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Analysis of Elementary School Students' Problem-Solving Abilities in Solving HOTS Questions

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ABSTRACT

This study aims to describe the problem-solving skills of fifth-grade elementary school students in solving HOTS-type mathematics problems. This study applies Polya's problem-solving steps. Type of this research is descriptive quantitative. The subjects of this study were 26 students in the odd semester of 2022/2023 the academic year 2022/2023 academic year at SDN 61 Bengkulu City. Instruments and data collection techniques used in this study were test sheets and interviews. Data analysis was carried out in descriptive analytical way. The results showed that 75% of fifth-grade students at SDN 61 Bengkulu city had the ability to understand problems, 63% had the ability to plan a settlement, 45% had the ability to solve problems according to plans that had been made, and 45% had the ability to look back at the answers. Only 45% of students have problem-solving skills.

Keywords: geogebra, group investigation, learning outcomes, quasi experiment

INTRODUCTION

One of the subjects that must be studied from elementary school to college is mathematics. Both science and everyday life require a strong understanding of mathematics [1]. Its significance in everyday life, such as in market buying and selling, doctor-prescribed medications, and other situations. Additionally, mathematical concepts related to probability are directly related to real-world situations.

Mathematics learning activities themselves, according to Siagian, are a very important component in learning mathematics [2], [3]. Of course, teachers will always ask questions after explaining the content to the class when they are studying mathematics. In order for students to be able to answer these difficulties, the teacher must still provide hints when asking questions, no matter how difficult they are

Darma believes that because problem solving is a very important skill in everyday life, teachers must include it in mathematics lessons. Students will gain a new understanding of mathematics subjects in particular and other fields of study broadly through problem solving [4]. One of the activities that form Higher Order Thinking Skills (HOTS) is the ability to answer mathematical problems. According to Hadi & Radiyatul; Wahyuda et al., problem solving skills, part of the mathematics curriculum, emphasize procedures and solutions for students to use rather than results [5], [6]. Being able to solve problems is a fundamental skill when learning mathematics. Therefore, every student must be able to solve problems, especially in answering HOTS questions. There are four ways to measure problem-solving ability: by recognizing the problem, formulating a plan, implementing it, and reassessing. These indicators will correspond to the level of difficulty of the HOTS questions.

Students must be able to understand mathematical concepts, explain their relationship to each other, and use concepts or methods flexibly, accurately, efficiently

and precisely when solving problems [7]. Learning mathematics will give students new perspectives and information, as well as very useful abilities [8]. Therefore, to teach children to express their thoughts naturally, it is important to develop the character that already exists within them. Teacher teaching must also encourage the development of students who have the ability to think logically, critically and creatively. Meanwhile, mathematics still has a rather minimal impact on higher order thinking skills. This assertion is in line with the statement of Suryapuspitarini et al. (2018), which states that students still struggle to master lesson material and struggle to answer questions that require reasoning [9]. This is because students often only memorize or retain formulas that have been used so that without realizing it they do not understand the concept. So when given various questions with the same mathematical concept, students are still confused about solving them and find it difficult.

Higher Order Thinking Skills, or HOTS, refers to higher order thinking abilities. Starting from C1 (Remembering), C2 (Understanding), C3 (Calculating), C4 (Analyzing), C5 (Evaluating), and C6 (Creating), Higher Order Thinking Skills are levels of thinking. Located at levels C4 (Analyzing), C5 (Evaluating), and C6 (Creating) in the HOTS cognitive domain. In addition, HOTS questions can be seen as stimulating students' critical and creative thinking, which is necessary for learning rather than just memorizing and memorizing [10]. Each student's knowledge and skills are evaluated using questions. Thus, it can be concluded that the ability to solve problems through analysis, evaluation and creation is what is called high-level thinking ability (HOTS).

In order to improve mathematics learning and problem solving abilities, HOTS questions are very important. However, with a high cognitive level which is an indicator of HOTS, it does not rule out the possibility that students will experience difficulty in solving HOTS type questions. According to research by Astuti & Adirakasiwi (2019), the majority of junior high school students' difficulties with HOTS questions can be attributed to indicators C5 and C6, which refer to challenges with conceptual learning, application of principles, and verbal problem solving [11].

According to other research, children still do not have the necessary problem solving skills as evidenced by their inability to solve HOTS questions. Research by Pradani & Nafi'an (2019) shows that from the re-examining stage, indicators in HOTS do not appear at this stage, only evaluating indicators are possessed by all high-ability students, while analyzing and creating only some of them appear for students [12]. The same thing was experienced by students at SD Negeri 61 Bengkulu City, where the children also had difficulty answering HOTS questions. This research was conducted to review students' abilities in facing challenges based on HOTS type questions.

Based on the results of an interview with one of the mathematics teachers at SD Negeri 61 Bengkulu City, information was identified that there were many obstacles for students in solving HOTS questions. This is because students do not master the concept, where students still use formulas incorrectly and determine formulas incorrectly. Then students do not master the prerequisite knowledge. Where prerequisite knowledge is the knowledge needed to learn new teaching material. This research aims to analyze students' problem solving abilities in solving Higher Order Thinking Skills questions in class V students at SD Negeri 61 Bengkulu City.

MATERIALS & METHODS

This research tries to test students' problem solving abilities when responding to problems that require Higher Order Thinking skills (HOTS). This type of research is quantitative descriptive research. Research location: SD Negeri 61 in Bengkulu City, Indonesia. The research

participants were 5th grade students at SD Negeri 61 Bengkulu City. Students' ability to solve problems when answering questions that require high-level thinking skills is research data. Semi-structured interviews and test methods are the methods used to obtain data.

This research instrument takes the form of a test and interview guide. The test is in the form of essay questions. Interview guidelines are used to deepen test results. The material in this research is the Building Volume of Space. Data analysis was carried out descriptively analytically, with the following criteria:

Table 1. Problem Solving Scoring Guide According to Polya

Aspects assessed	Score	Description
Understand the problem	0	Misinterpreted / completely wrong. (Does not mention/write what is known and what is asked about the question)
	1	Misinterpreting part of the question, ignoring the condition of the question. (State/write what is known and what is asked about the question incorrectly)
	2	Understand the complete problem. (State/write what is known and what is asked about the question correctly)
Create a problem solving plan Create a problem solving plan	0	No plan, making irrelevant plans (Does not present a sequence of completion steps at all)
	1	Making a solution plan that cannot be implemented, so that the plan cannot possibly be implemented. (Presents a sequence of completion steps that are impossible to do)
	2	Make plans according to procedures and lead to the correct solution (Presents the correct sequence of steps for solving but leads to the correct answer)
Carrying out plans/calculations	0	Not carrying out calculations
	1	Carry out the correct procedure and may produce the correct answer but the calculation is wrong
	2	Do the right process and get the right results
Looking Back	0	No inspection or no other information
	1	There was an inspection but it was not complete
	2	Inspections are carried out to see the correctness of the process

RESULT

The research results showed that as many as 75% of students were able to understand mathematical problems correctly. Then 63% were able to make a problem solving plan correctly. And as many as 45% of students were able to carry out the solution plan and check the answers again. Overall, only 45% of the top fifth grade students at SDN 61 Bengkulu City have the ability to solve mathematical problems. Meanwhile, the other 55% have not been able to solve math problems correctly. Based on the answers of students whether they were able to solve math problems correctly or not, the percentage of their mathematical problem solving abilities can be shown in Table 2.

Table 2. Percentage of Number of Students Regarding Their Problem Solving Abilities

Problem Solving Abilites	Percentage
Students are able to understand mathematical problems	75%
Students are able to develop problem solving plans	63%
Students are able to solve problems according to plan	45%
Students can check their answers again	45%

DISCUSSION

Most students already have the ability to understand mathematical problems by writing down what is known and what is asked about the problem correctly, but not all of them are able to use this to find the right solution idea. An example is student AZ's answer to question number 1 as seen in Figure 1.

Question number 1: "Find the volume of a cuboid whose total length of all edges is 128 cm, but the ratio of the edge lengths is p : l : t = 9 : 4 : 3."

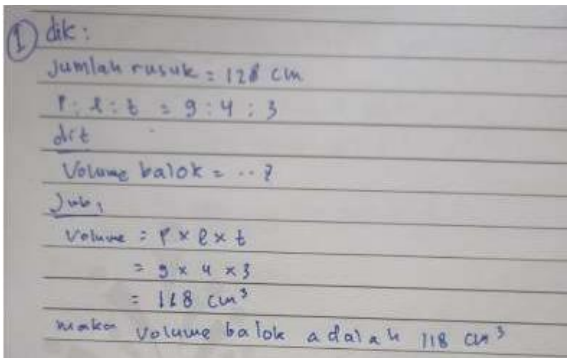

Figure 1. AZ's answer to Question No.1

AZ has been able to correctly write down the important information contained in the question, such as AZ writing down the length of the edges, the ratio of the edges, and what is being asked is the volume of the

cuboid. However, judging from his answer, AZ failed to plan well so he wrote the wrong answer. AZ does not plan to find the actual edge length of the cuboid from the comparison information provided. This is what causes students like AZ to fail to solve math problems.

This is supported based on the results of interviews with AZ students, which are as follows:

Researcher : Try to explain your answer to question number 1!

AZ : OK sir, in the question it is known that the length of the cuboid is 9 cm, the width of the cuboid is 4 cm and the height of the cuboid is 3 cm, and the total length of the edges is 128 cm. And what is asked is the volume of the cuboid. Cuboid Volume = p x w x t = 9 x 4 x 3 = 118.

Researcher : Try checking the length, width and height of the cuboid again. What is the formula for the total edge length of a cuboid?

AZ : Total = 4(p+l+t) =4(9+4+3) =64

Researcher : Take a look, the total should be 128 cm. So, in question number 1 what is known is comparison p: l: t. You should first look for length, width and height cuboid. Then find the volume of the cuboid.

Based on the results of the tests and interviews, students considered the length of the cuboid to be 9 cm, the width of the cuboid to be 4 cm and the height of the cuboid to be 3 cm. Meanwhile, in question number 1, what is known is the ratio p: l: t. Students should first find the length, width and height of the cuboid. Then find the volume of the cuboid. This shows that students have not been able to make appropriate problem-solving plans.

Another phenomenon was revealed from the research results. It turns out that students who are able to plan to solve mathematical problems well do not succeed in solving problems well. Like HY's answer to question number 2 shown in Figure 2.

Question no 2: "Calculate the volume of a cube whose total edge length is 72 cm."

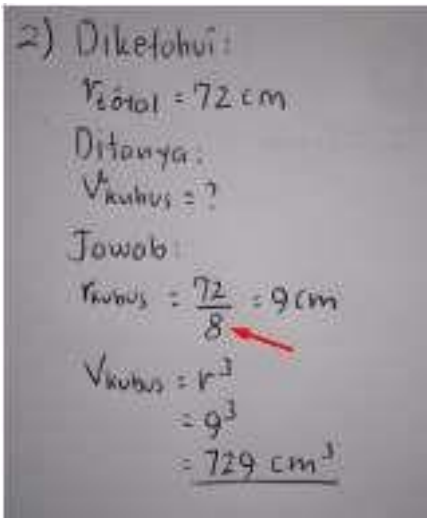

Figure 2. HY's answer to Question No.2

HY was able to write correctly the important information contained in the question, such as HY writing down the number of edge lengths, and what was asked was the volume of the cube. HY was also able to plan well to solve the problem in question number 2. As can be seen in Figure 2, HY had planned correctly to find the length of the edge of the cube before determining the volume of the cube. However, there was a conceptual error made by HY. HY remembers that the number of edges of the cube is 8, not 12, where 8 is the number of sides of the cube. This is what caused HY to fail to solve the problem, even though the problem plan was correct. This is supported based on interviews with HY students, as follows:

Researcher : How many edges are on the cube?

HY : 8 sir.

Researcher : Look at this picture of a cube (Researcher shows a picture of a cube). How many the edges?

HY : (HY looks at the picture of the cube, and counts the edges of the cube) 12 packs.

Researcher : Yes, that's right, there should be 12 edges in a cube, not 8.

Based on the results of tests and interviews, it shows that students have not been able to carry out the completion plan well due to conceptual errors.

Another interesting thing was obtained from the mathematics problem solving test of outstanding fifth grade students at SDN 61 Bengkulu City. In Table 2, it is known that class V students at SDN 61 Bengkulu City who were able to solve the questions according to plan were also able to double-check the answers correctly. One example of a student's answer, namely ST, who was able to solve the mathematics problem given in question number 3 is shown in Figure 3.

Question number 3: "Nawas has a large cube-shaped basket with sides 15 cm long. The basket will be filled with 24 chocolate cubes with sides 5 cm long. Will the basket fit more than 24 pieces of chocolate? Explain!"

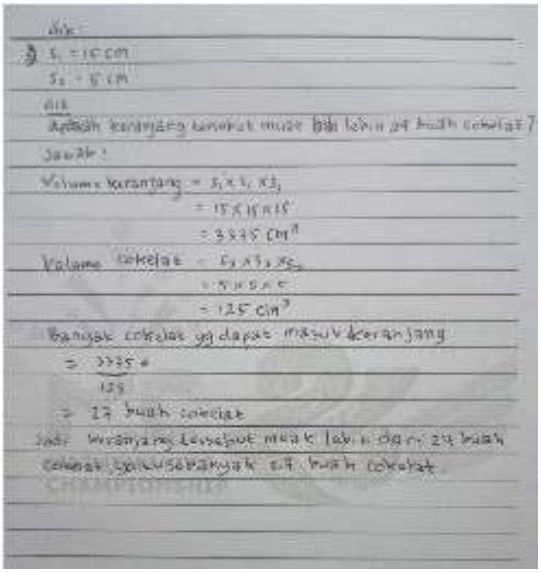

Figure 3. ST Answers to Question No.3

ST wrote the important information contained in the questions correctly, was able to plan and solve questions well in question number 3, and was able to double-check the final answer he wrote. If students can carry out the four Polya steps well, then the student can be said to have the ability to solve mathematical problems.

Based on the results of tests and interviews that have been conducted, it was found that overall only 45% of the top fifth grade students at SDN 61 Bengkulu City had the ability to solve mathematical problems. Meanwhile, the other 55% have not been able to solve math problems correctly. This shows that problem solving abilities are still low in solving HOTS questions. This is in line with the research results of Irmawati et al. (2021) which states that students' problem solving abilities in solving HOTS questions are still low [13].

CONCLUSION

The results of the research show that 75% of class V students at SDN 61 Kota Bengkulu have the ability to understand problems, 63% have the ability to plan solutions, 45% have the ability to solve problems according to the plans that have been made, and 45% have the ability to review answers. Only 45% of students have problem solving skills.

Declaration by Authors

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