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Students' Mathematical Problem-Solving Ability in Bengkulu Tabot Context Based on Polya Steps

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Abstract: This study aims to analyze the ability to solve mathematical problems in the context of Tabot in Bengkulu state junior high school based on Polya's steps. This type of research is descriptive research with a qualitative approach. Methods of data collection in the form of a test about the ability to solve mathematical problems in the context of Tabot, interviews, and competencies. The results of this study found that the average of all mathematical problem-solving abilities of state junior high school students was 46.54% with sufficient criteria. The average student in the ability to understand the problem is 54.08% with sufficient comparison, the average in the ability to compose problems is 50.45% with sufficient withdrawal, the average problem solving is 43.53% with sufficient comparison, and the average at the conclusion is 34.15% with low criteria. It is suggested to teachers practice solving problem-solving questions.

Keywords: analysis, Bengkulu Contexts, problem-solving, Tabot.

1. Introduction

According to the 2018 PISA survey results in the Organization for Economic Cooperation and Development (OECD) library, Indonesia is ranked 7th out of 73 countries with an average score of 379 in the mathematics category (Hermaini & Nurdin, 2020). Meanwhile, the results of the TIMSS international survey In 2015, Indonesia was ranked 49th out of 53 TIMSS participating countries. Based on the 2015 TIMSS survey, the present mathematical abilities of students in Indonesia are still below international standards.

In previous research that discussed students' ability to solve mathematical problems, it was shown that problem-solving skills were in a low category. This was seen in Susanta et.al, (2021) research on TIMSS questions, level of reasoning, students' and ability at the low criterion was 58.33%. medium 33.33% and high only 8.33%. In addition, there is also research on solving math problems at the SMP/MTs level whose results show that the level of problem-solving is still relatively low with a percentage of 53% (Bernard et al., 2018). Based on several studies, it can be obtained that students' problem-solving abilities are in a low category.

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The low ability to solve students' math problems at the junior high school level is because students do not or do not understand enough about the data in the questions, students are less or unable to make math problems, and are not careful in solving them (Utami & Wutsqa, 2017). The main reason is that there are differences between academic and informal knowledge of mathematics. The discrepancy between the mathematical problems found in schools and the mathematics found in everyday life makes it difficult for students to connect formal mathematical concepts with problems in the real world (Andriyani & Kuntarto, 2017). Research by Benard et.al (2018), students' ability to solve math problems based on Polya steps is lacking with an achievement proportion of 53%.

To improve students' problem-solving skills, teachers can develop students' mathematical literacy through contextual problems such as cultural, historical, or problems related to the student's environment. Mathematics learning activities aim to improve abilities in logical thinking, problem-solving skills, and abstract thinking abilities (Susanta, et.al, 2020). Problems related to culture certainly surround the process of learning mathematics, even all forms of mathematics (Fuadi, et.al, 2020). Based on these problems, in developing mathematical literacy problems, it is important to use the cultural context in the problem, or the social environment that surrounds students. In this study, mathematical literacy questions were developed using the Bengkulu context, namely Tabot which is the culture of the Bengkulu people.

Tabot is a Bengkulu custom that is held every year so that students are familiar with the problem of tabot. Solving problems related to tablets will be easier for students, for example, students visualizing the arrangement of tabot in calculating the volume of a block, or building other spaces. Through contextual questions that are close to students, it is hoped that students can make it easier to solve the problems given. When improving problem-solving skills, in addition to the need to think creatively, students must also learn the stages of solving them. The stages that can be used to guide students in finding solutions to problems are the stages in the Polya steps.

2. Method

This type of research is descriptive research with a qualitative approach. This research was carried out at state junior school 17 Bengkulu in May of the even semester of the 2021/2022 academic year. The subjects of this study were class VIII students of state junior school 17 Bengkulu in the even semester of the 2021/2022 academic year. For this analytical research sample, two classes were taken randomly, namely 27 students of class VIII D as a test and 28 students of class VIII A as a problem-solving test. The object of this student's research is the answer sheet from the analysis of the ability to solve mathematical problems in the context of tabot based on Polya steps that have been developed by researchers and validated by experts, namely mathematics lecturers and mathematics teachers. The questions analyzed in the answer sheet consist of 4 problem-solving questions.

Collecting data in this study using test methods, analytical methods, and interview methods. The instrument used in this study is a test instrument. The instrument used was a collection of descriptive questions used to measure students' ability to solve mathematical problems. The test instrument has been validated by the validator who is a lecturer in Mathematics Education at Bengkulu University and a Mathematics teacher at SMP Negeri 17 Bengkulu City and then tested before being used during research. The trial test was carried out to determine the validity and reliability of the questions. The trial of the test instrument in this study was to give pre-tests to students of class VIII D who had been selected. Testing of the test instrument was carried out to find out which number of questions can be used after being tested for validity and reliability.

3. Result and Discussion

This research was conducted to determine the level of students' abilities to solve mathematical problems based on the Polya solving steps. The indicators discussed in this study were students' ability to understand problems, students' ability to plan problem-solving, students' ability to solve problems, and students' ability to reassess answers and draw conclusions. Assessment of the ability to math problems in terms of learning materials, basic competencies, and learning indicators. The following is the result of the value of the mathematical problem-solving abilities of students of State junior high school 17 Bengkulu.

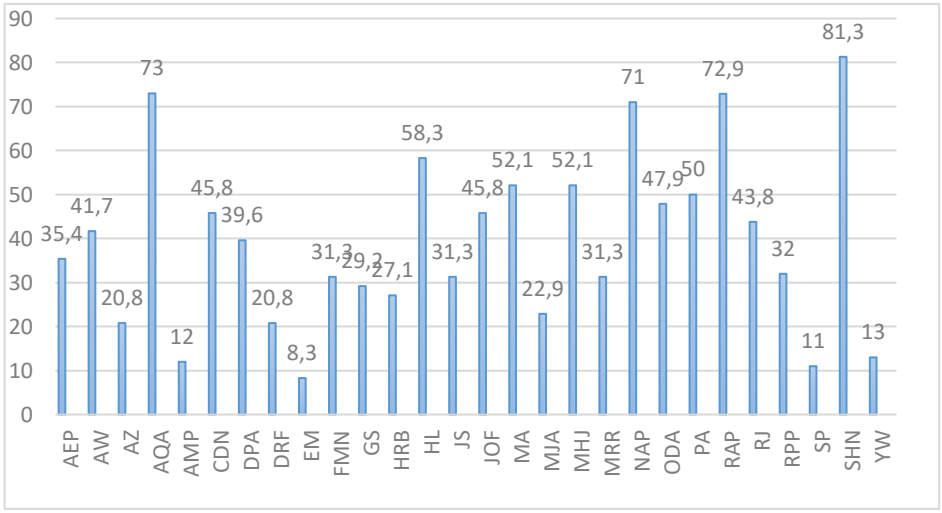

Fig. 1 – Assess students' mathematical problem-solving ability

Based on Figure 1, it can be seen that the maximum score of 28 class VIII A students of State junior high school 17 Bengkulu after working on 4 questions on mathematical problem-solving ability was 81.3 while the minimum score was 8.3. So, it can be concluded that the ability to solve math problems based on Polya solving steps in class VIII A students of State junior high school 17 Bengkulu is uneven because the class of research subjects is a heterogeneous class. Furthermore, the results of the analysis of students' problem-solving abilities by category can be summarized as follows.

Table 1 – Student Problem Solving Ability Level

Criteria	Interval	Students	Percentage
Very low	$0\% \leq P \leq 20\%$	2	7,14 %
Low	$20\% < P \leq 40\%$	13	46,43 %
Middle	$40\% < P \leq 60\%$	10	35,71 %
Hight	$60\% < P \leq 80\%$	2	7,14 %
Very hight	$80\% < P \leq 100\%$	1	3,57 %

Based on Table 1, we can see that the results of the mathematical problem-solving abilities of State junior high school 17 Bengkulu students who have worked on question four, Low withdrawals are at the highest percentage, namely 46.43%, of which 13 students out of 28 students are in a low category, Analysis was also carried out on the stages of each Polya, namely: (1) understanding the problem, (2) planning a solution, (3) solving the problem, and (4) reviewing it. The results of the score recap for each step are summarized in the following table.

Table 2- Step Score Recapitulation Based on Polya

Student Ability Level		Polya Steps			
		PM1	PM2	PM3	PM4
Very low	N	4	2	1	12
	%	14,28	7,14	3,57	42,85
Low	N	8	8	17	13
	%	28,57	28,57	60,71	46,42
Middle	N	11	9	9	2
	%	39,28	32,14	32,14	7,14
Hight	N	1	4	1	1
	%	3,57	14,28	3,57	3,57
Very hight	N	4	5	0	0
	%	14,28	17,85	0	0

Information:
PM1 : Understanding the problem
PM2 : Planning a solution
PM3 : Solve the problem
PM4 : Review

Based on table 2 shows that the percentage of students in a level of problem-solving abilities at the stage of understanding student problems with moderate criteria has the highest percentage, namely 39.28%. This can be interpreted that the average student is still unable to understand the problem, such as students' understanding of the information known from the problem. Furthermore, the ability to plan settlements with moderate criteria has the highest percentage, namely 32.14%. This can be interpreted that the average student is not yet capable enough of making a settlement plan, students have not been able to mention what is the main problem in the problem.

The ability to solve students' problems with low criteria has the highest proportion, namely 60.71%. This can be interpreted that the average student is not capable enough to solve the problems presented. students pay less attention to the correct completion steps and are less careful in carrying out arithmetic operations, so they do not find the right final answer.

At the stage of re-examining and making conclusions with low criteria, the highest percentage is 46.42%. This can be interpreted that students are still low and have not been able to carry out the re-examination stage and have not been able to make conclusions. Students still need more tutors to achieve this ability.

This shows that overall the students' mastery of the material in Flat Sided Room Buildings at SMP Negeri 17 Bengkulu City meets the low criteria. High and very high criteria, students are still very few. So, it is necessary to increase the ability to solve problems in class VIII students of SMP Negeri 17 Bengkulu City. Student results in the level of problem-solving based on the Polya Step, namely: (1) understanding the problem, (2) planning a solution, (3) solving the problem, and (4) looking back can be seen in the following graph.

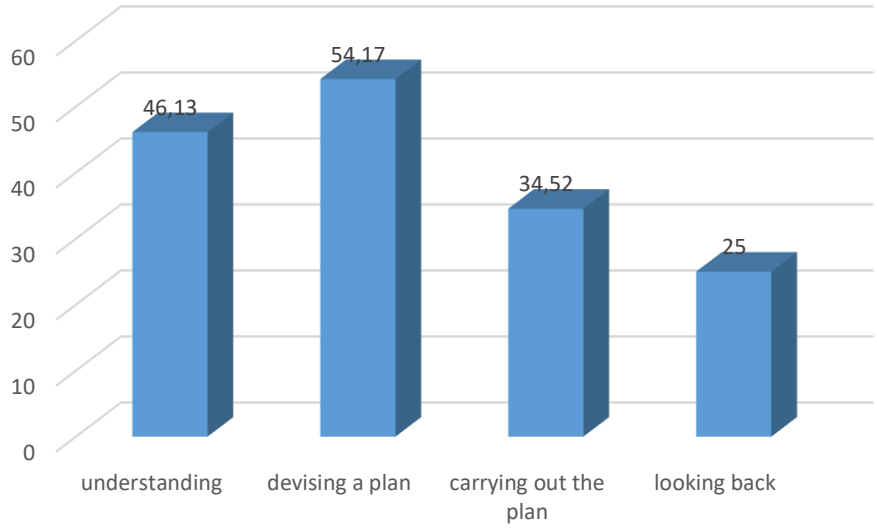

Fig. 2 – Description of the ability of each indicator

Based on Figure 2, shows that the average total value of the mathematical problem-solving ability of class VIII students of Bengkulu State Junior High School on the material of Constructing Flat Sided Space is 39.96%. The percentage meets the Low criteria, with the distribution of the level of problem-solving ability on the indicators of planning problem-solving being 54.17% the percentage meets the criteria enough. This is reinforced by the results of research by Novitasari and Wilujeng (2018) that students' abilities are low at the stage of planning a solution because students with low abilities do not understand the problem well so they

cannot make an appropriate mathematical model and by the given problem or in other words. cannot make connections between known and asked information, especially in mathematical models.

This can be interpreted that the indicator being the stage most mastered by students. This shows that students have been able to find the problems developed in the questions. Furthermore, the ability to understand the problem has a percentage of 46.13%, the percentage meets the criteria. This shows that students can make a plan of completion and understand of the formula that will be used to solve the problem.

In problem-solving ability, the average total student percentage is 34.52%. This percentage meets the low criteria, this can be interpreted that students are not able to solve problems, answer questions and get final answers. Furthermore, the ability of students to check again and make conclusions is 25%, the percentage is in the low criteria. This shows that the students are not capable enough or the students' ability is low in carrying out the stage of re-examining answers and answers. The results of this study are in accordance with the results of research conducted by Andayani and Lathifah (2019) that the student error rate is an indicator of determining data answers or understanding problems. 40.00% of students can understand the problem and 60.00% of students cannot understand the problem. Other studies have also found that problem-solving at the re-examination stage students have not reached this stage because they have not completed the previous stages correctly (Yuwono et al, 2018).

The results of the analysis of student answer sheets on one of the indicators, namely calculating the surface area of the cube Cubes, blocks, pyramids, and prisms show that students' understanding of mastery problems is 33.33%, planning problem solving is 72.62 %, problem-solving is 38.10%, and reassessed and made a conclusion of 33.33%. The following is an example of students' questions and answers in solving the problem of calculating the surface area of a cube.

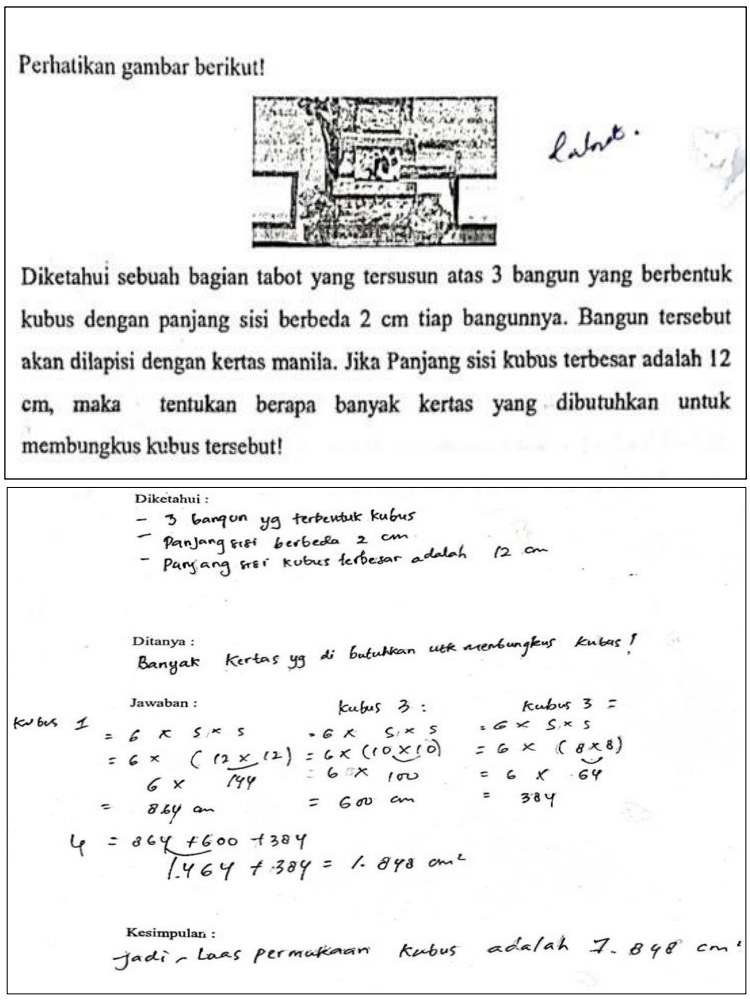

Fig. 3 – Student questions and answers (Subject AQA)

The following are the results of the analysis of students' problem-solving abilities based on the answer sheet above in solving the problem of calculating the surface area of a cube.

Understanding of Problems

At the stage of understanding the problem, subjects started by writing down what information was from the questions. On the known information, the subject wrote the information by what was written on the problem, correctly and completely, it's just that the way the subject did not write down the information on the problem with mathematical symbols, the subject wrote the information not using his sentence but in a sentence that was almost the same as the language on the question.

Planning Problem-Solving

At the problem-solving plan stage, subject's understanding of planning problem-solving can be said to be good, as seen in the way students write down what is required of the questions correctly, and completely, and write sentences. The ability of subjects in making settlement plans can be said to be high

Problem-solving

At the problem-solving stage, the Subject wrote down the answer correctly, but the result was wrong. subjects calculate the total surface area of the cube without subtracting the base and top of the cube. This shows that the student's ability to solve problems is quite good, it's just that they are not thorough.

Re-examining and Conclusions

At the re-examination stage or drawing conclusions, the subject writes the conclusions of the problem-solving results in the previous stage. The subject wrote the conclusion of the answer correctly, but the subject did not re-examine the answer at the previous stage so the result was not quite right. The ability of subjects in making conclusions is quite good.

The following is an excerpt of the researcher's interview with subjects on each problem-solving ability based on Polya's solving steps on the problem of calculating the surface area of a cube.

Understanding of Problems

Researcher	:	*What information do you get from the questions?*
Subject	:	*There are three stacked cubes, the higher up the smaller and the difference is 2 cm, then the side length of the largest cube is 12 cm.*
Researcher	:	*Why not just write it in mathematical symbols?*
Subject	:	*I'm confused ma'am, I often get confused when using symbols.*

Based on the results of the subject's answers and the results of the interviews that were conducted between the researcher and the subject, in the matter of calculating the surface area of the cube indicator of understanding the problem, the subject was able to understand the information known from the problem. subjects do not convert known information into mathematical symbols.

Planning Problem-Solving

Researcher	:	*What do you think the question asks for?*
Subject	:	*We were asked to find a lot of paper used to wrap the tabot bu.*
Researcher	:	*If you are looking for a lot of paper, what do you do?*
Subject	:	*Calculating the surface area*

Based on the results of the subject's answers and the results of the interviews that were conducted between the researcher and the subject, in item number 1 the indicator of planning for completion, the subject was able to explain what was required by the question so that he could solve the problem of calculating the surface area of a cube.

Problem-solving

Researcher	:	*Can you solve question number 1?* *What formula is used?*
Subject	:	*The formula for the surface area of a cube.*
Researcher	:	*Can you explain the process of solving the problem?*
Subject	:	*You can, ma'am, first calculate the three surface areas, then add all of them, so later you will get the combined surface area, ma'am.*
Researcher	:	*Here, we want to dismantle the building as shown in question number 1, do you think the top and bottom of the cube are wrapped together or not?*
Subject	:	*No ma'am*

Researcher : *So how should it be?*
Subject : *Subtracted by the stacked side mam*
Researcher : *Why isn't the answer reduced?*
Subject : *I forgot, I didn't read the questions carefully.*

Based on the results of the answers from the subjects and the results of interviews that have been conducted between researchers and subjects, in the matter of calculating the surface area of the indicator cubes carrying out problem-solving, subjects understand how to solve problems, but forget to reduce the number of sides that are not included in the paper, so the answers are less precise.

Re-examining and Conclusions

Researcher : *Do you check your answers and calculations after working on the questions?*
Subject : *I checked the solution ma'am, but didn't recheck the calculation*
Researcher : *Why not check the calculations again?*
Subject : *Because I'm sure with my calculations ma'am.*

Based on the results of the subject's answers and the results of interviews that have been conducted between researchers and subjects, on the question of calculating the surface area of the indicator cube, checking back and making conclusions, the subject is less careful in re-examining the calculations that have been done and on the matter of calculating the surface area of the cube, but subjects know how to write conclusions correctly.

Based on the results of the analysis of interviews conducted by researchers and subjects, on the number question that measures the area of the cube, students have been able to solve problems properly and correctly. Students understand the questions given but students are less careful in carrying out the completion steps so that the answers produced are less precise. In the matter of calculating the surface area of a cube, the ability of the subject has been able to solve the problem of calculating the surface area of a cube with Polya's rarity quite well.

4. Conculation

Based on the results and discussion previously described, this study concludes that the tabot context sufficiently influences students' understanding of solving problems, but students still have difficulty solving these problems. The average total mathematical problem-solving ability of SMP Negeri 17 Bengkulu City students is 46.54% with sufficient criteria. In this regard, the teacher must pay attention to the ability of students to solve problems gradually, so that the teacher knows how far the process of solving students' mathematical problems is related to the concepts they teach. Teachers need to pay attention to the difficulties faced by students to be able to understand what are the obstacles students face in answering questions

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