

# STUDENTS' MATHEMATICS REPRESENTATION AND THE ALTERNATIVE SOLUTIONS

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**Abstract**-the skill of representation has a very important role in the learning of mathematics that need to be owned by each student. This requires the ability of the mathematical representation in which students are able to describe, explain, or expand the idea of mathematics with a focus on the importance of forms. One aspect that can improve students' mathematical representation is to adopt a problem-based learning model. The author used problem based learning. One alternative solution that can solved problems in mathematics education is to improve the quality of learning through problem based learning (pbl). The main focus in efforts to improve the quality of learning is to position the teacher's role as designer and organizer of learning so that students have the opportunity to understand and make sense of mathematics through learning activities. Problem based learning will make the learning process more interesting for students, because students can share their ideas about the problem to be teachers give them. Problem based learning is a better way for the students and the teacher rather than the conventional ways to increase the representation and problem-solving skills. Each student is certain to have behaviour and characteristics tend to differ. In the study, the condition is important to note because by identifying the initial conditions of current students will follow the learning can provide important information for teachers in the selection of management strategy, which deals with how to organize teaching, especially the components of effective teaching strategies and in accordance with the characteristics of individual students so that learning will be more meaningful.

**Keywords:** mathematics, learning, representation, problem based learning

## 1. INTRODUCTION

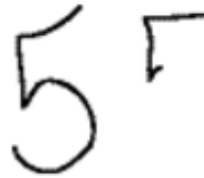
What first comes out in your mind, when you hear the word 'word problems'? Are you interested in continuing our conversation? Yes, indeed many feel about the story is a difficult problem to be understood and resolved. About the story, or in English is called word problems, is often regarded as a scourge that is scary and very frustrating, but the student must complete the word problems. In fact, one way to measure the ability of students is to see how the story students solve problems.

However, what about the story that so hard? What makes the story becomes a difficult problem? The author provides to these questions, which are answered by 18 students from 21 students, where the students stated that about the story difficult to do because the students did not understand the question. While the other three, answered, they already understand the meaning of the problems, but they are deciding which steps should come first to resolve such questions.

From the answers, we can conclude that students have difficulty understanding the meaning of the story and decide about the initial steps to resolve the matter of the story. The author introduces the term representation as one way to help students in solving word problems.

Maybe some people are still confused by the term representation. Before talking about the representation, the author will try to give the question. Why when we look at the apple, we can describe and call these objects 'apple'? Obviously because these objects meet the characteristics of apples, so we can call it an apple. We have represented the apple, but it is another example of the representation is number one, we can represent it with a '1', 'I', or 'i', and many other ways to represent the number one.

In line with the statement of the author, NCTM (National Council of Teachers of Mathematics), shows a representation of a child who was asked to represent 5 and a half of 5 is shown in Figure 1.



**Figure 1.** Student's Representation of Five and Half of Five

In Figure 1 seen, a child tried to represent his understanding of the statement of five and a half out of five. Apart from the student representation is true or false, these students have been able to show a representation had in mind. Teachers can also see the extent to which the student understanding, and students can be more daring present the results of their thoughts in the form of representation that give students free.

The ability of representation has a very important role in the learning of mathematics that need to be owned by each student. This requires the ability of the mathematical representation in which students are able to describe, explain, or expand the idea of mathematics with a focus on the importance of forms. One aspect that can improve students' mathematical representation is to adopt a problem-based learning model.

Problem Based Learning model has an advantage compared with other teaching model, in this model, the role of the teacher is thrusting a variety of problems, ask questions, and to facilitate the investigation and dialogue with students so that students active and motivated to solve the problem given by the teacher.

Teachers provide opportunities for learners to develop the subject matter to be discussed, although the teacher has set the problem of what to talk about. The main thing is the teacher provides support framework that can increase the need for students to carry out investigations and intelligence-ability learners in thinking through the learning process so that learners can solve the problem in a systematic and logical.

When viewed from the standpoint of the psychology of learning, the learning model based on cognitive psychology is rooted in the assumption that learning is a process of behavior change due to experience. Through this learning for learners to develop the model as a whole, which means that not only cognitive development, but students will also be developed in the field of affective and psychomotor automatically through problems.

Based on theory of Problem Based Learning is a cognitive psychology. The focus of learning in this study emphasizes what students think as long as they are involved in the learning process, rather than on what they do in the learning process.

### **1.1 Understanding Mathematical Representation**

So, what is representation? The concept of representation is one of the psychological concepts used in mathematics education to explain some important phenomena about the way of thinking of children [2]. But before Davis [2] states that a representation may be a combination of something written on paper, something that exists in the form of physical objects and the arrangement constructed ideas in one's mind.

Furthermore, in mathematical psychology, representation has a meaningful of the object with the description of the relationship between the symbols [2]. Representation is something that symbolizes the object or process. For example, words, diagrams, graphs, computer simulation, mathematical equations and others. Some representations are more concrete and serves as a reference for the concepts more abstract and as an aid in problem solving [2].

Representation had risen by the students are expressions of ideas or the ideas of mathematical shown students in efforts to find a solution to the problem at hand. The standard representation of the specified National Council of Teachers of Mathematics [4] for a program of learning from pre-kindergarten through 12th grade is a need to allow students to: (1) create and use representations to organize, record, and communicate mathematical ideas, (2) select, apply, and translate among mathematical representations to solve problems, and (3) use representations to model and interpret physical phenomena, social, and mathematics.

According to the [4], representation presented by the students do not have a conventional or already we know it, but it can be an unconventional representation they can understand. As described

in the NCTM. It is important for us to encourage students to represent their ideas in ways that they understand, even if their first representations unconventional. It is also important that they learn about the types of conventional representation to facilitate learning of mathematics and their communication with others about mathematical ideas.

The use of diverse representation will enrich students' learning experiences. McCoy [2] states that in mathematics learning in the classroom, the representation should not be bound to change one form to another, in one way, but it could be two-way or even in multiple ways. For example presented in the form of graphic representation, teachers can ask students to make other representations such as presenting them in Tables, equations / mathematical model or write the words.

But, unfortunately, the ability of students' mathematical representation is still low. Given the role of mathematical representation that is essential in the process of improving the quality of human resources, efforts the improvement of quality of learning mathematics, require serious attention.

This effort is essential considering some writings stating that the results of mathematics learning in schools have not shown satisfactory results [1]. The low results achieved in the national evaluation of mathematical, showed that the quality of students' understanding in mathematics still relatively low. Understanding in mathematics has long been an important issue. Some research and assessment in mathematics learning to concentrate and try to reach an understanding, but it has been believed by many that to achieve understanding and meaning of mathematics not as easy as it seems.

### 1.3 The Low Ability Students Mathematical Representation

One cause of low quality of math problem solving in elementary and junior high students according to the results of surveys IMSTEP-JICA in the city is because in the process of learning mathematics teachers are generally concentrated on solving exercises that are more procedural and mechanistic rather than understanding.

This is evident from the results obtained by Indonesian students in the TIMSS (Trends in International Mathematics and Science Study), which Indonesia started to take this test since 1999. TIMSS is used to measure the ability of math and science students throughout the junior high school. Having taken the sample 5648 junior high school students in Indonesia, which represents all students in grade VIII, Indonesia gained rank 36 out of 49 countries took part in TIMSS in 2007. The average value obtained Indonesian students are also significantly below the international average, TIMSS addition, there are also other tests, namely PISA (Programmed for International Student Assessment), which is an international studies student literacy achievement. In even this study, the position of Indonesia is quite low, i.e. the position 50 of 57 participants. In addition to the results of an international study, the authors also try to do a test to some students, to see the student's ability to perform mathematical representations.

To ensure the correct indication then the author gives some questions to the students about the comparisons for students. Authors give students five questions about Comparison of three questions routine and non-routine two questions. Then, I asked them to make representations on the matter. The author takes a non-routine question to students from their textbooks [3].

"Comparison of the volume of orange juice in a glass with orange juice in glass volume B is 5: 3. Half of the orange juice in a glass poured into the glass B. How many new comparison volume orange juice in a glass with orange juice in glass volume B?"

There is so much variation. However, the author is really interested in the representation of a student, as shown in Figure 2.

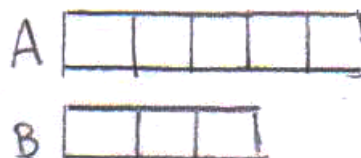


Figure 2. First Student's Answer

From the model shown in Figure 2, the actual students already understand the original intent of the question. However, students are not able to proceed to the next stage of the problem, namely when the juice of Glass A is moved as much as half a glass into glass B. Students are not able to represent further problems.

Then, for non-routine question, the author of a textbook taking students [3]. The question is stated below, "Mr. Rahim has the same amount of money in three bank accounts. He deposited \$ 44 into Account B and \$ 80 to the Accounts C. In the end, the ratio of the amount of money in the account A and the amount of money in the account C is 2: 7. How much money in the B account in the end? "

There are so many variations of student representation, but the author is interested in the representation of two students.

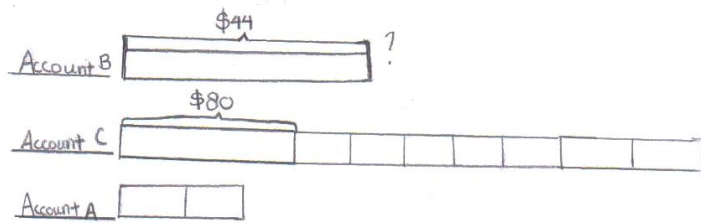


Figure 3. Second Student's Answer

From the model seen in figure 3, the authors noticed that students can not represent a problem to the correct model. In the model in Figure 3 can be seen that he thought a ratio of 2: 7 separated by \$ 80. He did not notice the phrase "In the end, the ratio of the amount of money in the accounts of A with the amount of money in the account C is 2: 7." Because students have a false understanding, then it represents a model to be wrong.

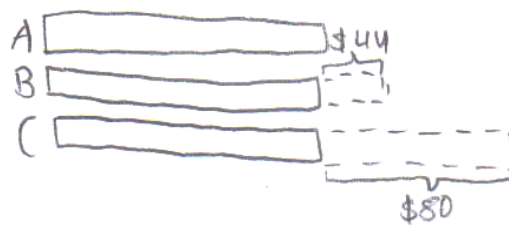


Figure 4. Third Student's Answer

From the model in Figure 4, the authors look at the students already understand the problem, because he could make the correct model, but he cannot use important information on the comparison between the amount of money in the account A to account the amount of money in C. It can be because of time limited, because students are the last student who gave the paper. However, students can already represent a problem using the correct model.

The students' answers to these questions indicate that there are so many students still cannot make a representation of the question, but if they cannot make the model as a representation of the question, they could not finish the question. This condition makes the writer as a mathematics teacher to see the ability of representation of students' problems still low.

In addition, it is also according to interviews conducted by the author in the day Tuesday, October 14, 2014 to all students in seventh grade at the School of Noble. Then, the author tries to give the question to them, "Please give another way to write 4 for the second, unless and give an example about the story using the concept of the division!" The students do not understand the meaning or intent of writing in another way.

Then, the author tries to give directions. "What denomination? Is there a relationship between the division and fractions?" Then, one student said, "So, can we write?" Students ask because he was not sure of the answer. Then the writer as teacher said that it was true.

After a while, no other students who can provide another way to represent, but they can provide some about the story, so they realize the math related to their daily lives. Then, the author as a teacher says that they can represent as a comparison or comparisons as well, like.

From a brief interview between the author and the students, the authors noticed that the ability of the student representation is still low, especially for material comparisons. Although they have studied this matter in the fifth grade and sixth grade, but they have been forgotten.

From this statement author found accordance with the results of the literature in which students can not represent a simple division in other ways. They need to understand the various interpretations of fractions, as a comparison, division, or part of a number. "So, from a brief interview, the authors look at the ability of the student representation is still low.

#### **1.4 Problem Based Learning**

One alternative solution that can solved problems in mathematics education is to improve the quality of learning through Problem Based Learning (PBL). The main focus in efforts to improve the quality of learning is to position the teacher's role as designer and organizer of learning so that students have the opportunity to understand and make sense of mathematics through learning activities.

PBL is an approach to learning that begins with problems exposes students with math. With all the knowledge and abilities they already had, students are required to solve problems with a rich concepts mathematical concepts. Characteristics of PBL them are: 1) positioned students as self-directed problem solver through collaborative activities, 2) motivate students to be able to find the problem and elaborated by asking the allegations and settlement planning, 3) to facilitate students to explore various alternative settlement and its implications, as well as collecting and distributing information, 4) train students to skilfully present the findings, and 5) familiarize the students to reflect on the effectiveness of their thinking in problem solving.

Selection of the type of problem that is advantageous to be presented to students in the PBL is important. The type used in PBL issues including the issue open (open-ended problems or ill-structured problem) and structured problems (well-structured problem). On the issue of structured, for answer given problem students faced with sub problems and inference. While the open issues, students are faced with problems which have many alternative ways to get it done and have one answer or multiple correct answers.

In Problem Based Learning model is different from other learning model, in this model, the role of the teacher is thrusting a variety of problems, ask questions, and to facilitate the investigation and dialogue.

Teachers provide opportunities for learners to develop the subject matter to be discussed, although the teacher has set the problem of what to talk about. It is primarily teachers provide support scaffold or framework that can increase the need for students to carry out investigations and intelligence ability learners in thinking through the learning process so that learners can solve the problem in a systematic and logical.

When viewed from the standpoint of the psychology of learning, the learning model based on cognitive psychology is rooted in the assumption that learning is a process of behavior change due to experience. Through this learning for learners to develop the model as a whole, which means that not only cognitive development, but students will also be developed in the field of affective and psychomotor automatically through problems.

Problem based learning model based on the theory of cognitive psychology as its theoretical support. The focus of learning in this model emphasizes what students think as long as they are involved in the learning process, rather than on what they do in the learning process.

Problem Based Learning model makes the author as a teacher is not only to teach the material to students, but the author will give some of the issues that can help students to develop their thinking skills, so they can find their own way to solve the problem. Then, the students will understand what they have learned is a material that can give them the support for learning in the learning process. Statements of the author in line with Taplin, "Presenting the problems and develop the skills needed to solve the problem would be more motivating than teach skills without context. It allows students to see the reason to learn mathematics, and therefore become more deeply involved in the learning process."

This shows that, Problem Based Learning will help teachers and students in the classroom. Problem Based Learning will make the learning process more interesting for students, because students can share their ideas about the problem to be teachers give them. Problem Based Learning is a better way for the students and the teacher rather than the conventional ways to increase the representation and problem-solving skills.

Each student is certain to have behaviour and characteristics tend to differ. In the study, the condition is important to note because by identifying the initial conditions of current students will

follow the learning can provide important information for teachers in the selection of management strategy, which deals with how to organize teaching, especially the components of effective teaching strategies and in accordance with the characteristics of individual students so that learning will be more meaningful.

Event analyze the capabilities and characteristics of the students in the development of learning is an approach that accepts students what it is and to draw up a learning system based on the state of the student. Thus, identifying the initial capabilities and characteristics of the students are aiming to determine what should be taught not need to be taught in the learning to be carried out. Therefore, this event is not to determine the pre-requisite in the selection of students before joining the study.

The ability of early math course each student is different, when the initial capability will be the capital of the students to solve problems that would be given in the process of problem-based learning. This is the reason the authors estimate their interaction with the initial ability of student mathematics problem-based learning.

## 2. CONCLUSIONS

Based on these discussion, it can be concluded: (1) The ability of representation has a very important role in the learning of mathematics that need to be owned by each student; and (2) One of the efforts to improve the ability of mathematical representation SSWA requires learning models that support for the upgrading of the mathematical representation, the problem-based learning.

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