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IDENTIFICATION ERRORS OF PROBLEM POSED BY PROSPECTIVE PRIMARY TEACHERS ABOUT FRACTION BASED MEANING STRUCTURE

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Abstract

The purpose of this study was to identify problem posed by prospective teachers about addition fractions based on meaning structure. This study is a quantitative descriptive to identify errors of fraction problem posed by prospective teachers based on the meaning. 46 prospective primary teachers in 8th semester in universities at Surabaya were involved in this research. Instrument in this study is a problem posing worksheet consisting two operations on fractions. Problems posed by prospective teachers were analyzed through three stages, grouping problems based on categories, structure of meaning, and analyze the error of the problem posed. The results of data analysis indicated that: (1) on the category of questions about fractions of 93.48% for 1stoperations and 97.83% for 2ndoperation, (2) on the Non-question category about operations fraction is 6.52% for 1st operations and 1.17% for 2nd operation. Grouping problems posed by prospective teachers based on structure meaning combined category is 62.79% for 1st operations and 75.56% for 2nd operation. For category of part relationships overall is 27.91% for 1st operations and 20% for 2ndoperation, while those which not belonging to the second category are 9.3% for 1st operations and 4.44% for 2nd operation. The errors of problem posed by prospective teacher based on meaning structure are (1) not related to daily life situation, (2) illogical problem, (3) unit is not appropriate, (4) fractions incompatible with the sum operation (5) gives whole number to give meaning fraction, (6) lost information, and (7) the added result exceeds the overall concept of the fraction.

Keywords:Errors, Problem Posed, Meaning, Fraction

In mathematics learning, students often taught how to solve problems than to pose problems. Problem solving is an important component of teaching and learning mathematics(NCTM, 2000). Problem solving is one of the tools to practice mathematical reasoning(Silver, E. A & Cai, 1996)to practice critical thinking and used as an indicator to know mathematical concepts were studied(Silver, 1994). Understanding the concept of mathematics in relation to daily life is one important component must be had by teachers and prospective class teachers(Ball, D. L, Hill, H. & Bass, 2005). The problem posed in this research is the formation of a new problem based on the given situation or previous experience(NCTM, 2000)in daily life situation.

Mathematics subject related to daily life situation is fraction. Based on curriculum 2013, fraction should be taught as soon as at primary schools and classroom teachers, who are mostly not mathematics education specialist, must teach this subject. Classroom teachers must take carefive subjects at once and all of it should be taught based on a theme. Therefore, prospective elementary teachers must understand the concept of fractions in order to make it concrete and related to daily life situation. Prospective teachers should be able to create learning environments that allow their students to recognize different forms of representation and how to move among those representations (Kar & Işık, 2014). Therefore, holdinga deep fractional concept is important, and preparing them to understand deeply the concept of fraction during their teacher education program is really expected.

Problem posingcan be categorized based on its complexity and its quality (NCTM, 2000). Silver (1994) grouped problem-solving questions based on three categories, (1) mathematical questions, (2) non mathematical questions, and (3) statements. The mathematical question is a question related to the fraction in question. Non mathematical question is a question that is not related to the fraction, for example declaring a fractional form. The mathematical questions are usually analyzed based on (1) syntax, related to grammar and (2) semantic, related to the meaning of words or sentences (Christou, Mousoulides, Pittalis, Pitta-pantazi, & Sriraman, 2005; Siswono, 2007). The semantic structure of the filing of the fractional addition problem based on the combining category (G) and the part-part-whole relation (BK) (Carpenter, T. P., Fennema, E. & Franke, 1996). Problem combine category (G) is a process that states the quantity, while the whole parts category (BK) is a process of combining two distinct fraction into the whole.

Many researchers have studied about problem posing by prospective teachers (Mcallister & Beaver(2012); Kar & Işık, (2014);Kilic, 2015). Mcallister & Beaver (2012) identified types of prospective teacher's error in making a problem about a fraction. The results show that prospective teachers are unable to pose problems related to daily life situation, unable to write fractions in the appropriate units, pose an illogical problem, and give the original numbers to give the meaning of the fractions. Kar & Işık(2014) analyzed the problems posed by prospective elementary school teachers based on its semantic structure. The results show that there are eight types of errors that found in raising the problem on fractional operations. Kilic(2015) investigated the type of semantic of fractional operations from problems posed by prospective elementary school teachers. In addition, the results of this study more emphasis on the operational meaning of the issue of fractions proposed. This study identifies the errors made by the prospective class teacher in problem posed about addition of fractions based on the meaning structure.

METHOD

Research approach in this study is quantitative descriptive. It is intended to identify the errors of problem posed by prospective teacher about fraction based on meaning. A total of 46 primary prospective teachers in 8th semester on the primary school teacher education program were involved in this study. The prospective teachers have passed the subjects of mathematics I, II where they learn mathematics concepts, mathematics learning development I, II. They have also learned how to design learning mathematics and teaching to students, and have followed the experience program I, II, and III, where they did mathematics teaching to real students.

A problem solving worksheet consisted of two fractional addition problems were used as the instrument in this study. Prospective teachers were asked to pose problems about fraction which related to daily life situation and can be solved using the fractional operations. Prospective teachers

were given 30 minutes to pose the problems. The posed problems were then analyzed through three steps

First step Categorize the problem into the category of questions, not questions, and statements. The problem is categorized as a question if it requires someone to add fractions. It is categorized as a non-question if it is not related operation addition fraction or that is not related to a fractional operation. From this grouping, the researchers calculate the percentage of each category.

Second step From the first step, the selected problemswere then grouped again based on the structure of meaning combination (G) and the part-part-whole relation (BK). From this grouping, the percentage of each category based on meaning structure was determined.

Third step Having grouped based on meaning structure,the researchers then identify errors contained in their posed problem. Several error categories have emerged from this step, namely:

- Problems that are not related to daily life situation symbolized K1.
- Illogical problems symbolized K2.
- Unit used in problems are not suitable in daily life situation symbolized K3.
- Problem they posed use different fraction symbolized K4.
- Gives natural number to make a fractional meaning symbolized K5.
- Missing data in problem they posed symbolized K6.
- Sum the given fractions exceeds the overall concept of the fraction symbolized K7.

RESULT AND DISCUSSION

Problem posed by the prospective teacher would analyzed based steps in the data analysis. First stage, grouped problems made prospective teachers based on the category of mathematical questions, non-mathematical questions and statements. First step, results of the analysis in the following table.

Table 1 Problem grouping based on question, non question and statements

Operation	Question	Non Question	Statement
I	93,48%	6,52%	0
II	97,83%	1.17%	0

Based on table 1, problem posed in operation I by the prospective teachers in the category questions is 93.48%, non-question is 6.52%. Problem posed in operation II, category question is 97.83%, non-question is 1.17%. From operation I and II, there is no prospective teacher has submitted a statement.

The next step is grouping questions into structure of meaning. Based on data analysis in the first stage, the results can be seen in the following table.

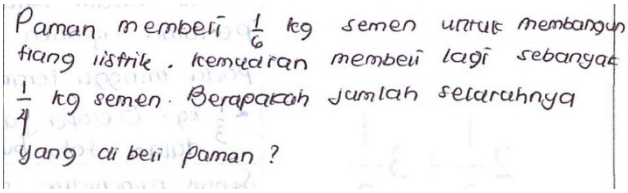
Table 2 Problem grouping based on meaning structure

Operation	Combine (G)	Part-part-whole relation (BK)	Not both
I	62.79%	27.91%	9.3%
II	75.56%	20%	4.44%

Based on table 2, problem posed operation I by prospective teachers in the combine category (G) was 62.79%, whole parts category (BK) was 27.91%, and not both was 9.3%. Problem posed operation II by the prospective teachers in combine category (G) was 75.56%, whole parts category (BK) was 20%, and not both was 4.44%.

The next step is determine the error of the problem posed by the prospective teacher based on the structure of meaning. At the most error of the problem posed by the prospective teacher on the operation I in combine structure as follows.

Table 3 Errors of problem posed on operation I in combine structure

Problem	
	*Uncle bought* $\frac{1}{6}$ *kg of cement to build electricity poles.* *Then uncle buy again* $\frac{1}{4}$ *kg cement.* *What is the total amount purchased by Uncle?*
Errors problem posed by prospective teachers - Not related in daily life situation (K1) - Illogical problem (K2) - Unit are not suitable in daily life situation (K3) - Use different fraction (K4)	

From table 3, problem posed by prospective teachers is build electricity poles. This problem is a problem not related in daily life situation and illogical problem because build electricity pole is impossible to do by personal but it build by a company. The units used to buy cement usually use sack. In this case, the prospective teacher posed a problem to buy $\frac{1}{6}$ kg and $\frac{1}{4}$ kg of cements. This is illogical problem and incompatible with the unit used to buy cement in daily life situation. From these problems, prospective teachers use different fractions that is $\frac{1}{6}$ and $\frac{1}{4}$ it should be use $\frac{1}{3}$ and $\frac{1}{2}$.

The most errors of the problem posed by the prospective teacher in operation I on the part-part-whole relation structure as follows.

Table 4 Error of problem posed on operation I in part-part-whole relation category

Problem	
Ibu pergi ke pasar membeli bawang putih sebanyak $\frac{1}{3}$ dan baembeli bawang merah $\frac{1}{2}$. Berapa jumlah seluruh belanjaan Ibu ?	*My mother went to the market to buy* $\frac{1}{3}$ *garlic and* $\frac{1}{2}$ *onion.* *How much is your mother groceries?*
Errors problem posed by prospective teachers - Illogical problem (K2) - Unit are not suitable in daily life situation (K3)	
Nenek memiliki 1 kue tart. $\frac{1}{3}$ bagian kue diberikan kepada Ani. kemudian $\frac{1}{2}$ bagian diberikan kepada Andi. Berapa bagian kue yang sudah diberikan nenek?	*My grandma has one tart.* $\frac{1}{3}$ *part of tart given to Any, then* $\frac{1}{2}$ *part given to Andy.* *How many part of tart has my grandma given?*
Errors problem posed by prospective teachers Gives natural number to make a fractional meaning (K5)	

From table 4, first problem posed is "My mother went to the market to buy garlic and onions. The problem posed is illogical because problem of buying $\frac{1}{3}$ garlic and $\frac{1}{2}$ onions. The units used are also not clear because the activity of buying and selling in the market unit used is kilograms. On second problem about the tart my grandmother is one tart, errors made by the teacher candidate is to give the natural number that is one tart. The prospective teachers were given natural number to make fractions from grandma's tart, then part of tart distributed $\frac{1}{3}$ part of the tart to Ani and $\frac{1}{2}$ part the tart to Andi. The fraction concept given to the problem posed by the prospective teacher is correct.

Error of problem posed by the prospective teacher on the operation II based on combine structure as follows.

Table 5 Error of problem posed in operation II in combine structure

Problem	
Adi sangat suka bermain air. Suatu hari Adi berenang dan tidak sengaja menemukan botol kosong. Lalu Adi mengisi botol itu dengan air. $\frac{1}{2}$ Ml dari air kolam yang digunakan Adi untuk berenang dan $\frac{3}{4}$ ml dari air kolam renang sebelah kolam renang yang Adi gunakan. Dalam botol sekarang ada berapa ... ml	Adi likes playing water. One day, Adi swam and found the empty bottle then Adi filled the bottle with water. $\frac{1}{2}$ *ml* water from pool used by Adi for swimming and $\frac{3}{4}$ *ml* from others pool. How many water in the bottle now...*ml*.
Errors problem posed by prospective teachers - Not related in daily life situation (K1) - Illogical problem (K2) - Unit are not suitable in daily life situation (K3)	

From table 5, the problem posed is put water in swimming pool into bottle. This problem not related to daily life situation and illogical problems because Adi swam and found bottles, this is not possible in swimming pool. Next statement is Adi put water into the bottle $\frac{1}{2}$ *ml* from the first pool and put $\frac{3}{4}$ *ml* from another pool. The units used are not appropriate because they use milliliter, it is impossible in daily life situation.

The analysis for operation I, it was found errors made by the prospective teacher were among the problems that were not related to daily life situation (K1), illogical problem (K2), the unit used was not suitable in daily life situation (K3), use different fraction (K4), gives the natural number to give meaning a fraction (K5). Error of problem posed by the prospective teacher on the operation II based on part-part-whole relation structure as follows.

Table 6 Error of problem posed in operation II in part-part-whole relation structure

Problem	
Bibi mengambil $\frac{2}{4}$ kg cabai yang ada di kebun, keesokan harinya bibi memanen lagi cabai sebanyak $\frac{3}{4}$ kg. Berapa jumlah seluruhnya cabai yang dipanen ?	My auntie took $\frac{2}{4}$ kg of chili in the garden. The next day, auntie harvested more chilies $\frac{3}{4}$ *kg*. How many chilies are harvested?
Errors problem posed by prospective teachers - Illogical problem (K2) - Use different fraction (K4)	
Paman membeli 1 pizza. $\frac{1}{2}$ bagian dimakan oleh ibu. Kemudian Ani memakan $\frac{3}{4}$ bagian. Berapa bagian yang sudah dimakan ibu dan Ani ?	My uncle bought one pizza. One halfpartwas eaten by mother. Then Ani ate $\frac{3}{4}$ her part. What are the total parts of the pizza hat have been eaten by Mom and Ani?
Errors problem posed by prospective teachers - Gives natural number to make a fractional meaning (K5) - Missing data that is how many section in one pizza divided (K6) - Sum the given fractions exceeds the overall concept of the fraction (K7)	
Syfa dapat makan soto $\frac{1}{2}$ piring. Sedangkan Ani menghabiskan nasi soto 3/4. Berapa total yang di habiskan Syfa dan Ani ke nasi soto	Syfa ate $\frac{1}{2}$ the soup plate. Ani spent $\frac{3}{4}$ the rest of rice soup from Syfa.What is the total rice soto spent by Ani and Syfa?
Errors problem posed by prospective teachers - Not related in daily life situation (K1) - Unit are not suitable in daily life situation (K3) - Sum the given fractions exceeds the overall concept of the fraction (K7)	

From table 6 above, first problem about aunty took chili in the garden $\frac{2}{4}$ kg, the amount is illogical because it can be expressed in simpler fraction that is $\frac{1}{2}$. Then, fractions expressed not correspond to the operation of the given fraction on operation. Then, errors made in the second problems, "Uncle bought a pizza" is missing information. The information missing is pizza purchased uncle cut into how many section, because usually pizza can be cut into 4 or 8 parts. The sum of the given fractions exceeds the overall concept of the fraction, expressed by "One part is eaten by Mother, thenAni eats $\frac{3}{4}$ her section. What is the total part of pizza that have been eaten by Mom and Ani?". The number parts of the pizza if put together will exceed the overall portion of the unknown pizza the number of pieces of pizza. For third problems, errors made are not related in daily life situation. The use "plate"is uncommon in daily life. Soup is not served by plate. It is served with bowl. Then "Ani spent $\frac{3}{4}$ the rest of rice soup from Syfa. What is the total rice soto spent by Ani and Syfa?".The sum of the given fractions exceeds the total amount of the fraction.

Analysis for operation II obtained errors made by prospective teachers, problem posed is not related to daily life situation (K1), illogical problems (K2), the unit used was not suitable in daily life situation (K3), use different fraction (K4), gives the natural number to give meaning a fraction (K5), missing information (K6), and the sum given exceeds the overall concept of fraction (K7). From the results above, the percentage of errors made by prospective teachers will be presented in the following table.

Table 7 Persentage errors of problem posed by prospective teacher

Operation	Structure	K1	K2	K3	K4	K5	K6	K7
I	G	11,11	72,22	8,33	8,33	0	0	0
	BK	0	30	10	0	10	0	0
II	G	10	55	27,5	7,5	0	0	0
	BK	17,6	35,3	5,88	0	17,6	5,88	35,3

Based on table 7 for operation I for combine structure for K1 is 11.11%; K2 is 72.22%, K3 is 8.33%, and K4 is 8.33%. Based on the structure of part-part-whole relation for K2 is 30% and K3 is 10%. For operation II, based on the combine structure for K1 is 10%, K2 is 55%, K3 is 27.5%, and K4 is 7.5%. For the structure part-part-whole for K1 is 17.6%, K2 is 35.3%, K3 is 5.88%, K5 is 17.6%, K6 is 5.88%, and K7 is 35.3%.

Problem posed influenced by the situation from the experience teacher candidate (Christou et al., 2005; Silver, 1997). Through problem posing, can help build relationships for fractions concept to representing fractions into problems and knowing their connections (McGrath, M. & Valenti, 2010). Prospective teachers have connections if able to make a transition from one representation to

another(Knuth, 2000). From the problem posed by the prospective primary teacher depends on the structure of mathematical knowledge(Kilic, 2015), imagination or creativity, as well as previous experience. From the results of analysis for fractional operations I and II errors made prospective teachers:

1. problem posed are not related to daily life situation (Kar & Işık, 2014; Mcallister & Beaver, 2012)
2. illogical problems(Mcallister & Beaver, 2012),
3. units used are not suitable in daily life situation (Kar & Işık, 2014; Mcallister & Beaver, 2012),
4. use different fraction(Kilic, 2015),
5. gives natural number to make a fractional meaning(Kar & Işık, 2014; Mcallister & Beaver, 2012),
6. missing information(Kilic, 2015) and
7. counting the given fractions exceeds the overall concept of the fraction(Kar & Işık, 2014).

Prospective teacher seems to understand fraction as merely part of the whole, and often confused with the meaning of fractions greater than 1(Fazio, L. & Siegler, 2010).Prospective teachers should have a deep understanding of mathematical concepts and be able to use them flexibly(Whitacre & Nickerson, 2016).

CONCLUSION

Problem posed by prospective teachers about addition fraction, grouped questions and non-question with their percentages. The errors by prospective teacher about operation I dan II that is (1) problem is not related to daily life situation, (2) illogical problem, (3) units used are not suitable in daily life situation, (4) use different fraction, (5) gives natural number to make a fractional meaning, (6) missing information, and (7) count the given fractions exceeds the overall concept of the fraction.

The limitations in this study is did not interviews prospective teachers who make errors to problem posed about addition fraction. So, there is no data why the prospective teacher to make errors to problem posed about additional fraction based on semantic structure. The researcher suggests that further research on semantic reasoning can be made problem posed. Validity and reliability are not done about operation given in operation about fraction.

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