www.ijres.net

International Journal of Research in Education and Science (IJRES)

An Investigation of Eighth Grade Students' Problem Posing Skills (Turkey Sample)

Elif Esra Arıkan[1], Hasan Ünal[2]
[1] Yildiz Technical University, Turkey, arikanee@gmail.com
[2] Yildiz Technical University, Turkey, hunal@yildiz.edu.tr

To cite this article:

Arikan, E. E. & Unal, H. (2015). An investigation of eighth grade students' problem posing skills (Turkey sample). *International Journal of Research in Education and Science (IJRES), 1*(1), 23-30.

International Journal of Research in Education and Science
Volume 1, Issue 1, Winter 2015 ISSN: 2148-9955

An Investigation of Eighth Grade Students' Problem Posing Skills (Turkey Sample)

Elif Esra ARIKAN[1*], Hasan UNAL[1]
[1] Yildiz Technical University

Abstract

To pose a problem refers to the creative activity for mathematics education. The purpose of the study was to explore the eighth grade students' problem posing ability. Three learning domains such as requiring four operations, fractions and geometry were chosen for this reason. There were two classes which were coded as class A and class B. Class A was consisted of successful students in comparison to class B in terms of mathematical acquisition. The study has been carried out by means of qualitative research. On the other hand, independent samples T test was used for obtaining statically inference. Moreover, chi-square test was used whether this students' problem posing ability is independent of mathematics topics.

Key words: Eighth grade students; Requiring four operations; Fractions; Geometry; Problem posing

Introduction

Problem posing and problem solving are accepted in the center of mathematical thinking. It can be possible to approach a standard subject from a different standpoint by means of problem posing activity (Turhan, 2011). Teachers usually teach mathematics as they learned in past. But it is necessary to break the chain in terms of understanding of education for training students who are self-realized individuals (Ersoy, 2002). By reason of, students must be had an opportunity to pose their problems and investigate deeply a relevant topic in mathematics (Korkmaz, Gür & Ersoy, 2004). Some researchers have defended in line with their studies that problem posing activity must be situated in mathematics curriculum (Brown & Walter, 1993; Silver & Cai, 2005). Problem posing is inventive activity to be able to use in mathematics course. Problem posing refers to a mirror that reflects the nature and aspect of students' mathematical experiences (VanDenBrink, 1987). A similar result was reached by studies which were performed by primary teachers (Leung & Silver, 1997). Semantic structure in word problems is enriched by force of problem posing for primary students (Lee, 2002). Problem posing helps creative thinking to improve (Kilpatrick, 1987; Silver, 1997; Yuan & Sriraman, 2010). Also, students' problem solving abilities are improved when they examine solution of posed problem (Cai, 1998; English, 1997; Grundmeier, 2003). On the other hand, one of the most debated topics is whether a clear link between problem posing and problem solving. While a close relationship between problem posing and problem solving has been found by Arıkan and Unal, Cai and Hwang based on their studies, Silver et al. and Crespo have not found a strong correlation in their study (Arıkan & Unal, 2014; Cai & Hwang, 2002; Crespo, 2003; Silver, Mamona-Downs & Leung, 1996).

Problem posing activity makes a sensation; enables autonomous learning; diverse and flexible thinking; prevents misunderstanding and preconceptions; helps to deplete anxiety about mathematics learning by means of interactive learning environment (English, 1998). In literature, one of common students' difficulty is organization of given situations during problem solving, they try to solve problems by coordinating initial data excursively (Işık & Kar, 2011; Jitendra et al., 2007; Xin, 2007). Whether students have a complete comprehending of a concept can be determined by using problem posing activity.

Recently, many mathematics teachers realized the importance of generating or reformulating a problem as well as solving a problem in U.S. and Australia (NCTM, 2000; Skinner, 1991). Moreover, Australia Education Association emphasized that encouraging students to pose their problems is a vital factor in education (HSU, 2006). In Japan, open-ended problems were improved for upgrading mathematics education by using problem posing at all levels to university (Hashimoto, 1997).

[*] Corresponding Author: *Elif Esra ARIKAN, arikanee@gmail.com*

Turkey like other countries made an education reform because of globalization. Therefore, new mathematics curriculum have been used since 2006 that it was reorganized in accordance with student centered education. Hereunder, students have found an opportunity to pose their problems (Kılıç, 2011). Mathematical educational programs in the sixth and eighth classes of the elementary schools; the students carry out finding a solution for the problems requiring fractional calculations as well as composing the problems themselves, they can pose the problems requiring a drawing of a figure during the operation of the solution.

They can solve the problems which are related with the around and the area of the planar regions as well as composing the problems themselves (MEB, 2009). In the curriculum which was conducted by The Ministry of National Education in Turkey, the importance of problem posing skills have been emphasized. But some teachers think that students are not interested in problem posing because of the fact that they are getting used to solve stereotype question as a test. As a result of this situation, teachers do not prefer to deal with problem posing activity (Dede & Yaman, 2005).

Problem posing situations were envisaged such as free (pose a problem which is difficult), semi-structured (pose a problem which is given by equation, photograph or figure) and structured (pose a problem which is reconstruction from initial problem or solution of problem) (Stoyanova & Ellerton, 1996).

Ellerton’s the study was to compare eight high ability children and eight low ability children for problem posing. As a result, more talented students posed problems were more complex in comparison with less talented students. Therefore, Ellerton reported that there is strong correlation between problem posing and problem solving (Ellerton, 1986).

Abu-Elwan’s the study was to develop of mathematical problem posing skills for prospective middle school teachers. Two groups were experiment; one group was control group. While one of experiment groups’ students posed problems by “examining textbook problems”, another experiment group’ students posed problems by “semi-structured situation strategy”. As conclusion, semi-structured situation was found more effective strategy to develop problem posing ability (Abu-Elwan, 1999).

With regard to math anxiety, posed a problem has been seen as motivated activity to students (Buerk, 1982; Baxter, 2005). Brown and Walter emphasized that problem posing is to overcome math phobia in their book “There is good reason to believe that problem generation might be a critical ingredient in confronting math anxiety because the posing of problems or asking a questions is potentially less threatening than answering them. The reason is in part a logical one. That is, when you ask a question, the responses “right” or “wrong” are inappropriate, although that category is paramount for answer to questions” (Brown & Walter, 2005).

Moses, Bjork and Goldenberg (1990) highlighted that classroom climate should be prepared for problem posing activity and mathematics teacher should encourage students to share their ideas about problem mutually. In accordance with this purpose, the researchers suggested 4 rules to teacher as follows:

- Ask students known, unknown and conditions of problem
- Help students to identify features of problem
- Foster students to not fear using uncertain situations and pose an easy problem
- Create an environment for students to play a mathematical game which can be changed in any form.

In Dickerson’s study, five different instructional approaches were implemented for improving students’ problem solving ability in line with purpose of doctorate thesis. Problem posing for three groups and problem solving for two groups were executed. First group: combination of problem posing interventions which were structured, acting-out, what-if-not and open-ended strategies, Second group: problem solving intervention by teacher, third group: problem solving intervention by researcher, fourth group: structured problem posing implementation, fifth group: what-if-not problem posing implementation. It was emphasized that problem posing approaches were an effective way to raise the successful of problem solving of students. In terms of gender differences, the results showed that while females were more successful than males in Group 2 and 3, the exact opposite was the case for Group 1, 4 and 5 (Dickerson, 1999).

Stickles (2006) purposed to identify kind of posed problems by pre-service and in service teachers. The participants posed problems according to statement (generation) and a given problem (re-formulation) for this reason. Generated problems were classified as specific goal, specific goal problem-added information, specific goal problem-initial condition manipulation, specific goal problem-initial condition manipulation, added information, general goal problem, added information.

Reformulated problems were categorized as add information, change the context, combination, equivalent wording, change the given, change the wanted, extension, simplified problem, switch given and wanted. Also, Stickles found a strong relationship between experience and problem posing skill (Stickles, 2006).

Yuan (2009) examined a relationship between creativity and problem posing ability in doctorate thesis. In accordance with the purpose of study, two groups of high school students from Shangai and Jiaozhou in China and one group of high school students from U.S. participated in the research. According to result of this research, expected relationship between creativity and problem posing ability was only found in Jiaozhou group (Yuan, 2009).

In our study, we tried to monitor eighth grade students' problem posing ability according to operations, fractions and geometrical measures.

Method

Participants

Participants of the present study were 46 eighth grade students. There were two groups which were class A and class B. Students of Class A had been more successful in mathematical problem solving compare to students of Class B

Research Questions

This study has been shaped around two questions that were

- Which subject force to students during the problem posing activity?
- Is there any significant difference between class A and class B in terms of problem posing ability?

Data Collection

Three mathematics teachers and three associates in education faculty opined to en-sure the study's reliability and validity. The participants were presented worksheet which was three semi-structured problem situations and then they were asked to pose three for each such as four operations, fractions and geometry problems. Also, students were asked whether they received support apart from school. During the implementation, both of researcher and mathematics teacher made an observation and took notes separately. Namely, observation and written material was used for the study. Therefore, this study has been carried out as qualitative research (Yıldırım & Şimşek, 2008). Survey method and direct observation were used for data collection tool.

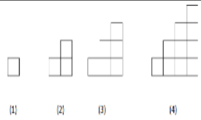
Data Analysis

Descriptive analysis was used since the study was tackled in all its parts and in its natural environment. Students' responses were analyzed as correct or incorrect. In the final, statistical analysis (independent T test) was applied for identifying difference between class A and class B. Students' responses were assessed as correct or incorrect. Moreover, chi-square test for 3x3 table was used whether problem situations and mathematics topics are independent.

Results and Discussion

After the study was executed as paper-pencil-test, responses which belongs to class A and class B were presented respectively in Table 1 and Table 2.

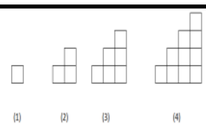
Table 1. Number of posed problems by class A

Learning subdomains/semi-structured problem situations	9x4=36 36÷3=12 Pose a problem such that its solution is above mentioned	$\frac{1}{2}$ Pose a problem such that its responsive is above mentioned	 Pose a problem according to pattern models above mentioned
Requiring four operations	9	9	14
Fractions	6	6	9
Geometrical measures	10	2	5

When examining the number of posed problems related with according to learning subdomains, while twenty one students' worksheets were identified properly, seven students' papers were not incorporated in the study because of empty.

Four students for first situation, one student for second situation and three students for third situation answered correctly. On the other side, five students for requiring four operations, two students for fractions and two students for geometrical measures replied accurately. One student follows all problem situations correctly.

Table 2. Number of posed problems by class B

Learning subdomains/semi-structured problem situations	9x4=36 36÷3=12 Pose a problem such that its solution is above mentioned	$\frac{1}{2}$ Pose a problem such that its responsive is above mentioned	 Pose a problem according to pattern models above mentioned
Requiring four operations	13	13	20
Fractions	4	11	9
Geometrical measures	7	10	7

Twenty five of thirty one students' papers were analyzed and the rest of them were removed from the study because of empty. In this class, two students for first problem situation, seven students for second problem situation and seven students for third problem situation responded rightly. On the other hand, seven students for requiring four operations, three students for fractions and three students for geometrical measures answered correctly.

With respect to observations of mathematics teacher and researcher, common opinions were manifested. First of all, the most forced subject to students was fractions. Many students generated problem like that" I have 4 m coating. If 5/3 of it is flawed, then how many meters coating do I have?", "I have six slices pizza. If I eat 4/1, then how many slices do I have?" and "4/3 of 150 km way I run. How many km do I run to finish?". For this reason, mathematics teacher expressed that students had not comprehended fractions completely. An intervention was not executed for class A but motivation was used for class B students. For instance, class B students exchanged ideas each other, discussed real life problems, used probability to pose problems and were active during the implementation. Mathematics teacher emphasized "I would like to say in accordance with tables and our observations, class A students assumed that they can generate a problem if and only if their problem solving they had to remember problems which problem solving experiences are evoked. However, class B students were so relax in execution. It was surprised to me that they tried to construct a problem of probability which had been treated freshly. They were not obsessed with their problem solving experiences. Moreover, I recognized they had not comprehended to have a grasp of fractions. Therefore I have decided to lecture of fractions to fifth grade students by using materials". When researcher asked to mathematics teacher how often they implement problem posing activity during the mathematics lesson, she answered that "if we have enough time at the end of the course, we do problem posing activity. In other words, we solely execute due to complete course subjects on time".

Indeed, the teacher's observation about students' comprehending of fraction is line with the result found by Silver. Silver mentioned that problem posing enables insight into students' understanding (Silver, 1993).

According to statistical independent samples T test, significant 2-tailed score was 0, 618 with 95% confidence interval. Hence, there is no significant difference between class A and class B although class A students more successful then class B students in mathematics exams. Problem posing facilitates students to study as a team and to discuss mathematically (Schiefele, 1991). Class B studied as a team and they found themselves in pleasure during problem posing for this reason.

It can be examined posed problems by students in terms of mathematical and linguistically and complexity.

Table 3. An example of first question according to geometry problem

Bir oduncunun 9 cm'lik 4 odunu vardır. Bunlar ile bir kare oluşturur. Bu karenin her 3 santimine bir mum koyarsa toplam kaç mum koyar	A woodsman has 4 woods which each of them are 9 cm. He creates a square by means of banding together and he put a candle in per every 3 cm. Then, how many candles he put?

Table 4. An example of second question according to fraction problem

Bir zarın havaya atılması deneyinde çıkan sayının tek sayı olma olasılığı nedir?	A dice is thrown into the air. What is the probability that an odd number of the top surface?

Table 5. An example of third question according to fraction problem

4. adımda 10 karesi olan bir örüntünün $\frac{2}{49}$'si bordoya boyanıyor. Geri kalan ise lacivert boyanıyor. Lacivert boyanan tüm $\frac{8}{10}$ kaçtır?	There are ten blocks in forth step of a pattern. 2/10 of these blocks are painted by Bordeaux. If the rest of blocks are painted by dark blue, then what is the ratio of dark blue blocks to full blocks?

Table 6. An example of third question according to geometry problem

Bir örüntüde ilk adımdaki karenin çevresi toplam 4 cm'dir. 2. adımdaki karelerin çevresi 12 cm'dir. İlk adımdaki karenin çevresi ile 2. adımdaki karelerin çevresi farkı kaçtır	Circumference of the square is 4 cm in first step of a pattern and circumference of the squares is 12 cm in second step of the pattern. What is the difference between first and second steps of the pattern?

When examining problems in Table 3, 4, 5 and 6, students posed problems a lower level than expected. It may be caused that students have not been familiar to problem posing activity. Giving chance to students for writing their own problems, many of linguistic difficulty may be cut down (Bums & Richards, 1981; Resnick & Resnick, 1996; Wright & Stevens, 1980). The writing aspect of problem posing assists students' communication skills (Burton, 1992; Matz & Lerer, 1992).

Students should have an opportunity to create their problems. Because problem posing provides autonomous learning, a sense of ownership of mathematics, to foster creative thinking and to improve fluency in mathematical language (Nohda, 1995).

While H_0= problem posing situations and mathematics topics which are executed in this study was independent, H1= this two qualitative variables are not independent. According to chi-square test, because of $\chi 2=5.08$, H_0 has been accepted. Therefore, it was not determined that problem posing situations and mathematics topics are two dependent qualitative variables.

Conclusion and Implications

Eighth grade students posed word problems according to geometrical measures and fractions. Actually, in Turkey, problem posing is a new topic. Therefore, these students generated with their sentences problems at first time. Even if a student is not able to solve a problem, she/he can pose her/his own problem. While some researchers found a correlation between problem solving and problem posing, the others did not find it. Therefore, problem posing ability may be affected by other factors.

One of these factors might be motivation. For example, in our study, although Class B students were not good at problem solving, they were accomplished with the Class A. Teachers can find their students incapable to solve a problem. For this reason, they do not prefer their students to pose a problem because of waste of time. But if we want to our students to solve their problems, problem posing is very important activity to think creatively and critically. Therefore, teacher should foster students to pose a problem consistently. Namely, motivation is used for posing a problem.

Transferring of calculation based knowledge by means of teaching rules sequences creates a perception that mathematical subjects are independent from each other. There have been two different solution finder who solves the mathematical problems; master and apprentice. While the master reaches to a solution by means of making an activity based on his or her conceptional knowledge for the problems he or she is working on, the apprentice tries to ask him or herself whether he or she has been faced with the similar situation or problem before. That's why the creation of the conception learning is to be provided and as a result of this action, the student has to find out a required meaning for the calculation that he or she has directly been involved in.

Concerning this issue, two concepts which are fractions and length-area measures can be given as example. Rational (fractional) numbers are abstract concept for secondary school students. When students learn new knowledge, they build it on old knowledge (Yağbasan & Gülçiçek, 2003). In other words, the learning gap effects mathematics instruction. Students should mingle with concrete materials related mathematics subject instead of solving complex operations. For this reason, students need many concrete experiences by the means of using materials such as numerical axis (fraction bars), area models (pizzas) and solid models (rainbow cubes, orange and bread etc.) (Baki, 2008). This case is the same for geometrical measures. Geometry lessons can be supported by virtue of computer programs such a sketchpad.

The teacher emphasized motivation factor during conversation. Motivation has been accepted as energy to achieve the objective. Since learning requires effort, motivation plays an important role. One of components of the motivation to learn is external motivators. Students must feel themselves to have opportunities for sharing their responses and thoughts freely (Frith, 1997). Learning environment must be designed for students to exchange of views and students feel relaxed during the process. In the study, motivating students affected their problem posing performance (for class B).

Although Class B was better than Class A in terms of problem posing according to fractions and geometrical measures, chi-square test shows that problem posing ability is independent of areas of mathematics. As mathematics teacher mentioned that problem posing requires thinking rather than memorization because of open-ended process. But class A students' making sense of problem posing was related to their past experiences with problem solving. Also, problem posing was depicted as an assessment tool by the teacher to obtain students' acquisitions about mathematics concepts. Similar result was specified by Lin and Leng (2008). Based on their study, a teacher can gain pattern about his/her students' mathematical thinking and learning by using problem posing activity.

Mathematical experiences are necessary but not sufficient condition for problem posing. Although class A students more capable than class B students for mathematical content knowledge, the result of the implementations had no significant difference. Because class A students neither eager nor curious during the problem posing activity. They only wanted to solve problems. Also they perceived problem posing as exercise questions. There-fore they forced to themselves to remember test questions. It may be defined as a vicious cycle. Mathematics teacher passed her opinion for problem posing that it is useful activity to identify students' mathematical accumulations and to be used as an assessment tool. Namely, problem posing let teachers to obtain information about students' mathematical learning and thinking.

It must be mentioned that students' problem posing skills are concerned with their teachers' approaches to posing a problem. It was explained that teachers have difficulty because of inexperience or limited experience in problem posing activity (Rizvi, 2004). For this reason, teachers should mingle with problem posing as far as possible. On the line, problem posing activities should be executed in education faculty. Posed problems can be examined in terms of creativity, originality and complexity. In the present study, students were limited on fractions. Actually, many applications are used by developing technology in schools. Using technology simplifies teachers' work for students' intuitive understanding and making sense of fractions. Another notable point is time. Problem posing activity should be allocated time in mathematics curriculum. Cross-national studies may be carried out later on sub domain subjects like fractions and geometrical measures.

References

Abu-Elwan, R. (1999). The development of mathematical problem posing skills for prospective middle school teachers. In A. Rogerson (Ed.) *Proceedings of The International conference on Mathematical Education into the 21st Century: Social Challenges, Issues and Approaches*, *2*, 1-8, Cairo, Egypt.

Arıkan, E.E. & Ünal, H. (2014). Problem posing and problem solving ability of students with different socio economics levels. *International Journal of Social Science Research*, *2*(2), 16-25.

Baki, A. (2008). *Kuramdan uygulamaya matematik eğitimi*. Ankara: Harf Eğitim Yayıncılığı.

Baxter, J.A. (2005). Some reflections on problem posing: A conversation with Marion Walter. *Teaching Children Mathematics,12*(3), 122-128.

Brown, S.I. & Walter, M.I. (1993). *Problem posing: Reflection and application*. Hilsdele, NJ: Erlbaum Associates.

Brown, S.I. & Walter, M.I. (2005). *The art of problem posing*. Mahwah, NJ: Lawrence Erlbaum Associates.

Buerk, D. (1982). An experience with some able women who avoid mathematics. *For the Learning of Mathematics*, *3*(2), 19-24.

Bums, M. & Richards, K. (1981). Making sense out of word problems. *Learning*, *9*(6), 26-32.

Burton, G. (1992). Using language arts to promote mathematical learning. *The Mathematics Teacher*, *3*(2), 26-31.

Cai, J. (1998). An investigation of U.S. and Chinese students' mathematical problem posing and problem solving. *Mathematics Education Research Journal*, *70*(1), 37-50.

Crespo, S. (2003). Learning to pose mathematical problems: Exploring changes in preservice teachers' practices. *Educational Studies in Mathematics*, *521*, 243–270.

Cai, J. & 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.

Dede, Y. & Yaman, S. (2005). Matematik öğretmen adaylarının matematiksel problem kurma ve problem çözme becerilerinin belirlenmesi. *Eğitim Araştırmaları Dergisi*, *18*, 41-56.

Dickerson, V.M. (1999). *The impact of problem-posing instruction on the mathematical problem-solving achievement of seventh graders.* (Unpublished doctoral dissertation). University of Emory, Atlanta.

Ellerton, N.F. (1986). Childeren's made-up mathematics problems. *A new perspective on talented mathematicians. Educational Studies in Mathematics*, *17*, 261-271.

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

English, L.D. (1998). Children's problem posing within formal and informal contexts. *Journal for Research in Mathematics Education*, *29*(1), 83-106.

Ersoy, Y. (2002). Bilişim teknolojileri ve matematik eğitimi-II: Köklü yenilikler ve bilişsel araçların etkileri. Matematik etkinlikleri, 24-26 Mayıs 2001, matematik sempozyumu kitabı (Düz: O. Çelebi, Y. Ersoy & G. Öner), 78-86. Ankara: Matematikçiler Derneği Yayınları.

Frith, C. (1997). *Motivation to Learn*. Retrieved 16.01.2014 from http://general.utpb.edu/FAC/keast_d/Tunebooxs/pdf/Motivation.pdf.

Grundmeier, A.T. (2003). *The effects of providing mathematical problem posing experiences for K-8 Pre-service Teachers: Investigating teacher's beliefs and Characteristic of posed problems* (Unpublished doctoral dissertation). University of News Hampshire, USA.

Hashimoto, Y. (1997). The methods of fostering creativity through mathematical problem solving. *International Reviews on Mathematical Education, 3*, 86-87.

HSU, S.C. (2006). *A learner-ınitiating tutoring system with cognitive knowledge for understanding word problems*. (Unpublished doctoral dissertation). National Yunlin University of Science and Technology, Republic of China, Taiwan.

Işık, C. & Kar, T. (2011). İlköğretim 6, 7 ve 8. sınıf öğrencilerinin sayı algılama ve rutin olmayan problem çözme becerilerinin incelenmesi. *Ahi Evran Üniversitesi Eğitim Fakültesi Dergisi*, *12*(1), 57-72.

Jitendra, A.K., Griffin, C.C., Deatline-Buchman, A., & Sczesniak, E. (2007). Mathematical word problem solving in third-grade classrooms. *The Journal of Educational Research*, *100*(5), 283-302.

Kılıç, Ç. (2011). İlköğretim matematik dersi (1-5 sınıflar) öğretim programında yer alan problem kurma çalışmalarının incelenmesi. *Mersin Üniversitesi Eğitim Fakültesi Dergisi, 7*(2), 54-65.

Kilpatrick, J. (1987). *Problem formulating: where do good problems come from?* In A.H. Schoenfeld (Ed.), Cognitive science and mathematics education, 123-147. Hillsdale, NJ: Lawrence Erlbaum Associates.

Korkmaz, E., Gür, H., & Ersoy, Y. (2004). Problem kurma ve çözme yaklaşımlı matematik öğretimi II: Öğretmen adaylarının alışkanlıkları ve görüşleri, *Matematikçiler Derneği Bilim Köşesi*. www.matder.org.tr.

Lee, C.H. (2002). *The effect of problem posing on fifth graders understanding of semantic structure in arithmetic word problem and on their problem solving capability*. (Unpublished master thesis). National Taipei Teachers College, Taipei, Taiwan.

Leung, S.S. & 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.

Lin, K.M. & Leng, L.W. (2008). Using problem-posing as an assessment tool. *Paper presented at the 10th Asia-Pacific Conference on Giftedness*, Singapore.

Matz, K. & Leier, C. (1992). Word problems and the language connection. *Arithmetic Teacher*, *39*(8), 14-17.

MEB (2009). *İlköğretim matematik dersi 1-5. sınıflar öğretim programı.* Ankara: MEB Basımevi.

Moses, B., Bjork, E., & Goldberg, E. (1990). *Beyond problem solving: Problem posing*. In R. Cooney & C. Hirsch (Eds.), Teaching and learning mathematics in the 1990s. Reston, Va.: National Council of Teachers of Mathematics.

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

National Research Council, (1998). *Teaching about evolution and the nature of science*. Washington, DC: National Academy Press.

Nohda, N. (1995). Teaching and evaluating using “open-ended problems” in the classroom. – In: ZDM, *Zentralblatt für Didaktik der Mathematik 27*(2), 57–61.

Resnick, D. & Resnick, L. (1996). *Performance assessment and the multiple functions of educational measurement*. In M. B. Kane and R. Mitchell (Eds.), Implementing performance assessment: Promises, problems, and challenges, 23-29. New Jersey: Lawrence Erlbaum Associates.

Rizvi, N.F. (2004*). Prospective teachers' ability to pose word problems*. Retrieved 18.03.2014 from http://www.cimt.plymouth.ac.uk/Journal/rizvi.pdf.

Schiefele, U. (1991). Interest, learning, and motivation. *Educational psychologist*, *26*(3-4), 299-323.

Silver E.A. (1993). On mathematical problem posing. In R. Hirabayasshi, N. Nohda, K. Shigematsu, & F. L. Lin (Eds.), *Proceedings of the 17th Conference of the International Group for the Psychology of Mathematics Education*, *1,* 66-85, Tsukuba, Japan: PME.

Silver, E.A., Mamona-Downs, J., & Leung, S.S. (1996). Posing mathematical problems: An exploratory study. *Journal for Research in Mathematics Education*, *27,* 293–309.

Silver, E.A. (1997). Fostering creativity through instruction rich in mathematical problem solving and problem posing. *ZDM*, *3*, 75-80.

Silver, E.A. & Cai, J. (2005). Assessing students' mathematical problem posing. *Teaching Children Mathematics*, *12*(3), 129-135.

Skinner, P. (1991). *What's your problem? Posing and solving mathematical problems, K-2*. Portsmouth, NH: Heinemann

Stickles, P.R. (2006). *An analysis of secondary and middle school teacher's mathematical problem posing*. (Unpublished doctoral dissertation). Indiana University. (UMI No. 3219902).

Stoyanova, E. & Ellerton, N.F. (1996). A framework for research into student's problem posing in school mathematics. *Technology in mathematics education. Mel bourne: Mathematics Education Research Group of Australia*.

Turhan, B. (2011). P*roblem kurma yaklaşımı ile gerçekleştirilen matematik öğretiminin ilköğretim 6. sınıf öğrencilerinin problem çözme başarıları, problem kurma becerileri ve matematiğe yönelik görüşlerine etkisinin incelenmesi.* (Yüksek lisans tezi), Anadolu Üniversitesi, Eğitim Bilimleri Enstitüsü, Eskişehir.

VanDenBrink, J. (1987). Children as arithmetic book authors. *For the Learning of Mathematics*. *7*(2), 44-48.

Wright, J. & Stevens, N. (1980). Improving verbal problem solving performance. *Arithmetic Teacher*. *31*(2), 40-42.

Xin, P.Y. (2007). Word problem solving tasks in textbooks and their relation to student performance. *The Journal of Educational Research*, *100*(6), 347-359.

Yağbasan, R. & Gülçiçek, G. (2003). Fen öğretiminde kavram yanılgılarının karakteristiklerinin tanımlanması. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi*, *13*, 110-128.

Yıldırım, A. & Şimşek, H. (2008). *Sosyal bilimlerde nitel araştırma yöntemleri*. Ankara: Seçkin Yayınevi.

Yuan, X. (2009). *An exploratory study of high school students ' creativity and mathematical problem posing in China and the United States.* (Unpublished doctoral dissertation). Illinois State University.

Yuan, X. & Sriraman, B. (2010). *An exploratory study of relationshıps between students' creativity and mathematical problem-posing abilities*. In B.Sriraman, K. Lee (eds.), The Elements of Creativity and Giftedness in Mathematics, xx–xy.