this process, what they do, and what difficulties they face. Because it is thought that the examination of the problem posing process will show us the invisible and reveal a wondered issue about problem posing.

In Turkey mathematics curriculum in geometry there are learning outcomes about problem posing as well as problem solving (MoNE, 2009). It is thought that having such learning outcomes in the curriculum will contribute to students' problem posing skills in geometry learning. (Geçici, 2018). It is stated that if students participate in problem solving and problem posing activities while learning geometry, they will see that geometry is more than just knowing definition, recognizing and classifying geometric shapes. (Geçici, 2018 quoted from Walter, 1980).

When the literature is examined, it is seen that, most of the problem-posing studies in mathematics education are gathered around certain topics such as problem posing ability (English, 1997a; Van Harpen and Presmeg, 2013; Ngah, Ismail, Tasir and Mohammad-Said, 2016), classification of the problems posed (Singer, Voica and Pelczer, 2017; Işık and Kar, 2015). There are also other studies about problem posing processes in the literature (Pelczer and Gamboa, 2009; Adelina and Fatma, 2018). However, it is seen that most of them are focused on algebra and number learning, and generally they are conducted with teachers and teacher candidates. On the other hand, it is seen that there are problem posing studies in geometry, but their number is few. These problem posing studies mostly done with dynamic geometry software (Christou, Mousoulides, Pittalis and Pitta-Pantazi, 2005; Fukuda and Kakihana, 2009; Abu-Elwan, 2011).

In the literature, there are not many studies in the field of geometry learning that cover all of the middle school class levels and reveal students' problem posing processes. So, the purpose of this research is to examine the problem posing processes of middle school students in geometry, which is one of the important part of mathematics curriculum. This study which is carried out for this purpose is thought to contribute to mathematics education.

2. Method

In this research, problem posing processes of the middle school students in geometry of establishing were examined. Accordingly, case study, one of the qualitative research methods, was used to reach the research purpose. (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz and Demirel, 2017).

The research is done in a metropolis city of Turkey with 160 different students chosen from 14 different middle schools in grades 5, 6, 7 and 8 (aged between 11-14) whose success levels are low, middle and high. The selection of students with different academic success levels was made by using the marks of mathematics lessons of the previous year and the opinions of the mathematics teachers.

In order to collect data clinical interview and problem posing activities were used. During the clinical interview, the students questioned and observed while posing geometry problems.

In this study, “Problem Posing Activities” are created separately in accordance with the 5th, 6th, 7th and 8th grade levels (aged between 11-14) by taking into account the education program of middle school students' (MoNE, 2013; MoNE, 2018) on different geometry topics. In these activities, students were asked to pose problems in accordance with the given situations. Moreover, an interview form was prepared in order to have in-depth knowledge to reveal students' problem posing processes and problem posing strategies. In the implementation of the problem posing activity, students were given a time of two lessons. Problem posing activities were applied to some students individually, while others were applied as group work (3-4 students with different success levels). During the application of the problem posing activity, the students were asked not to use any eraser. It is stated to the students that they can write the new expression they want to write by drawing a single line on the expression they want to change. During the activity, students were free to solve or not to solve the problems they posed. After applying the forms, 123 of the students who participated in the research were interviewed.

In the research, content analysis was used to determine the processes of students' posing geometry problems. Firstly, the interview records transcripted and turned into a written document. The common answers given by the students, the behaviors they exhibit were grouped and certain codes were created. In the direction of these codes, the data collected in the research were examined entirely again and student responses were included in the suitable categories. Later, using these categories, problem posing processes were categorized and named. Finally, the data were analyzed in accordance with these named categories.

3. Results

In the research the problems posed by the students and the interviews with them about these problems were examined. it was revealed that the students followed certain steps in the problem posing process. The processes are divided into some categories. In the following part, these categories are identified by the light of the data.

At the beginning of the problem posing process, the students were seen that they were trying to find an answer to the questions of, "What is the situation given to me and what is the situation that is asked from me?” It was observed that the students first examined the problem posing situation in the activities given and tried to understand what they were asked to do. It was understood that the students completed this process after perceiving the given problem posing situation and the aim of the situation. This category is named as **"The Step of Understanding the Problem Posing Situation."** Some students' interview transcripts are given below.

> *S_{33}: First I looked at what I was given in the problem, what it wanted from me, I decided what happened in case of problem posing, after understanding what was given ...*
>
> *(5^{th} Grade Student – Quote from interview)*
>
> *S_{139}: I started by examining the shape, I examined the information given and tried to extract something from this information.*
>
> *(8^{th} Grade Student – Quote from interview)*
>
> *S_{118}: While posing a problem, I first looked at the information given, I tried to understand the information, and then I tried to write a story according to this information.*
>
> *(7^{th} Grade Student – Quote from interview)*

According the data when the students understand the problem posing situation they started looking for an answer to the question “How will I write?". It was understood that the students looking for an answer to this question decided on the strategy they would use while posing a problem in this process. After the students had decided on the problem posing strategy, they completed this process. This category is named as **“The Step of Determining Problem Posing Strategy.”** Some students' interview transcripts are given below.

S_3: I thought how I could pose the problem, I dreamed of the event as if I was experiencing it. For example, in the garden question, I said Bengü as if I was in the problem myself.

(5th Grade Student – Quote from interview)

It is understood from the interview transcripts above that the student was imaging herself and used a strategy to pose the problem by imagining herself in the problem.

S_{49}: I thought how I could pose the problem. I tried to think of the problems that I saw in the lesson and the books generally. I tried to remember what was written and what were the numbers in the problems I had solved before.

(6th Grade Student – Quote from interview)

From the interview transcripts above, it is seen that the student tried to pose the problem by thinking of the problems he / she encountered before and created a strategy to pose a problem.

It is observed that the students who determined the strategy started to write the problem by using the problem posing strategy. This category is considered as **“The Step of Implementing the Strategy Determined.”** Some students' interview transcripts about this are given below.

S_{44}: I love writing stories, I write stories at home too. In my problems, I wrote stories about my daily life. I tried to make them similar to the problems I solved in class before.

(6th Grade Student – Quote from interview)

S_{109}: ... After deciding how to pose the problem, I started to write the problem scenario I remembered from past times and wrote the events that came to my mind from the lesson and test books

(7th Grade Student – Quote from interview)

S_{135}: If there is a shape, I first draw the shape and write the appropriate question accordingly. If there is no shape, I visualize a shape in my head and then I start writing the problem. I feel like it has to be a shape when posing geometry problems. For example, in the postponing question, I first I visualized the shape in my mind and after that started writing the event.

(8th Grade Student – Quote from interview)

On the other hand, it was confirmed that some of the students read the part of their problems they wrote over and over again during the problem posing process, and changed the numbers, names etc. they wrote in the problem. It is understood that some students made these changes randomly. In addition, some students made these changes after trying to solve the problems they established, if the numbers they gave did not have a solution or to make the calculations easier. This category is named as **"The Step of Editing-Fixing and Solving."** Some students' interview transcripts about this are given below.

S_8: It can be solved. After writing the numbers, I tried to solve it to see whether it can be solved with the numbers I gave, if not, I changed the numbers, I had already tried to pose the problem with the corresponding solvable numbers while posing it.

(5th Grade Student – Quote from interview)

S_{76}: First, I give the numbers out of my head, then I pose the problem, if I can solve it myself, I leave it like that. If not, I change it. Finally, if I want to make it harder, I change the numbers

(6th Grade Student – Quote from interview)

S_{100}: I wrote the mathematical expressions in the problem by solving it with the numbers I had given so that the number I gave can be solved. If the problem is not solved with the numbers I gave, I change the numbers.

(7th Grade Student – Quote from interview)

It was seen that some of the students read and solved their problem after writing the problem completely, corrected the mistakes and / or deficiencies (words, numbers, etc.). It was understood that some the students did this to check the problem they had posed. For this reason, this category has been named as **"The Step of Assessment of the Problem."** Some students' interview transcripts are given below.

S_{26}: Actually, I solved the problem after I had given the numbers. But after I pose the problem completely, I solved it again to check the problem.

(5^{th} Grade Student – Quote from interview)

S_{60}: Yes, I tried to solve it. While posing the problem, I did the solution, then after the story was completely over, I solved it again for another check.

(6^{th} Grade Student – Quote from interview)

S_{118}: Yes, have solved it. I think it can be solved. After finishing the question, I solved it and also tried it after giving the numbers. But when I was solving it for the last time, I solved it to check my problem. If there was nothing wrong, I continued to another problem posing activity.
(7^{th} Grade Student – Quote from interview)

In the summary, it is possible to give the steps to pose problems as follows.

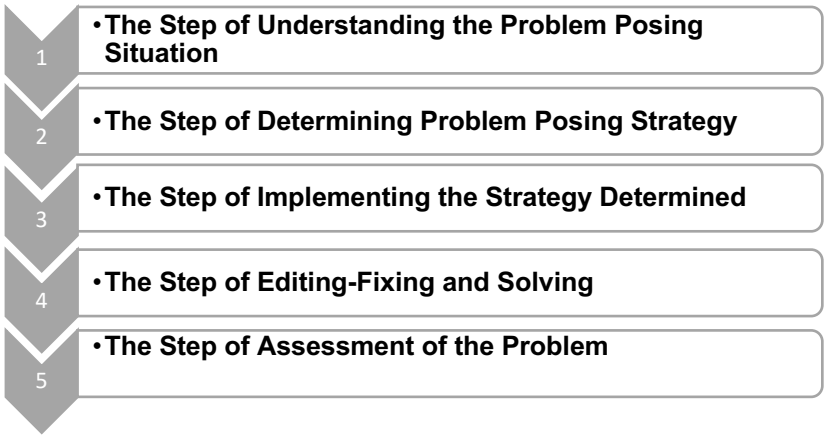

Figure 1: The steps of problem posing

The way students use the steps specified in the problem posing process varies according to whether they use some steps or not. According to the problem posing processes, it can be divided students into four types in the most general sense. It can be seen in Table 1.

Table 1: *The Student Types Which Steps They Used*

The Steps of Problem Posing	Type 1	Type 2	Type 3	Type 4
The Step of Understanding the Problem Posing Situation	✓	✓	✓	✓
The Step of Determining the Problem Posing Strategy	✓	✓	✓	✓
The Step of Implementing the Strategy Determined	✓	✓	✓	✓
The Step of Editing-Fixing and Solving	✓		✓	
The Step of Assessment of the Problem	✓			✓

There are students who use all the problem posing steps (1-2-3-4-5) as well as students who do not use some steps in the problem posing process. All of the students used the first three steps of problem posing. After these

three steps, some of the students' problem posing process ended (1-2-3). Some students have also used the step of **editing-fixing and solving** (1-2-3-4) after the first three steps to complete the problem posing process. Some of the them completed the problem they posed after the step of **implementing the strategy determined** and then passed directly to the **assessment of the problem** step (1-2-3-5). This results in differences in students' problem posing processes. In the most general sense, the quotation of a student (Coded S_{118} - 7th Grade Student) who used all problem posing steps and the problem that the student posed are given below.

A: What kind of a path did you follow when you posed a problem?
S118: While I was posing the problem, I first looked at the information given, I tried to understand the information, and then I tried to write a story according to this information.

A: What did you think when posing a problem? What was in your mind?
S118: The first thing that comes to my mind comes is the given situation's place in daily life. In addition to this, I tried to remember the problems that I had solved in the lesson in the test books so that I could make my problem similar to them while posing it.

A: What did you do after you decided how to write the problem?
S118: My job gets easier when I bring back the questions I had solved before or the given situation's equivalent daily life. While writing the problem, I wrote things from daily life, for example, I wrote my brother in basketball question, because he likes basketball. And I made one of the problems similar to a problem that our Maths teacher solved.

A: How did you decide on the mathematical expressions in the problem?
S118: First I give the numbers randomly, then I try to solve the problem if the result is not odd, the number remains, but if the result is odd or the problem cannot be solved, I change the number.

A: Do you think the problem you wrote can be solved? Did you try to solve the problem?
S118: Yes, I did. I think it can be solved. After finishing the question, I solved it and also tried it after giving the numbers, but when it was finished, I finally solved it to check my problem.

The student states that before posing the problem, first, he tried to understand what was given by reading. This shows that the student starts writing problems with ***the Step of Understanding the Problem Posing Situation.***

After the student understands what is given in problem posing situation, he states that he tries to find the equivalent of those given in the daily life and / or tries to compare them to the problems he has encountered before. This shows that the student is in ***the Step of Determining the Problem Posing Strategy.***

After the student determined the problem posing strategy, it was understood from his answers that he put the strategy into practice and started to pose the problem so he is in ***the Step of Implementing the Strategy Determined***

The student stated that he gave the numbers randomly while posing his problem and then changed these numbers if these numbers were not suitable (if they are not solved, the result is not an exact number etc.). This shows that the student is in ***the Step of Editing-Fixing and Solving.***

The student expresses that after posing the problem completely, he / she solves it in order to check the problem, which indicates that the student has ended the problem posing process with ***The Step of Assessment of the Problem.***

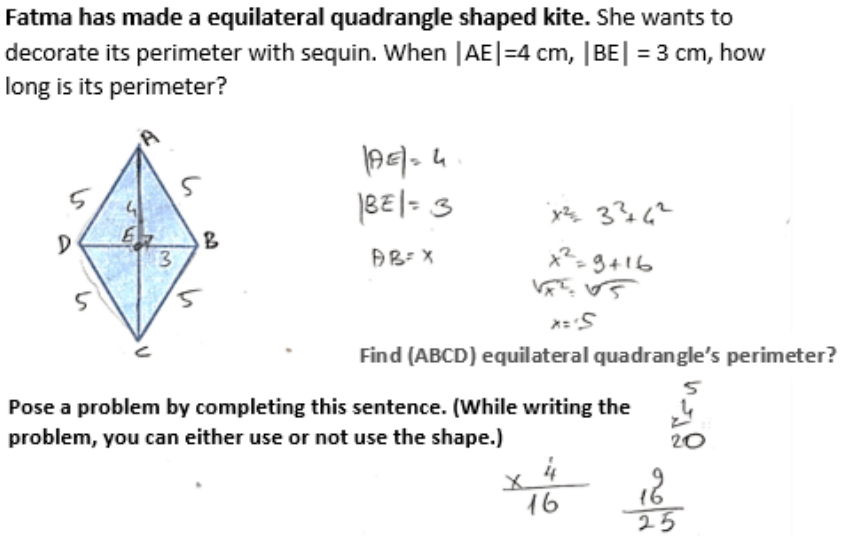

Figure 2: A Problem Posed by Student

When the interview with the student and the responses of the student in the problem-posing activity are examined, it is seen that the student starts problem posing with **the Step of Understanding the Problem Posing Situation** first. Later, the student stated that "he tries to find equivalent of the given situation in his daily life and/or tries to compare it to the problems he has encountered before." This indicates that the student has passed to **the Step of Determining the Problem Posing Strategy**. Then, when the student's response to problem posing activity (Figure 2) is examined, it is seen that the student started to set up the problem in accordance with the problem posing strategy, that means he is in **the Step of Implementing the Strategy Determined.** After this step, it is understood that the student is editing the data in the problem while posing the problem from the statements written in the problem posing activity of the student ($x^2 = 3^2 + 4^2$, $x^2 = 25$, $x = 5$); and the student gives the numbers randomly while posing the problem, if it is not suitable (if it cannot be solved, or the number is fructional etc.) he changes the numbers. This shows that the student is in **the Step of Editing-Fixing and Solving.** Finally, it is seen that the student solves the problem he posed. This shows that the student is in **the Step of Assessment of the Problem.**

4. Discussion and Conclusion

When the findings obtained in the study were examined, it was understood that the students followed certain steps while posing a problem. The processes that students experienced while posing problems were classified and divided into 5 steps. These are; The Step of Understanding the Problem Posing Situation, The Step of Determining the Problem Posing Strategy, The Step of Implementing the Strategy Determined, the Step of Editing-Fixing and Solving and The Step of Assessment of the Problem.

These steps partially coincide with the work of Brown and Walter (2005). It is stated in the study that, problem solving is progressed systematically and with the steps of Starting Point Identification, Listing Qualifications, What If Not? Strategy, Problem Posing and Problem Analysis. In this context, the Step of Understanding the Problem Situation in our study coincides with the descriptions of the Starting Point Identification and Listing Qualifications steps, which are given as the first two steps of problem posing and includes both steps. The problem posing step which is named as The step of Assessment of the Problem in this study, coincides with the Evaluation Level. It is pointed out for both of these steps that, they are in the last stage of problem posing process and their purpose is to check the problem.

In addition, it was understood in the study that students differed according to the way they used the problem posing steps mentioned above while posing problems. It is understood that some students use all of the problem posing steps in the problem posing process, while some students use some of these steps.

The reason why students' problem posing processes differ can be that the students who are experienced in problem posing can use transformations and follow the cyclic way while novice students have a simpler problem posing process (Pelczer and Gamboa, 2009). The students participated in this research are divided into four different types of students according to the way they use the problem posing steps.

If we take the steps of problem posing in general terms; In the processes of geometry problem posing of all students, the steps of Understanding the Problem Posing Status, Determining the Problem Posing Strategy and Implementing the Strategy Determined are included. The problem posing processes of the students differ according to whether not using any of the Steps of the Editing-Fixing, Solving and Assessment of the Problem, or using only the Step of Editing-Fixing. Solving, using only the Step of Assessment of the problem, or using both. In a study conducted in the field of algebra learning with middle school students (Ekici, 2016), students were divided into 5 different types according to their problem posing processes. Even the names of these steps are not the same, there are some similarities between these student types and the student types included in our study, according to the descriptions of the steps and the order of the students using these steps.

When students' geometry problem posing processes are considered, it is seen that students go through certain problem posing steps in problem posing processes, while some students use all of these steps others use just some of these steps. Students are divided into four different types according to the way they use these steps in their problem posing processes. Understanding the Problem Posing Situation, Determining the Problem posing Strategy and Implementing the Strategy Determined, are the steps which are used by all students during the problem posing process. This shows that the problem-posing process progresses systematically and in the same way up to a certain step for all of the students as in Brown & Walter, (2005)’s research, then some of the steps differentiate in our research.

It has been observed that students using all problem posing steps can write more valid problems compared to other students. But, there are also some students who do not write valid problems even though they use all problem posing steps Based on the data students who did not use the step of Editing-Fixing, Solving from the problem posing steps wrote problems that could not be solved mathematically. In addition, it students using the Step of Assessment of the Problem and therefore solving the problems that they created, made it possible for them to pose mathematically more valid.

Based on the results obtained in the research, the following suggestions were made.

- The fact that students having information about the problem-posing process can enable students to pose more qualified problems by going through the problem-posing steps. For this reason, it is recommended to inform students about the problem posing process and to carry out sample problem posing activities based on this information. If teachers involve problem-posing activities in the classroom in parallel with the problem-posing process, the activities can be more efficient.
- Teachers having knowledge of problem posing process can enable them to create correct and effective problems.
- If teachers involve problem posing activities in the classroom environments in parallel with the problem posing process, the activities can be more efficient.
- This research, which reveals the processes of establishing geometry problems for middle school students, can be carried out with primary school students, high school students, teacher candidates and teachers, and the number of studies on the problem posing process can be increased. In this way, more in-depth and detailed information about the problem posing process can be provided.
- In this study, the factors affecting the middle school students' process of establishing geometry problems were not examined. In other studies, to be carried out in this context, it is recommended to examine

middle school students' problem posing processes in terms of different variables such as the socioeconomic structure, gender, level of success, etc.

References

Abu-Elwan, R. (2011). Effect of using Cabri II environment by prospective teachers on fractal geometry problem posing. In M. Joubert, A. Clark-Wilson & M. McCabe (Eds.), *Proceedings of the 10th International Conference for Technology in Mathematics Teaching* (pp. 56-61). Portsmouth, UK.

Adelina, R. and Fatma, M. (2018). Enhancing students' mathematical problem posing skill through writing in performance tasks strategy. *In Journal of Physics: Conference Series* (Vol. 948, No. 1, p. 012022). IOP Publishing.

Brown, S. I. and Walter, M. I. (2005). *The art of problem posing third edition*. London: LEA.

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö.E., Karadeniz. Ş. and Demirel. F. (2017). *Scientific research methods*. 17th edition, Ankara: Pegem Akademi.

Cai, J. and Hwang, S. (2002). Generalized and generative thinking in US and Chinese students' mathematical problem solving and problem posing. *Journal of Mathematical Behavior*, 21, 401-421.

Cankoy, O. and Darbaz, S. (2010). The effect of problem posing based problem solving education on the success of understanding a problem. *Hacettepe University Faculty of Education Journal*, 38, 11-24.

Christou, C., Mousoulides, N., Pittalis, M. and Pitta-Pantazi, D. (2005). Problem solving and problem posing in a dynamic geometry environment. *The Mathematics Enthusiast*, 2(2), 124-143.

Crespo, S. (2003). Learning to pose mathematical problems: Exploring changes in preservice teachers' practices. *Educational Studies in Mathematics*, 52(3), 243-270.

Crespo, S. and Sinclair, N. (2008). What makes a problem mathematically interesting? inviting prospective teachers to pose better problems. *Journal of Mathematics Teacher Education*, 11(5), 395–415.

Cunningham, R. F. (2004). Problem posing: An opportunity for increasing student responsibility. *Mathematics and Computer Education*, 38(1), 83-39.

Ekici, D. (2016*). Investigation of middle school students' mathematical problem posing strategies* (Master's thesis). Dokuz Eylul University Institute of Educational Sciences, Izmir.

English, L. D. (1997a). The development of fifth-grade children's problem- posing abilities. *Educational Studies in Mathematics*, 34, 183-217.

Geçici, M. E. (2018). *Analyzing Eighth Grade Students' Skills of Posing Geometry Problems* (Master's Thesis). Dicle University Institute of Educational Sciences, Diyarbakır.

Fukuda, C. and Kakihana, K. (2009). Problem posing and its environment with technology. *In Proceeding of 33rd conference of Japan Society for Science Education*.

Işık, C. and Kar, T. (2015). Analyzing the problems that sixth grade students pose for the open-ended verbal story about fractions. *Turkish Journal of Computer and Mathematics Education*, 6(2), 230-249.

Kılıç, Ç. (2013). Determining the performance of the elementary school teacher candidates in different problem posing situations. *Journal of Educational Sciences in Theory and Practice,* 13(2), 1195-1211.

Kojima, K., Miwa, K. and Matsui, T. (2009). *Study on support of learning from examples in problem posing as a production task.*

Downloaded from http://www.apsce.net/ICCE2009/pdf/C1/proceedings075-082.pdf on 25th April 2016

Leung, S. S., and Silver, E. A. (1997). The role of task format, mathematics knowledge, and creative thinking on the arithmetic problem posing of prospective elementary school teachers. *Mathematics Education Research Journal*, 9(1), 5-24.

Ministry of National Education. (2009). *Primary school mathematics lesson 6th - 8th grades' curriculum and guide.* Ankara: MEB Printing House.

Ministry of National Education. (2013). *Middle school mathematics lesson (grades 5, 6, 7 and 8) curriculum*. Ankara: MEB Printing House.

Ministry of Education. (2018). *Mathematics curriculum (primary and middle school 1, 2, 3, 4, 5, 6, 7 and 8th grades).* Ankara: MEB Printing House.

National Council of Teachers of Mathematics (NCTM). (2000). *Principles and standards for school mathematics*. Reston, VA: NCTM.

Ngah, N., Ismail, Z., Tasir, Z. and Mohamad Said, M. N. H. (2016). Students' ability in free, semi-structured and structured problem posing situations. *Advanced Science Letters*, 22(12), 4205-4208.

Osana, H.P. and Pelczer, İ. (2015). A review on problem posing in teacher education. jinfa cai and james middleton (seri ed.), *Matematical Problem Posing From Research to Effective Practice.* 469-490.

Pelczer, I. and Gamboa, F. (2009). *Problem posing: Comparison between experts and novices.* Tzekaki, M., Kaldrimidou, & C.Sakonidis (Eds.), Proceedings of the 33rd International Conference of the International Group for the Psychology Mathematics Education, (pp. 353-360). Thessaloniki, Greece: PME.

Rosli, R., Mary, M.C., Goldsby, D., Gonzales, E., Onwuegbuzie, A. J. and Capraro C. M. (2015). Middle-grade preservice teachers' mathematical problem solving and problem posing. jinfa cai and james middleton (seri ed.), *Mathematical Problem Posing From Research to Effective Practice*, 333-355.

Silver, E. A. (1994). On mathematical problem posing. *For the Learning of Mathematics*, 14(1), 19-28.

Silver, E. A. and Cai, J. (1996). An analysis of arithmetic problem posing by middle school students. *Journal for Research in Mathematics Education*, 27, 521–539.

Singer, F. M., Voica, C. and Pelczer, I. (2017). Cognitive styles in posing geometry problems: Implications for assessment of mathematical creativity. *ZDM Mathematics Education*, 49(1), 37–52.
https://doi.org/10.1007/s11858-016-0820-x.

Yaman, S. and Dede, Y. (2005). Problem posing applications in mathematics and science education. *Ondokuz Mayıs University Faculty of Education Journal*, 20, 1-11.

Van Harpen, X. Y. and Presmeg, N. (2013). An investigation of relationships between students' mathematical problem-posing abilities and their mathematical content knowledge. *Educational Studies in Mathematics,* 83(1), 117-132.