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ANALYSIS OF STUDENTS' PROBLEM SOLVING ABILITY ON SET MATERIAL ACCORDING TO POLYA MODEL

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ABSTRACT

Students' mathematical problem solving ability is very influential on learning outcomes that can be implemented in everyday life. However, the facts in the field show that students' mathematical problem solving skills are still low. The purpose of this research is to analyze student difficulties in set material in terms of problem solving theory according to Polya's model. The method used is descriptive qualitative, with data obtained through a test instrument of mathematical problem solving ability on set material with the applied subjects, namely 32 seventh grade students from one of the State Junior High Schools in Cipeundeuy District. Based on the results obtained, the students' ability to solve math problems based on polya steps is high. However, there were still some errors in the results of student answers in solving problem solving questions, including: not writing down what was known, what was asked, and not describing these elements, the process of planning problem solving was not systematic, not understanding the problem, errors in internal calculation of answers and conclusions which are not in accordance with the results of the solution.

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INTRODUCTION

Mathematics is used as a science that must be learned by each person, so that mathematics is applied as a core lesson in elementary school to the lecture level (Yensy, 2020). Mathematics itself has a crucial function to increase the responsiveness of thinking and solving mathematical and life problems (Amelia et al., 2020). However, learning math well is not something that is easy to do. A number of students still think that math is difficult and boring because the language and symbols are dense, accurate and meaningful resulting in students still having difficulty understanding the concepts so that they do not like math lessons. In the implementation of mathematics learning itself, the ability to solve problems must be prioritized, because through dealing with problems, students can be encouraged to think creatively and intensively to solve their problems (Sriwahyuni & Maryati, 2022).

Set material is material presented in the odd semester of grade VII junior high school. The material set delves into the concept. But on the other hand, there are various diagrams, notations, and symbols on set material. Set material is a fundamental material that relates to everyday life, but there are still a number of students who find it difficult to understand or understand. (Mursalina et al., 2019) mentioned the conclusion that errors when working on set material problems, namely students (1) understand the problem, (2) make mistakes in making the correct strategy for completion, (3) are unable to translate into mathematical form, and (4) cannot correctly carry out mathematical procedures. The causative factors according to Dwidarti et al., (2019) are (1) lack of problem solving skills in reasoning about the set; (2) the processing stages are less systematic; (3) lack of accuracy when solving set problems; (4) less accustomed to concluding; (5) lack of practice working on problems; (6) weak student capabilities in describing problems in real contexts. Another problem is that students are more accustomed to solving problems that have answer choices.

According to Riffyanti & Setiawan (2017) problem solving ability is a step to achieve a goal which includes organizing skills and concepts as a new pattern. This problem solving is not only in the form of routine problems but also leads to problems related to daily life. (Amam, 2017) explains, problem solving ability is a basic cognitive skill that needs to be developed and trained by students. (Andayani & Lathifah, 2019) also explained that the ability to solve mathematical problems is a potential of individuals in solving non-routine problems, story problems, and the application of mathematics in everyday life.

But in fact, the capability of students to solve problems is not as expected or still lacking. The lack of students' ability to solve mathematical problems is inseparable from the teaching and learning activities of mathematics (Arofah & Noordyana, 2021). Until now, mathematics still has an impression that is far from the substance of problem solving (Chen et al., 2019). Based on the results of research from Asih & Ramdhani (2019), it is found that students' ability to solve problems is still lacking because they find it difficult to interpret the problem which then makes it difficult to answer it. In addition, the results of research by August & Ramlah (2021) show that students' ability to solve mathematical problems varies, and has difficulties in certain parts. As a result of this research, there needs to be a solution to improve the ability to solve mathematical problems in students.

There are several steps to determine problem solving referring to Polya (Anggraeni & Kadarisma, 2020), including: (1) In the first stage, namely understanding the problem, it can be said that students have reached this stage if they already know what components are known and what are the questions correctly in the test problem. (2) In the second stage, the preparation of a solution plan, learners need to connect their existing knowledge to identify strategies or stages that will facilitate problem solving. (3) In the third stage, namely the implementation of the solution plan, students are believed to be able to reach this stage if they carry out the process of calculating the answer as planned in the previous step of the problem request. (4) At the stage of rechecking the results of their answers in the test, students are believed to be able to complete this stage correctly if they can draw conclusions from the results of the answers and write them correctly.

As described above, researchers are interested in conducting research "Analysis of Mathematical Problem Solving Ability of Junior High School Students on set material based on Polya".

METHOD

Researchers here use a qualitative descriptive method, to describe and analyze student errors in set material in terms of Problem Solving ability according to the Polya Model. The subjects applied were 32 seventh grade students from one of the State Junior High Schools in the

Cipeundeuy District area, with data obtained through the provision of instruments in the form of set material tests based on indicators of problem solving ability based on Polya's model of 4 items of question descriptions that researchers adopted in research Hasibuan (2016) with indicators of set material, namely solving problems using set concepts related to slices and solving problems using set concepts related to combinations. This study uses indicators of problem solving ability consisting of 4 steps, namely (1) understanding the problem, (2) planning the solution, (3) implementing the plan and (4) checking back. The data will then be analyzed by researchers through three stages, namely checking for student answers, presenting test data, and concluding results. As for analyzing student test data scores, it is used:

Table 1. Percentage of Problem Solving Achievement

Mastery Level	Criteria
81% - 100%	Very High
61% - 80%	High
41% - 60%	Medium
21% - 40%	Low
0% - 20%	Very Low

RESULTS AND DISCUSSION

Results

The tests that researchers give to students relate to set material with indicators of set material, namely solving problems using set concepts related to slices and solving problems using set concepts related to combinations. The data that researchers get will then be analyzed by referring to the score guidelines for the ability to solve mathematical problems. Referring to (Hendriana et al., 2017), it is explained that there are four steps in the problem solving process that can be considered in the table below along with the results of the percentage calculation of answers from students.

The calculation of this percentage can be classified into Syah (Pujiastuti, 2020):

Table 2. Criteria for Student Mathematical Problem Solving Results

Stage	**Percentage**	**Criteria**
Understanding the problem	86.7%	Very High
Planning the solution	67.9%	Higt
Implementing the plan	82.7%	Very High
Rechecking	38.5%	Low

Referring to table 2, it is found that the results for the "understanding the problem" stage get a percentage of 86.7% or are in very high criteria. This condition reflects that students can determine what is asked and known in the problem. Then for the "planning a solution" stage, a percentage of 67.9% or including high. Students here have been able to transform problems into mathematical models as planning in carrying out solutions. The "implementing the plan" stage gets a percentage of 82.7% or very high. This condition reflects that students can carry out planning because this stage is related to the second stage, namely to form a plan in solving the problem. This condition is known through the percentage value of the "planning for

completion" stage, which is 67.9%. Then for the "checking back" stage, it was obtained at 38.5% or low, where the majority of students here did not check their answers again and did not give conclusions for the answers they got.

As for understanding how students make mistakes when working on problems that researchers have given, the answers students give will be analyzed based on the question number, which includes:

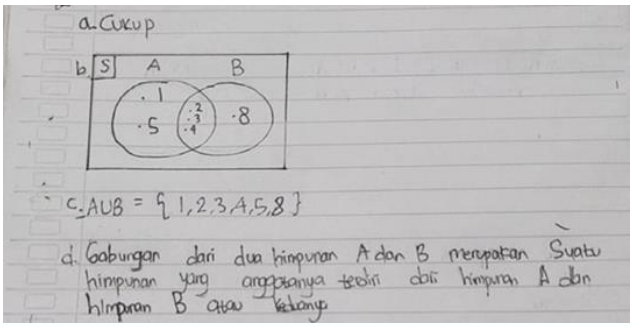

Figure 1. Answer to question number 1 from one of the students

Students here do not carry out the first step, namely "understanding the problem" where it is not written what is known or what the problem asks. While students in "planning the solution" are able to describe the Venn diagrams of the two sets. Students in the "implementing the plan" stage have also been able to determine the members of A combined with B appropriately. However, for the stage of "checking back" there is an error in the form of inaccuracy in the conclusion.

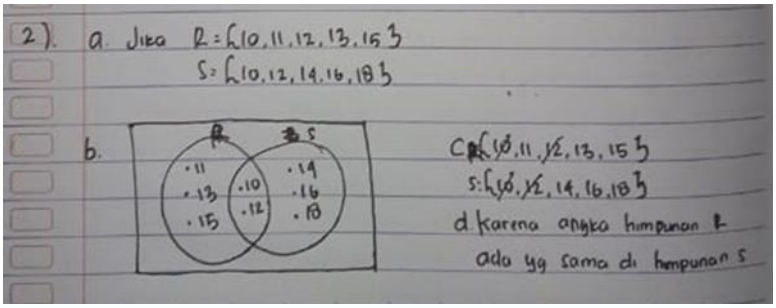

Figure 2. Answer to question number 2 from one of the students

Based on Figure 2, students in the "understanding the problem" stage can determine what they know but do not write what the question is asking. Students at the "solution planning" stage have been able to describe the Venn diagrams of the two sets. At the "implementing the plan" stage, students have also been able to determine the members of A intersection B by crossing out the two members of the same set but students do not write down the members. However, there is an error in the "checking back" stage where the conclusion written is not correct.

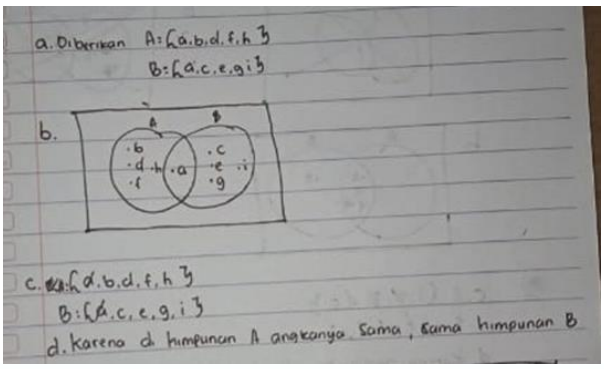

Figure 3. Answer to question number 3 from one of the students

Based on Figure 3, students in the "understanding the problem" stage are able to determine what they know but do not write what the problem asks. Students at the "solution planning" stage are able to describe the Venn diagrams of the two sets. At the "implementing the plan" stage, students have also been able to determine the members of A combined with B by crossing out the two members of the same set but students do not write down the members. At the "checking back" stage, students form the final conclusion but the answer is not correct.

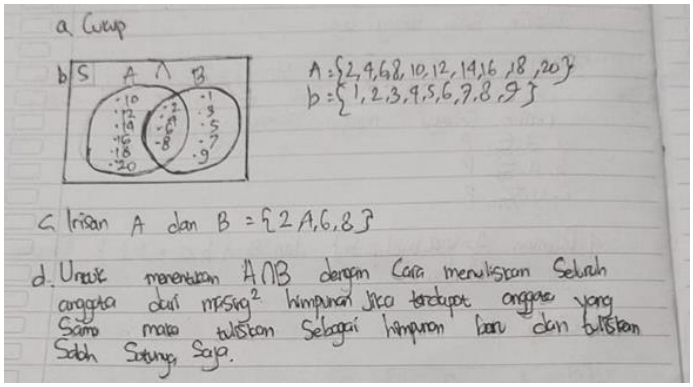

Figure 4. Answer to question number 4 from one of the students

Referring to Figure 4, students in the "understanding the problem" stage write the known things but students are still wrong when registering the set members. At the "planning the solution" stage, students have been able to describe the Venn diagrams of the two sets. At the stage of "implementing the plan", students have also been able to determine the members of A slice B appropriately. However, there is an error in the "checking back" stage where the conclusion is not correct.

Discussions

In the first step, namely "understanding the problem" is in a very high category. This condition is in accordance with the results of research Zakiyah et al., (2018) which found that students' ability to provide an understanding of the problem and make it into something that is asked and known is good. It can be said that the majority of students write everything they know about the question and what is asked about each item completely. However, there are a number of students who still make mistakes in the problem solving process because they do not write what is known and asked as the information listed in the problem (Kristofora & Sujadi, 2017).

In the second step, namely "planning for completion" including high criteria. It can be said that students can carry out the second stage well, understand how and what information needs to be used in solving a problem. This is also conveyed in the results of research Rambe & Afri (2020) that students with high problem-solving abilities have also been correct in answering and identifying the mathematical model that will be used to solve the problem. According to Irawan (Rachmawati, 2021) understanding the subject matter well can encourage students to be able to apply the formula used correctly based on the information in the problem.

In the third step, namely "implementing the plan" is in a very high category. However, there are some students who do not implement the plan properly. This is also conveyed in the results of research Rianti (2018) that during the implementation of problem solving, some students can carry out the correct process so that they get the correct answer, but there are also some students who miscalculate and get the wrong answer. According to Aulia & Kartini (2021) insights from students who lack understanding of mathematical symbols result in them not being able to continue calculations. This condition is in line with Sundari et al., (2019) where if students do not really understand mathematical symbols, when working on problems they will experience many mistakes that make them unable to complete the problem.

In step four, namely "checking back" including low criteria, the thing that causes students' mistakes is their inaccuracy to carry out checks, which results in many mistakes. This condition is in line with the statement Fatmala et al., (2020) that students do not pay attention when working on problems and are in a hurry to do it quickly, so they do not double-check their answers. According to Fitria (2018) that in problem solving, after completing the calculation process, students must check the results that have been obtained which aims to determine whether the answer obtained is correct or not. This agrees with his research Amaliah et al., (2021) that this re-examination must be carried out by each student to ensure that the written answer is correct.

CONCLUSION

Referring to the results of this study, it can be said that the ability of students to solve mathematical problems as Polya's steps is in high criteria. Referring to the results that researchers get, the stage of "understanding the problem" includes very high criteria. "solution planning" is high, "plan execution" is very high, while checking back is "low". This reflects that teachers need to pay more attention in guiding students in solving math problems, especially for the checking back stage. As for suggestions for future researchers, they can analyze problem solving skills with different materials and more subjects than previous researchers.

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