



Students' Mathematical Problem Solving Abilities Through Realistic Mathematics Educational Approach in Elementary Schools

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Abstract

The aim of this research is to analyze students' ability in solving mathematics problems through Realistic Mathematics Educational Approach (RMEA). The subjects of this research are six Grade-5 students at State Elementary School 6 of Kutablang which were chosen through communicative indicators. The instruments used in this study are test of math problem solving and guided interview. The data obtained were then analyzed qualitatively and elaborated descriptively. The result of the study shows that four out of six students are competent in meeting the indicators in implementing and apply the correct strategies in solving the math problems. Moreover, three students were able to solve the math problems in different contexts by creating the new mathematics insights, monitoring, and reflecting the process of math problems solving. The result of this study also shows that the students used RMEA in solving math problems by comprehending the problem, deciding the right strategies to solve the problems, having background knowledge suitable to use for the current math problems they face, and at the end they were capable in concluding the ideas they have to use as a solution.

Keywords: problem solving ability; realistic mathematics approach.

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1. Introduction

One mathematicability that should be acquired by students is the ability to solve a problem. This ability is a basic activity a human should have because essentially, the purpose of education is to help humans to get through a continuous process where we have to continually solve problems we are facing [9]. As it mathematics, problem solving is the main purpose of the mathematics learning [10]. The ability to solve problems is someone ability to solve story problems, solve not-routine problems, apply mathematics in daily life or in different occasion, and prove, create, and test any conjectures [11]. The authors [4] most of students do not yet achieve the ability to solve math problem appropriately. The first factor which causes this lack of ability in solving math problems is the current learning process which cannot facilitate students in developing their abilities in communicating the math ideas in the right way. Moreover, the current learning used in class doesn't facilitate students to comprehend and understand the mathematics concept and mathematics problem solving [3]. The indicator for mathematics problems solving consist of the ability to implement and adjust various strategies in solving any particular problems, to solve the problems appeared in the mathematics process contextually, to develop advanced mathematics knowledge by problem solving, and to monitor and reflect on the process of solving the mathematics problems [9]. The result of study conducted by the Author [5] shows that the ability to solve systematic problems of elementary school students is not satisfying. This result is in line with the observation done by the researcher of this study in State Elementary School 6 of Kutablang. The researcher distributed the problems of fraction by using the indicators of incorrect strategies, so that the students were likely to solve the problem right away. This problem appears because the strategy used by the teacher in class is not suitable enough. Therefore, teachers can initiate the implementation of learning approaches which trigger students to train students to solve the mathematics problems they face by using Realistic Math Educational approach. Realistic Math Educational Approach is a learning approach which is student-oriented. It means to actually relate the math problems with daily life contextually. In other words, it is to take students learning experience to actually relate to reality [2]. He also adds that RME emphasizes on the real things experienced by students, the ability of process of doing mathematics, the ability to discuss and collaborate, and the ability have various arguments with peers in class, so that students figure out the solutions themselves. At the end, they will use mathematics to solve the problems they have [8]. The first principle of RME is guided discovery with the indicator of developing new mathematics knowledge through problems solving. In problem solving, there is actually guided discovery to actually aim the proper strategy to solve any problems. The second principle of RME is that learning phenomenon with contextual problems relates to the indicator which applies implementation and adjustment of various strategies to solve the contextual problems. Moreover, the third RME principle is self-developed models which mean to relate the phenomenon in daily lives or the previous experiences relating to the indicators of solving mathematics problems appears from the mathematics itself or other contexts [6]. The Realistic Mathematics Educational approach correlates to problem solving ability. The study result done by The Authors [1] shows that learning process which is conducted by using the realistic mathematics educational approach can meet the achievement targets for problem solving in fracture materials. Besides that, the Authors [7] in a study conducted, it can be concluded that students are successful in math learning when the RME was done. However, these previous studies did not analyze how RME affects problems solving qualitatively. Therefore, the researcher of this study aims to analyze students' ability in solving

mathematics problems by using Realistic Mathematics Educational approach in Elementary School setting.

2. Method

The subjects of this research are Grade Six Grade-5 students of State Elementary School of Kutablang. These subjects are chosen because they are communicative students. Thus, the researcher expected the students to say their minds and elaborate further on it. It allows the researcher to explore the subject of the research deeper. The data were collected through problem solving test to obtain students ability in solving the problem in fraction. While the guided interview as used to obtain the opinion and thought from the subjects. Triangulation used in this study was technical triangulation. The researcher collected the data from the same research subjects with different ways and at different time. The data obtained from test and interviews are supported by the documentation of students test results in the next problem solving. It was conducted openly so that the researcher could dig deeper data.

3. Result and discussion

This study involves six students as the research subjects chosen for the good communication skill the subjects have. They were given problem solving test about fracture. The subjects who meet the indicators were then interviewed to examine thoroughly their ability to solve the mathematics problems. The data analysis was based on each indicator of the mathematics problems. The indicators of implementing and adjusting can be seen in the strategies used by students in comprehending the problem mathematically. Students' ability in implementing and adjusting the correct strategies is shown the answer they write. The problems given in the test were related to the addition of two fractions which denominators multiplied as we can see in the problem as follow "In the group work they have, Raisa has done $\frac{1}{6}$ parts of job while Dhafin has done $\frac{1}{12}$ parts of the job. What is the total of job that they have done?" The expected answer for problem one is that students are; first, students can actually transcript the information they get into the written form of, Raisa $\frac{1}{6}$ parts while Dhafin $\frac{1}{12}$ parts. Then the information follows is the total works both characters have done. The next indicator is that how to calculate two fractions with different denominators. The ways they finish the task were first by equating the nominators by finding the Least Common Multiple (LCM) which is 12. The parts that they have done are transcribed as $\frac{1}{6} + \frac{1}{12}$, thus the result is $\frac{1}{4}$ parts. Therefore the parts that they have done are $\frac{3}{12}$ and $\frac{1}{12}$ parts. The result shows that four out of six students started the steps of problem solving by writing down the information from the problems they were about to finish. They started by writing down the information such as, Raisa for $\frac{1}{6}$ part and Dhafin $\frac{1}{12}$ part. Then, the students will transcribe the information into mathematical model which become the fraction form. After that, students transformed the mathematical model into the addition of fraction form which was then calculated with the correct algorithm. The description of the answer written by students can be seen the following Figure. 1.

Dik : = Raisa $\frac{1}{6}$ bagian
 = Rafin $\frac{1}{12}$ bagian
 Dit : Berapa bagian yang dikayakan mereka?
 jawab :
 $6 = 6, 12, 18, \dots$ KPK = 12
 $12 = 12, 24, \dots$
 $\frac{1}{6} + \frac{1}{12} = \frac{2+1}{12} = \frac{3}{12}$ bagian

Figure 1: student answer for the indicator of implementing and adjusting the correct strategy in solving the problems

Based on the figure.1, we can see that the student tried to identify the information provided in the problem and the information being asked, so the student understands the intention of the problem that needs to be solved. The student then transcribes the daily problem into mathematics model which is in a form of fraction. This is supported by the interview result with the students which show that the student first comprehended the problem. Then he/she wrote the information about the problem, both the information provided in the problem and the question being asked. After that, the students solve the problem by transforming the addition of fraction into the fraction with the same nominator to be calculated later. The result of the test and interview shows that the student meets the indicators of identifying any factors provided in the problem and identifying the question. Therefore, the student is considered to meet the indicators of ability to implement and adjusting the correct strategy to solve any given problem. The indicator of ability to solve the problem appears either in mathematics or other contexts can be seen in the students' ability in comprehending the question of the problem. Moreover, the students are expected to comprehend the context of the given question. The students plan the strategy and assumption and try to relate the characteristics with the suitable mathematics model. The results of each student answer and supportive data are the interview transcription of the researcher and students regarding the given problem. The problem was related to the addition of two fractions where one of the nominators is the multiplication of another one. The problem is explained as follow. "Siba first bought $\frac{3}{4}$ m ribbon and then she bought another $\frac{2}{9}$ m. How long is Siba's ribbon now in meter?" The expected answer for such question like this is that students are able to comprehend the information provided in the problem which is Siba bought $\frac{3}{4}$ m ribbon and $\frac{2}{9}$ m ribbon. Students are also expected to identify the question of the problem which is the total length of Siba's ribbon. The different nominators were first done by finding the Least Common Multiplication of 4 and 9. Then, it is obtained that the result is $\frac{35}{36}$ m. Thus the answer of the expected question is $\frac{35}{36}$ m. Based on indicator, students are expected to explain the problem by writing the information and by comprehending the problem and finish the problem by using the mathematics model and plan the correct strategy. Students are considered to understand the problem when they can write down: Siba bought $\frac{3}{4}$ m ribbon, and then she bought another $\frac{2}{9}$ m and write the question of the total ribbon. The students make the assumption as the transform the mathematics model they have made into addition from of fractions which is then finish correctly by using fraction algorithm. The description of written form can be seen the following Figure. 2.

Dik : Siba membeli $\frac{3}{4}$ meter pita, membeli lagi $\frac{2}{6}$ meter
 Dit : Panjang pita sekarang?
 $4 = 4, 8, 12, 16 \dots$ KPK = 12
 $6 = 6, 12, \dots$
 $\frac{3}{4} + \frac{2}{6} = \frac{9+4}{12} = \frac{13}{12}$ bagian meter pita

Figure 2: student's answer of problem solving test appears in mathematics and other contexts

Based on Figure 2, the subjects explain the context of the problem by transcribing it into written form. This information was transcribed into the written form of information provided in problem and the thing being asked. This data are supported by the interview transcription of the researcher and the interviewee. The students shows that they understand that the idea of buying more ribbon means addition of the fractions, so the students finish the equation of $\frac{3}{4}$ m + $\frac{2}{6}$ m by firstly finished the denominators of four and six. The students were sure that they have to do this first, unless this addition cannot be finished. From the analysis result of test answer and interview, it shows that the students guessed first to find the correct strategy to be implemented in solving the problem. Therefore, it may be concluded that students have solved the problem according to the mathematics principle. In other words, it may be concluded that the students meet the indicators of solving the given problems by understanding the context of the problems. Next, the indicator of finding and using the patterns is started by comprehending and thoroughly understanding the question. After that students try to understand the context of the question that then to be transform into mathematics model. The student solves the problem related to the addition of two fractions with the denominators from the same multiplication then the students were asked to finish the equation. The problem of the question is "Alia has $\frac{2}{4}$ liter of vegetable oil. After she used it for frying fish, the remaining vegetable oil is $\frac{1}{5}$ liter. How many liter is the vegetable oil used in the cooking?" The expected answer from question number 1 is that the student is able to write down the information from the problem which is "Alia has $\frac{2}{4}$ liter of vegetable oil with the remaining of $\frac{1}{5}$ liter. The students should find the difference of the two fractions with different denominators. First the students should find the Least Common Multiplication of 4 and 5 which is 20. Thus, the amount of vegetable oil used in the cooking can be calculated as it is written in the following equation = $\frac{2}{4} - \frac{1}{5} = \frac{10-4}{20} = \frac{6}{20}$ liter. Therefore, the amount of vegetable oil used in the cooking is $\frac{6}{20}$ liter. The indicator of forming the new mathematics knowledge can be seen from students who tried to finish the questions related to subtraction of two fractions with denominators of different multiplication. Thus the students are expected to find the result of this subscription. Students are expected to gain new knowledge when they try to finish any particular problem. The idea of forming new knowledge canbe obtained by students in a form of problem solving strategy. The students comprehend the questions and write down what they know from the problem and then finish the question using the strategy they have planned. The description of the written test result can be seen in the following Figure 3.

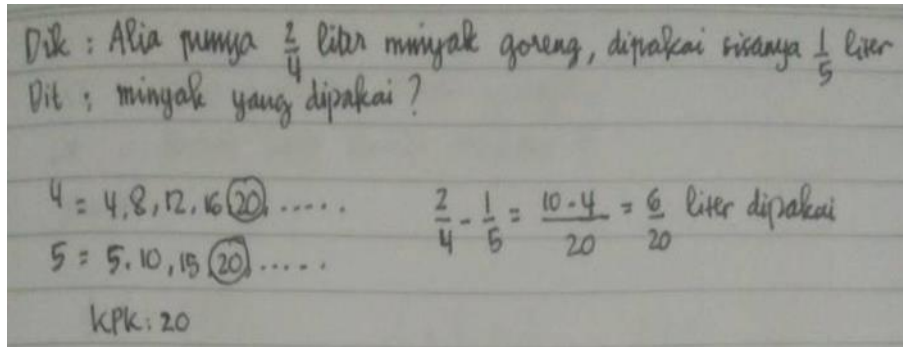


Figure 3: student answer which shows the development of new knowledge of mathematics through problem solving

Based on Figure 3, we can see that the student wrote what he/ she knows from the question. The student wrote “Alia has $\frac{2}{4}$ liter of vegetable oil and after using some of it, Alia got $\frac{1}{5}$ liter left” to solve the problem at question. 3. The data are supported by the result of interview conducted by the researcher with the subject explained as follow. The researcher asked the students ways in solving the problem. The student understands the problem in the question by comprehending the phrase “the remaining vegetable oil” which is understood as subtraction equation. The student then tried to relate the problem with the previous knowledge she/he has which is the subtraction of fractions. The student used the strategy of finding the least common multiplication of the two denominators, and then she/he calculates the numerators. It can be concluded that the student is able to meet the indicator of forming new mathematics knowledge through problem solving. The indicator of monitoring and reflecting the process of solving the mathematics problems consists of students activities where they recheck the answer that they have obtained in their calculation. First, the students tried to understand the question being asked, then finish the problem as planned and at the end the student have a review of the answer. The result of written test and interview of each subject are related to the addition of fractions of two nominators of the same multiplication where the students were asked to define the answer of the addition. The problem is in question number 4 written as “At a market, there are two plastic bags of sugar weight of $\frac{3}{4}$ kg and $\frac{1}{2}$ kg. What is the total weight of the two plastic bags?” The expected answer for question number 4 is that students are able to write down the provided information in the problems which are $\frac{3}{4}$ kg and $\frac{1}{2}$ kg. The students calculate the two different fractions by finding out the Least Common Multiplication of 4 and 2 and the answer is 8.

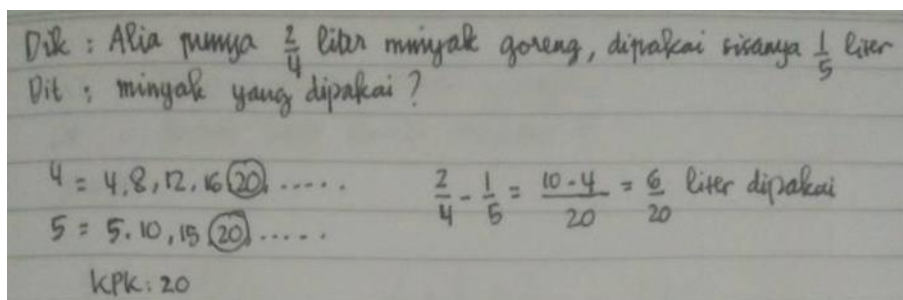


Figure 4: student answer from the indicators of monitoring and reflecting on the process of solving mathematics problems

This makes the total of the two plastic bags weight at $\frac{5}{4}$ kg. Students utilized the strategies they had achieved in solving the problems. Then they will check the calculation again by using mathematics principles. The way students ensure their answer are through reviewing the answer based on what they know and recheck the calculation. The written result can be seen the following Figure.4

Based on figure4, it can be seen that students answered the problems correctly and review the answer and wrote what he/ she had known previously. He/she also wrote what would be asking later in the interview. The student run his/ her plan by writing what she/he knows from two plastic bag weighting $\frac{3}{4}$ kg and $\frac{1}{2}$ kg along with the total weight of the two plastic bags. Then the student solves the problem by reviewing the result that she/ he had done. He/ she also attempted to ensure that their work was correct by checking the calculation again. This information is supported by the interview result which is elaborated as follow. The researcher asked about how the students solve the mathematics problem given to them. The answer shows that they finish the answer by finishing the denominators of the two fractions which follow by finding the Least Common Multiple of the two numbers. After that, the students ensure the answer form the calculation he/she had previously done. It may be concluded that the indicators of monitoring and reflecting the process of solving mathematics problem are met.

4. Conclusion

The result of this study shows that the ability to solve problems by using RME varies and it depends on the indicators of each problem. Four out of six students were able to meet the indicators which are implementing and adjusting to the proper strategy to solve the problems. This is due to students understanding towards the test and implements the correct strategy to solve the problems. Three out of six students were able to finish the indicators which are solving the problem appearing from the mathematics or other contexts, developing new mathematics knowledge and monitoring and reflecting the process of mathematics problem solving. This is due to students background knowledge related to the problems they face so they can solve the problems correctly. Therefore, students develop ideas from the information they already have to become the solution in answering the test and they are able to review the process of solving the problems they are doing.

5. Recommendations

Teachers should familiarize students with solving problems related to problem solving skills through one model, namely a realistic mathematical approach so students are not surprised by the problem solving problems given. Students' difficulties need to be considered by the teacher as a material for learning development and problem solving problems. Teachers must provide more motivation and attention to students who are mathematically capable when solving problems solving problems.

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