SDU International Journal of Educational Studies

Mathematical and Linguistic Examination of the Problems Posed by Sixth Grade Students

Memet Karakuş[1], **Buket Turhan Türkkan**[1], **Başak Karakoç Öztürk**[1]
[1]Çukurova Üniversitesi

To cite this article:
Karakuş, M., Turhan-Türkkan, B. & Karakoç-Öztürk, B. (2020). Mathematical and linguistic examination of the problems posed by sixth grade students. *SDU International Journal of Educational Studies, 7*(2), Page 287- Page 304. Doi: 10.33710/sduijes.735814

SDU International Journal of Educational Studies

Volume 7, Number 2, November 2020, Page287-304 e-ISSN: 2148-9068

Mathematical and Linguistic Examination of the Problems Posed by Sixth Grade Students*

Memet Karakuş [1], Buket Turhan Türkkan[2†], Başak Karakoç Öztürk[3]
[1]Çukurova Üniversitesi
Orcid ID: 0000-0002-6099-5420
[2]Çukurova Üniversitesi
Orcid ID: 0000-0003-2528-4022
[3]Çukurova Üniversitesi
Orcid ID: 0000-0002-5783-3471

Received: 11/05/2020 **Accepted:** 08/08/2020

Abstract

The general aim of the study is to examine the problems posed by secondary school students for the arithmetic mean mathematically and linguistically. In order to determine the problem posing skills of students, the "Problem Posing Test for Arithmetic Mean" was used. Within the scope of the data analysis, a rubric with two different levels, being the mathematical and linguistic dimension, was created for the problem posing test. In accordance with the results of the study, the problems posed by the students were determined to be at a moderate level in the mathematical dimension according to the average of the scores obtained in the mathematical dimension. However, according to the average scores obtained in the linguistic dimension, the problems posed by the students were determined to be at a high level. Moreover, there was no significant relationship between the mathematical dimension scores and linguistic dimension scores.

Keywords: Analysis of language mistakes, assessment of the problem posing skill, mathematics teaching, problem posing

INTRODUCTION

The information society aims to raise individuals who know what, why, and how they should learn, who can use the information learned and can produce new information, instead of raising individuals who accept ready information without questioning it (Güven & Kürüm, 2008). In today's horizon of mathematics teaching, activities and practices, in which students produce mathematical knowledge and rules by themselves; come to the forefront rather than students' acquiring and applying these mathematical knowledge and rules in a ready form (Olkun, 2003). In contemporary mathematics teaching, it is important to introduce students with mathematical skills, with which students can actively think mathematically, create their own mathematical knowledge by doing and experiencing mathematics, recognize mathematical problems in real life, and create effective solutions for these problems (Olkun & Toluk, 2003; Olkun, 2008; Turhan & Güven, 2014). One of these skills is the problem posing skill. Gaining the problem posing skill to students is a skill that is beyond solving mathematical problems that are available in course books. In addition to the solution of the problems given by a teacher or a course book, problem posing, during which learners create problems, is defined as an important activity in mathematics education (Kojima, Miwa & Matsui, 2015). Problem

* A part of this study was presented at the 4th International Congress on Curriculum and Instruction (October 27-30, 2016, Antalya, Turkey).

† Corresponding Author*: Buket Turhan Türkkan, Çukurova University Faculty of Education, Adana, Turkey, bturhan@cu.edu.tr*

posing is also addressed as changing a given problem by presenting it in a different way (Shuk-kwan, 1997). In the problem posing process, students can see a specific situation from different viewpoints by creating new information and thoughts and can approach the mathematical situations they face in real life from a critical point-of-view (Turhan & Güven, 2014). This can allow students to effectively see mathematics in real life. For these reasons, problem posing is regarded as an important skill among mathematical skills (Silver, 1997). The benefits and importance of problem posing can be clearly observed in studies conducted on this subject. In this context, it has been expressed that including problem posing in mathematics teaching improves the problem-solving skill (Silver, 2013), and also develops students' habits of thinking with regard to reinforcing and enriching basic mathematical concepts (Kwek, 2015), increases mathematical comprehension and academic achievement (Solórzano, 2015), provides the discovery of knowledge (Mishra & Iyer, 2015), improves creativity (Silver, 1997), and contributes to the understanding of mathematical problem situations and the establishment of a solid basis for posing new problems (English, 1997). Taking into consideration these opinions, the importance of problem posing emerges.

According to Stoyanova (1997), there are three types of problem posing strategies: structured, semi-structured and free problem posing. In structured problem posing, a problem is posed by changing the data in a given problem; in semi-structured problem posing, a problem is posed by using the previously given data; while students pose their own problems freely in free problem posing (Stoyanova, 1997). Nevertheless, within the scope of the activities for problem posing, Bush and Fiala (1993) suggested a new activity in the form of "creating a problem story" and stated that students could create problem stories for unique and non-routine problems in the problem story creation activity. These strategies and activities can be used by teachers in order to develop the problem posing skills of students. However, it is stated that problem posing is not implemented much in teaching processes although it is included in mathematics curricula (English, 1997; Akkan, Çakıroğlu & Güven, 2009; Bonotto, 2010; Ellerton, 2013; Tertemiz & Sulak, 2013; Klaassen & Doorman, 2015; Kojima, Miwa & Matsui, 2015; Van Harpen & Presmeg, 2013). Accordingly, it is expressed that more importance should be attached to problem posing (English & Watson, 2015; Klaassen & Doorman, 2015).

Kwek (2015) states that problem posing fills the gap in determining what students know, provide teachers with information on the understanding, knowledge, skills and tendencies of students, and can be used as a formative evaluation tool. Accordingly, it can be said that evaluating the problems posed by students is important in the process of gaining the problem posing skill. There are different strategies, methods, tools and criteria in the literature on evaluating the problems posed by students. Criteria such as the fact that the expression written by a student is a mathematical problem, has a solution, the level of difficulty of the problem posed, the number of operations needed to solve the problem, the originality of the problem, the use of the situations that are required from the student in the problem posing activity, sufficiency of the data that the problem includes, the use of the language correctly and well can be taken into consideration in the evaluation of the problems posed (Silver & Cai, 1996; Grundmeier, 2003; Albayrak, İpek & Işık, 2006; Gülten, Ergin & Ergin, 2007; Lin & Leng, 2008; Turhan, 2011; Yıldız & Özdemir, 2015). Nevertheless, the types of the qualities possessed by the problem posed both mathematically and in terms of the language use, and the correct and effective use of the language in the problem posing activity are regarded as important as mathematical skills in the evaluation of the problem posed by students (Silver & Cai, 1996; Yıldız & Özdemir, 2015). Furthermore, one of the ways of using the language effectively is writing. The writing skill is used in different ways and for different purposes in mathematics courses.

Many teachers accept that the writing skill should be included in mathematics lessons (McCarthy, 2008). However, teachers mostly find it hard to combine the writing and mathematics skills, although both disciplines complement one another (Wilcox & Monroe, 2011). The aim of expression through writing is to create a text. In linguistic terms, a text is a series of sentences that follow one another, and create sequential and meaningful wholes (Günay, 2003). Therefore, no text that emerges as a result of writing is a random product but is a product of the thought. In-depth thinking and communication are intertwined processes in the teaching of mathematics. Writing in mathematics lesson can be helpful in strengthening the process of thinking that is necessary to reveal students' thoughts and reflect them on their work (National Council of Teachers of Mathematics, 2000). In the

light of all this literature, it is important to examine the problems posed by students in mathematics lesson and expressed in writing multi-dimensionally, both mathematically and linguistically.

Upon examining the studies conducted in Turkey on gaining the problem posing skill, it is observed that the studies conducted are on the effects of problem posing approach-based mathematics teaching, determination of the mathematical skills related to the problem posing skill, investigation of the problems posed by students, pre-service teachers and teachers in mathematical terms, opinions of teachers and pre-service teachers on problem posing, and problem posing studies included in the mathematics curriculum (Korkmaz & Gür, 2006; Cankoy & Darbaz, 2010; Çelik & Özdemir, 2011; Işık & Kar, 2012; Arıkan & Ünal, 2013; Kılıç, 2014; Turhan & Güven, 2014; Kar & Işık, 2015). No study addressed mathematically and linguistically was encountered among the studies on problem posing in Turkey, while a limited number of studies that investigate the problems posed by students multi-dimensionally, mathematically and linguistically, was encountered when the studies conducted abroad were examined (Silver & Cai, 1996). Nevertheless, in the studies carried out, it is stated that students fail to effectively use the language in problem posing activities and have difficulty in posing problems as a result of the difficulties experienced when expressing verbally although their mathematical skills are at a good level (Arıkan & Ünal, 2013; Şengül Akdemir & Türnüklü, 2017; Turhan Türkkan, 2017). Herefrom, it is considered that the multi-dimensional examination of the problems posed by students will contribute to the literature.

Although the measures of the data are considered as an important way to describe the data, it is expressed that among these measures, the most common numerical explanations of the data set can be addressed with the measures of spread, being mode, median, and arithmetic mean, and with the measures of distribution, being variance and dispersion (Van De Walle, Karp & Bay-Williams, 2012). Within the scope of data teaching, it is suggested to start teaching with the questions of students about the events they encounter in real life and are curious about (Pesen, 2008). The arithmetic mean is calculated by summing all numbers in the set and dividing them by the total number of elements in the set (Van De Walle, Karp & Bay-Williams, 2012). However, the arithmetic mean is also addressed as an equilibrium point of the whole data (Cai, 2000). It is stated that students are accustomed to calculating the arithmetic mean due to the calculations they make in order to determine the achievement grade of a course they take, and therefore, such informative knowledge can be used in the teaching of the arithmetic mean concept (Altun, 2005). The teaching of the arithmetic mean concept by associating it with real life is also emphasized in the mathematics curriculum, and the importance of the subject of arithmetic mean is mentioned (Ministry of National Education, 2017). In this respect, it is emphasized that the subject of arithmetic mean is important not only in statistics but also in real life practices (Batanero, Godino, Vallecillos, Green & Holmes, 1994). Similarly, Cai (2000) states that the subject of arithmetic mean is important both in statistics and in the operational algorithm. However, it is expressed that there is a limited number of studies on how to integrate problem posing in the curriculum, especially in statistics subjects (English & Watson, 2015). Taking into account the importance of the subject of arithmetic mean and the importance of integrating problem posing studies into real-life situations, it is considered that conducting problem posing studies for arithmetic mean will contribute to the literature. Here from, the general aim of this study is to examine the problems posed by secondary school students in the subject of the arithmetic mean both mathematically and linguistically. Accordingly, the answers to the following questions were sought:

- What is the mathematical level of the problems posed by secondary school sixth-grade students in the subject of the arithmetic mean?
- What are the mathematical features of the problems posed by secondary school sixth-grade students in the subject of the arithmetic mean?
- What is the level of the problems posed by secondary school sixth-grade students in the subject of the arithmetic mean in terms of language use?
- What are the features of the problems posed by secondary school sixth-grade students in the subject of the arithmetic mean in terms of language use?
- Is there a significant relationship between the mathematical and linguistic levels of the problems posed by secondary school sixth-grade students in the subject of the arithmetic mean?

METHOD

Research Design

The survey method among quantitative research methods was used in accordance with the aim of the study. Survey studies are research approaches that aim to describe a past or an existing situation as it is (Karasar, 2008). This study also has the quality of a survey study on the problem posing skill of secondary school sixth-grade students.

Participants

The convenience sampling method among probability-based sampling methods was used in order to determine the participants of the study. Convenience sampling includes selecting the most accessible samples, and this sampling method is the sampling with the least cost, and it is the most convenient sampling in terms of time, money and power (Marshall, 1996). In this sampling method, the researcher selects a close and easily accessible situation (Yıldırım & Şimşek, 2008). Accordingly, the participants of the study consist of 73 students studying at the sixth grade in the 2015-2016 academic year at a state school at the upper socio-economic level in Bilecik province which the researcher can easily access. 43 of these students are girls, and 30 are boys. In order to determine the competences of students in the Turkish and mathematics courses, the school achievement scores were examined. In this context, while the average achievement score of the Turkish course was calculated to be 83.21 out of 100 points, the average achievement score of the mathematics course was determined to be 84.46. In this respect, it can be said that students have the competences to answer the problem-posing test. However, the mathematics teacher of participant students was interviewed, and classes with the sufficient mathematics achievement in terms of problem posing and arithmetic mean were selected. Since the students learnt the subject of arithmetic mean just before the test was applied, the basis of the students on the arithmetic mean was considered to be adequate.

Data Collection and Data Analysis

The “Problem Posing Test for Arithmetic Mean” developed by the researchers and consisting of four open-ended questions was used in order to determine the problem posing skills of students. The test includes one structured, one semi-structured, one free problem posing and one problem story creation type questions. The implementation duration of the test was determined to be one course hour, i.e. 40 minutes. The opinions of mathematics and Turkish teaching experts were taken on the Problem Posing Test for Arithmetic Mean and the rubric. The pilot application of the test was carried out at a school that bears similarities to the school where the research data were collected. Since no problem occurred during the pilot application, and the opinions of the experts on the test were positive, the actual application of the test was performed in the second semester of the 2015-2016 academic year.
Two different rubrics, in the mathematical and linguistic dimensions, were created in relation to the Problem Posing Test for Arithmetic Mean. It has been determined in the studies conducted to assess the problem posing skill that different criteria such as solvability, language and expression, information that the problem includes, the number of operations required for the solution, problem posing in the desired direction, achievement of a solution, originality, complexity, and data amount are taken into consideration (Silver & Cai, 1996; Grundmeier, 2003; Gülten, Ergin & Ergin, 2007; Turhan & Güven, 2014; Arıkan & Ünal, 2015; Yıldız & Özdemir, 2015). Taking into account the criteria addressed in these studies, five sub-dimensions, being the state of being a problem, using what is required, solvability, originality, and the level of difficulty, were included in the rubric for the mathematical dimension. By using the rubric, the lowest score to be obtained from the problem posing test in the mathematical dimension is 20, and the highest score is 60. The scores between 20 and 33 are regarded as low, between 37 and 47 are regarded as medium, and between 48 and 60 are regarded as high. Four sub-dimensions being the syntax, word selection, punctuation marks and spelling rules were included in the rubric in the linguistic dimension. The syntax, which is one of the sub-dimensions of the rubric in question, was considered important because it includes the rules that form

the sentence and word groups and examining the conditions in which words come together. When writing a mathematical problem, it is necessary that words come together and form a union according to certain rules so that emotions and thoughts can be explained; in this context, a syntactic examination is required. Another sub-dimension, word selection, is significant in that it demonstrates whether the student uses the appropriate word for the richness and meaning of the vocabulary. According to Sever (2004), the effective expression of students of what they think and design depends on the richness of the vocabulary. If students do not use even a word in their written text in a way that is appropriate to its meaning, the linguistically established communication will be disrupted, the product of thought put forward will be missing in terms of the linguistic competence, and the desired meaning will not be achieved. Spelling rules and punctuation marks must be applied correctly to a written text so that a language can be used well, and feelings and thoughts can be fully and completely explained. Punctuation marks that are used to facilitate the understanding of writing, distinguish sentences from each other, and make the meaning effective, also clarify the meaning and awake the attention of the reader (Banguoğlu, 1998). The two main functions of spelling rules are to facilitate communication between the reader and the writer and to provide integrity in writing. It is necessary for students to know the generally accepted meanings and correct spellings of words and to apply them in written expressions when designing a text. Therefore, problems posed by students were evaluated in terms of the correct use of spelling rules and punctuation marks in the rubric. By using the rubric, the lowest score to be obtained from the problem posing test in the linguistic dimension is 16, and the highest score is 48. The scores between 16 and 26 are regarded as low, between 27 and 37 are regarded as medium, and between 38 and 48 are regarded as high. Descriptive statistics and the Pearson correlation coefficient were used in the analysis of the quantitative data obtained from the study. The deductive analysis approach was used in the analysis of the qualitative data of the study, considering the dimensions in the rubric. The analyzes were conducted by a Turkish education expert and a mathematics education expert.

An example of the data analysis is expressed below (First the posed problem is presented in original language and presented in Figure 1; then the posed problem has been translated into English and presented in italics):

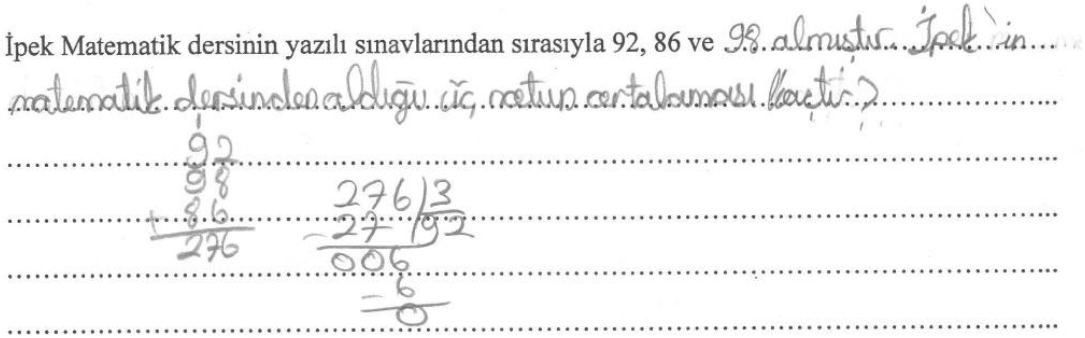

Figure 1. An example of the posed problems of students

İpek received 92, 86, and 98, respectively, from the written exams of the mathematics course. What's the average of the three points İpek got from mathematics course?

In this posed problem for the linguistic dimension, all sentences conform to the Turkish syntax, all words were selected in accordance with their meaning and correctly, all punctuation marks were used correctly and the spelling rules were applied without mistakes. So, for syntax, word selection, punctuation marks and spelling rules sub-dimensions, 3 points were given. For the mathematical dimension, the posed problem is a mathematical problem, is an arithmetic mean problem in the data of which 3 and more changes are made, is a problem that can be resolved, is a very common and not original problem and is a simple problem that can be solved in 1-2 steps. So for the state of being a problem, the state of using what is required and solvability sub-dimensions, 3 points were given. For the originality and level of difficulty sub-dimensions, 1 point was given. So the posed problem analyzed with the qualifications in the rubric and the posed problems scored with this respect.

FINDINGS

Findings in Terms of the Mathematical Dimension

Within the scope of the findings in terms of the mathematical dimension, the descriptive statistics related to the mathematical dimension scores for the problem posing test and the findings related to the qualities of the problems posed by students in mathematical terms are presented.

Table 1. Descriptive statistics related to the mathematical dimension scores for the problem posing test

Question No	Type of Problem	Arithmetic Mean	Standard Deviation
Question 1	Structured	11	1.54
Question 2	Semi-structured	11.10	1.86
Question 3	Problem story	10.45	1.85
Question 4	Free	10.77	1.90
Total		**43.32**	**4.88**

As can be seen from Table 1, the arithmetic mean of the first question of the structured problem posing type was calculated to be 11, the arithmetic mean of the second question of the semi-structured problem posing type was calculated to be 11.10, the arithmetic mean of the third question of the problem story creation type was calculated to be 10.45, and the arithmetic mean of the fourth question of the free problem posing type was calculated to be 10.77. It was determined that the arithmetic means of these four questions were close to one another. Moreover, it can be said that the question in which students were the most successful was of the semi-structured problem posing type, while the question in which they were the most unsuccessful was of the problem story creation type. The arithmetic mean for the total score on the overall test was calculated to be 43.32. Herefrom, it was determined that the problems posed by students were at the medium level by the average of the scores obtained in the mathematical dimension.

Table 2. Qualities of the problems posed for the first question in mathematical terms

Theme	Codes	Frequency
The State of Being a Problem	An explanation that does not include a mathematical expression	1
	A mathematical expression in the type of exercise	2
	Mathematical problem	**70**
The State of Using What is Required	An arithmetic mean problem in the data of which maximum 1 change is made	8
	An arithmetic mean problem in the data of which 2 changes are made	4
	An arithmetic mean problem in the data of which 3 and more changes are made	**61**
Solvability	A problem that cannot be solved completely	9
	A problem that can be partially solved but is not completely resolvable	8
	A problem that can be resolved	**56**
Originality	**A very common and not original problem**	**64**
	A rare and original problem	9
	A very creative and unique problem that has never been encountered	-
Level of Difficulty	**A simple problem that can be solved in 1-2 steps**	**35**
	A medium level problem that can be solved in 3-4 steps	**35**
	A difficult problem that can be solved in 5 and more steps	3

As can be seen from Table 2, it was determined that most of the problems posed by students in the context of the first question were a mathematical problem, an arithmetic mean problem in the data of which three and more changes were made, were a resolvable problem, a very common and not original problem, simple and moderately difficult problems. It can be said that the problems posed in the context of the first question are at the sufficient level in terms of being a problem, the state of using what is required and solvability dimensions. Nevertheless, it can be said that very frequently encountered problems that do not include creativity were generally posed within the scope of the originality dimension. As for the level of difficulty dimension, it can be said that students tended to pose simple and medium difficulty problems. It was also determined that certain problems that were not sufficient in terms of the state of using what is required and solvability were posed.

Table 3. Qualities of the problems posed for the second question in mathematical terms

Theme	**Codes**	**Frequency**
The State of Being a Problem	An explanation that does not include a mathematical expression	1
	A mathematical expression in the type of exercise	10
	Mathematical problem	**62**
The State of Using What is Required	Not an arithmetic mean problem	6
	An arithmetic mean problem but not related to open-ended text	2
	An arithmetic mean problem but related to open-ended text	**65**
Solvability	A problem that cannot be solved completely	8
	A problem that can be partially solved but is not completely resolvable	5
	A problem that can be resolved	**60**
Originality	**A very common and not original problem**	**56**
	A rare and original problem	17
	A very creative and unique problem that has never been encountered	-
Level of Difficulty	**A simple problem that can be solved in 1-2 steps**	**49**
	A medium level problem that can be solved in 3-4 steps	11
	A difficult problem that can be solved in 5 and more steps	13

As can be seen from Table 3, it was determined that most of the problems posed by students within the scope of the second question were a mathematical problem, a problem about the arithmetic mean and related to the open-ended text, a resolvable problem, a very common and not original problem, problems of low difficulty that can be solved in one or two steps. It can be said that the problems posed within the scope of the second question were at the sufficient level in terms of the state of being a problem, the state of using what is required and solvability dimensions. Nevertheless, it can be said that very frequently encountered problems that did not include originality were generally posed within the scope of the originality dimension. As for the level of difficulty dimension, it can be said that students tended to pose simple problems more. It was also determined that certain problems that were not sufficient in terms of the state of being a problem, the state of using what is required and solvability were posed.

Table 4. Qualities of the problems posed for the third question in mathematical terms

Theme	Codes	Frequency
The State of Being a Problem	An explanation that does not include a mathematical expression	3
	A mathematical expression in the type of exercise	5
	Mathematical problem	**65**
The State of Using What is Required	A problem that is not related to arithmetic mean and which the visual data is not used	9
	A problem that is related to arithmetic mean and which the visual data is not used or just the opposite	8
	A problem that is related to arithmetic mean and which the visual data is used	**56**
Solvability	A problem that cannot be solved completely	16
	A problem that can be partially solved but is not completely resolvable	8
	A problem that can be resolved	**49**
Originality	**A very common and not original problem**	**61**
	A rare and original problem	12
	A very creative and unique problem that has never been encountered	-
Level of Difficulty	**A simple problem that can be solved in 1-2 steps**	**58**
	A medium level problem that can be solved in 3-4 steps	13
	A difficult problem that can be solved in 5 and more steps	2

As can be seen from Table 4, it was determined that most of the problems posed by students within the scope of the third question were a mathematical problem, a problem which was both about the arithmetic mean and in which data in the visual were used, a resolvable problem, a very common and not original problem, and simple problems that can be solved in one-two steps. It can be said that the problems posed within the scope of the third question were at the sufficient level in terms of the dimensions of the state of being a problem, using what is required and solvability. Nevertheless, it can be said that very common problems were generally posed within the scope of the originality dimension. As for the level of difficulty dimension, it can be said that students generally tended to pose simple problems. It was also determined that certain problems that were not sufficient in terms of the state of being a problem, the state of using what is required and solvability were also posed.

Table 5. Qualities of the problems posed for the fourth question in mathematical terms

Theme	Codes	Frequency
The State of Being a Problem	An explanation that does not include a mathematical expression	3
	A mathematical expression in the type of exercise	11
	Mathematical problem	**59**
The State of Using What is Required	Not an arithmetic mean problem	8
	A problem involving arithmetic mean but not solved by using arithmetic mean	10
	An arithmetic mean problem	**55**
Solvability	A problem that cannot be solved completely	10
	A problem that can be partially solved but is not completely resolvable	6
	A problem that can be resolved	**57**
Originality	**A very common and not original problem**	**49**
	A rare and original problem	20
	A very creative and unique problem that has never been encountered	4
Level of Difficulty	**A simple problem that can be solved in 1-2 steps**	**53**
	A medium level problem that can be solved in 3-4 steps	16
	A difficult problem that can be solved in 5 and more steps	4

As can be seen from Table 5, it was determined that most of the problems posed by students within the scope of the fourth question were a mathematical problem, were on the subject of arithmetic mean, a resolvable problem, a very common and not original problem, and simple problems that can be solved in one-two steps. It can be said that the problems posed within the scope of the fourth question were at the sufficient level in terms of the state of being a problem, using what is required and solvability dimensions. Nevertheless, it can be said that very common and not original problems were generally posed within the scope of the originality dimension. As for the level of difficulty dimension, it can be said that students tended to pose simple problems more. It was determined that certain problems that were not sufficient in terms of the state of being a problem, the state of using what is required and solvability were also posed.

Table 6. Qualities of the problems posed in general in mathematical terms

Criteria	Level of Achievement	Frequency
The State of Being a Problem	**Exemplary (3)**	**256**
	Medium(2)	28
	Insufficient(1)	8
The State of Using What is Required	**Exemplary (3)**	**237**
	Medium(2)	24
	Insufficient(1)	31
Solvability	**Exemplary (3)**	**222**
	Medium(2)	27
	Insufficient(1)	43
Originality	Exemplary (3)	4
	Medium(2)	58
	Insufficient(1)	**230**
Level of Difficulty	Exemplary (3)	22
	Medium(2)	75
	Insufficient(1)	**195**

As can be seen from Table 6, it was determined that most of the problems posed by students were a mathematical problem and they were at an exemplary level in the context of the state of using what is required and solvability in the overall problem posing test. Nevertheless, it was also determined that certain students were at the insufficient level in the dimensions of the state of being a problem, the state of using what is required and solvability. It was also determined that most of the problems posed by students in the originality dimension were common and not original problems, and most of the problems posed in the level of difficulty dimension were at a simple level. Furthermore, the problems at an exemplary level, i.e. original and creative problems and difficult problems were low in number; and problems that were at a successful level in terms of originality and difficulty were also posed.

Findings in Terms of the Linguistic Dimension

Descriptive statistics related to the linguistic dimension scores for the problem posing test and the findings on the linguistic qualities of the problems posed by students are presented within the scope of the findings in terms of the linguistic dimension.

Table 7. Descriptive statistics related to the linguistic dimension scores for the problem posing test

Question No	Type of Problem	Arithmetic Mean	Standard Deviation
Question 1	Structured	10.12	1.61
Question 2	Semi-structured	10.47	1.33
Question 3	Problem story	9.84	1.77
Question 4	Free	10.16	1.54
Total		**40.59**	**5.21**

As can be seen from Table 7, the arithmetic mean of the first question of the structured problem posing type was calculated to be 10.12, the arithmetic mean of the second question of the semi-structured problem posing type was calculated to be 10.47, the arithmetic mean of the third question of the problem story creation type was calculated to be 9.84, and the arithmetic mean of the fourth question of the free problem posing type was calculated to be 10.16. It was determined that the arithmetic means of these four questions were close to one another. Nevertheless, it can be said that

the question in which students were the most successful was of the semi-structured problem posing type, while the question in which the students were the most unsuccessful was of the problem story creation type. The arithmetic mean for the total score of the overall test was calculated to be 40.59. Herefrom, it was determined that the problems posed by students were at a high level according to the average of the scores obtained from the linguistic dimension.

Table 8. Linguistic qualities of the problems posed for the first question

Themes	**Codes**	**Frequency**
Syntax	There is syntactic violation in 3 and more sentences	1
	There is syntactic violation in 1 or 2 sentences	11
	All sentences conform to the Turkish syntax	**61**
Word Selection	3 or more words were used in the wrong place or improperly	-
	1 or 2 words were used in the wrong place or improperly	9
	All words were selected in accordance with their meaning and correctly	**64**
Punctuation Marks	There are mistakes in the use of 3 or more punctuation marks	24
	There are mistakes in the use of 1 or 2 punctuation marks	19
	All punctuation marks are used correctly	**30**
Spelling Rules	Mistakes were made in 3 or more points in the application of the spelling rules	8
	Mistakes were made in 1 or 2 points in the application of the spelling rules	32
	The spelling rules were applied without mistakes	**33**

As can be seen from Table 8, it was determined that all sentences fitted the Turkish syntax, all words were selected in accordance with their meaning and correctly in most of the problems posed by students within the scope of the first question. Accordingly, it can be said that the problems posed by students were at the sufficient level in the syntax and word selection dimensions. Nevertheless, it was also determined that the students who made mistakes in the use of the punctuation marks were predominant, while there were also students who used all punctuation marks correctly in the dimension of punctuation marks. Furthermore, it was observed that the students who made mistakes in implementing the spelling rules in the dimension of spelling rules were predominant, while there were also students who implemented the spelling rules without making any mistake. In this context, it can be said that there were mistakes in terms of the punctuation marks and spelling rules in most of the problems posed by students.

Table 9. Linguistic qualities of the problems posed for the second question

Theme	Codes	Frequency
Syntax	There is syntactic violation in 3 and more sentences	2
	There is syntactic violation in 1 or 2 sentences	15
	All sentences conform to the Turkish syntax	**56**
Word Selection	3 or more words were used in the wrong place or improperly	1
	1 or 2 words were used in the wrong place or improperly	9
	All words were selected in accordance with their meaning and correctly	**63**
Punctuation Marks	There are mistakes in the use of 3 or more punctuation marks	5
	There are mistakes in the use of 1 or 2 punctuation marks	29
	All punctuation marks are used correctly	**39**
Spelling Rules	Mistakes were made in 3 or more points in the application of the spelling rules	8
	Mistakes were made in 1 or 2 points in the application of the spelling rules	27
	The spelling rules were applied without mistakes	**38**

As can be seen from Table 9, it was determined that all sentences fitted the Turkish syntax, all words were selected in accordance with their meaning and correctly in most of the problems posed by students within the scope of the second question. Nevertheless, it was also determined that there were students who made mistakes in the syntax and word selection dimensions. Accordingly, it can be said that the problems posed by students in the syntax and word selection dimensions were generally at the sufficient level, but certain students had deficiencies on this subject. It was also determined that the number of the students who made mistakes in the use of the punctuation marks in the dimension of punctuation marks and the number of the students who used all of the punctuation marks correctly were close to each other. Finally, in the dimension of spelling rules, it was observed that the number of the students who made mistakes in implementing the spelling rules and the number of the students who implemented spelling rules without mistakes were close to each other. In this context, it can be said that the problems posed by students in the dimension of the punctuation marks and spelling rules were partially sufficient.

Table 10. Linguistic qualities of the problems posed for the third question

Theme	Codes	Frequency
Syntax	There is syntactic violation in 3 and more sentences	4
	There is syntactic violation in 1 or 2 sentences	15
	All sentences conform to the Turkish syntax	**54**
Word Selection	3 or more words were used in the wrong place or improperly	-
	1 or 2 words were used in the wrong place or improperly	6
	All words were selected in accordance with their meaning and correctly	**67**
Punctuation Marks	There are mistakes in the use of 3 or more punctuation marks	27
	There are mistakes in the use of 1 or 2 punctuation marks	18
	All punctuation marks are used correctly	**28**
Spelling Rules	Mistakes were made in 3 or more points in the application of the spelling rules	15
	Mistakes were made in 1 or 2 points in the application of the spelling rules	27
	The spelling rules were applied without mistakes	**31**

As can be seen from Table 10, it was determined that all sentences fitted the Turkish syntax and all of the words were selected in accordance with their meaning and correctly in most of the problems posed by students within the scope of the third question. Nevertheless, it was also determined that there were students who made mistakes in the syntax and word selection dimensions. Accordingly, it can be said that the problems posed by students in the syntax and word selection dimensions were at the sufficient level in a general sense, but certain students had deficiencies on this subject. Furthermore, it was determined in the dimension of punctuation marks that the students who made mistakes in the use of the punctuation marks were predominant, but there were also students who used all of the punctuation marks correctly. Finally, in the dimension of spelling rules, it was observed that the students who made mistakes in implementing the spelling rules were predominant, while there were also students who implemented spelling rules without making any mistake. In this context, it can be said that there were mistakes in terms of punctuation marks and spelling rules in most of the problems posed by students.

Table 11. Linguistic qualities of the problems posed for the fourth question

Theme	**Codes**	**Frequency**
Syntax	There is syntactic violation in 3 and more sentences	2
	There is syntactic violation in 1 or 2 sentences	15
	All sentences conform to the Turkish syntax	**56**
Word Selection	3 or more words were used in the wrong place or improperly	-
	1 or 2 words were used in the wrong place or improperly	6
	All words were selected in accordance with their meaning and correctly	**67**
Punctuation Marks	There are mistakes in the use of 3 or more punctuation marks	16
	There are mistakes in the use of 1 or 2 punctuation marks	20
	All punctuation marks are used correctly	**37**
Spelling Rules	Mistakes were made in 3 or more points in the application of the spelling rules	14
	Mistakes were made in 1 or 2 points in the application of the spelling rules	29
	The spelling rules were applied without mistakes	**30**

As can be seen from Table 11, it was determined that all sentences fitted the Turkish syntax and all of the words were selected in accordance with their meaning and correctly in most of the problems posed by students within the scope of the third question. Nevertheless, it was also determined that there were students who made mistakes in the syntax and word selection dimensions. Accordingly, it can be said that the problems posed by students in the syntax and word selection dimensions were at the sufficient level in a general sense, but certain students had deficiencies on this subject. It was also determined in the dimension of punctuation marks that the number of the students who made mistakes in the use of the punctuation marks and the number of the students who used all of the punctuation marks correctly were close to each other. In this context, it can be said that the problems posed by students were partially sufficient in the dimension of punctuation marks. Finally, in the dimension of the spelling rules, it was observed that the students who made mistakes in implementing the spelling rules were predominant, while there were also students who implemented the spelling rules without making any mistake. From here, it can be said that there were mistakes in terms of spelling rules in most of the problems posed by the students.

Table 12. General linguistic qualities of the problems posed

Criteria	Level of Achievement	Frequency
Syntax	**Good(3)**	**227**
	Medium(2)	56
	Insufficient(1)	9
Word Selection	**Good (3)**	**261**
	Medium (2)	30
	Insufficient (1)	1
Punctuation Marks	**Good (3)**	**134**
	Medium (2)	86
	Insufficient (1)	72
Spelling Rules	**Good (3)**	**132**
	Medium (2)	**115**
	Insufficient (1)	45

As can be seen from Table 12, it was determined that most of the problems posed by students fitted the Turkish syntax and all of the words in the problems posed were selected in accordance with their meaning in the overall problem posing test. Nevertheless, it was also determined that certain students were at the insufficient level in the syntax and word selection dimensions. It was also determined that most of the students made mistakes in the dimensions of punctuation marks and spelling rules. Furthermore, it was observed that the students who used the punctuation marks and spelling rules without mistakes and correctly were also a lot in number.

Findings on the Relationship between the Mathematical Dimension and Linguistic Dimension

Findings on the relationship between the mathematical dimension and linguistic dimension are given on Table 13.

Table 13. The relationship between the scores obtained in the mathematical dimension and linguistic dimension in the problems posed

	Linguistic Dimension	Mathematical Dimension	$\dot{X}$	SD
Linguistic Dimension	1	**.121**	40.50	5.21
Mathematical Dimension	**.121**	1	43.32	4.88

As can be seen from Table 13, no significant correlation was found between the scores of the mathematical dimension and the scores of the linguistic dimension.

RESULTS, DISCUSSIONS AND SUGGESTIONS

According to the average of the scores obtained in the mathematical dimension, the problems posed by students are at the medium level in the mathematical dimension. Upon examining the qualities of the problems posed by students in mathematical terms, it was determined that most of them were a mathematical problem, exemplary in the dimensions of using what is required and solvability, a very common and not original problem and a simple problem that can be solved in one-two steps. Herefrom, it can be said that while students are sufficient in terms of the state of being a problem, using what is required and solvability in their problem posing studies, they remain at a low level in the dimensions of originality and the level of difficulty. In this context, it is considered that the

dimensions of originality and the level of difficulty should be developed in terms of the problem posing skill. Upon examining the problem posing studies conducted in Turkey on secondary school students, it was determined that students were not sufficiently successful in posing problems (Akkan, Çakıroğlu & Güven, 2009; Çelik & Özdemir, 2011; Gökkurt, Örnek, Hayat & Soylu, 2015) and experienced various difficulties in posing problems (Işık & Kar, 2012). It can be said that there are similarities to these studies in question with the fact that the problem posing skills of students are at the medium level and there are deficiencies especially in the dimensions of originality and the level of difficulty.

According to the average of the scores obtained from the language use dimension, the problems posed by students are at a high level. Upon examining the qualities of the problems posed by students in linguistic terms, it was determined that most of them were at a good level in the syntax and word selection dimensions, but they contained mistakes in the punctuation marks and spelling rules dimensions. From here, it can be said that while students are sufficient in terms of the syntax and word selection dimensions in their problem posing studies, they are at the medium and insufficient level in the punctuation marks and spelling rules dimensions. Accordingly, it is believed that it is necessary to eliminate deficiencies in terms of the dimensions of the punctuation marks and spelling rules in the context of problem posing studies. In the study conducted by Silver and Cai (1996), it was determined that a significant part of the problems posed by students were syntactically and semantically at a high level. In this context, it can be said that the results of the study are similar in terms of the syntax and word selection.

No significant correlation was found between the mathematical dimension scores and linguistic dimension scores. Upon examining the studies that address the relationship between mathematics achievement and achievement in the Turkish lesson, it was stated that there was a significant relationship between the achievement scores in the Turkish lesson and mathematics achievement scores (Güleç & Alkış, 2003; Güneyli, Özder, Konedralı & Arsan, 2010). In this case, the fact that no significant relationship was found between the mathematical dimension and the language use dimension may seem like an unexpected situation. The way of expression through written expression and creating a linguistic product in mathematics are a complex and difficult process that requires higher-order thinking. Problem posing is a skill that requires original thinking as a skill at the synthesis level. However, a different result may have emerged since an evaluation was made more at the comprehension and practice levels and problem solving and multiple-choice tests are used more in the exam-based system in developing and determining the mathematics achievement at the secondary school level.

Various suggestions were made in accordance with the results achieved in the study. Studies on eliminating the deficiencies of the problems posed by students, especially in mathematical terms, can be conducted, and students can be encouraged to perform problem posing studies. While there are activities on problem posing in course books, there is no attainment regarding problem posing in the secondary school mathematics curriculum. Therefore, arrangements can be made for problem posing in the mathematics curriculum. Similar studies can be carried out at different grade levels and on different subjects since this study is limited only to the sixth-grade level and the subject of the arithmetic mean. The texts written by students can be examined by branch teachers other than Turkish teachers in terms of language use, and the necessary feedback can be provided. Problem writing from an interdisciplinary point-of-view can be included, and practices for problems to have an original feature can be conducted when designing activities for paragraph writing in Turkish lessons.

REFERENCES

Akkan, Y., Çakıroğlu, Ü. & Güven, B. (2009). İlköğretim 6. ve 7. sınıf öğrencilerinin denklem oluşturma ve problem kurma yeterlilikleri. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi, 9*(17), 41-55.

Albayrak, M., İpek, A. S. & Işık, C. (2006). Temel işlem becerilerinin öğretiminde problem kurma-çözme çalışmaları. *Erzincan Eğitim Fakültesi Dergisi, 8*(2), 1-11.

Altun, M. (2005). *İlköğretim ikinci kademede (6, 7 ve 8. sınıflarda) matematik öğretimi*. Bursa: Aktüel Yayınevi.

Arıkan, E. E. & Ünal, H. (2013). İlköğretim 2. sınıf öğrencilerinin matematiksel problem kurma becerilerinin incelenmesi. *Amasya Üniversitesi Eğitim Fakültesi Dergisi, 2*(2), 305-325.

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

Banguoğlu, T. (1998). *Türkçenin grameri*. Ankara: Türk Dil Kurumu Yayınları.

Batanero, C., Godino, J. D., Vallecillos, A., Green, D. R. & Holmes, P. (1994). Errors and difficulties in understanding elementary statistical concepts. *Journal of Mathematical Education in Science and Technology, 25*(4), 527-547.

Bonotto, C. (2010). Engaging students in mathematical modelling and problem posing activities. *Journal of Mathematical Modelling and Application, 1*(3), 18-32.

Bush, W. S. & Fiala, A. (1993). Problem stories: a new twist on problem posing. In S. I. Brown & M. I. Walter, (Eds.), *Problem posing: reflections and applications* (1st ed.) (pp.167-173). New Jersey: Lawrence Erlbaum Associates.

Cai, J. (2000). Understanding and representing the arithmetic averaging algorithm: an analysis and comparison of US and Chinese students' responses. *Journal of Mathematical Education in Science and Technology, 31*(6), 839-855.

Cankoy, O. & Darbaz, S. (2010). Problem kurma temelli problem çözme öğretiminin problemi anlama başarısına etkisi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 38,* 11-24.

Çelik, A. & Özdemir, E. Y. (2011). İlköğretim öğrencilerinin orantısal akıl yürütme becerileri ile oran-orantı problemi kurma becerileri arasındaki ilişki. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi, 30*(1), 1-11.

Ellerton, N. F. (2013). Engaging pre-service middle school teacher-education students in mathematical problem posing: Development of an active learning framework. *Educational Studies in Mathematics, 83*(1), 87-101.

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

English, L. D. & Watson, J. M. (2015). Statistical literacy in the elementary school: opportunities for problem posing. In F. M. Singer, N. F. Ellerton & J. Cai (Eds.), *Mathematical problem posing: from research to effective practice* (pp.241-256). New York: Springer.

Gökkurt, B., Örnek, T., Hayat, F. & Soylu, Y. (2015). Öğrencilerin problem çözme ve problem kurma becerilerinin değerlendirilmesi. *Bartın Üniversitesi Eğitim Fakültesi Dergisi, 4*(2), 751-774.

Grundmeier, T. A. (2003). *The effects of providing mathematical problem posing experiences for K-8 pre-service teachers: investigating teachers' beliefs' and characteristics of posed problems.* Unpublished doctoral dissertation, University of New Hampshire, New Hampshire.

Güleç, S. & Alkış, S. (2003). İlköğretim birinci kademe öğrencilerinin derslerdeki başarı düzeylerinin birbiriyle ilişkisi. *İlköğretim Online, 2*(2), 19-27.

Gülten, D., Ergin, H. & Ergin, T. (2007). İlköğretim 3. Sınıf öğrencilerinin problem kurma becerileri ile bilişsel işlemlerden eşzamanlılık ve planlama arasındaki ilişki. *Anadolu Üniversitesi VI. Ulusal Sınıf Öğretmenliği Eğitimi Sempozyumu,* 27-29 Nisan 2007, Eskişehir. Ankara: Nobel Yayın Dağıtım.

Günay, D. (2003). *Metin bilgisi* (2. bs.). İstanbul: Multilingual Yayıncılık.

Güneyli, A., Özder, H., Konedralı, G. & Arsan, N. (2010). İlköğretim öğrencilerinin Türkçe ile diğer ders başarıları arasındaki ilişki. *Akdeniz Eğitim Araştırmaları Dergisi, 7,* 60-72.

Güven, M. & Kürüm, D. (2008). Öğretmen adaylarının öğrenme stilleri ile eleştirel düşünme eğilimleri arasındaki ilişki (Anadolu Üniversitesi Eğitim Fakültesi öğrencileri üzerinde bir araştırma). *İlköğretim Online, 7(1),* 53-70.

Işık, C. & Kar, T. (2012). Sınıf öğretmeni adaylarının problem kurma becerileri. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi, 12*(23), 190-214.

Kar, T. & Işık, A. (2015). Ortaokul matematik öğretmenlerinin kesirlerle çıkarma işlemine yönelik problem kurma becerilerinin incelenmesi. *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi, 24*, 243-276.

Karasar, N. (2008). *Bilimsel araştırma yöntemi*. Ankara: Nobel Yayın Dağıtım.

Kılıç, Ç. (2014). Sınıf öğretmenlerinin problem kurmayı algılayış biçimlerinin belirlenmesi. *Kastamonu Eğitim Dergisi, 22*(1), 2013-214.

Klaassen, K. & Doorman, M. (2015). Problem posing as providing students with content-specific motives. In F. M. Singer, N. F. Ellerton & J. Cai (Eds.), *Mathematical problem posing: from research to effective practice* (pp. 215-240). New York: Springer.

Kojima, K., Miwa, K. & Matsui, T. (2015). Experimental study of learning support through examples in mathematical problem posing. *Research and Practice in Technology Enhanced Learning, 10*(1), 1-18.

Korkmaz, E. & Gür, H. (2006). Öğretmen adaylarının problem kurma becerilerinin belirlenmesi. *Balıkesir Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 8*(1), 64-74.

Kwek, M. L. (2015). Using problem posing as a formative assessment tool. In F. M. Singer, N. F. Ellerton & J. Cai (Eds.), *Mathematical problem posing: From research to effective practice* (pp.273-292). New York: Springer.

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

Marshall, M. N. (1996). Sampling for qualitative research. *Family Practice Oxford University Press, 13*(6),522-525.

McCarthy, D. S. (2008). Communication in mathematics: Preparing preservice teachers to include writing in mathematics teaching and learning. *School Science and Mathematics, 108,* 334−340.

Ministry of National Education. (2017). *Mathematics curriculum (Primary school and secondary school 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, and 8th grades).* Ankara: Ministry of National Education.

Mishra, S. & Iyer, S. (2015). An exploration of posing-based activities as an assessment tool and as an instructional strategy. *Research and Practice in Technology Enhanced Learning, 10* (5), 1-19.

National Council of Teachers of Mathematics (2000). *Executive summary principles and standards for school mathematics.* Retrieved February 28, 2014 from http://www.nctm.org/uploadedFiles/Math_Standards/12752_exec_pssm.pdf.

Olkun, S. (2003). Öğrencilere hacim formülü ne zaman anlamlı gelir? *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 25,* 160-165.

Olkun, S. (2008). Matematik eğitiminde beceriler. A. Özdaş, (Ed.), *Matematik, fen ve teknoloji öğretimi* içinde (ss. 31- 48). Eskişehir: Anadolu Üniversitesi Açıköğretim Fakültesi Yayınları.

Olkun, S. & Toluk, Z. (2003). *İlköğretimde etkinlik temelli matematik.* Ankara: Anı Yayıncılık.

Pesen, C. (2008). *Yapılandırmacı öğrenme yaklaşımına göre matematik öğretimi*. Ankara: Sempati Yayıncılık.

Sever, S. (2004). *Türkçe öğretimi ve tam öğrenme*. Ankara: Anı Yayıncılık.

Shuk-kwan, S. L. (1997). On the role of creative thinking in problem posing. *ZDM, 29*(3), 81-85.

Silver, E. A. (1997). Fostering creativity through instruction rich in mathematical problem solving and problem posing. *ZDM, 29*(3), 75-80.

Silver, E. A. (2013). Problem-posing research in mathematics education: looking back, looking around, and looking ahead. *Educational Studies in Mathematics, 83*(1), 157–162.

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

Solórzano, L. S. (2015). Problem-posing as a didactic resource in formal mathematics courses to train future secondary school mathematics teachers. *Journal of Technology and Science Education, 5*(2), 64-74.

Stoyanova, E. N. (1997). *Extending and exploring students' problem via problem posing.* Unpublished doctoral dissertation, Edith Cowan University, Joondalup, Australia.

Şengül Akdemir, T. & Türnüklü, E. (2017). Ortaokul 6. sınıf öğrencilerinin açılar ile ilgili problem kurma süreçlerinin incelenmesi. *International Journal of New Trends in Arts, Sports & Science Education, 6*(2), 17-39.

Tertemiz, N. & Sulak, S. E. (2013). İlköğretim beşinci sınıf öğrencilerinin problem kurma becerilerinin incelenmesi. *İlköğretim Online, 12*(3), 713-729.

Turhan, B. (2011). *Problem kurma yaklaşımı ile gerçekleştirilen matematik öğretiminin ilköğretim 6. sınıf öğrencilerinin problem çözme başarıları, problem kurma becerileri ve matematiğe yönelik görüşlerine etkisinin incelenmesi.* Yayımlanmamış yüksek lisans tezi, Anadolu Üniversitesi, Eskişehir.

Turhan Türkkan, B. (2017). *Sosyomatematiksel konularla bütünleştirilmiş matematik öğretimi: Sosyal adalet ve eşitlik değerlerine ilişkin farkındalık ile problem kurma becerisi geliştirmeye yönelik bir eylem araştırması.* Yayımlanmamış doktora tezi, Çukurova Üniversitesi, Adana.

Turhan, B. & Güven, M. (2014). Problem kurma yaklaşımıyla gerçekleştirilen matematik öğretiminin problem çözme başarısı, problem kurma becerisi ve matematiğe yönelik görüşlere etkisi. *Çukurova Üniversitesi Eğitim Fakültesi Dergisi, 43*(2), 217-234.

Van De Walle, J. A., Karp, K. S. & Bay-Williams, J. M. (2012). *İlkokul ve ortaokul matematiği – gelişimsel yaklaşımla öğretim*. (S. Özel ve Z. E. Yetkiner-Özel, Tr.) Ankara: Nobel Yayıncılık.

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

Wilcox, B. & Monroe, E. E. (2011). Integrating writing and mathematics. *The Reading Teacher, 64*(7), 521-529.

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

Yıldız, Z. & Özdemir, A. Ş. (2015). Analyzing of problem posing abilities of preservice middle school mathematics teachers. *International Online Journal of Educational Sciences, 7* (2), 130-141.

APPENDIX

Problem Posing Test for Arithmetic Mean

1) The average mass of tomatoes in four crates is 19 kilograms. There are 12 kilograms of tomatoes in the first crate, 16 kilograms of tomatoes in the second crate, and 28 kilograms of tomatoes in the third crate. Accordingly, how many kilograms of tomatoes does the fourth crate contain?
Pose a new problem that requires the calculation of the arithmetic mean by changing the information in the above-mentioned problem.
Note: You can do any kind of change in the problem. You can change numbers, operations or the names/objects used.

……
……
……

2) Pose an arithmetic mean problem by completing the story of the problem given below.
Ipek got 92, 86 and ……., respectively, from the written exams of the mathematics lesson

……
……
……

3)

Pose a problem that requires calculating the arithmetic mean by using the data given in the adjacent figure.

……
……
……

4) Pose a mathematical problem that can be solved with arithmetic mean.

……
……
……