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Prospective Elementary Mathematics Teachers' Problem Posing Skills about Absolute Value

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Abstract

Generalization in mathematics is one of the ways that can be used for developing the skill of relating numbers with structures by referring principles and operations, and by providing some principles and numbers to pose problem status accordingly. In this regard, students should be assigned some numbers and operations and they should be made study on organizing problems that they need to use the assigned numbers in the operations by performing the signified conditions. This study aims at evaluating prospective teachers' problem posing skills on absolute value. First grade students at elementary school mathematics teaching were given algebraic statements on absolute value and asked to pose an ordinary non-math problem about this statement. The problems that they posed were evaluated with the problem posing evaluation criteria and then, interviews about the positive and negative sides of the problem posing study were carried out with students. Students arrived at a consensus that experience is crucial in problem posing studies and at the end of the research it was determined that the students who did problem posing studies before were more successful. Students need to do problem posing studies and they need to gain experience on this topic starting from the first years of the elementary school.

Key Words: Problem posing, absolute value, mathematics education

Introduction

At the end of the national and international researches done about mathematics education, new mathematics program was created and began to be applied based on the developed countries mathematics program and mathematics education experiences in our country. This program bases on the mathematical concepts, the relations between these concepts, the meanings lying behind the operations and gaining the ability of operation. This program's focus is on the learning areas consisting of concepts and relations. Conceptual approach needs to have time for establishing the conceptual bases of mathematical knowledge, and also to balance between conceptual and operational

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knowledge and skills. By using conceptual approach it was aimed to help students in order to construct mathematical meanings from concrete experiences, intuition, and abstract. In addition to developing mathematical concepts, it was also intended to develop certain important skills with this approach. These skills are problem solving, communication, reasoning and associating. This program grounds on the active participation of the students in the mathematics process. In this program it is overemphasized to provide students with an environment in which students can make research, find out, solve and pose problems, share and discuss the solutions and approaches. Therefore, there are some certain changes in teachers' roles in this program. Teachers are the ones who develop, direct, motivate themselves, develop and practice activity, examine, make them ask question and think, listen, work together and evaluate (Kıroğlu, 2006). Consequently, this new program aims at students' are educated in an environment in which they are active, and in which they can solve and pose problems. Ministry of Education, council of education and morality state that students shouldn't be always obliged to solve the problem fully. They should be asked whether there is something missing or extra, and it should be provided to state the problem in a different way or give opportunity to pose a similar problem (MEB, 2005). We believe that as students become more successful in problem posing process, and as they feel their ideas are regarded, their self-confidence at mathematics and problem solving skills increase. Consequently, they become more patient, more self-confident and creative in problem posing. They learn communication and they develop ultimate thinking skills by using mathematics.

To have a general view, in the schools in the US and England mathematics teachers use problem posing approach, while they are trying to apply structuralism education in teaching format. National council of Teachers of Mathematics (NCTM, 1989) which is in the school's mathematics curriculum and evaluation standard, identifies problem posing as "an activity in the heart of doing mathematics". Problem posing is defined as an important component of students' mathematical development and it is stated that it is students' self-learning activity in the body of literature (NCTM, 1991; Silver, 1994). Problem posing dialogue goes back to the studies of Piaget and Dewey who potently support researching and active education in which student centered program is effective (Akay, 2007).

The problems in the mathematics course books may remain incapable and also they may not be suitable for the students' level or may not meet students' interest and needs. In such conditions students and teachers should know how to pose a problem in order to teach the lesson relevantly. "The sympathy in students who succeed in problem posing increases towards the math and anxiety decreases and they don't overestimate the problems. When the problem is posed from the answer, students can easily understand the solution and which operations are used for what reason since they know the answer. This situation helps them to solve a problem that they encounter firstly" (Altun, 1997: 117).

Points to be considered in problem posing:

1. It should be related to the subject: in problem posing studies students should know which subject the problem is related to and be able to produce suitable problem related to that subject.
2. Relevancy for the student: Student's age, educational background and their prior knowledge should be sufficient for posing a problem.
3. It should be realistic and reasonably coherent: It should be considered that in problem posing study the problem that will be posed is related to daily life, reflects the truth as well as possible. It would be appropriate to choose the problem at first from experiences, to use local standards and idioms, and to be reasonably coherent. (a hen having five feet, it shouldn't be a rocket whose length is mm).
4. It should arouse attention: shapes should be benefitted for this situation, however it should be regarded that shapes are related to the problem. The shapes which are used to take attention but which aren't related to the problem may distract.
5. It should be paid attention to its language: Since students are budding, their memories have difficulty in understanding long sentences or implications. The language that will be used in the problem should be simple and clear; especially it should consist of short sentences. The children who are at that age tend to story, tale and play so the statement of the problem has to be in this direction (Albayrak & Erkal, 2003). In the problems which were prepared in the form of scenario it should be

avoided to add unnecessary and repeated statements, and the numbers that are not used. Problem posing situations can be summarized as follows (Stoyanova & Ellerton, 1996; Abu-Elwan, 1999; Stoyanova, 2003):

- *Free problem posing situations*; these are the situations in which students are asked to produce a problem from an artificial or natural situation. "Pose a problem related to mathematics completion" or "pose a money problem".
- *Semi structured problem posing situations*; It is the situation in which students are provided with open-ended situation and they are asked to find out the structure in that situation. As examples for this problem posing situation, similar problems to given ones, the problems about special theorem and non-graphic problems composed of given pictures or algebraic statements are presented.
- *Structured problem posing situations*: It is the situation in which problem posing activities are based on a special problem. For instance, last night there was a party at your cousin's home and the door was knocked 10 times. When the door was first knocked, just one guest came. Whenever the doorbell rings, three more people come. **Ac**cording to it, how many guests will have come when the bell rings 10^{th} time? By using this information create as many problems as possible.

Since in science and mathematics education, students struggle with the problems more, they should be directed to pose new problems besides the ability of solving the given problems (Yaman & Dede, 2005).

In the mathematics lesson in which precondition processing relations are quite strong, one of the conceptions in which that relation is most powerful is the "absolute value" concept. Absolute value concept is the basis of many subjects like series, sequences, convergence, divergence, limit and derivative. Although according to the previous mathematics teaching program it was began to be taught in details at 9^{th} grade, students were acquainted with absolute value concept at 7^{th} grade. Then, at 8^{th} grade the subject was re-handled as a second time and the problems increasing the skill of doing operation with absolute value were included. However, with the new program that was put into practice since 2006-2007 academic year that concept has been introduced to students from the 6^{th} grade. Thereafter, even if they learn just its definition, students encounter absolute value concept starting from the 6^{th} grade and its definition is stated as "absolute value of a number is its distance to starting point" (MEB, 2007; Yenilmez & Avcu, 2009).

In some studies, it was determined that students had difficulty and misconceptions about absolute value. The result that was found out in these studies presents that compared to operational questions the performance is lower in the conceptual questions about absolute value and it is still a troublesome subject even for the students at higher educational level (Şandır, Ubuz & Argün, 2002; Şandır, 2003; Moralı, Köroğlu & Çelik, 2004; Baştürk, 2004; Yenilmez & Avcu, 2006).

Absolute value is one of the important subjects of mathematics. Students may have to use absolute value in all the subjects on distance concepts, in geometry, and in radical expressions. Therefore, it is important for the researches of mathematics education to determine the skills of the students at the mathematics teaching department on an important subject such as absolute value and to suggest proposal for its development.

When the studies that have been done till today is considered;

In a study named as "Problem posing experiences and the use of open-ended questions in mathematics education" done by Akay, Soybaş and Argün (2006), 5^{th} grade students' average concept and their problem posing approaches about the area concept in geometry was researched and it was observed that some of the students had misconceptions about this topic and most of the problems posed by the students were in the form of routine exercise problems which didn't include any creativity.

Kılıç (2013) stated in her study named as "Determining Performance of Elementary Students related to Problem Posing Activities Requiring Four Arithmetical Operations with Natural Numbers" that during the problem posing process students have some problems such as using missing data, using decimal numbers instead of natural numbers, writing exercise and posing problems for different topics.

Işık, Işık and Kar (2011) aimed at analyzing the problems that prospective mathematics teachers pose intended to verbal and visual representations in their study named "Analysis of The Problems Related to Verbal and Visual Representations Posed by Prospective Teachers". The findings of the study indicated that prospective teachers' success in problem posing for different representations is generally low.

In their study named "Problem Designing-Solving Studies in Teaching of Basic Operation Skills" Albayrak, İpek and Işık (2006) intended to determine to what extent teachers include problem posing-solving studies in teaching of basic operation skills and to present prospective teachers skills in this topic. Teachers' practices towards this topic were tried to be determined with observation technique, and skills of prospective teachers were tried to be determined with a test having developed by researchers. The findings indicate that prospective teachers aren't trained adequately for this topic, and the teachers who are at in-service training remain inadequate in this process.

In the study named "Determining the skills of prospective mathematics teachers' mathematical problem posing and problem solving" that was carried out by Dede and Yaman (2005) collectively, they stated that problem solving is an important activity in mathematics and problem posing practices should be involved for students' developing their skills in order to overcome the problems. Therefore, this study tried to determine the problem solving and problem posing skills of prospective mathematics teachers. For this reason prospective mathematics teachers were given a "Mathematical Problem Solving and Problem Posing Test" consisting of 5 open ended questions. As a result of the analysis of the research data, it was identified that prospective mathematics teachers can generally solve the problems, however, they cannot pose new problems with refer to given problems and solutions.

The study done by Gür and Korkmaz (2002), aimed at investigating the development of elementary school 7th grade students' skills of posing a problem. As a result of the study, it was proved that students have difficulty in posing a problem, and posing a new problem by using number sentence was determined as the most challenging situation, and by making changes on it, producing a problem that is its modification was determined as the easiest situation.

In a study done by Gür and Korkmaz (2006) it was intended to determine the prospective teachers' problem posing skills. What control and experimental groups that consisted of prospective class and mathematics teachers did was observed during the problem solving process and the difficulties they had, their success levels were compared, and also it was found out that there were some insufficiencies in the process that they followed. In this study, it was concluded that prospective teachers had some common fallacies and complications about the feature and organization of problems. A significant difference was found on behalf of M_d and S_d between the point averages of problem posing skills of prospective teachers who composed the mathematics teaching groups (M_k, M_d) and class teaching groups (S_k, S_d).

In a study done by Işık (2011) the conceptual analysis of the problems that prospective elementary mathematics teachers posed for multiplication and division in fraction was done. In consequence of the analyses it was proved that prospective teachers had deficiency at multiplication in fraction with whole number and attributing a meaning to fractional number and the operation intending the division of two fractions.

Akkan, Çakıroğlu and Güven (2009) did their research with the aim of determining 6^{th} and 7^{th} grade students' competence at posing equation from arithmetical and algebraic verbal problems, and posing suitable problems with the given arithmetical and algebraic equation and to compare them in terms of gender. The findings demonstrate that 6^{th} and 7^{th} grade students are more qualified in posing an equation for the problem situation, regarding posing a problem for the equation situation. It was observed that in both subjects, boys are more qualified than girls by a narrow margin. Besides, it was also established that students at both grades were more successful in posing an equation from arithmetical verbal problems and posing suitable problems for arithmetical equation compared to posing equation from algebraic verbal problems and posing problem from algebraic equation.

Fidan (2008) researched the effects of doing problem posing activities at elementary school 5^{th} grade on the students' success in problem solving and the effects of studies for problem posing on the success of Polya's problem solving steps (understanding the problem, making plan, implementation

the plan, control). As a result, it is provided that doing problem solving and problem posing studies have a positive effect on the students' success in problem solving.

In a study done by Demir (2005), it was aimed to find out the effect of problem posing teaching method on the students 'success in probability topics, probability and attitude towards mathematics. As result of the study, in terms of probability success results, probability and their attitudes towards mathematics, there is a significant difference between the students (experimental group) who were applied Problem Posing Teaching Method and the students (control group) who were applied Traditional Teaching Method on behalf of the experimental group. This result indicates that Problem Posing Teaching Method increases the students' probability success level and changes their attitude towards mathematics in a positive way.

In the study named "Examination of the effects of mathematics education done with problem posing approach on the students' academic success, skill of problem solving and their creativity", Akay (2006) aimed at examining the impact of problem posing approach on the students' academic success, skill of problem posing, and their creativity in teaching the unit of integral and its practices in "Mathematics II" course at the 1st grade of university. As a result, it was determined that problem posing approach that was administrated in teaching the unit integral and its practices in "Mathematics-II" course, has a significant effect in a positive way on the students' academic success and their problem solving skill.

The study "Teachers' use of Webquest method on the internet in developing their mathematical problem posing skills" was researched by Abu-Elwan (2006). As a result of this research, it is clearly seen that the ones who take the web quest training (experimental group) are critically better at problem posing teaching than those who don't have that education (control group). In other words, experimental group's problem posing performances are higher when compared to control group. Besides, experimental groups are more successful than the control group at problem posing that was constructed regarding a given situation. Teachers' ideas on problem posing via Web quest also changed positively.

In their collective study, Işık and Kar (2012) aimed at determining the problem posing skills of prospective classroom teachers via semi structured occasions in a study they did. It was established that the prospective teachers have more difficulty especially in posing various problems regarding Euclidean division.

With reference to this study, it can be stated that problem posing is an approach which helps students and prospective teachers to succeed in problem solving and to have self-confidence. In addition, it is an important problem that students and prospective teachers fail in problem posing studies. It is a great necessity to search, discuss and provide solution offers for this problem.

Korkmaz and Gür (2006) stated in the study they did that it should be put emphasis on training of prospective teachers who will start profession soon, on problem posing.

It is thought that prospective mathematics teachers who will be mathematics teachers in the future should be qualified in problem posing skills as well as problem solving skills on absolute value. However, there hasn't occurred any study in the literature on what prospective teachers' sufficiency is on problem posing in absolute value concept.

By this study, prospective teachers' sufficiency in problem posing related to absolute value will be determined and if there is deficiency, what their reasons are and what needs to be done will be discussed. When they become teachers, they will have experience in bringing their students the skills of problem posing. This study will discuss about the prospective teachers' ideas towards problem posing in absolute value subject and add a different dimension and different view to the education. Besides, it is considered that the evaluation criteria for problem posing which were established for this study will contribute to the field literature in terms of being used in similar studies.

The Aim of the Study

The aim of the study is to evaluate the problem posing skills of prospective elementary mathematics teachers on "absolute value". In accordance with this purpose, answers will be searched for the following questions.

What are the problem posing skills of prospective elementary mathematics teachers about "absolute value"?

What are the ideas and suggestions of prospective elementary mathematics teachers about problem posing in the subject "absolute value"?

Method

Research Design

The study was designed as a case study which is one of the qualitative research approaches. Instead of measurement, qualitative research pays attention to consider the conditions on which events and facts occur by revealing the relations which enable explanations (Yıldırım & Şimşek, 2008). So the research problem was described by having been analyzed deeply within the handled condition.

Population and Sample

The population consists of the prospective teachers studying at elementary school department at the educational faculties in the universities all over Turkey. However, since the subject composing the population cannot be reached easily in the designed research, the educational faculty at which the researcher works and at which there are limited numbers of samples was chosen. The sample of the research consists of 30 randomly selected 1st grade prospective teachers who study at the Department of Mathematics Teaching, at the Educational Faculty, at University in Rize.

Data Gathering tools and Data Analysis

This study was carried out with 30 first grade prospective teachers who study at elementary school mathematics teaching at a university in Rize. At first, pilot studies were administered with 30 prospective teachers studying at elementary school mathematics teaching at the same university. Problem solving test about the absolute value subject was applied to 30 prospective teachers and they were asked to pose problems with the given absolute value. It was observed that prospective teachers succeeded in the problem solving test, but there were significant problems in their problem posing skills. As a result of these investigations, criteria for the evaluation of problem posing were established and algebraic expressions were chosen on the absolute value subject on which prospective teachers would pose semi-structured problems for the main research. These evaluation criteria and algebraic expressions took their final shape with the contribution of literature and with the ideas of the experts in their field. The prospective teachers were asked to pose "ordinary verbal problems" for the expressions having given to 30 prospective teachers who study at the first grade, with x whole number;

1.$|x+5|=10$ (solvable)
2.$|2x-5|=5$ (solvable)
3.$|x+2|\leq -1$ (not solvable).

Later on, the prospective teachers' problem posing skills were analyzed related to this subject and an evaluation was done according to the problem posing evaluation criteria (Figure1). The evaluation criteria is as follows (Figure 1).

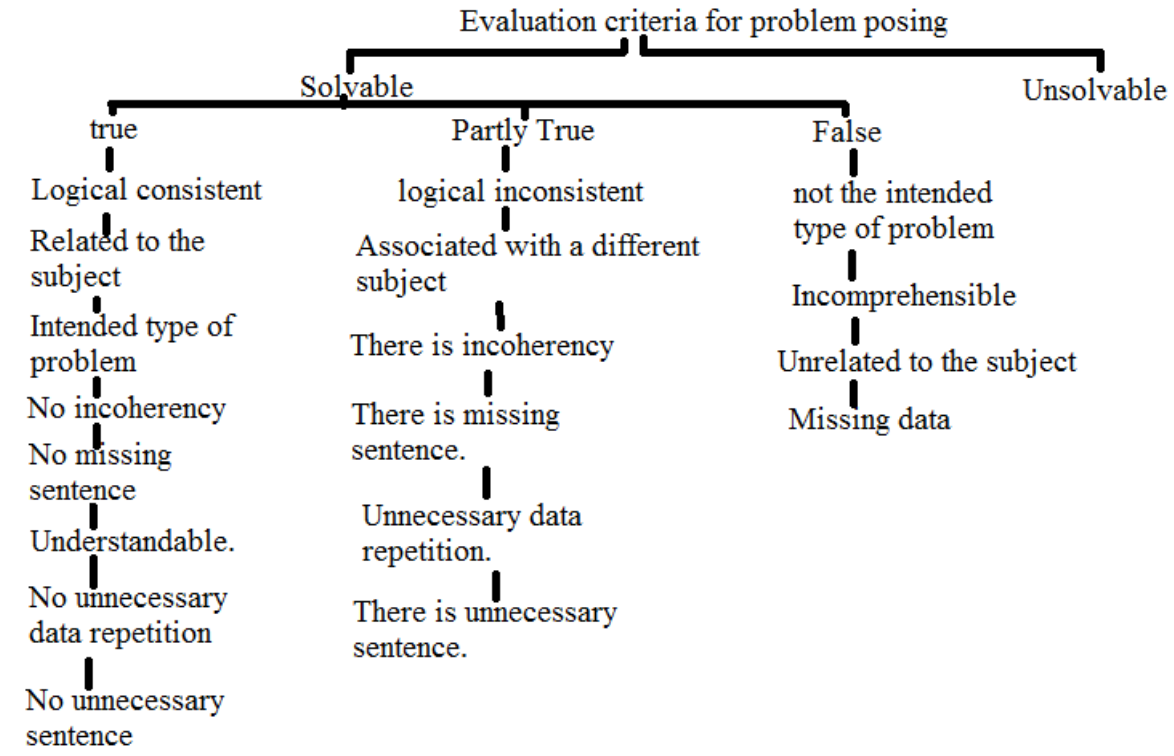

Figure 1. Evaluation criteria for problem posing

While the evaluation was being done according to the evaluation criteria, student responses were turned into frequency and percentage and presented in the tables.

Later on, semi structured interviews including three questions were conducted with the prospective teachers. During these interviews, students were asked:

1. What are the positive sides of problem posing to you?
2. What are the negative sides of problem posing to you?
3. What are your suggestions for the problem posing studies?

In the semi-structured interview method, the researcher already prepares protocol including the questions that he/she plans to ask. However, depending on the flow of the interview, the researcher can affect the flow with different side and sub questions and can provide participants to clarify and elaborate their responses (Türnüklü, 2000). The interviews were conducted in a quite comfortable and authentic environment with the aim of making students answer heartily and sincerely.

The research was figured regarding the descriptive analysis of qualitative data. In the study, based upon the descriptive coding analytical inductive content analysis which helps to make generalization from the qualitative data intending to determine the relations between concept and concepts under the data was administrated (Bryman & Burgess, 1994; Yıldırım & Şimşek, 1999). In the research, the data collection tools in which there are open ended questions having answered in a written way by the students were analyzed and similar and different answers were gathered in black and white for each question. After that, a coding key was formed by having written all different and similar answers that were given for the open ended questions in the data collection tool in the form of choices. In order to determine the reliability of coding key, five each data tool that were chosen among the data collection tools were submitted to two researchers and they were provided with reading and analyzing them. The researcher himself/herself arrived at a consensus with the other two researchers literally (Miles & Huberman, 1994).

Findings

The findings related to the problem posing skills

In this study which is a semi structured problem posing study, 30 1st grade prospective teachers who were studying elementary school mathematics teaching in a university in Rize were asked to pose an "ordinary problem" for the expressions with x as a whole number,

1. Ix+5I=10 (solvable),
2. I2x-5I=5 (solvable)
3. Ix+2I≤-1 (unsolvable)

Prospective teachers' problem posing skills were evaluated according to the following criteria.

Table 1.
Prospective Teachers' Problem Posing Skills Related to the Expression I2x-5I=5

Classification	Criteria	Frequency (percentage)	Examples
Accurately posed problem	✓ Logical consistent ✓ Related to the subject ✓ Intended type of problem ✓ No incoherency ✓ No missing sentence ✓ Understandable ✓ No unnecessary data repetition. ✓ No unnecessary sentence.	5(16,6)	If the distance from the starting point of a number: two times the number minus 5 equals to 5 unity on a numerical axis, what can be this number?
Partly accurate posed problem	✓ Logically inconsistent	2(6,6)	On a numerical axis, if the distance of a numbers' 2 times from number 5 is 5 unit, what can be this number?
	✓ Related to a different topic	1(3,3)	Ali's age equals to two times' minus 5's square of Mehmet's age. Given that Ali is 25, how old is Mehmet?
	✓ There is incoherency	4(13,3)	Which number's two times minus 5 equals to 5 unity on a numerical axis?
	✓ Unnecessary Data	2(6,6)	Today the weather temperature is 5. If the temperature difference between two times of yesterday's air temperature and today's air temperature which is five, is five what was the yesterday's temperature?
	✓ Unnecessary sentence	2(%6,6)	I am in an A room. The difference between the two times of A room's temperature and another room whose temperature is 5 degrees is 5. Then what is the temperature of A?
	✓ Unrelated to the subject	2(6,6)	Given that on a numerical axis, two times of a number' minus 5 is 5, what is this number?

False	✓ Missing data	1(3,3)	Which number's distance to 5 on a numerical axis equals to 5?
	✓ Not in desired type (ordinary verbal problem)	1(3,3)	The number of my muscatels is 5. If there is a relation as I2x-5I=5 between my friend's muscatels and mine, what is the number of my friend's muscatels?
	✓ Incomprehensible	1(3,3)	Which natural numbers' two times plus its minus 5 equals to 5?
Unsolvable		3(10)	What is the solution set of whole numbers whose two times minus 5 is 5?
No effort		4(13,3)	-

As it can be seen from the table, since 7 (23,3%) prospective teachers met all the criteria they were established as the ones whose "problem posing skills are good". Since 11(36,6%) prospective teachers didn't meet some of the criteria and posed partly true problems they were established as the ones whose "problem posing skills are medium"; since 7(23,3%) prospective teachers posed false problems they were established as those whose "problem posing skills are poor". 1 (3,3%) prospective teacher posed unsolvable problems and 4 (13,3%) prospective teachers didn't have any effort to pose a problem so that they weren't involved in the evaluation.

Table 2.
Prospective Teachers' Problem Posing Skills Related to the Expression: Ix+5I=10

classification	Criteria	Frequency(percentage)	examples
True	✓ Logical consistent ✓ Related to the subject ✓ Intended type of problem ✓ No incoherency ✓ No missing sentence ✓ Understandable ✓ No unnecessary data repetition. ✓ No unnecessary sentence.	8(%26,6)	Which number's minus 5 distance from the starting point equals to 10 unit on a numerical axis?
		4(%13,3)	What are the numbers whose distance from -5 equals to 10 unit on numerical axis?
		1(%3,3)	When Zeynep who is in a lift goes 5 floors up from the floor she is on, her distance from the ground floor becomes 10 times . which floors she is on, firstly?
Partly true	✓ Logically inconsistent	1(%3,3)	Whether they are clean or dirty, we wash the clothes in the washing machine and get them as clean. Whether X+5 is clean or dirty, it is delivered as 10, that is clean. Then, what is X?
		1(%3,3)	When a diver goes 5m up from the point where s/he is, s/he says there are 10 m more to the sea level. What can be the diver's location?
	✓ Related to a different topic	-	-
	✓ There is incoherency	1(%3,3)	Which point's 5 unit distance is 10 unit to the starting point?

	✓ Unnecessary data	1(%3,3)	Considering a number's 5 plus, the distance of the number plus 5 to 0 is 10. What is this number?
	✓ Unnecessary sentence	1(%3,3)	On a numerical axis if a number's 5 plus distance to 0, or a number's distance to -5 equals to 10 unit, what is this number?
False	✓ Unrelated to the subject	2(%6,6)	When a bird which is at a 5m height goes up Xm long, its ground clearance becomes 10m. How much does this bird go up?
	✓ Missing data	-	-
	✓ Not in desired type (ordinary verbal problem)	1(%3,3)	X+5=10 and x+5=-10 thenwhat is x?
		4(%13,3)	Which number's 5 plus absolute value equals to 10?
	✓ Inconsistent	1(%3,3)	On a numerical axis, you move on +5 and reach 10. At which points do you pass?
Unsolvable		1(%3,3)	If a seagull goes up 5m from the sea level, the distance between the seagull and fish becomes 10 unit. What is the first location of the seagull?
No effort		3(%10)	-

As it is presented in the table, since 13 (43,3%) prospective teachers met all the criteria and posed correct problems, they were established as the ones whose "problem posing skills are good"; since 5(16,6%) prospective teachers didn't meet some of the criteria and posed partly true problems they were established as the ones whose "problem posing skills are medium"; since 8(26,6%) prospective teachers posed false problems they were established as those whose "problem posing skills are poor". 1 (3,3%) prospective teacher who posed a false problem and 3 (10%) prospective teachers who didn't show any effort weren't involved in the evaluation.

Table 3.
Prospective Teachers' Responses about the Expression Ix+2I≤-1

True	14(46,6%)	A problem cannot be posed because there isn't a solution
Partly true	7(23,3%)	If the distance of number's 2 plus from 0 is less than -1, is it possible to find that number?
False	5(16,6%)	Which number's plus 2 distance to 0 is less than or equal to -1?
No effort	4(13,3%)	-

As it is clear from the table, 14 (46,6%) prospective teachers' responses were accepted as true and they were established as "good problem posing skill". 7 (23,3%) prospective teachers' responses were accepted as partly true and they were evaluated as "medium problem posing skill". 5 (16,6%) prospective teachers' responses were accepted as false and evaluated as "poor problem posing skill". 4(13,3%) prospective teachers didn't have any effort to write an answer.

It was found out that except for them, even if some prospective teachers' problem posing skills were at medium or low level, they were quite successful in solving the problem.

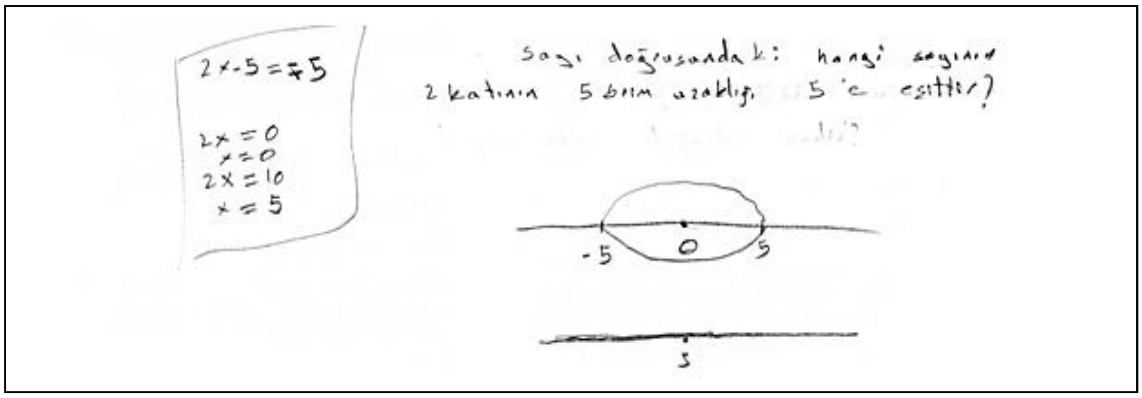

Figure 2. An example whose problem posing skill is medium but successful in solving.

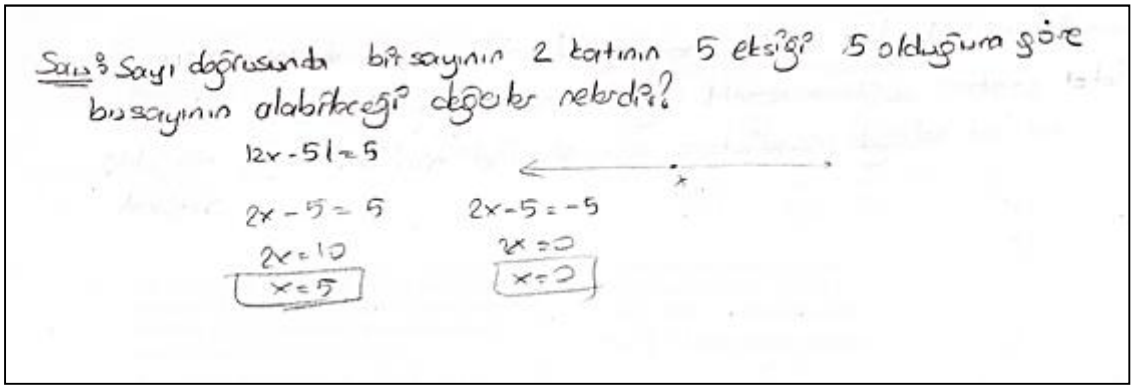

Figure 3. An example whose problem posing skill is poor but successful in solving

The findings obtained from the interviews

Qualitative data were constructed within the scope of main theme and sub theme patterns that are shown in Table 4.

Table 4.
Students' Ideas about Students' Problem Posing.

Main theme patterns	Sub-theme	theme
Positive sides	Affective dimension	interest, love, confidence
	Learning dimension	Enable conceptual learning
	Teaching dimension	Making teaching easy.
Negative sides	Difficulty dimension	Insufficiency of conceptual knowledge, not being able to associate with daily life, inexperience
	Time dimension	It needs much time
suggestions	Learning dimension	Preparation, Plan Teacher' support Experience

The themes of positive sides in the dimension of learning the subject in problem posing studies:

Providing affective (interest, love, confidence) learning: The prospective teachers who were interviewed with stated that problem posing studies would increase the students' interest, their self-confidence and they would like it.

When students can pose their own problems their confidence increases.
They learn the subject better, their interests arouse and even their attitudes increase.
Although not in this subject I have posed problem in another subject, therefore, I didn't have any difficulty, I liked it. Students will probably like it too.

The views related to learning (providing conceptual learning):

The prospective teachers, who were interviewed with, expressed that students would learn the subject better thanks to problem posing studies.

Children do not understand the problems and take steps without knowing. That leads students to memorization. They focus on finding the result without being with it. However, problem posing enables them to understand the event and conceptually learn the subject.
Problem posing studies absolutely should be done at elementary schools and even at universities. The knowledge that students have learnt will be more persistent.
It enables students to make decision by probing into the subject and reconsidering it. it is useful in terms of cognitive activities. It enables them to think. It keeps them away from ready making and memorization.
Students can notice their failure when they cannot pose a problem. The teacher can also notice it and enables them to focus on that topic by finding the reason of this failure.

Views related to teaching (Facilitating teaching):

The prospective teachers who attended the interview stated that problem posing studies would be effective in teaching the subject.

In problem posing study student can understand the process in a better way and learn the subject better. This situation facilitates the teacher's work
It is an effective way of teaching for the teacher.

Themes in difficulty aspects of <u>negative</u> sides in problem posing studies:
Inadequacy of conceptual knowledge:

The prospective teachers having attended the interview stated that problem posing studies would be difficult if the students didn't have comprehensive knowledge.

I had difficulty in the subject of absolute value that means I see that I didn't have comprehensive knowledge about the subject.

Associating with daily life:

The prospective teachers who took part in the interview pointed out that; absolute value subject was not suitable for problem posing and they couldn't associate it with daily life, so that they had difficulty.

I had difficulty in problem posing because the topic is about the absolute value. If it had been another topic, such as profit and loss, equations I would have solved it more easily. Absolute value subject was not quite appropriate subject for problem posing. I had difficulty in associating it with daily life.
I can't even think of problem posing studies on the subjects such as analytical geometry, limit, and derivative. We have already had difficulty. Probably I couldn't have done problem posing.

Inexperience:

Most of the prospective teachers in the interview stated that they had difficulty because they didn't have any experience on this subject.

During the elementary school years problem solving studies used to be done. We have never done problem posing in any mathematics topic. Therefore, I had difficulty since we didn't have any experience on this topic.

In our previous educational years problem posing studies were not done. We always studied on problem solving and test techniques because we were getting ready for the university entrance exam. Even in problem solving we preferred to apply practical rules instead of understanding the problem. For this reason, I had difficulty in posing the problem because problem posing needs the skill of using conceptual knowledge. I feel inadequate in this subject.

Time

Most of the participated prospective teachers pointed out in the interview that they had difficulty as they didn't have enough time.

I had difficulty because the time wasn't adequate.
While solving the same question, I solved it in a shorter time. However, while trying to pose a problem, I need more time.

Students' suggestions about problem posing:

Suggestions:

The interviewed prospective teachers' suggestions about problem posing studies were related more with having comprehensive knowledge; that means understanding the subject well, the necessity of teacher support and experience.

If the child tries to pose problem before understanding the subject comprehensively, he/she cannot succeed.
Students should have good preliminary preparation. They should have a good plan for the problem that they will pose.
Their teachers should be able to help them.
Students firstly should learn the problem posing in easy subjects. They should have experience. Then, these studies should be done with more difficult subjects.

Results and Discussion

It was established that since the problems that the prospective teachers whose problem posing skills were poor, tried to pose weren't related to the subject, involved missing data, weren't the desired type (ordinary verbal problem) and weren't comprehensible, their problem posing skills were poor. It is thought that the reason of their not being able to carry these criteria is prospective teachers' misconceptions about absolute value. In the study having done by Moralı, Köroğlu and Çelik (2004) with the aim of determining prospective mathematics teachers' misconceptions and attitudes towards Abstract Mathematics, they pointed out that absolute value subject is still a problematic subject even for the students who are at the university level. The reason of these misconceptions about absolute value can be psychological as well as it can be epistemological. That is, these students consider absolute value as the solution for equation with one unknown system by generalizing absolute value to algebraic equation. As a result of his study investigating the difficulties Turkish-French high school 1st grade students encounter on absolute value concept, Baştürk (2004) found out that the most common mistakes done by students stem from the fact that they solve the question as if there weren't absolute value.

Another reason is that prospective teachers cannot make any sense of some mathematics subjects and cannot associate mathematics with daily life. Thus, in the interview prospective teachers

stated that they had difficulty because absolute value subject was not suitable for problem posing. Prospective teachers consider some of the mathematics subjects as free from everyday life, and as abstract as not being described with even similes by using imagination. This subject is an important problem to be discussed under a different title in our educational system. The more abstract and the freer from daily life students see mathematics, the more difficult it becomes to understand it. In his study Ersoy (2004) mentioned the importance of benefitting from real world problems based on the students' own experiences in mathematics teaching with problem posing and solving approach. Also, in this study, it was observed that there are problems resulting from prospective teachers' not being able to associate real world with posing absolute value problems.

It was concluded that the prospective teachers whose problem posing skills were at medium level, had conceptual knowledge about the absolute value subject, however, while they were posing problems they made mistakes such as incomprehensibility, unnecessary data use, unnecessary sentence, logical contradictions, associating with a different subject. One of the main reasons of not being able to meet these criteria is thought to stem from the lack of experience on problem posing subject. Thus, the prospective teachers who were interviewed expressed that they didn't have enough experience on problem posing subject. Another reason was that they felt anxiety about problem posing so that they had difficulty in putting their knowledge into mathematical expressions. We can also call it as lack of confidence. Gür and Korkmaz (2002) stated that when students face with the problem posing duty, 62% of the students who were interviewed expressed that they felt uneasy and the reason of this fact is fearing from making mistakes, and lack of self-confidence. As the prospective teachers also mentioned in the interviews, in elementary and secondary school years students were given the subjects and they tended to solve examples via these subjects. It was thought that the reason was caused by the teachers' text anxiety, fear of not being able to finish the topics or their taking long time. When students are given sufficient time to pose problem, they will think and analyze better and they will show better performances. According to the interview results, one of the causes of prospective teachers' having difficulty was insufficient time.

It was observed that some of the prospective teachers, whose problem posing performances are good, posed the problems by using square root statements about the fact that absolute value subject is related to the distance of a number on the numerical axis from the starting point and some posed the problem on temperature difference without feeling anxiety. It can be said that the reason is that prospective teachers have enough conceptual knowledge, they can associate the subject with real world and they have had experience on problem posing studies.

In the absolute value expression as $|x+2| \leq -1$ which is unsolvable, most of the prospective teachers gave the expected true answer by stating that "a problem cannot be posed because it is unsolvable". The prospective teachers who stated that" If a number whose distance from 0 plus 2 is less than -1, is it possible to find out that number?" knew that there wasn't any solution for it. However, since they used the statement: "if its distance from 0 is less than -1" their responses were accepted as partly true. Also the prospective teachers who tried to pose the problem were evaluated as those who had false answers because of:

1. Their carelessness
2. Feeling they have to pose the problem whatever happens
3. Their lack of self-confidence
4. Lack of knowledge.

It is possible to see similar results in the study on "determining the problem solving-posing skills of prospective teachers in unit operation skills" done by Albayrak and his colleagues (2006).

It was found out that although most of the prospective teachers were poor in problem posing skills, they were so successful in solving the problem.

The reason is that even though there is some missing conceptual knowledge in prospective teachers, they are good at operational skills. Because they regard mathematics that they see in their learning process as operational. Most students tend to learn the mathematics that they see as operational during their high school education, without associating them with concepts, rules and algorithms and they can succeed in the university entrance exam by this way. However, in advance

mathematical subjects at the university these students cannot be so successful with the mathematical problems which need conceptual thinking (Baki, 1998).

As a result, to have good performances in problem posing prospective teachers need to:

1. Have sufficient conceptual knowledge: Teachers have great responsibility for this. Teachers should teach the subjects by making connection with the daily life, they should provide students with opportunities to think, discuss, and make logical deduction. The teacher should try to confirm and quell the misconceptions if there is any in students
2. Be able to associate with daily life: the topics should be related with daily life as well as possible. Visual representations and analogies can be used for this.
3. Gain experience: students should be assigned to do problem posing studies as much as possible. Group work can be administrated for it. Students should be encouraged during these problem posing struggles. The following steps should be followed in problem posing.
4. Provide enough time: Students should be given enough time to pose problem, on condition that the time is insufficient, it can be assigned as homework and be expected to complete it another time.

It is also possible to make students do problem posing studies by using group work and discussion method. It can be benefitted from the following steps while making them do these studies:

1. Make plan to pose the problem,
2. Pose the problem,
3. Solve the problem,
4. Organize and complete it.

The studies about problem posing method should be done at the university level, and students should be gained experience about this subject. The next study may be the investigation, evaluation and developing the problem posing performances of elementary and high school students.

References

Abu-Elwan, R. (2006). The Use of Webquest to Enhance the Mathematical Problem-Posing Skills of Pre-Service Teachers. College of Education, Sultan Qaboos University, Sultanate of Oman.

Akay, H. (2006). Problem Kurma Yaklaşımı İle Yapılan Matematik Öğretiminin Öğrencilerin Akademik Başarısı, Problem Çözme Becerisi ve Yaratıcılığı Üzerindeki Etkisinin incelenmesi. GaziÜ. Ortaögretim Fen ve Matematik Alanları Egitimi Bölümü, Ankara :Doktora Tezi.

Akay, H., SoybaĞ, D. ve Argün, Z. (2006). Problem Kurma Deneyimleri ve Matematik Öğretiminde Açık-Uçlu Soruların Kullanımı. *Kastamonu Eğitim Dergisi, 14(1),* 129–146.

Akay, H. (2007), Problem Kurma Yaklaşımı İle Yapılan Matematik Öğretiminin Öğrencilerin Problem Çözme Becerileri Üzerindeki Etkisinin İncelenmesi**,** XVI. Ulusal Eğitim Bilimleri Kongresi.

Akkan, Y., Çakıroğlu, Ü. & Güven, B. (2009). İlköğretim 6. ve 7. Sınıf Öğrencilerinin Denklem Oluşturma ve Problem Kurma Yeterlilikleri (in Turkish). *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi, 9 (17),* 41- 55.

Albayrak , M. ve Erkal, M. (2003). Başarıya Giden Yolda İfade ve Beceri Derslerinin (Türkçe-Matematik Birlikteliği, *Milli Eğitim Dergisi, 158.*

Albayrak, M., İpek, A.,S., Işık, C., (2006). Temel İşlem Becerilerinin Öğretiminde Problem Kurma – Çözme Çalışmaları. *Erzincan Eğitim Fakültesi Dergisi, 8(2).*

Altun, M. (1997).Matematik Öğretimi, Erkam Matbaası, Bursa, s.117.

Baki, A. (1998). Matematik öğretiminde işlemsel ve kavramsal bilginin dengelenme- si, Atatürk Üniversitesi 40. Kuruluş yıldönümü matematik sempozyumu, Atatürk Üniversitesi, Erzurum.

Baştürk, S. (2004) .Türk-Fransız Lise I. Sınıf Öğrencilerinin Mutlak Değer Kavramında Karşılaşmış Oldukları Zorluklar, VI. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, Marmara Üniversitesi, 9-11 Eylül, İstanbul.

Baykul, Y. (2009). İlköğretimde Matematik Öğretimi (6.-8.sınıflar), Pegem yayıncılık, Ankara.s:80.

Dede, Y. (2004). Ögrencilerin Cebirsel Sözel Problemleri Denklem Olarak Yazarken Kullandıkları Stratejilerin Belirlenmesi. Matematikçiler Dernegi Bilim Kösesi. http://www.matder.org.tr 13.01.14

Dede, Y. & Yaman, S.(2005). Matematik Ögretmen Adaylarının Matematiksel Problem Kurma ve Problem Çözme Becerilerinin Belirlenmesi. *Egitim Arastırmaları Dergisi, 18.*

Demir, B.(2005). The Effect of Instruction With Problem Posing On Tenth Grade Students Probability Achievement and Attitudes Toward Probability. Ortadogu Teknik Üniversitesi, Ortaögretim Fen ve Matematik Alanları Egitimi Bölümü, Yüksek Lisans Tezi, Ankara.

English, L. D. (1997). The Development Of Fifth-Grade Children's Problem Posing Abilities. *Educational Studies in Mathematics*, 34, 183–217.

Fidan, S. (2008). İlköğretim 5. Sınıf Matematik Dersinde Öğrencilerin Problem Kurma Çalışmalarının Problem Çözme Başarısına Etkisi. (Yayınlanmamış Yüksek Lisans Tezi). Gazi Üniversitesi, Ankara.

Gür, H., & Korkmaz, E.(2002). İlkögretim 7. Sınıf Ögrencilerinin Problem Ortaya Atma Becerilerinin Belirlenmesi. Matematik Etkinlikleri Sempozyum **.** <www.matder.org> 13.01.14

Gür, H., Korkmaz, E.(2006).Öğretmen Adaylarının Problem Kurma Becerilerinin Belirlenmesi. *Balıkesir Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 8(1),* 64-74.

Işık, C. (2011). İlköğretim Matematik Öğretmen Adaylarının Kesirlerde Çarpma Bölmeye Yönelik Kurdukları Problemlerin Kavramsal Analizi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *41,* 231-243.

Işık, A., Işık, C.,Kar, T. (2011). Matematik Öğretmeni Adaylarının Sözel ve Görsel Temsillere Yönelik Kurdukları Problemlerin Analizi. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi, 30*, 39-49.

Kılıç, Ç. (2013). İlköğretim Öğrencilerinin Doğal Sayılarla Dört İşlem Gerektiren Problem Kurma Etkinliklerindeki Performanslarının Belirlenmesi. *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi, 20,* 256-274.

Kıroğlu, K. (2006). Yeni İlköğretim Programları (1- 5. Sınıflar), Pegem Yayıncılık, İstanbul.

MEB, (2005), İlköğretim Matematik Dersi Öğretim Programı ve Klavuzu(6.-8.sınıflar), Ankara, MEB.

MEB. (2007). İlköğretim Matematik Dersi 6-8. Sınıflar Öğretim Programı ve Kılavuzu. Ankara, MEB.

Miles, M. B. & Huberman, A. M. (1994). *Qualitative Data Analysis : An Expanded Sourcebook.* California: Sage Publications.

Moralı, S., Köroğlu, H. ve Çelik, A. (2004). Buca Eğitim Fakültesi Matematik Öğretmen Adaylarının Soyut Matematik Dersine Yönelik Tutumları ve Rastlanan Kavram Yanılgıları, *Gazi Eğitim Fakültesi Dergisi, 24(1)*, 161-175.

National Council of Teachers of Mathematics Commission on Standards for School Mathematics. (1989). Curriculum and evaluation standards for school mathematics. Reston

National Council of Teachers of Mathematics. (1991). Professional standards for teaching mathematics. Reston.

Silver, E. A. (1994). On Mathematical Problem Posing. *For the Learning of Mathematics*. 14(1), 19-28.

Stoyanova, E.& Ellerton, N. F. (1996). A Framework for Research into Students' Problem Posing in School Mathematics. In,*Technology in Mathematics Education*, ed. P. Clarkson, (pp.518–525) .Melbourne: Mathematics Education Research Group of Australasia.

Stoyanova, E. (2003). Extending Students' Understanding of Mathematics Via Problem Posing. *The Australian Mathematics Teacher, 59(2),* 32-40.

Şandır, H., Ubuz, B. ve Argün, Z. (2002). Ortaöğretim 9.sınıf öğrencilerinin mutlak değer kavramındaki öğrenme hataları ve kavram yanılgıları, V. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, 16-18 Eylül, ODTÜ, Ankara.

Şandır, H., (2003). "Tanısal öğretim yönteminin 9. sınıf öğrencilerinin mutlak değer konusundaki başarılarına etkisi", Yayınlanmamış yüksek lisans tezi, Gazi Üniversitesi, Ankara.

Türnüklü, A. (2000). Eğitim bilim araştırmalarında etkin olarak kullanılabilecek nitel bir araştırma tekniği: Görüşme. *Kuram ve Uygulamada Eğitim Yönetimi*, 6 (24), 543-559.

Yaman, S. ve Dede, Y. (2005). Matematik ve Fen Eğitiminde Problem Kurma Uygulamaları. *Ondokuz Mayıs Üniversitesi Eğitim Fakültesi Dergisi, 20,* 1-11.

Yenilmez K. Ve Avcu T., (2009). İlköğretim öğrencilerinin mutlak değer konusunda karşılaştıkları zorluklar. *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi, 12,* 80-88.

Yıldırım A., Şimşek H. (2008) *Sosyal Bilimlerde Nitel Araştırma Yöntemleri* (7. Baskı) Ankara: Seçkin Yay.