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Research Article

The student involvement in view of mathematical problem solving ability

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ABSTRACT

Students are still less involved in the teaching and learning process in class in mathematics. Lack of student involvement resulted in students' problem-solving abilities being weak. Constraints faced by students included difficulties in building plans, errors in operationalizing plans, and wrong conclusions. The purpose of this study was to determine student involvement in terms of students' mathematical problem-solving abilities in mathematics. This study uses a descriptive qualitative research approach. The subjects in this study were 12 students of class XII IPA-2 at MAN 4 North Aceh. Data collection techniques used in this study were observation, interviews and documentation. Data analysis techniques using data reduction, data presentation, and drawing conclusions. The results of the study show that in general high problem-solving abilities are also accompanied by high involvement, and vice versa. However, students in the high group have not been involved in finding answers, exploring variations and sorting information, and making inductions. Medium group students have not been involved in classifying, exploring variations and expressing in their own words and finding answers, sorting information and making inductions. Meanwhile, students in the low group were only able to clarify, associate and generalize, use previous knowledge, create mathematical objects and provide examples.

Keywords: student's engagement; mathematics; problem-solving; learning-process; mathematics learning

1. INTRODUCTION

Minister of Education and Culture No. 21 of 2016 concerning educational content standards states that one of the goals of learning mathematics is to have involvement and attention in learning mathematics. Involvement according to Mustari (2011) is an action and attitude that continues to seek to know more deeply and broadly than what is heard, seen and learned. According to Samani (2012) defines involvement as an act of students who will always motivate themselves to continue to know and seek new things so that they will add knowledge and experience in learning. According to Dharmayana et al (2012), student involvement is needed in achieving academic achievement.

One aspect that is influenced by student involvement is the ability of students to solve problems. The results of research from Divine (2012) suggest that learning that makes students actively involved in discovering their own learning concepts can help students improve and enhance problem-solving skills and cognitive processes. Melani's research (2012) also concluded that knowledge that involves students to discover for themselves personally can strengthen comprehension, memory and transfer of information. This learning will be fun for students, because it involves a lot of students and can motivate students to keep looking until they find the right answer. However, several previous studies have shown that students' problem-solving abilities in learning have not been achieved as expected. One of them can be seen from the results of research from Basri et al (2018) in solving math problems students can only work up to the stage of understanding the problem and compiling the problem. Students are not able to reach the stages of carrying out the plan and the stage of checking again, so that the metacognitive skills that can be involved in these two stages are not measurable.

Research from Ansari, Taufiq and Saminan (2020) shows that some students have indeed been able to solve problems based on indicators, but have not been able to solve them because of a miscalculation problem. Some students are also less able to find patterns of solving a problem and less precise in drawing the correct conclusions to obtain indepth basic knowledge which is one indicator of involvement.

This problem is very important to study in order to obtain detailed and indepth information about student weaknesses in the engagement aspect when viewed from student problem solving. The data obtained by researchers can then be used to determine appropriate learning strategies. Thus, this article discusses student involvement in terms of mathematical problem solving abilities in mathematics.

2. RESEARCH METHOD

The research describes the real situation that occurred at the research location. So, this study uses a qualitative research approach with descriptive methods. This research was carried out through several important processes such as asking questions and procedures, collecting detailed data from participants, analyzing data that had been collected inductively starting from specific themes to general themes and interpreting the meaning of the data. Data collection techniques used in this study are documentation, observation, and interviews. The research collection instruments were student answer sheets, student observation sheets, and student interview transcripts. Data analysis techniques using data reduction, data presentation, and drawing conclusions

3. RESULTS AND DISCUSSION

This study was conducted in class XII IPA-2 learning carried out 3 learning meetings. The first meeting is the basic understanding of elements in space, the second is the relationship of points, lines and planes in space, and the third meeting is the distance between two points. After all the material is finished, students are given 3 problem solving questions according to the indicators of students' problem solving abilities (KPM), namely (1) Understanding the problem, (2) Developing a problem solving plan, (3) Operational planning, (4) Reviewing the answers and the process.

The low group is students who are only able to fulfill one KPM indicator. The medium group is students who are only able to fulfill two KPM indicators. The high group is students who meet at least three KPM indicators

3.1. Results

Low Group Students

The results of the documentation of students' answers were obtained by three students who were included in the low group. Following are the results of sides' answers to question number 1.

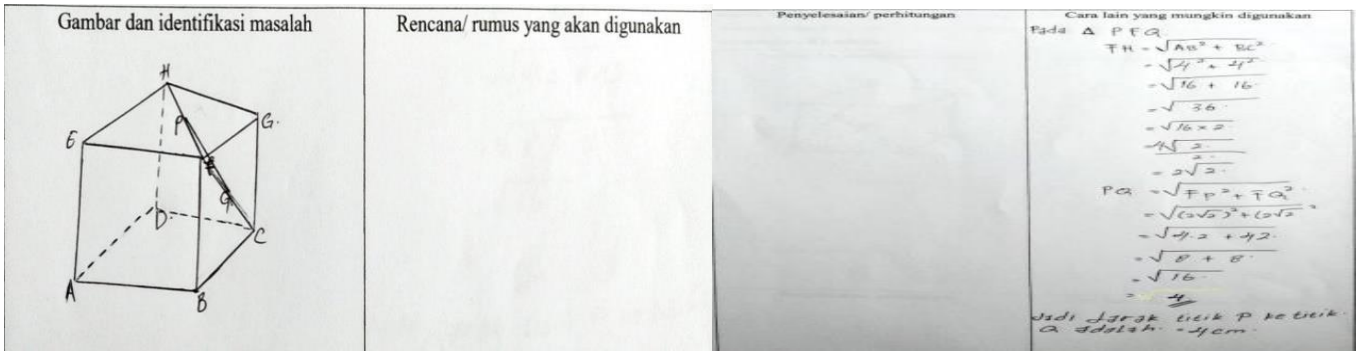

Figure 1. Low group student's answers to question number 1

Based on **Figure 1**, it can be seen that students write answers that do not match the boxes provided. Students are able to describe the geometric shapes mentioned in the questions properly and correctly. However, students did not describe the problem identification of the geometric shapes. Students also do not write down the plan/formula to be used, so they directly operate the problem solving plan. The results of the answers written by students were not quite right because they could not clarify the type of triangle. Students seem unable to obtain information from the images that have been made. Students can draw conclusions properly according to the questions given. The interview results also showed that students were only able to understand the problem. Students make mistakes in developing problem-solving plans to find solutions. The following is the result of the answer sheet for the low group students in question number 2.

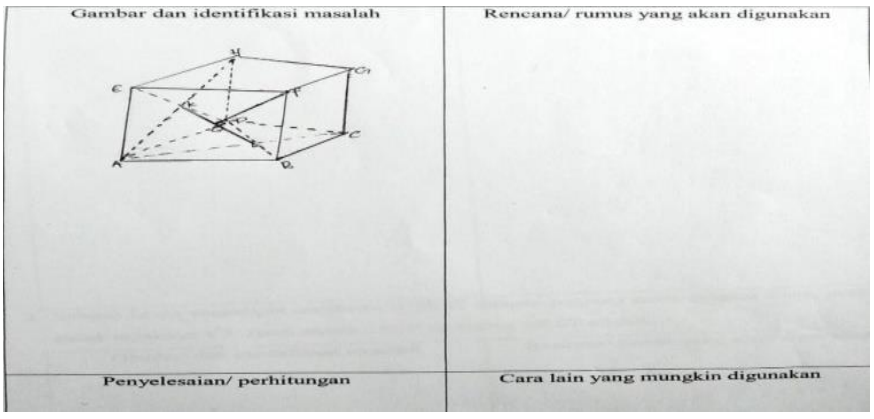

Figure 2. Low group student's answers to question number 2

Based on **Figure 2,** students are able to describe the geometric shapes mentioned in the problem properly and correctly. However, the students did not describe the problem identification of the geometric shapes. In addition, students do not write other solutions. The interview results also showed that students were only able to understand the problem. students have not been able to develop and operate a problem-solving plan to find a solution to problem number 2. This is because students do not understand what concept to use. Students admitted that they did not review their answers and the process in answering question number 2. Students admitted that even though they reviewed them, they still did not understand them. Furthermore, the results of the answers to the low group student answer sheets on question number 3.

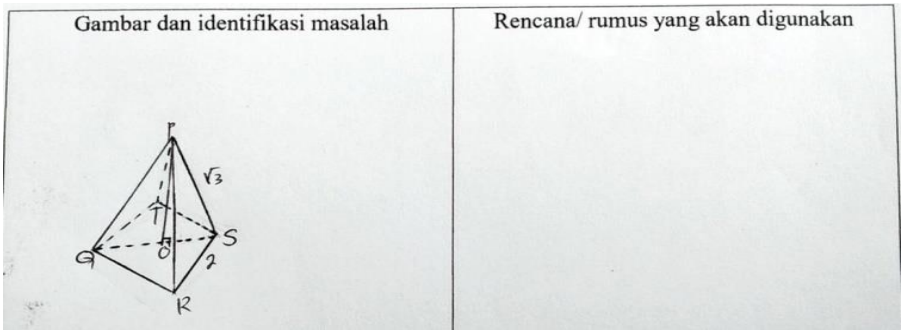

Figure 3. Low group student answers to question number 3

Based on **Figure 3**, it appears that students are able to describe the geometric shapes mentioned in the questions properly and correctly. However, the students did not describe the problem identification of the geometric shapes. Students also do not write down other solutions. The interview results also showed that students were only able to understand the problem. Students have not been able to develop and operate a problem-solving plan to find a solution to problem number 3. This is because students admit that they have never worked on questions like this and do not understand what concept to use. Students admitted that they did not review the answers and the process in answering question number 3. Students admitted that even though they reviewed them, they still did not understand them. The results of the observation of involvement were carried out using 2 indicators consisting of 7 aspects in each indicator. The following are the results of observations on low group students in **Table 1**.

Table 1. Observation Results of Low Group Student Engagement

Indicators	The number of aspects fulfilled (meeting)		
	I	II	III
Synthesis and connection creation	5	5	7
Related to personal orientation towards concepts, methods, properties, relationships and implications	4	5	5

Based on **Table 1**, it can be seen that in the learning process at the first meeting there were 9 aspects that were fulfilled, the second meeting there were 10, and the third meeting there were 12 aspects that were fulfilled. The results show that there was an increase in aspects that were met at the second and third meetings. Aspects that were not achieved in the low group in a row at the three meetings were aspects of summarizing the development of ideas and comparing/classifying.

Medium Group Students

The results of the documentation of students' answers were obtained by seven students who were included in the medium group. Following are the results of the answers of students in the middle group on question number 1.

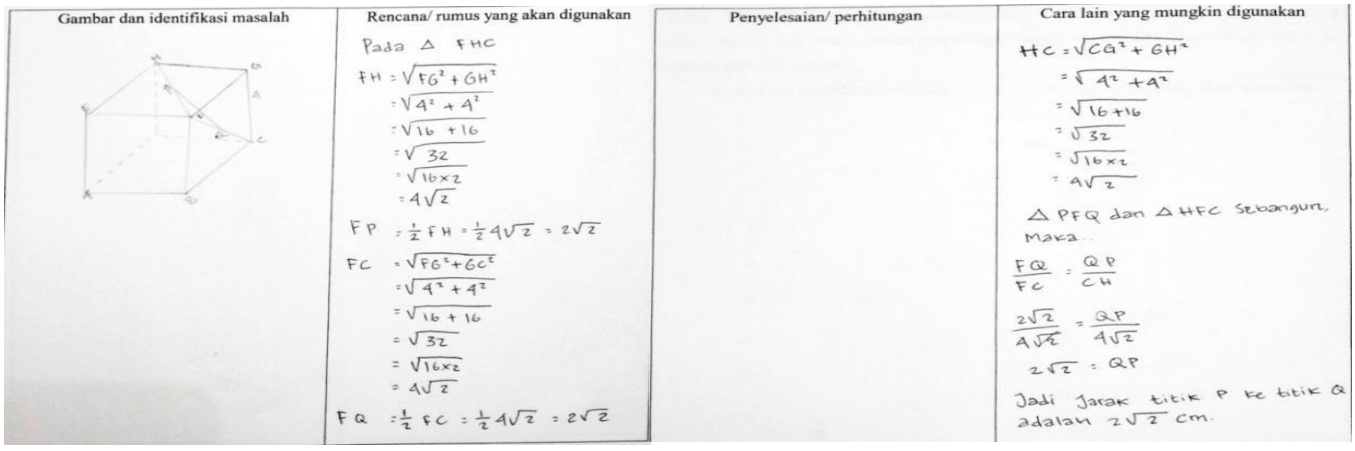

Figure 4. Answers of student's in the middle group on question number 1

Based on **Figure 4**, students can use their previous knowledge well in solving problems such as triangle congruence but do not take advantage of the knowledge of the similarity of the diagonals of the cube area. Students seem unable to sort out the information provided because it makes solving problems that are not really needed. Students also do not write down other ways that might be used. This means that students do not try to find other ways to answer. Students can draw conclusions well according to the questions given. The results of the interview on question number 1 showed that students were able to understand the problem. Students are also able to develop and operate plans properly and correctly. Students admitted that they did not review the answers and the process in answering question number 1. Students admitted that they only checked their answers if the answers written had been confirmed to be wrong by the teacher or friends. The following are the results of the students' answers in the middle group on question number 2.

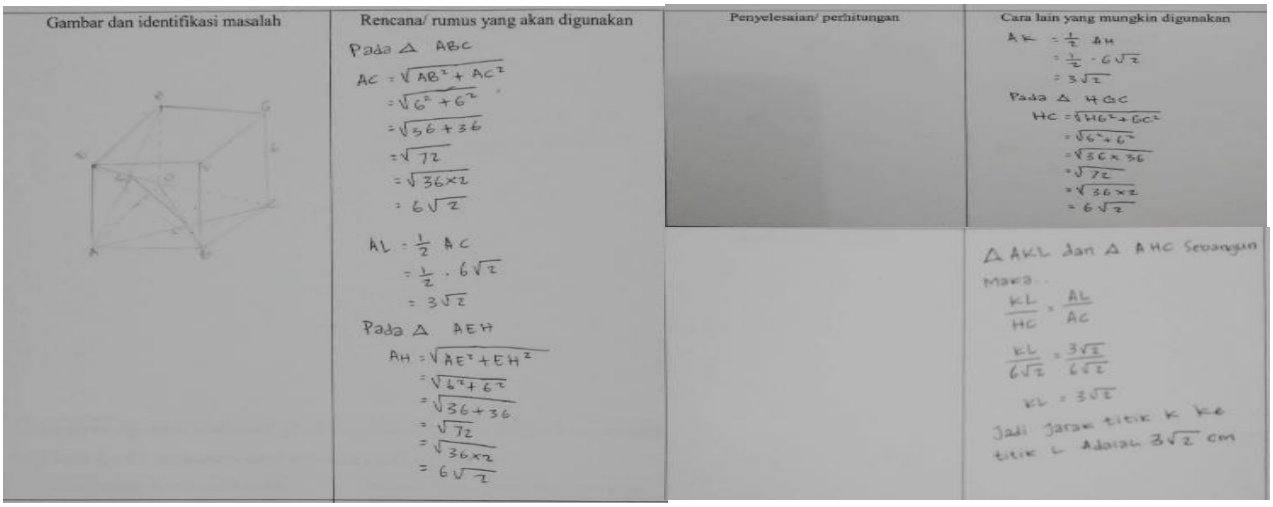

Figure 5. Answers of students in the middle group on question number 2

Based on **Figure 5**, students only answered half and students did not try to develop a new plan to solve the problem completely. Students do not draw conclusions properly because they are not in accordance with the questions given. Interviews with students on question number 2 obtained the same results, namely students were only able to understand the problem, had not been able to develop and operate the plan in question number 2. This was because students were confused in determining the right triangle and the formula that had to be used. Students admitted that they did not review the answers and the process in answering question number 2. Students admitted that they only checked their answers if the answers written had been confirmed to be wrong by the teacher or friends. The following are the results of the students' answers in the middle group on question number 3.

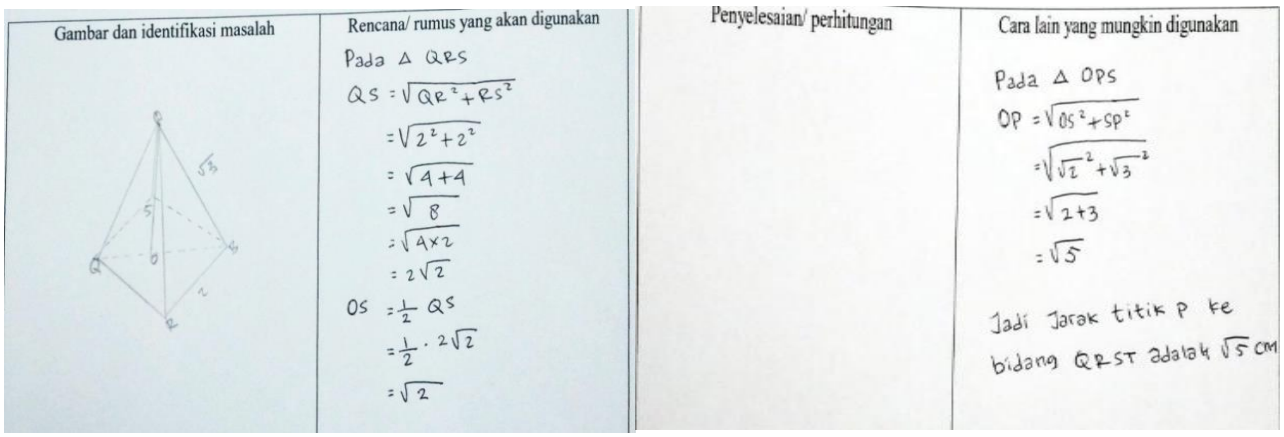

Figure 6. Answers of students in the middle group on question number 3

Based on **Figure 6**, students developed a problem-solving plan to find a solution to problem number 3. However, students made a mistake when operating the plan on problem number 3. This was because students incorrectly determined the Pythagorean formula used. Students admitted that they did not review the answers and the process in answering question number 3. Students admitted that they only checked their answers if the answers written had been confirmed to be wrong by the teacher or friends. Furthermore, the results of observations on group students were obtained as follows.

Table 2. Observation Results of Middle Group Student Engagement

Indicators	The number of aspects fulfilled (meeting)		
	I	II	III
Synthesis and connection creation	5	6	7
Related to personal orientation towards concepts, methods, properties, relationships and implications	5	6	6

Based on **Table 2**, it can be seen that in the learning process at the first meeting there were 10 aspects that were fulfilled, the second meeting there were 12, and the third meeting there were 13 aspects that were fulfilled. The results show that there was an increase in aspects that were met at the second and third meetings. The aspect that was not achieved in the low group in a row at the three meetings was the aspect of comparing/classifying.

High Group Students

The results of the documentation of students' answers were obtained by two students who were included in the high group. The following are the results of the high group students' answers to question number 1.

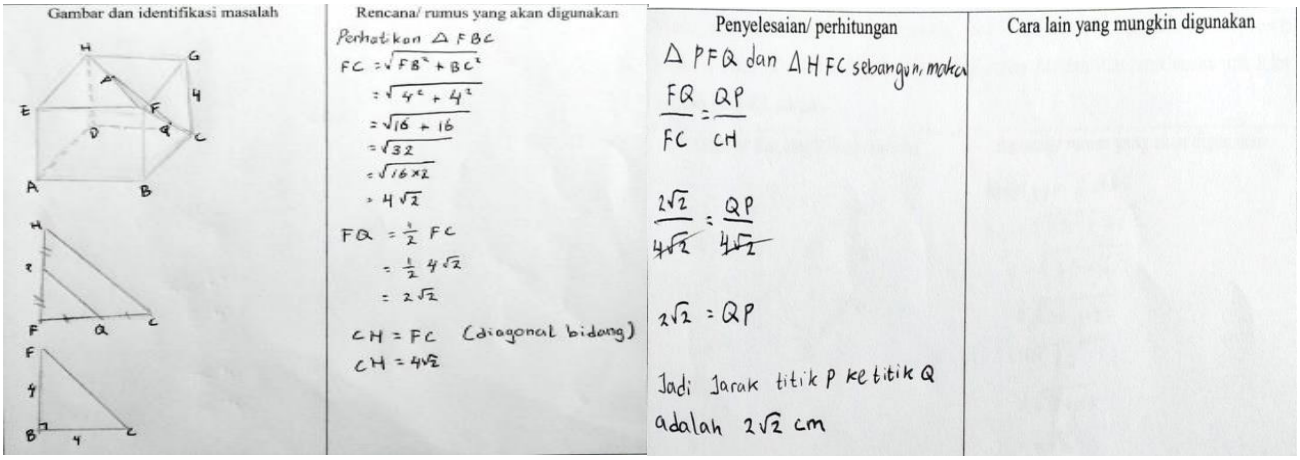

Figure 7. High group students answers to question number 1

Based on **Figure 7**, students are well able to solve problems such as triangle congruence, similarity of the diagonals of the cube area. Students are able to sort out the information needed in solving problems. However, students did not write down other methods that might be used. Students can draw conclusions well according to the questions given. This result is supported by the results of interviews, namely students are able to understand this problem. Students are able to explain and describe in detail the problems that exist in the problem. Students are also able to develop and operate plans properly and correctly. Students are able to choose a triangle and determine the formula correctly. students admitted to reviewing the answers and the process in answering question number 1. The following are the results of the high group students' answers to question number 2. Results of answers and interviews with students on questions

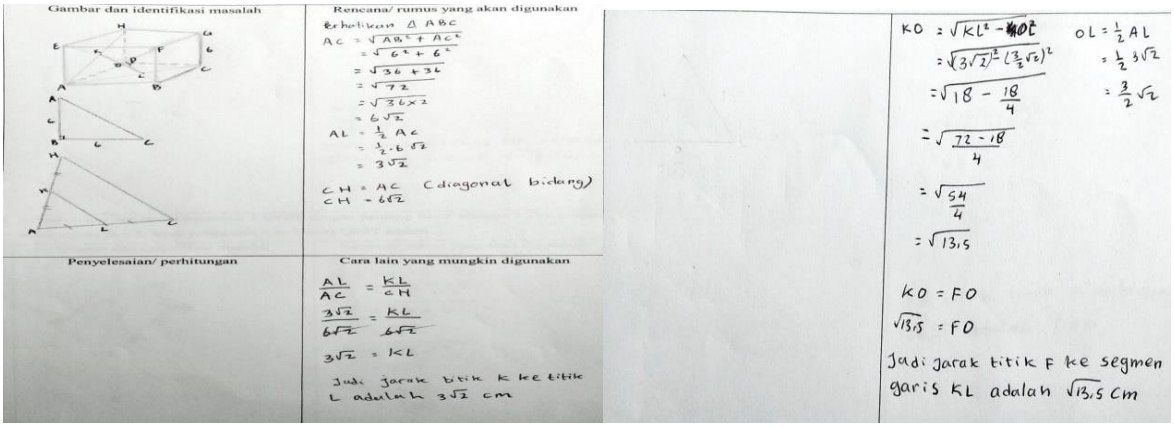

Figure 8. High group students answers to question number 2

Based on **Figure 8**, students can understand the problem. Students explain and describe in detail the problems that exist in the problem. Students make mistakes in developing problem-solving plans, due to conceptual errors so that operational plans are also wrong. the student admitted to reviewing the answers and the process but still answered wrong question number 2. The following are the results of the high group students' answers to question number 3.

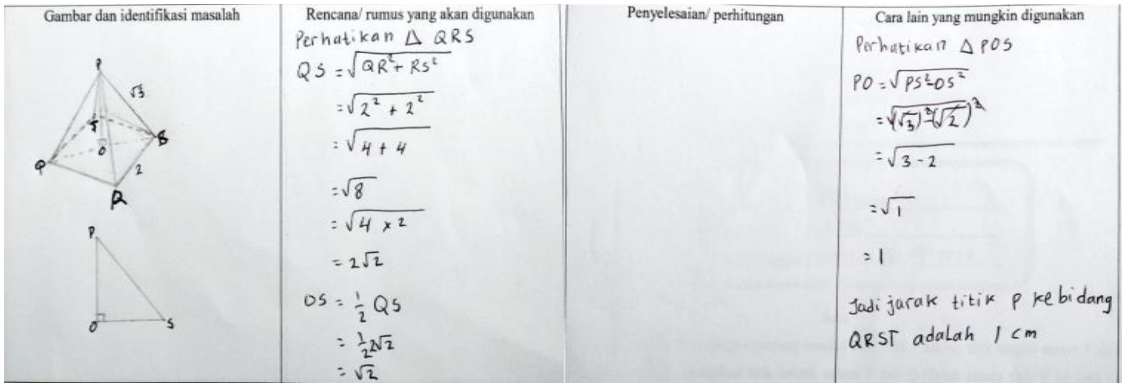

Figure 9. High group students answers to question number 3

Based on **Figure 9**, students solve problems well but students do not write down other methods that might be used. In line with the results of the interviews, namely students are able to understand the problem, develop and operate plans properly and correctly, choose triangles and determine formulas correctly. Observation of involvement is carried out by observing 2 indicators consisting of 7 aspects in each indicator. The results of observations on low group students were obtained as follows. Table 3. Observation Results of High Group Student Engagement.

Indicators	The number of aspects fulfilled (meeting)		
	I	II	III
Synthesis and connection creation	5	7	7
Related to personal orientation towards concepts, methods, properties, relationships and implications	6	7	7

Based on **Table 3**, it can be seen that in the learning process at the first meeting there were 11 aspects that were fulfilled, the second meeting there were 14, and the third meeting there were 14 aspects that were fulfilled. The results show that there was an increase in the aspects that were met at the second meeting. The aspect that was not achieved in the high group was the aspect of summarizing the development of ideas.

3.2 Discussion

The high subject group is able to understand the problem, this can be seen from the students' ability to explain and write problem analysis. In general, students are able to plan, operate plans and re-check answers. Students have difficulty with very challenging questions. Students are able to be involved in aspects of summarizing ideas, abstracting and making new definitions. Students are able to be involved until the third meeting in 2 aspects, namely expressing in their own words, exploring variations, finding answers and sorting out information. However, students have not been involved in aspects of making inductions at each meeting. The findings obtained are in accordance with the results of research by Basri et al (2018) which found that involvement as an action will always encourage oneself to continuously seek and find new things so that it will add knowledge and experience in learning.

Moderate subject groups are generally able to reach the stage of understanding the problem and developing a problem solving plan. However, students have not been able to reach the stage of operating the completion plan. Students have difficulty determining formulas and forming relationships between triangles, due to a lack of knowledge about the prerequisite material. Students do not re-check answers and processes, only check that the answers written have been confirmed to be wrong by the teacher or friends. Students are able to be involved until the third meeting in aspects of describing, summarizing ideas, abstracting and making new definitions. Students are able to be involved only in aspects of looking for patterns, comparing, expressing in their own words, exploring variations. However, students have not been able to be involved in the aspects of finding answers, sorting information and making inductions at each meeting. The findings are in accordance with the results of research by Ansari et al (2020) which found that student involvement can foster the ability to describe, summarize ideas, abstract and define new things.

Low category students are only able to reach the stage of understanding the problem. students have not been able to compile and operate a problem-solving plan. The reason is that students do not understand the material due to a lack of prerequisite knowledge and an error in selecting the formula. students also do not re-examine the answers and processes, because they do not know their use. Students have not been able to be involved in aspects of finding answers, exploring variations, sorting out information and making inductions and expressing them in their own words at every meeting. This finding is supported by the research results of Mashuri, et al (2018) which concluded that student involvement in learning can encourage students to understand the material due to a lack of prerequisite knowledge and errors in formula selection.

4. CONCLUSION

Based on the results of the study it can be concluded as follows : **1)**. High group students are generally able to understand the problem, devise plans, operationalize plans and re-check answers. However, they are not yet involved in finding answers, exploring variations and sorting out information, and making inductions. **2)**. Medium group students are generally able to reach the stage of understanding the problem and developing a problem solving plan. This is due to the difficulty in determining the formula and forming relationships between triangles. Students have not been involved in classifying, exploring variations and expressing in their own words and finding answers, sorting information and making inductions. **3)**. Low group students were able to reach the stage of understanding the problem only but did not understand the material because of a lack of prerequisite knowledge and an error in selecting the formula. In general, student in-volvement is only capable of clarifying, associating and generalizing, using prior knowledge, making mathematical objects and giving examples.

CONFLICT OF INTEREST

There are no conflicts of interest declared by the authors.

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