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THINKING PROCESS OF SITUATION MODELING IN REAL LIFE MATHEMATICAL PROBLEM SOLVING

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ABSTRACT

The purpose of this study was to determine the description of the thinking process in situation modeling in solving real-life mathematical problems. This type of research is qualitative with a case study design. The subjects of the study were fifth grade students of SD No. 1 Bhaktiseraga. Data on students' abilities in situation modeling in solving real-life mathematical problems were collected by essay tests and interviews. Furthermore, the data were analyzed using descriptive statistics. The results showed that the average overall student score of the three problems was 75.57 and this was categorized as good. In general, students' situation modeling abilities for problem number 1 were very good, problem number 2 was categorized as good, and problem number 3 was categorized as sufficient. Students' abilities in situation modeling for problem number 1 were very good at 55.74%, and good at 44.26%. Students' abilities in situation modeling for problem number 2 were very good at 42.62%, and good at 57.38%. For problem number 3, the students' situation modeling ability is very good at 11.48%, good at 47.54%, sufficient at 3.28%, not good at 4.92%, and very bad at 32.78%. There are several situation modeling strategies used by students as a form of their thinking process. In problem 1, the strategy used is division. In problem 2, students use the addition strategy as a result of their thinking process, while in problem 3, students use the addition strategy, but many students are still unable to determine the situation modeling.

Keywords: thinking process, situation modeling, real-life mathematical, problem solving

1. INTRODUCTION

Real-life math problems are problems that use real-life contexts. Real-world knowledge of the context of the problem or the problem situation involved is essential to see aspects of the problem including in mathematical modeling, interpreting the results into the original problem. Real-life problem solving by students not only provides students with the opportunity to carry out language processes, mathematical processes, and reasoning on situations, but also provides students with the opportunity to think critically by linking their problems or answers to real situations or conditions in everyday life. The results of Suharta's research (2016) show that in solving real-life mathematical problems there is a tendency for students to ignore appropriate real-life considerations. Many students understand and answer real-life mathematical problems without considering the factual relationship between real-world situations and mathematical operations.

Suharta and Parwati (2020) found that students' ability to provide real answers with realistic reasons is relatively lacking. In terms of gender, male students are better than female students in providing realistic reasons. In these studies, students' ability to solve real-life problems is only based on the

procedures and results shown by students. These results have weaknesses because they do not describe students' abilities according to the stages in solving real-life problems. According to Gilbert Greefrath and Katrin Vorhölter (2016), the steps in solving real-life problems consist of: constructing a situation model, compiling a mathematical model, solving the problem. and interpretation of results in the form of real situations. The results of Suharta and Puja Astawa's research (2023) are that students' ability to create situation models is classified as very bad. Students' errors in creating situation models, amounting to 60.61%, are classified as sufficient.

The errors made by students in problem solving tend to be in creating situation models. Students' errors in situation modeling cause students to make mistakes in the mathematical modeling stage, and errors in mathematical modeling cause errors in problem solving. A problem is a problem (non-routine problem) if the solution procedure is not yet known, and there is an interest in solving it (Megan Che, Elaine Wiegert, Karen Threlkeld, 2012; Vesife Hatisaru, Carol Murphy,2019). Real-life mathematical problems are mathematical problems in the form of stories with a real-life context, and in solving them require arguments or considerations according to real-life.

According to Gilbert Greefrath and Katrin Vorhölter (2016) the steps in solving story problems consist of: understanding the problem situation, situation modeling, mathematical modeling, problem solving, and interpreting and evaluating the results in the form of practical situations. Therefore, real-life considerations are very important in solving real-life mathematical problems, namely in making models of problem situations and mathematical modeling and in interpreting the results that have been obtained.

2. RESEARCH METHOD

The type of research used is qualitative with a case study design. The subjects of the research are fifth grade students of Elementary School No. 1 Bhaktiserga Singaraja. The number of research subjects is 63 people, but when the test was conducted there were 2 students absent, so the number of effective research subjects was 61 people. The data collection technique used tests and interviews. The mathematical test deals with the concept of arithmetic operations, namely division with remainder, addition, and multiplication. An example of a problem is as follows.

> *Agus, a fifth-grade elementary school student, whose house was flooded. His 25 friends felt sorry for Agus. All of Agus' friends donated to Agus. How much donation did Agus receive?*

To answer this question, 3 questions were asked:

a) What do the children think in order to determine the amount of donation received by Agus?
b) How do you determine the amount of donation received by Agus?
c) Are the children sure about the answers above?

Each question is given a maximum score of 100, with question point a given a maximum score of 40, and question point b given a maximum score of 60, while question point c is not scored.

For each question, students are asked to provide answers related to the formulation of the situation model.

Next, 6 students (3 males and 3 females) were selected as respondents to be interviewed. The subjects selected were students who showed good answers, to verify and elaborate on the students' thinking process.

Furthermore, the data was analyzed using descriptive statistics. Students' situation modeling abilities were classified into very good, good, sufficient, not good, very bad, with conversion guidelines using absolute norms as follows.

If $X \geq 85\%$ then very good

If $70\% \leq X < 85\%$ then good

If $55\% \leq X < 70\%$ then sufficient

If $42\% \leq X < 55\%$ then not good

If $X < 42\%$ then very bad

The research procedure is as follows.

1. All fifth-grade students are given a real-life mathematics test in the form of a description related to arithmetic operations. The mathematics test consists of 3 questions.
2. For each question, students are asked to provide answers related to situation modeling,
3. Analyze students' answers in terms of their ability to formulate situation models.
4. Classify the situation modeling abilities carried out by students.
5. Select 6 students (3 males and 3 females) whose situation modeling is good to be interviewed in an effort to describe the thinking process carried out by students.
6. Conduct interviews with selected subjects.

3. RESEARCH RESULTS AND DISCUSSION

Research Results

As described in the previous chapter, data were collected by tests and interviews. The test was conducted on August 23, 2024. Using the conversion guidelines as described above, the following are the results of data analysis related to students' situation modeling abilities.

Table 01. Situation Modeling Ability

Problem	average	Catagory	Situation Modeling Ability (%)				
			SB	B	C	TB	STB
1	85.57	very good	55.74	44.26	0.00	0.00	0.00
2	84.26	Good	42.62	57.38	0.00	0.00	0.00
3	56.89	Sufficient	11.48	47.54	3.28	4.92	32.78

The average overall student score of the three problems is 75.57 and this is categorized as good. In general, students' situation modeling ability for problem number 1 is very good, problem number 2 is categorized as good, and problem number 3 is categorized as sufficient. In detail, students' abilities in situation modeling are as follows. For problem number 1, there are 55.74% of students who have very good situation modeling abilities, and there are 44.26% who have good ones. The strategy used in determining the modeling of problem situations as a form of the results of the thinking process is division. Students divide 130 by 40, the result is 3 and the remainder is 10, so 4 cages are needed.

This is supported by the interview results:

Subject S1

R: Good... try to tell me what is meant by question number one

S1: a farmer has one hundred and thirty ducks that are put into a cage that can accommodate forty ducks
R: determine the number of cages needed....what is good to think about...
S1: division...
R: division...division...
S1: one hundred and thirty divided by forty...
R: what is the result?
S1: three cages contain forty ducks and one cage contains ten ducks
R: good....sure the result...
S1: sure..sure

Note: R = researcher, S1 = subjek 1

Subject S2

R: Dwik caba explain the meaning of question number one
S2: the meaning of the question is like this...
R: what is the meaning of the question...
S2: a farmer has ducks...(while pointing to the question)
R: don't read it...in your own words
S2: a farmer has 130 ducks
R: e..e..e...
S2: Each cage can accommodate 40 ducks....so how many cages are needed so that all the ducks can enter the cage
R: e..e..e...
S2: so I need four cages..
R: why
S2: because three cages contain....eh..eh....because one hundred and thirty divided by forty still has a remainder..
R: so by dividing
S2: yes..so I answered three cages contain forty ducks and one cage contains ten ducks..
R: by dividing yes..
S2: yes,,

Note: R = researcher, S2 = subjek 2

Based on the interview transcript, students understand the context of the problem very well and students determine the situation modeling by using the division thinking process. For problem number 2, there are 42.62% of students who have very good situation modeling skills, and there are 57.38% with good skills. The strategy used by students as a result of the thinking process is by adding. All students use the addition strategy.

This is supported by the following interview results.

Subject S3
R: What does question number two mean?
S3: The distance from Edo's house to the school is two thousand five hundred meters and the distance from Siti's house to the school is four thousand seven hundred and forty meters... so I just add them up
R: just add them up.
S3: between Edo's house and the distance from Siti's house to the school. I add them up..so I get seven thousand two hundred and forty meters
R: yes..good

Note: R = researcher, S3 = subjek 3

Subject S6

R: what is the meaning of the question
S6: the distance between Edo's house and the school is two thousand five hundred and the distance between Siti's house and the school is four thousand seven hundred and forty
R: how to determine the distance between Edo's and Siti's houses
S6: by adding.... the distance between Edo's and Siti's houses is seven thousand two hundred and forty.

Note: R = researcher, S6 = subjek 6

For question number 3, the students' situation modeling abilities were respectively 11.48% very good, 47.54% good, 3.28% sufficient, 4.92% not good, and 32.78% very bad. Students who have very good and good abilities use the addition strategy. However, students misunderstand the problem, students add up the value of money in the problem picture. After being directed, students can understand that the amount of donation given to Agus is free, so the money received by Agus depends on the donation assumption of each student. However, 21.31% of students did not answer this question because they did not understand the meaning of the question.

Subject S4

R: What is the meaning of number three?
S4: Agus' house was flooded...Agus' friends donated...twenty-five people donated to Agus voluntarily. This is also money (pointing to the picture) given by Agus' friends..so I just added it up..
R. oh I see..if now Agus' friends give ten thousand rupiah,,all the same...there are twenty-five people each giving ten thousand...how much money does Agus receive...
S4: e..e..e
R: each giving ten thousand..Agus' friends are twenty-five people..how much money does Agus receive..
S4: e..e..e
R. if each giving a thousand rupiah...there are twenty-five people...how much money does Agus receive..
S4: twenty-five..
R: if all Agus' friends give ten thousand..how much money does Agus receive...
S4: one hundred twenty-five..
R: one hundred twenty-five..how do you calculate it to get one hundred twenty-five
S4: add it up..
R: there are twenty-five people...each giving ten thousand....
S4: .e..e....
R: nothing.. nothing..
Note: R = researcher, S4 = subjek 4

Discussion

Based on the results of the study above, in general the students' ability in modeling situations is classified as good. In other words, students can well model problem situations through their thinking process. There are several situation modeling strategies used by students as a form of their thinking process.

In the first question, the strategy used is division. Students have a good understanding of the real situation of the problem, that 130 ducks will be put into a cage, where each cage can accommodate a maximum of 40 ducks. Students create a situation modeling by dividing, namely 130:40. This is the concept of division with remainder. Students can determine the result of the division is 3 and the remainder is 10 ducks. So 1 more cage is needed. The process of thinking about modeling situations used by students begins with understanding the problem well, what is known, and what is asked. This strategy is a strategy for identifying things that are known, asked and needed (Reys, R. E,at all ,2020).

No students have used other strategies, such as repeated subtraction or repeated addition. Conceptually, it can actually be done by repeated addition, namely 130 = 40 + 40 + 40 + 10, so 4 cages are needed. None of the students used the repeated subtraction strategy as their thinking process, such as, 130 - 40 - 40 - 40 - 10 = 0. In the second problem, students used the addition strategy as a result of their thinking process. Students have a good understanding of the real situation of the problem. This can be seen from examples of student work or interview transcripts. In the minds of students, Edo's house, school, and Siti's house are in a straight line. So the distance from Edo's house to Siti can be determined by adding or adding the distance from Edo's house to the school and the distance from Siti's house to the school. The students' thinking process about modeling the situation is not entirely correct, because the school is imagined as a point, even though in reality the length of the school can be determined. Therefore, the distance from Edo's house to Siti is the distance from Edo's house to the school + the length of the school + the distance from Siti's house to the school.

In the third problem, students use the addition strategy, but many students are still unable to determine the situation modeling. In addition, none of them use the multiplication strategy as a result of their thinking process. Students misunderstand the problem. The picture of money in the problem is thought to be a donation received by Agus, so students add up the values of the money in the picture. Based on the results of the interview, after students were directed to the meaning of the problem, students still could not calculate the amount of donations received by Agus. Thus, the main problem faced by students is determining the real situation of the problem.

4. CONCLUSION AND SUGGESTIONS

Based on the results of the discussion above, the average overall student score for the three problems is 75.57 and this is categorized as good. In general, students' situation modeling abilities for problem number 1 are very good, problem number 2 is categorized as good, and problem number 3 is categorized as sufficient.

For problem number 1, there are 55.74% of students who have very good situation modeling abilities, and there are 44.26% with good. For problem number 2, there are 42.62% of students who have very good situation modeling abilities, and there are 57.38% with good. For problem number 3, students' situation modeling abilities are respectively 11.48% very good, 47.54% good, 3.28% sufficient, 4.92% not good, and 32.78% very bad. There are several situation modeling strategies used by students as a form of their thinking process. In the first problem, the strategy used is division. In the second problem, students use the addition strategy as a result, meanwhile, the third problem is that students use addition strategies, but many students are still unable to determine the situation modeling.

In accordance with the conclusions above, it is recommended that teachers provide more real-life mathematical problems, how to determine real situations, model situations, create mathematical models, solve and interpret initial real problems.

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