Analysis of Ability to Understand Mathematical Concepts Class Students XI in Geometric Transformation Materials

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ABSTRACT

The low ability of students to understand mathematical concepts is proven by the majority of students not being able to reformulate the solution to the problem given. This research aims to describe students' ability to understand mathematical concepts for each indicator so that it is known which indicators students experience problems with. The method used in this research is descriptive qualitative. The instruments in this research are test and interview instruments. The research subjects were 26 students of class XI Science 1 SMAN 5 Sukabumi City. Data were analyzed using data reduction, data presentation, and drawing conclusions. In data reduction, researchers summarize the data and classify the data. Based on the results of data analysis, it was concluded that students with high and medium abilities had excellent concept understanding abilities in restating a concept, classifying objects according to the concept, and presenting concepts in various forms of mathematical representation. while students with low abilities are in the good category. Highly capable students are able to restate the concepts they have learned and apply concepts or problem solving algorithms very well. Meanwhile, students with medium and low ability are in the sufficient category. In linking various concepts, high, medium and low ability students have quite good ability to understand mathematical concepts.

Keywords: ability understand mathematical concepts; transformation geometry

INTRODUCTION

Mathematics is a very important subject, because this mathematical material supports the development of other sciences. However, some students still feel less interested in learning mathematics, because the learning process is always teacher-centered, causing students to have difficulty learning mathematics. (Wijaya, 2020). Difficulties faced by students include students not being able to understand the problems to be solved and students not being able to remember the concepts that will be used to solve mathematical problems.

The difficulties faced by students cause them to use fast methods in their learning. Irwan (2022) stated that students tend to do math problems carelessly and memorize formulas without understanding the concept first, even though memorizing formulas that are not based on understanding the concept will not be effective, because it will not last long in the student's memory. Basically, learning mathematics requires an understanding of concepts so that the material studied can be ingrained in students' minds for a long time. Apart from that, understanding concepts is needed because the mathematics material is continuous, if students cannot understand the concepts in the previous material, it will be difficult for

students to learn the next material. Jeheman (2019) states that, mastery of other mathematical concepts requires mastery of the simplest mathematical concepts.

Sutiarso & Coesamin M. (2018) said that the level of difficulty of learning geometry is much more difficult than algebra and statistics. Misunderstanding geometry includes two aspects, namely conceptual and procedural. Conceptual misunderstandings are errors in identifying objects and associating mathematical relationships with those objects, while procedural misunderstandings are errors in using symbols, rules and algorithms to solve problems. This shows a lack of understanding of students' mathematical concepts in geometric transformation material. Geometric transformation is one of the materials that requires students to think abstractly. In the geometric transformation material, students must imagine how a transformed object looks in terms of position and shape, both the initial object and the shadow object.

From the results of interviews with teachers who teach mathematics at SMAN 5 Sukabumi City, there is an illustration that the adaptation of mathematics learning so far has not provided optimal results, in the sense that there are still many students who complain about the difficulty of learning mathematics, one of which is geometric transformation material. In learning, only a few students play an active role in asking questions when they do not understand. The teacher also said that there were several indicators of students' lack of understanding of mathematical concepts, one of which was choosing certain procedures or operations.

The low ability to understand mathematical concepts is also shown based on research results. Yufentya (2019) stated that students with high abilities have good ability to understand concepts in circle material, but students with medium and low abilities have poor concept understanding abilities. The thing that causes students' understanding of concepts to be low is due to the lack of student participation in forming concepts independently and is limited to remembering the formulas given so that students' understanding is not good enough in the circle material. This happens because students pay less attention to algebraic material. The difference with previous research is that researchers want to analyze students' ability to understand mathematical concepts in understanding geometric transformation material.

This research was conducted to determine students' ability to understand mathematical concepts in learning mathematics and what difficulties students face when working on geometric transformation material problems which refer to indicators of students' ability to understand mathematical concepts. The benefit of this research is that teachers can consider more about what methods can support student success in learning.
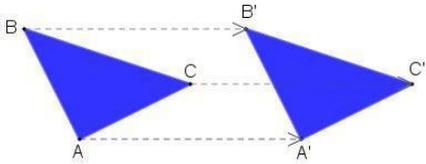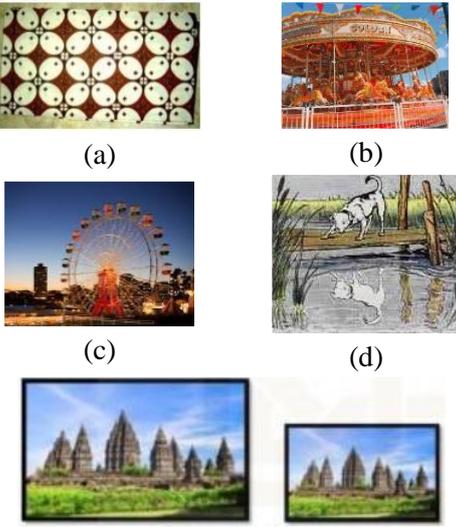
RESEARCH METHODS

This type of research is descriptive qualitative. The subjects in this research were 30 students of class XI IPA 1 SMAN 5 Sukabumi City. The instrument used in this research is a description test question consisting of 5 questions on the ability to understand mathematical concepts related to geometric transformation material that has been validated. Test questions are tested to determine validity, reliability, distinguishing power and level of difficulty. Test result data is processed and analyzed by referring to scoring guidelines. The indicators for

the ability to understand mathematical concepts used in this research are from the results of the study (Suhartini, 2019)

1. Classify objects according to certain properties in accordance with the concept (interpretation).
2. Provide examples and non-examples of a concept (interpretation).
3. Presenting concepts in various forms of mathematical representation (translation).
4. Developing necessary and sufficient conditions for a concept (extrapolation)
5. Using and utilizing and choosing certain procedures or operations (extrapolation)

The test questions and indicators of the ability to understand mathematical concepts used are as follows:

Table 1. Test Questions and Indicators of Students' Ability to Understand Mathematical Concepts

No	Question	Indicator
1	Does the following image include dilation? Give your reasons!	Classify objects according to certain properties in accordance with the concept
2	Look at the picture below! (a) (b) (c) (d) (e) Of the five images, which one is an example of a reflection application? Explain!	Provide examples and non-examples of a concept
3	Rifqi and Rizki are playing chess. The position of their queen when illustrated on the coordinate plane is as follows.	Presenting concepts in various forms of mathematical representation
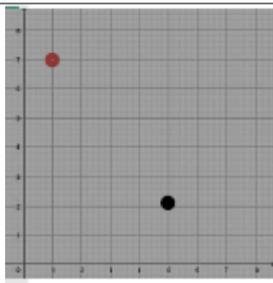
	The color of Rifqi's queen is red which is at the coordinate point (1,7). The color of Rizki's queen is black which is at the coordinate point (5,2). If Rifqi's queen shifts Rizki's queen, write down the mathematical matrix form of the shift of Rifqi's queen!	
4	A rectangle with points and and is dilated with a center and a scale factor of 3. Is the information in the problem sufficient to determine the area of the triangle after dilation? If not, give a reason!	Developing necessary and sufficient conditions of a concept
5	A helicopter flies to the airport in Pekanbaru. However, when approaching the airport, the wind was blowing so hard that the helicopter could not land straight away. If the helicopter is at coordinate point (5,1) and rotates about the size of the airport. Meanwhile the airport is at coordinates (2,2). If using the rotation concept, determine the position of the helicopter after rotating and draw it in Cartesian coordinates!	Using and utilizing and selecting certain procedures or operations

Guide for scoring students' ability to understand mathematical concepts using *rubric holistic*. (Iryanti, 2004). that a holistic rubric is a guideline for grading based on an overall impression or a combination of all criteria. Guidelines for scoring tests of ability to understand mathematical concepts are presented in the Table 2.

Table 2. Scoring The Ability to Understand Mathematical Concepts

Indicator of Ability to Understand Mathematical Concepts	Information	Score
Classify objects according to certain properties in accordance with the concept	Blank answer	0
	Cannot classify objects according to their concepts	1
	Can mention the characteristics according to the concept but there are still many mistakes	2
	Can mention characteristics in accordance with the concept but not yet precise	3
	Can mention the characteristics according to the concept correctly	4

Provide examples and non-examples of a concept	Blank answer	0
	Cannot provide examples and non-examples of a concept	1
	Can mention examples according to the concept but the reasons given are wrong	2
	Can mention examples according to the concept but the reasons given are not correct	3
	Can mention examples according to the concept and can provide appropriate reasons	4
Presenting concepts in the form of mathematical representation	Blank answer	0
	Cannot present a concept in the form of a mathematical representation	1
	Can present a concept in the form of a mathematical representation but makes lots of mistakes	2
	Can present a concept in the form of a mathematical representation but not yet precise	3
	Can present a concept in the form of a mathematical representation correctly	4
Develop necessary conditions/sufficient conditions of a concept	Blank answer	0
	Unable to develop necessary/sufficient conditions	1
	Can develop necessary/sufficient conditions but there are still many errors	2
	Can develop necessary/sufficient conditions but not yet appropriate	3
	Can develop necessary/sufficient conditions appropriately and correctly	4
Using and utilizing and selecting certain procedures or operations	Blank answer	0
	Unable to use, utilize, and choose procedures or operations	1
	Can use, utilize, and choose procedures or operations but there are still many mistakes	2
	Can use, utilize, and choose procedures or operations but not yet correctly	3
	Can use and utilize and choose certain procedures or operations appropriately	4

RESULTS AND DISCUSSION

The results of this research were to examine students' ability to understand mathematical concepts. There are 5 questions given to students, each of which measures an indicator of understanding mathematical concepts (Astuti, 2021). The results of the analysis of student answers can be seen in Figure 1.
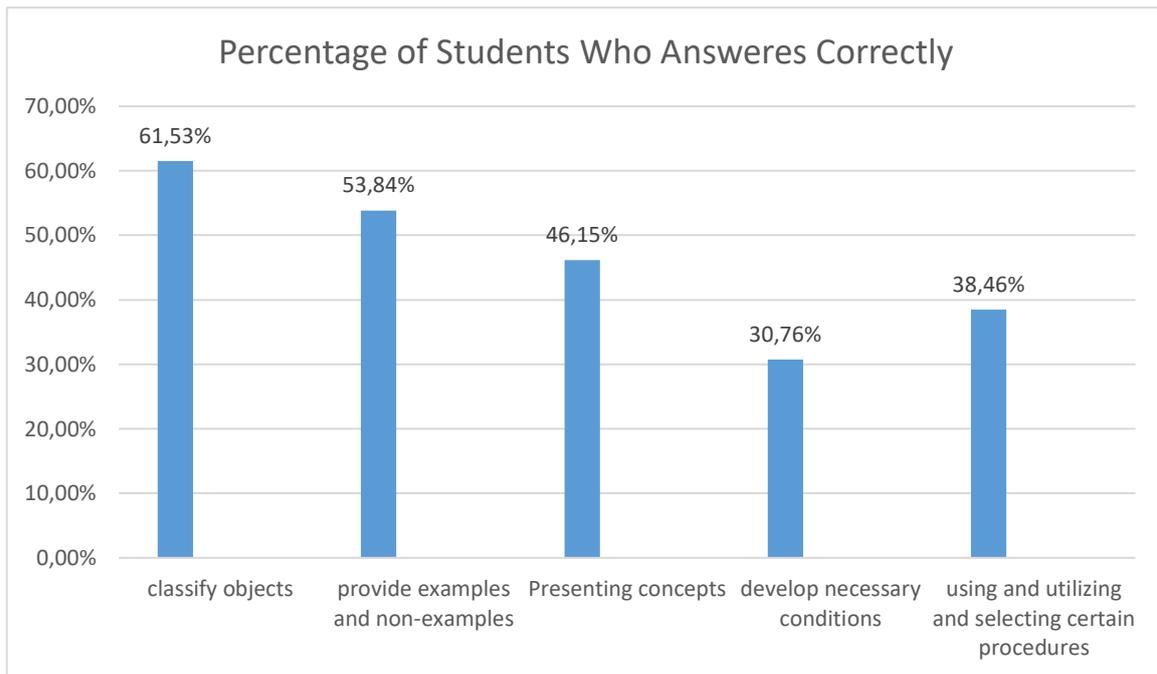
Figure 1. Percentage of Students Who Answered Correctly

Furthermore, the percentage of ability to understand mathematical concepts per indicator can be qualified based on the adaptation of Andini (2021) as follows:

Table 3. Criteria for Percentage of Ability to Understand Mathematical Concepts

No	Percentage	Criteria
1	0% - 20%	Very less
2	21%-40%	Not enough
3	41%-60%	Enough
4	61%-80%	Good
5	81%-100%	Very good

The formula for the percentage score for the ability to understand mathematical concepts is as follows:

$$x = \frac{a}{b} 100\%$$

Information:

x = percentage of students' correct answers

a = correct answer score

b = maximum score possible

Based on table 3, we can get information that only some students have been able to master it. The first indicator of the ability to understand mathematical concepts, namely classifying objects according to certain properties in accordance with the concept, is the indicator most mastered by students. It can be seen in table 3 that there are 16 students who have mastered these indicators with a percentage of 61.53%. The second indicator is providing examples and non-examples of a concept. There were 14 students with a percentage of 53.84% who were able to master this indicator. The third indicator is presenting concepts in various forms of mathematical representation which only 12 students were able to master with a percentage of 46.15%. The fourth indicator develops the necessary

and sufficient conditions for a concept. There were 8 students who were able to master this indicator and it was the indicator least mastered by students with a percentage of 30.76%. The fifth indicator is using and utilizing and choosing certain procedures or operations. It can be seen in table 3 that only 10 students mastered these indicators with a percentage of 38.46%.

CONCLUSION

Based on the results of the analysis of students' ability to understand mathematical concepts, it can be concluded that the students' ability to understand mathematical concepts in class XI IPA 1 at SMAN 5 Sukabumi City in geometric transformation material is still categorized as low. This refers to students' answers as a whole not meeting the indicators of ability to understand concepts with the average percentage of ability to understand mathematical concepts obtained at 36.96%. Of the 5 indicators, only 2 indicators have been sufficiently mastered by students, namely the indicators of classifying objects according to certain characteristics according to the concept and providing examples and non-examples of a concept, although students are still found to be unable to master these indicators. Students find it difficult to understand what is known and questioned in the questions, and students also experience problems when implementing concepts, Algorithmic solutions and determining ways to solve mathematical problems. The factors that influence the low percentage of ability to understand mathematical concepts are students' lack of concentration in learning, students' irregular study habits and less interesting learning methods.

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