

Analysis of Concept Understanding and Mathematic Algorithm Students in Mathematics Learning with The Application of Model The Realistic Mathematic Education (RME) Algebrator Software Assistant

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Abstract. Problems with mathematical concepts and algorithms are increasingly being demanded from students to better understand mathematics lessons. This study aims to describe the ability of students to understand mathematical concepts and algorithms as well as to analyze the difficulties experienced by students in understanding concepts and algorithms in mathematics learning after the learning process is carried out with the application of realistic mathematical education (RME) models assisted by algebrator software. The subjects of the study were students of class X Mia 2 SMA Private ASSISI Siantar, totaling 31 students. The research instrument is a test of the ability to understand concepts, mathematical algorithms and interview guidelines. Data analysis was carried out using the Miles and Huberman model. The results showed: (1) The students' ability to understand mathematical concepts on the material of a system of linear equations. Three variables in the Assisi Siantar High School students in class x mia 2 belong to the Medium category, this can be seen from the results of the average score of each indicator, worth in 59.43. (2) Ability of Mathematical Algorithm students of SMA Assisi Siantar class x mia 2 on the material of linear equation system. Three variables are classified at the moderate level of ability, this can be seen from the results of the score on each indicator that is still in the average category of 55.2. (3) The difficulties experienced by students in completing the ability test for understanding mathematical concepts and algorithms in learning mathematics with the Realistic Mathematical Education learning model with the help of Algebrator software have difficulty understanding concepts, difficulties in applying principles, and also difficulties in implementing operations.

Keywords: Analysis, Understanding Mathematical Concepts, Mathematical Algorithms, Realistic Mathematical Education, Algebrators

1 Introduction

The gap in the mathematical ability of our students in the rankings is very concerning in every assessment and ranking of mathematical abilities conducted by various international survey institutions. As in (pisa-score-2018-list-ranking-mathematical ability-what-a-report-Indonesian) Indonesia listed itself as ranked 73rd out of 79 assessment participants.

In mathematics. The teaching pattern and paradigm of mathematics teachers generally teach with the expository lecture method, this shows that students are less active in learning so that students' mathematical understanding abilities will be very difficult and not even many students do not understand the lessons given and explained by the teacher (Rahmadani, 2013). Understanding mathematical concepts is central to school mathematics learning. With understanding students are able to draw and make conclusions. (Sari, 2012) states that understanding is a fundamental aspect of learning so that the learning model must include the main points of understanding. Learning mathematics requires the ability to understand mathematical concepts and algorithms to solve mathematical problems. Based on this description, the ability to understand mathematical concepts and algorithms is one of the mathematical abilities that students need to develop and possess. But in reality, in learning mathematics, students' understanding of mathematical concepts is still low (sari, 2012 and Sumarmo, 2002). The interesting thing that became a topic in the era of technology and information is Learning using computers in the form of software is now starting to be widely used This is because IT-based learning provides opportunities for students to solve problems individually, increases the development of students' understanding of the material presented, stimulates students to learn with full of enthusiasm, and makes it easy for students to determine their own pace of learning (Nuryadin, 2013).

This study tries to focus on Algebrator Software to help students understand concepts and algorithms for solving mathematical problems. There are several approaches that are suitable for carrying out this learning program, in this case the researcher will use the Realistic Mathematics Education (RME) approach. Realistic Mathematics Education (RME) is a learning approach that supports the involvement of students in learning activities. The RME (realistic mathematics education) learning model and algebrator software were chosen as models and learning aids in providing learning materials because these models and software are expected to be able to provide differences in the quality of learning that lead to measuring the ability to understand mathematical concepts and algorithms.

2 Literature Review

2.1. Definition of analysis

Linguistically, analysis or analysis is a study carried out on a language in order to examine the structure of the language in depth. Anne Gregory (2009) analysis is the first step of the planning process. Dwi Prastowo Darminto and Rifka Julianty (2020) analysis is the decomposition of a subject from its various parts and a study of the parts themselves, as well as the relationship between the parts to obtain the right understanding and understanding of the meaning of the whole. Prastowo (2020) analysis means evaluating the condition of the posts or verses related to accounting and possible reasons for the differences that arise, from the opinions of the experts above it is concluded that analysis is a description of a subject on the various parts and the study

of the parts themselves and the relationship between the parts to obtain a proper understanding and understanding of the meaning of the whole.

2.2. Ability to Understand Mathematical Concepts

The ability to understand mathematical concepts is the ability to absorb abstract mathematical ideas and apply them into estimates and simple statements that can be represented to help solve mathematical problems.

Table 1. Scoring of Mathematical Concept Understanding Indicators

Indicator Understanding concept	Description	Score
Restate a concept	Blank answer	0
	Cannot restate concept	1
	Can restate concept but still many errors	2
	Can restate concepts but not yet correct	3
	Can restate concepts correctly	4
Presenting concepts in the form of mathematical representations	Blank answer	0
	Can present a concept in the form of a mathematical representation but it is not precise and there are still many errors	1
	Can present a concept in the form of a mathematical representation but it is incomplete	2
	Can present a concept correctly but incomplete	3
	Can present a concept correctly and completely	4
Applying the concept of algorithms in problem solving Blank answer	Blank answer	0
	Unable to apply the appropriate formula procedures in solving problem solving problems	1
	Can apply formulas according to procedures in solving problem solving problems but there are still many errors	2
	Can apply formulas according to procedures in solving problem solving problems but not yet right	3
	Can apply formulas according to procedures in solving problem solving problems correctly	4

2.3. Mathematical algorithm skills

The ability of mathematical algorithms is the ability to think logically to solve problems carried out in systematic steps.

Table 2. Scoring of Mathematical Algorithm Ability Indicators

Scoring Indicators for Mathematical Concepts	Understanding	Score
1. Simplify a math problem	no answer	0
	there is an answer but	1
2. Solve mathematical problems with logic	it's wrong	2
	there is an answer, but a small part is correct	
3. Select and use certain settlement procedures	there is an answer, partially correct	3
	there is an answer, totally correct	4
4. Presenting solutions systematically repeatedly		

2.4. Difficulty understanding mathematical concepts and algorithms

- a. Difficulty in understanding concepts is an obstacle in absorbing abstract mathematical ideas to solve mathematical problems which causes the inability to master the defined concept competencies. In this study, the material taught to students is a three-variable linear equation system, while the difficulties in understanding the concept of a three-variable linear equation system material experienced by students include:
- (1) Conceptual difficulties: students are not able to correctly define the meaning of a three-variable system of linear equations,
 - (2) Principle Difficulty: Students are not able to determine the model of mathematical problems
 - (3) Operational Difficulty: students are not able to apply the completion process according to the procedure.
- b. The difficulty of the mathematical algorithm is an obstacle in logical thinking to solve mathematical problems that causes the inability to master the specified algorithm competence. In this study, the material taught to students is a three-variable linear equation system, while the difficulty of mathematical algorithms in the three-variable linear equation system material experienced by students is between other:

- (1) Concept difficulty: students are not able to determine the interpretation of the problem into mathematical symbols
- (2) Principle Difficulty: Students are not able to simplify the model of mathematical problems
- (3) Operational Difficulty: students are not able to use algebraic operations that apply logically and systematically repeatedly.

2.5. Realistic mathematics education (RME)

Realistic mathematical education (RME) is an approach to learning mathematics to find mathematical ideas and concepts through exploration of real problems that are actually experienced in everyday life.

2.6. Algebrator Software

Algebrator software is one of the algebraic software that is able to solve algebraic problems and basic geometry problems in an easy way, just by typing the problem using the help of several existing toolbars.

3 Method

This research is a descriptive research that uses a qualitative approach. What is described in this study is the ability to understand mathematical concepts and algorithms of ASSISI SIANTAR SMA students. The aim is to describe the achievement of each indicator to determine students' ability to understand mathematical concepts and algorithms and try to uncover the causes of difficulties in understanding concepts and algorithms in students. The conclusions from this study only apply to students in the class under study and are not generalized. The data of this research are in the form of answers and written data obtained from written tests and student interview data. The subjects of this research were 31 students of ASSISI Private High School class X. The instruments used in the form of questions about the ability to understand concepts and mathematical algorithms that have been validated and interview instruments.

The description of the targeted research process carried out by researchers systematically can be seen from the following chart:

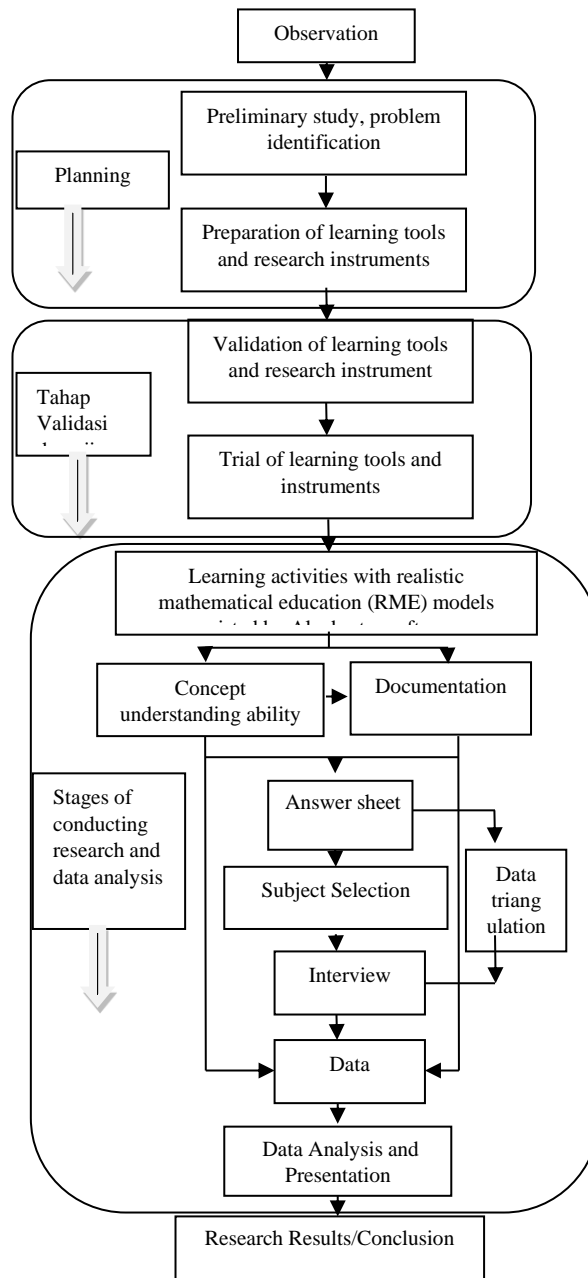


Fig. 1. Research process

4 Result and Discussion

4.1 Result

The results of the study were obtained from the data analysis process based on the ability to understand mathematical concepts and algorithms which were carried out to students of class X SMA. Based on the test results, the overall data obtained regarding the description of the ability to understand mathematical concepts and algorithms of class X students. After the data is collected, the next step is to make conclusions. The descriptive statistic used is the mean. The mean category is carried out with the aim of clarifying the scale category and making it easier to analyze each question based on the average (mean) that has been obtained.

From the results of data analysis on each indicator provides an overview of the level of knowledge of students' conceptual understanding which can be seen from the results of the average comparison of the three indicators of concept understanding ability which can be illustrated in the following diagram:

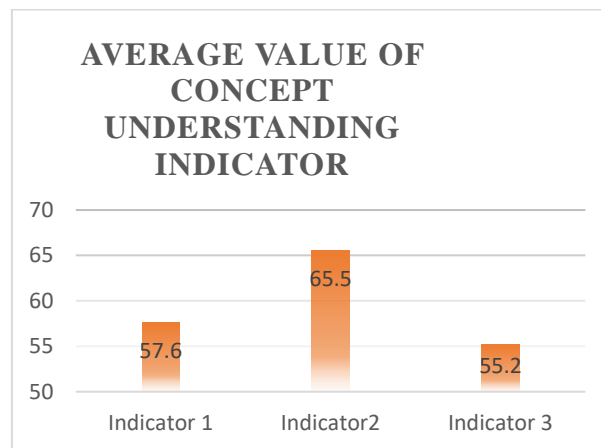


Fig. 2. The level of understanding ability concept based on the Three Indicators

From the results of the student's mathematical algorithm ability test as many as 31 people, it is obtained that the level of student's mathematical algorithm ability is spread across five criteria, namely very high, high, medium, low, and very low. The diagram can be seen in the following figure:

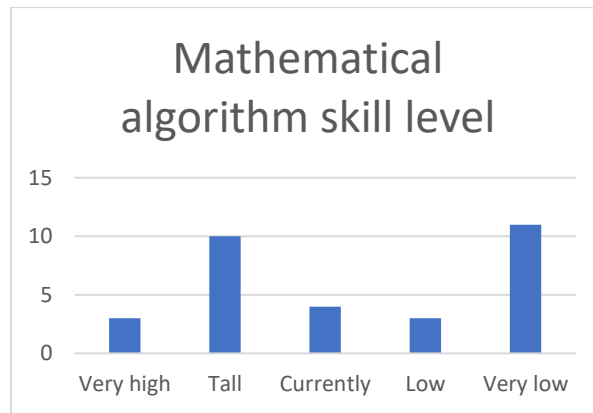


Fig. 3. The level of mathematical algorithm ability

From the results of tests and interviews conducted on selected subjects, it was found that the difficulty of understanding mathematical concepts and algorithms from triangulation of written test data and interviews was carried out as shown in the following table:

Table 3. Difficulty in Understanding Concepts and Algorithms for students in the Very Low category

NO	Indicator	Subject	Information	
			Written test	Interview
1	Concept Difficulty	K10	Students have conceptual difficulties because students cannot make answers in two different ways	Students have conceptual difficulties because students cannot explain how to solve problems
		K11	Students have conceptual difficulties because students cannot make answers in two different ways	Students do not have concept difficulties because students cannot explain how to solve problems
2	Principle Difficulty	K10	Students have not been able to understand and apply the formula so that the work is not systematic	Students have no difficulty in remembering the formulas used so that the work is systematic
		K11	Students have not been able to understand and apply the formula so that the work is not systematic	Students do not have difficulty in remembering the formula used so that the work is systematic
3	Operation Difficulty	K10	Difficulty operating operations because students can't complete the answer correctly	There are operational difficulties because students have not completed the correct answer
		K11	Difficulty operating operations because students can't complete the answer correctly	There are operational difficulties because students have not completed the correct answer

4.2 Discussion

From the results of the analysis and the learning process that was carried out for two meetings in class X Mia SMA PRIVATE ASSISI gave reflective learning results. The difficulty of students from the category of ability to understand mathematical concepts and algorithms is very low, namely students have difficulty solving all the questions given. There are no indicators of the ability to understand mathematical concepts and algorithms that meet the requirements. This can be seen from the students' answers which only contain what is known on the questions and cannot complete the answers properly. Meanwhile, students from the category of ability to understand concepts and mathematical algorithms are in the medium category, students have difficulty in solving problems, namely difficulties in indicators of concepts, principles and operations. However, each student did not experience difficulties in each of these indicators. There are students who have difficulty with concept indicators. There are also students who have difficulty with indicators of concepts and principles. And there are also those who have difficulty in principle and operating indicators. This can be seen in the answers of students who still have many errors. Then the difficulty of students from the category of ability to understand concepts and high mathematical algorithms can be seen from the achievement of the indicators. In addition, the ability to understand mathematical concepts and algorithms in the medium category shows that students still do not meet the indicators of difficulty of concepts, principles, and operations. This shows that students' mathematical difficulties are still relatively low. Students have not been able to develop the ability to understand mathematical concepts and algorithms through the learning provided by the teacher. And the difficulty of students from the category of high creative thinking ability is only on the operating indicators. This can be seen from the results of students' answers which are generally wrong on the operating indicators. In addition, the ability to understand mathematical concepts and algorithms in the high category shows that students have almost no difficulties in the indicators of concept, principle, and operation difficulty.

5 Conclusion

Based on the results of the analysis, research findings and research discussions that have been described after learning with realistic mathematical education models assisted by algebraator software, conclusions are obtained about the ability to understand mathematical concepts and algorithms and the difficulties experienced by students, especially students of ASSISI Siantar Private High School class X mia 2, namely : The ability to understand students' mathematical concepts in the material of a system of linear equations. Three variables in students were obtained that the lowest achievement score was on the indicator of applying the concept of an algorithm in problem solving, followed by the indicator restating a concept, then on the indicator presenting the concept in the form of a mathematical representation. Then seen from the average score of achievement indicators carried out through the ability test for understanding the concepts of high school students Assisi Siantar class x mia 2 classified in the Medium category. The ability of students' mathematical algorithms on the material of a system of linear equations. Three variables are classified at the moderate level of ability, this can be seen from the results of the scores on each indicator that are still in the average category of 55.2. Difficulty in understanding mathematical concepts in mathematics learning with the Realistic Mathematical Education learning model with the help of Algebraator Software, as follows: in the high category, students do not experience difficulties; in the medium category, students have difficulty

understanding concepts so that students experience confusion when solving problems; and students also have difficulty in operating the equation; in the very low category, students have difficulty in all indicators on the ability to understand concepts. Students are not able to use the solution method so they are not able to solve the problem.

Difficulty in the ability of mathematical algorithms in learning mathematics with the Realistic Mathematical Education learning model Assisted by Algebrator Software, as follows: in the high category, students do not experience difficulties; in the medium category, students have difficulty understanding the procedure which is a solving algorithm so that the student experiences confusion when solving problems; and students also have difficulty in operating the equation; in the Very low category, students have difficulty in all indicators of Algorithm ability. Students are not able to use solving methods and algorithm procedures so they are not able to solve problems.

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