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INVESTIGATION OF PROBLEMS POSED BY PRESERVICE ELEMENTARY MATHEMATICS AND PRIMARY SCHOOL TEACHERS

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Abstract: The aim of this study is to examine the problems posed by the preservice elementary mathematics and primary school teachers. For this purpose, 112 teacher candidates in total at a state university, 47 from the 4. grade students from elementary mathematics education and 65 from the 3. grade students from primary education, have been asked to pose a problem related to the solution of a problem in the 2015-2016 Academic Year. The type of the study is survey and the data have been analyzed in respect of the problem analysis diagram created by the researchers. The statistics upon the study have been stated with percentage and frequency. At the end of the study, it has been seen that elementary mathematics teacher candidates pose problems in a higher rate than the candidates of primary school teacher candidates.

Keywords: Problem posing, teacher education

Introduction

As an ability emphasized by prominent scientists, problem-posing is indicated as more important than the effort given to solve a problem (Stoyanova, 2003). Having a profound place in mathematics education, problem-posing has been included in educational programs of many countries during recent years (NCTM, 2000; MEB, 2005; AEC, 1991, Cited: Silver, 2013). According to Stoyanova and Ellerton (1996), problem-posing is based on individual's mathematical experiences and contains the expression of concrete cases as a mathematical problem. In the literature, there are studies available revealing that problem-posing has positive effects on problem solving skills, attitude towards mathematics and perception of self-efficacy, it allows for understanding and interpretation of mathematical concepts and ensures flexible thinking (Akay, 2006; Akay & Boz, 2010; English, 1997, Akkan Çakıroğlu & Güven, 2009; Gonzales, 1998).

In studies, a wide perspective is employed for problem-posing (Silver, 2013). Some of these studies on problem-posing contain analysis of problems established towards learning fields from various aspects (Silver & Cai, 1996; English, 1998; Akay, Soybaş & Argün, 2006). For instance, Canköy (2014) addressed the problems posed by the 5th graders in terms of solvability, being rational and mathematical structure. Silver & Cai (1996) analyzed 6th and 7th graders' problems they posed for a selected verbal situation firstly in terms of whether a mathematical question was specified and then in terms of solvability of questions that were considered as a mathematical question. These researchers analyzed these posed mathematical problems from the point of semantic and linguistic aspects. A linguistically similar analysis was conducted by Kar & Işık (2011) on problems posed by teacher candidates.

Problem-posing activities used in researches may differ in terms of objectives. In this study, structured problem-posing activity is employed and the purpose of use of structured problem-posing activity is to allow teacher candidates to think prospectively and to reveal their ability of associating a solved situation with mathematical concepts and real life. Problems prepared by teacher candidates are discussed in terms of being suitable for solution or not, whether they are linguistically comprehensible, question type (exercise, problem), whether the

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context is suitable for real life and their state of containing meaning of average. Consequently, the research problem is determined as follows: "What are appropriateness levels of problems to specified criteria as posed by primary school and elementary mathematics teacher candidates?"

Method

Since the purpose of this research is aimed at revealing an existing condition, the research is a survey model. Study group consists of a total of 112 teacher candidates including 65 3rd graders from primary education and 47 4th graders from elementary mathematics education from a state university during the spring term of 2015-2016 academic year. Data collection tool is a mathematical operation in which teacher candidates are requested to pose a problem suitable for the given solution. The question directed to teacher candidates is as follows:

$$30+40+50=120$$

$$120 \div 3 = 40$$

Write a problem sentence that requires the above mentioned solution."

Findings

In this section, for the understanding of criteria used to classify posed problems, a few problem samples are given first.

$$30 + 40 + 50 = 120$$
$$120 \div 3 = 40$$

Yukarıdaki çözüme uygun bir problem cümlesi yazınız.

70'in 50 fazlasının
 $\frac{1}{3} = x$ ise x kaçtır?

Figure 1. Inappropriate to the solution 1.

As shown in Figure 1, it can be seen that the student posed a question unrelated to the solution.

$$30 + 40 + 50 = 120$$
$$120 \div 3 = 40$$

Yukarıdaki çözüme uygun bir problem cümlesi yazınız.

$2 + 2 + 10 + 2 + 20 = 120$
ise Bu sayının ortalaması kaçtır?

Figure 2. Inappropriate to the solution 2.

As shown in Figure 2, it's thought in the first glance that the student used the average concept correctly within the problem. Besides, although there aren't any situations relating to unknown in the solution.

$$30 + 40 + 50 = 120$$

$$120 \div 3 = 40$$

Yukarıdaki çözüme uygun bir problem cümlesi yazınız. Ayşe, Fatma ve Meruğ Pazardan 30, 40 ve 50 TL'lik alışveriş yaptılar. Ödemeyi üçü arasında paylaşıyorlar. Her birine kaç TL düşer?

Figure 3. Lack of equal sharing statement

In Figure 3, any problems cannot be seen at first glance, while sharing statement was used, any other information was not given regarding whether this statement included meaning of equal.

$$30 + 40 + 50 = 120$$

$$120 \div 3 = 40$$

Yukarıdaki çözüme uygun bir problem cümlesi yazınız.

ailenin yaşı 39, babasının yaşı 40 annesinin yaşı ise 50 olduğuna göre 3'ün yaş ortalaması kaçtır?
 $30 + 40 + 50 = 120$ $120 \div 3 = 40$

Figure 4. Non-compliant with real life context

In Figure 4, it's observed that, while the problem posed by the teacher candidate is compliant with the solution, it's non-compliant with the real life context.

In the research, non-compliant problem posed by teacher candidates were not included in assessment as per other criteria. Classification of problems as per determined criteria, as posed by teacher candidates with regard to the given solution, is provided in Table 1.

Table 1. Classification of problems

Criterion	Elementary Mathematics				Primary School			
	Compliant f	Non-compliant t %	Compliant f	Non-compliant t %	Compliant f	Non-compliant t %	Compliant f	Non-compliant t %
Solution	37	78.7	10	21.3	34	52.3	31	47.7
Language	32	86.4	5	13.5	32	94.1	2	5.9
Context	33	89.2	4	10.8	30	88.2	4	11.8
Question Type	36	97.3	1	2.7	33	97.1	1	2.9

Analyzing Table 1, it can be seen that elementary mathematics teacher candidates showed a higher level of success compared to class teacher candidates from the point of posing compliant problems. Considering related rates, even elementary mathematics teacher candidates showed success at a level of 78.7%. Analyzing the posed problems linguistically, it can be seen that primary school teacher candidates were quite high in success, and elementary math teacher candidates showed better performance.

Table 2. Classification of problems from the point of meaning of average

Criterion	Elementary Mathematics		Primary School	
	f	%	f	%
In Meaning of Average	14	37.8	11	32.4
Containing the Average	15	40.5	5	14.7
Expression Other	8	21.6	18	52.9

Analyzing Table 2, it's observed that elementary mathematics teacher candidates gave place to contexts with the meaning of average and containing average meaning more than primary school teacher candidates.

Conclusions and Recommendations

Considering the results, it can be said that teacher candidates' problem-posing skills aren't at the desired level. It's apparent that teacher candidates experience difficulties in problem-posing that affects problem-solving skill positively. According to the research results, courses that discuss problem-solving and posing in detail may be added to undergraduate programs for teacher candidates. It's a remarkable result that, while teacher candidates don't experience much difficulty in contextually and linguistically in their posed problems, they cannot write a problem requiring solution. However, it's impossible to generalize since the research includes analysis of a single problem. Therefore, more detailed and longer term studies with larger study groups may be conducted.

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