

Teachers' Responses on Students' Understanding when Students Resolve Mathematics

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Abstract This article aims to describe the teachers' responses when students' problems are based on students' understanding. Data obtained from observations directly to the subject of research when responding to students who are making strategies to solve problems. The research subject was chosen based on the response given by the teacher so that students were able to make strategies to solve the problem. The results of this study are responses given by the teacher in the form of assistance to students so that students are able to make strategies to solve problems.

Keywords Teachers' Responses, Teachers' Assistance, Mathematical Problem

1. Introduction

In mathematics, problems are usually in the form of mathematical questions. However, not all math problems are mathematical problems. Hudojo[4] have stated that a problem called a problem depends on the knowledge possessed by the question answerer. If the question answerer can answer the problem using a routine procedure, then the question is not a problem. If answering questions requires organizing knowledge that has been routinely owned and answering questions about being challenged to solve it, then the question is a problem. National Council of Teachers of Mathematics[19] have stated that mathematical problems are a problem in mathematics and there are no routine procedures that can be used to solve them.

In learning mathematics, there are several abilities students must possess. One of the abilities students must possess is the ability to solve mathematical problems. National Council of Teachers of Mathematics[19] have stated that the ability to solve mathematical problems is an integral part of mathematics learning. In addition, the

ability to solve problems is one of the important goals in learning mathematics.

To solve mathematical problems, cognition is needed from students. Sternberg[20] have stated that cognition is understood as a mental process, because it reflects thought and cannot be observed directly. However, cognition can be observed directly through the behavior displayed. Therefore, the cognition possessed by students to solve mathematical problems can be displayed through students' skills when making strategies to solve problems.

Lester[18] have stated that research shows that the strategies used by students to solve problems can be used to find out more deeply the understanding of students who make these strategies. With the accuracy of the teachers when paying attention to the strategies students use, the teachers can interpret students' understanding. Jacob, et al[16] have stated that the teacher can interpret students' mathematical understanding based on the strategies students use in solving problems. In fact, the teacher can also decide to respond to the strategies used by students to solve problems based on the students' mathematical understanding.

However, not all students are able to solve mathematical problems. Based on the TIMSS survey results in 2011, the ability of Indonesian students in solving mathematical problems is still weak. Similarly, based on observations made by the author during the odd semester of the academic year 2017/2018, some vocational high school students have not been able to solve mathematical problems. Therefore, actions from the teacher are needed so that students are able to solve mathematical problems. The actions taken by the teacher are the teacher's response to help students solve mathematical problems faced by students. Anghileri[1] have stated that there are 3 levels in providing assistance, namely: (1) environmental provisions, (2) explaining, reviewing and restructuring, (3) developing conceptual thinking.

Therefore, based on the explanation above, the response

given by the teacher to students' understanding will be described when students solve mathematical problems.

2. Materials and Methods

2.1. Teacher's Response

The actions given by the teachers are to stimulate students' thinking so that students are able to make strategies to solve mathematical problems. Everyone who learns mathematics must understand [5] and [6]. Understanding is the ability to capture the meaning of the material being studied. Therefore, Bloom [7] have stated that understanding is needed by students to be able to grasp the meaning of the actions given by the teacher.

Rittle and Siegler [8] have stated that various mathematical concepts can be understood only after people have acquired skills in using procedural concepts which then lead to better understanding. The skills to use this procedure are needed so that people do not meet the obstacles and goals of learning in the classroom on target, especially in learning mathematics [9] and [10].

Several studies show that success in solving mathematical problems is supported by ideas that allow deep understanding [11] and [12]. In solving problems, people need support from strategies that will regulate the interpretation and manipulation of information in analyzing and interpreting to select the right procedures and make the right decisions with the ability to think [13], [14] and [15].

Ball, et al. [2] have stated that response is one of the activities that are often carried out by teachers in learning. Response is given based on a particular event [3] and [17]. Jacob, et al. [16] have stated that teachers can provide responses based on students' mathematical understanding when making strategies to solve problems if the teacher understands students' mathematical understanding when making strategies. However, the teacher can also respond when students do not understand the meaning of the problem. The response given by the teacher aims to provide assistance to students so that students are able to make strategies to solve problems. Anghileri [1] have stated that there are 3 levels in providing assistance, namely: (1) environmental provisions. That is, assistance can be provided by using everything in the class. For example, the teacher asks students to pay attention to examples that are similar to the problems faced in the book, (2) explaining, reviewing and restructuring. That is, assistance can be in the form of explanations, directives reviewing the problems faced, and directives to restructure the problem at hand. For example, the teacher gives a simpler example of the problem at hand. (3) developing conceptual thinking. That is, the assistance provided is in the form of direction to develop conceptual thinking. For example, the teacher gives a more complex example of the problem at hand.

2.2. Research Methods

Data is obtained using observation techniques. Observation is carried out when the subject of the study takes action so that students are able to make strategies in solving problems. The purpose of this observation is to obtain data about the responses given by the research subjects. The response that is observed is the assistance given by the research subject to students so that students make strategies in solving problems. In the process of this observation, the author recorded all the events that were carried out by the research subjects while giving a response. From this data, the author can classify the behavior of the research subjects as seen or not when the research subject provides a response that is adjusted to the indicators arranged. Furthermore, the author explores which behaviors the students included in the responses made by the research subjects.

The subjects in this study were 3 (three) categories of mathematics teachers. The three teachers consist of the first teacher, young teacher, and middle teacher. The first teacher in question is a teacher who has a credit score between 100 and 199. The young teacher in question is a teacher who has a credit number between 200 and 395. The middle teacher is a teacher who has a credit score between 400 and 700. The credit score is obtained from value in terms of teacher learning, teacher-owned education, and ongoing professional development that the teacher has ever participated in.

Subjects are chosen by specifying specific characteristics that are in accordance with the research objectives. The purpose of this research is to describe the response given by the subject based on students' understanding in making a strategy.

The selection of subjects in this study begins with grouping the teacher into the first teacher, young teacher, and teacher. Then all three categories of teachers sought specific characteristics when paying attention to students who were unable to solve mathematical problems. After getting the special characteristics of the three categories of teachers, the specific characteristics are adjusted to the research objectives. The three categories of teachers who have characteristics in accordance with the objectives of the study were selected as subjects in this study. The first teacher was named S1, the young teacher was named S2, and the middle teacher was called S3.

2.3. Teacher's Response to Students' Understanding in Making Strategies to Resolve Problems by Way of Asking Students to Pay Attention to Examples Similar to Problems Faced by Students

The teacher can respond to students who do not understand the meaning of the problem faced by asking students to pay attention to examples that are similar to the problems at hand. For example, when students are unable to create mathematical symbolic problems for the sentence

of many seven male students more than twice as many female students, the teacher gives a similar example that is many male students are more than many female students. Like the response given by S1

S1: Then is the symbolic mathematical form of if there are 7 male students more than twice as many female students?

Student: Confused sir

S1: Suppose that many male students are 7 more than many female students. What are more male students or female students?

Student: Man sir

S1: Suppose there are 10 female students. How many male students?

Student: 20 people

S1: How many more boys than girls?

Student: 7 people

S1: There are 10 female students. What male students?

Student: 20 people

S1: Where from?

Student: Uh ... no 47 people

S1: Many male students are 7 more than many female students. For example, 10 female students. How many male students?

Student: 17 people

S1: Where from?

Student: 10 female students and many 7 male students more than women. Means male students 17 people

2.4. Teacher's Response to Student Understanding by Providing Simpler Examples of Problems Faced by Students

The teacher can respond when students do not understand the meaning of the problem faced by giving a simpler example of the problem at hand. For example, when students are not able to create mathematical symbolic problems for the sentence of many seven male students more than twice as many female students, the teacher gives a simpler example that many male students are equal to seven more female students. Then the teacher expands the question by making a question that is, many male students equal twice as many female students and more 2. After students are able to make symbolic mathematical problems, the teacher applies them to the actual questions

S2: If a lot of male students are supposed to be L and female students are supposed to be P, then $L = 17$ and $P = 10$. Because many L are 7 more than P, then $L = 7 + 10$. This is if many male students are 7 more from female students. For many male students, 7 is more than twice as many female students. How many boys are there?

Student: Means 7 times 2 plus 10. That means there are 24 male students

S2: Read again. Not more than 7 times. But, 7 more than twice as many female students. How many women many times?

Student: Twice

S2: The two times, are there many female students or male students?

Student: Many female students

S2: Means L is equal to how much more than 7. If written $L = \dots + 7$

Student: 2 times P. So, $L = 2P + 7$

S2: That means you can get two forms of symbolic mathematics. What is the first and second?

Student: $L + P = 52$ and $L = 2P + 7$

2.5. Teacher's Response to Student Understanding by Providing More Complex Examples of Problems Faced

Teachers can respond to students to provide a deeper understanding of problems by giving more complex examples. The teacher's response is a teacher's request to solve a more complex problem than the previous problem.

S3: You have obtained the form $L + P = 52$ and $L = 2P + 7$, what is the shape. Try checking again?

Student: Yes sir

S3: Fine, try to create a symbolic mathematical problem from "Many male students are less than 7 times twice as many female students"

3. Conclusions

There are 2 different characteristics when the first teacher gives a response. First, there are 3 (three) responses given, namely: (1) asking students to pay attention to examples that are similar to the problems faced by students, (2) provide simpler examples of problems faced by students, (3) provide more complex examples of problems faced by students. Second, there are 2 (two) responses given, namely: (1) asking students to pay attention to examples that are similar to the problems faced by students, (2) provide simpler examples of problems faced by students, (3) provide more complex examples of problems faced by students.

There are 2 different characteristics when young teachers respond. First, there are 3 (three) responses given, namely: (1) asking students to pay attention to examples that are similar to the problems faced by students, (2) provide simpler examples of problems faced by students, (3) provide more complex examples of problems faced by students. Second, there are 2 (two) responses given, namely: (1) asking students to pay attention to examples that are similar to the problems faced by students, (2) provide simpler examples of problems faced by students, (3) provide more complex examples of problems faced by students.

There are 2 different characteristics when the middle teacher gives a response. First, there are 3 (three) responses given, namely: (1) asking students to pay attention to

examples that are similar to the problems faced by students, (2) provide simpler examples of problems faced by students, (3) provide more complex examples of problems faced by students. Second, there are 2 (two) responses given, namely: (1) asking students to pay attention to examples that are similar to the problems faced by students, (2) provide simpler examples of problems faced by students, (3) provide more complex examples of problems faced by students.

From the response given by the three categories of teachers, it can be seen that the teacher gives a response with the aim of providing assistance to students so that they are able to make strategies correctly. There are 3 levels in providing assistance, namely: (1) environmental provisions. That is, assistance can be provided by using everything in the class. The teacher asks students to pay attention to examples that are similar to the problems faced in the book, (2) explaining, reviewing and restructuring. That is, assistance can be in the form of explanations, directives reviewing the problems faced, and directives to restructure the problem at hand. The teacher gives a simpler example of the problem at hand. (3) developing conceptual thinking. That is, the assistance provided is in the form of direction to develop conceptual thinking. The teacher gives a more complex example of the problem at hand.

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