

Student Mathematical Modeling Ability with Blended Learning Approach on Two Linear Inequality Materials

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ABSTRACT

This study aims to describe student's mathematical modeling abilities after the application of learning with the Blended Learning approach to the linear inequalities of two variables. This research type is descriptive research with the research subjects are students of class X IPS 4 at SMAN 14 Palembang, totalling 19 people. The data collection technique was carried out with a written test consisting of nine descriptive questions to measure students' mathematical modeling abilities. The test questions are arranged based on mathematical modeling indicators. Based on the results of the study, it was found that the mathematical modeling abilities of students in class X IPS 4 at SMAN 14 Palembang were in the sufficient category with the following details: 3 students are in the very good category, 8 students are in the good category, 3 students are in the sufficient category, and 5 are students in the poor category.

Keywords: *Mathematical Modeling Ability, Blended Learning*

1. INTRODUCTION

The purpose of the Education Unit is to build a foundation for the development of creative and innovative potential of students, in accordance with mathematical modeling the creative needs of students to solve everyday problems into mathematical form [1].

According to Niss [2], there are five modeling arguments included in the curriculum, namely: formative, critical, practical, cultural, and instrumental. Niss explained that application and modeling should be part of the mathematics curriculum resulting: (1) Generate, develop, and qualify students' critical potential towards the use of mathematics, (2) Prepare students to be able to practice application and modeling in mathematics subjects, (3) Build a representative and balanced picture of mathematics as character and role in the world.

However, according to the results of [3] in class VIII E at SMPN 2 Badegan Ponorogo there are still many students who find it difficult to contemplate math problems on algebraic material. Which are the students find it difficult to define concepts, create models, define symbols and images. This is in accordance with the results of research by [4] which showed that students

experienced errors in solving linear inequality problems of two variables, in which students experienced errors in translating questions by 60%, errors in translating questions into mathematical models by 40%. This problem occurs because of the lack of inculcation of mathematical concepts in students, therefore according to [5] understanding the concept needs to be instilled for a student, since the first time they received a mathematical material at the elementary education level. In line with this, Many teachers in the field still apply conventional and teacher-centered learning which causes students to get bored with learning mathematics [6],[7]. The results of the study [8] stated that students had difficulties in processing the information contained in the questions, had difficulty using the concept of a linear inequality of two variables and did not reread parts that were not understood, namely not finding errors when solving problems even though the completion steps used did not appropriate, and also does not correct the error.

In the current state of the need for innovation in learning mathematics, one of the learning approaches that can be used is the blended learning approach. The understanding of mathematical concepts and problem-solving abilities of students who apply the blended

learning approach is better than those who follow conventional learning [9].

Based on the description above, the role of the Blended Learning approach for students' mathematical modeling abilities is to become a link that can be used in solving real-world problems with the knowledge possessed by students. In this study, it will describe students' mathematical modeling abilities after applying the Blended Learning approach to linear inequalities of one variable.

2. METHOD

2.1. Research Procedure

This research is a descriptive research, means a research that aims to describe students' mathematical modeling abilities using the Blended Learning approach on the material of two-variable linear inequalities.er than those who follow conventional learning.

2.2. Subject

The subjects in this study were students of class X IPS 4 at SMA Negeri 14 Palembang, totalling 19 people. The selection of subjects in this study was based on the recommendations of the subject teacher.

2.3. Data Analysis

This research consists of three stages, which consists the preparation stage, the implementation stage, and the data analysis stage. At the preparation stage, the researcher made student worksheets (LKPD), made lesson plans, and create test questions which are then validated with the supervisor and two lecturers and also with one of the mathematics teachers.

At the implementation stage, which is a learning method using the Blended Learning approach on the material of linear inequalities of two variables that carried out 3 times, consisted of 2 meetings of the learning process, and 1 meeting to conduct tests. The steps of learning mathematics using the Blended Learning Approach refer to the ability of students' mathematical modeling. Furthermore, the data was collected through a written test. Researchers used test questions in the form of essay tests to measure students' mathematical modeling abilities. The test questions are made based on indicators of mathematical modeling ability, which are then corrected according to the scores that have been made.

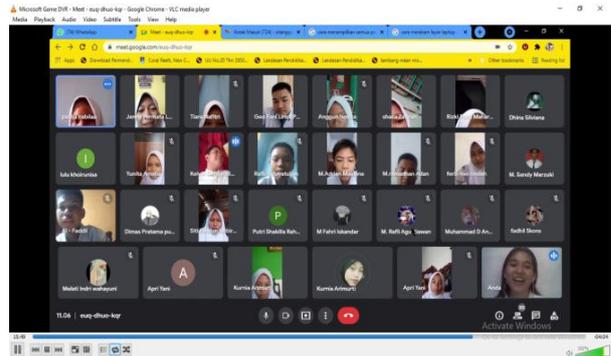


Figure 1 Learn by using Google Meeting

The results of the test data will be analyzed to see the students' mathematical modeling abilities. Based on the results of the test, a score of the student's modeling ability will be obtained and the score will be added up and analyzed.

Table 1. Category of student's mathematical modeling ability

Student Score	Modeling Ability Category
$80 \leq S \leq 100$	Excellent
$60 \leq S < 80$	Good
$40 \leq S < 60$	Fair
$20 \leq S < 40$	Poor
$0 \leq S < 20$	Very Poor

3. MATH AND EQUATIONS

This research was applied in class X IPS 4 at SMAN 14 Palembang. This research was conducted for 3 meetings, 2 times of the learning process, and 1 time for test of students' mathematical modeling abilities. At the implementation stage, the learning process with the Blended Learning approach is carried out online with the main activity of the teacher guiding students in learning according to the characteristics of the Blended Learning approach, aiming for information based on online or offline, expressing, and finding and understanding the problems given to be able to construct knowledge, based on the results of analysis and formulation of conclusions [10]

After learning using the Blended Learning approach for 2 meetings, at the third meeting, a test was carried out. The test questions given contain 9 description questions which are stages of mathematical modeling that aim to obtain data on students' mathematical modeling abilities. The test questions used are as follows:

SOAL TES

NAMA :
 KELAS :
 HARI/TANGGAL :
 Petunjuk pengerjaan soal :
 1. Perhatikanlah soal dengan teliti !
 2. Kerjakanlah soal dari tahap pertama sampai akhir dengan baik dan benar!

Ongkir dari Bukit Kecil ke Batam Kota dengan berat paket 1.000 gram

Kurir	Layanan	Sampai (Hari)	Ongkir (Rp)
JET	CRG	11	3.360.000
JET Express	Cargo		
JET	PRI	2	61.000
JET Express	Priority		
JET	REG	6	29.000
JET Express	Regular		

Diki adalah pengusaha yang menjual barang secara online. Diki mengirimkan setiap barang jualannya menggunakan JET Express. Seorang pembeli meminta pengiriman barang yang dibelinya dari Palembang ke Batam. Dia akan meminta Diki untuk mengirim barang dengan waktu 2-4 hari dan dengan rentang waktu 5-10 hari akan tetapi dia hanya memiliki uang tidak lebih dari Rp 500.000,00. Maka berapa banyak jumlah barang yang mungkin dikirim oleh diki jika pembeli tersebut pasti membeli barang yang sampai 2-4 hari dan 5-10 hari ?

1. Apa masalah yang dihadapi oleh Diki ?
2. Perhatikan daftar ongkos kirim paket di atas! Tentukanlah layanan JET express yang akan digunakan oleh Diki untuk dokumen dan barang
3. Apa saja yang mempengaruhi jumlah paket yang akan dikirim oleh Diki ?
4. Ubahlah hal yang mempengaruhi jumlah paket yang akan dikirim oleh Diki menjadi variabel
5. Buatlah model matematika dari permasalahan yang telah ditemukan !
6. Jika Diki ingin mengirim 4 Dokumen dan 10 Kg barang. Apakah uang yang dimiliki Diki cukup ?
7. Jika diki akan mengirim dokumen saja dan barang saja maka tentukanlah
 - a. Jumlah dokumen saja
 - b. Jumlah barang saja
8. Jika Diki diwajibkan untuk mengirim dokumen dan barang berapakah jumlah maksimum barang dan dokumen yang mungkin dikirim oleh diki ?
9. Solusi yang diperoleh oleh diki untuk jumlah barang dan dokumen adalah

Figure 2 Mathematical modeling ability test questions

The test questions given refer to indicators of mathematical modeling ability. After students collect the test questions, they are working on to the researcher's email. The test results are then checked by the researcher based on indicators of mathematical modeling ability. Furthermore, a score is given based on the assessment that has been made in accordance with the indicators of mathematical modeling, each of which has a maximum score of 50 with the provisions of the first indicator, which is identifying problems given a maximum score of 10, second is determining assumptions (determining variables) given a maximum score of 10 points, third is determining the mathematical model given a maximum score of 10 points, the fourth is problem solving with a mathematical model is given a maximum score of 10, and the fifth indicator is interpreting the problem (providing conclusions) given a maximum score of 10. Then the score is converted to a swimming value of 0-100. Students' mathematical modeling abilities can be seen from Table 2.

Table 2. Frequency distribution of mathematical modeling ability

Score	Category	Frequency	Percentage
$80 \leq S \leq 100$	Excellent	3	15,78%
$60 \leq S < 80$	Good	8	42,10%
$40 \leq S < 60$	Fair	3	15,78%
$20 \leq S < 40$	Poor	5	26,31%
$0 \leq S < 20$	Very Poor	0	0%
Mean	Fair	56,73%	

From the data in Table 2, it can be seen that the average mathematical modeling ability of students in class X IPS 2 at SMAN 14 Palembang got a score of 56.73 and was categorized as fair.

Based on the test results that have been obtained, the first student is one of the students with a very good modeling ability category. The following are the results of the student's work on the test questions. Students have done all stages of modeling skills well.

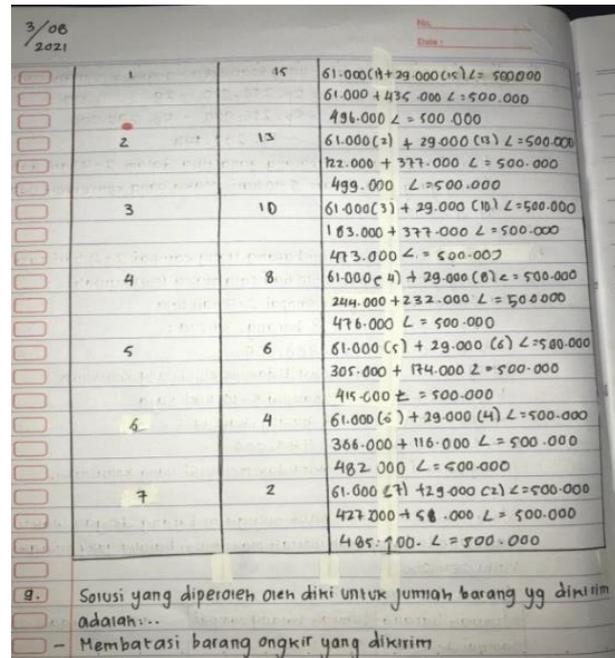


Figure 3 Student test results in excellent category

Based on the picture above, students have been able to meet all indicators of mathematical modeling ability, only on the indicator of interpreting the results in question number 8 students cannot change the results found into mathematical sentences. This is in line with the opinion of [11] which states that students are less thorough in working on problems so that in interpreting the solutions obtained are less precise or inappropriate. This statement is also supported by Pape and Wang in their research which states that students have difficulty in interpreting problems in the form of variables or into other mathematical forms [12]. This causes students to experience problems in converting problems into mathematical form.

The second student is one of the students with a good category, the student has been able to complete the stages of mathematical modeling but is not much different from the first student, the second student missed several stages of mathematical modeling so that he did not get good results

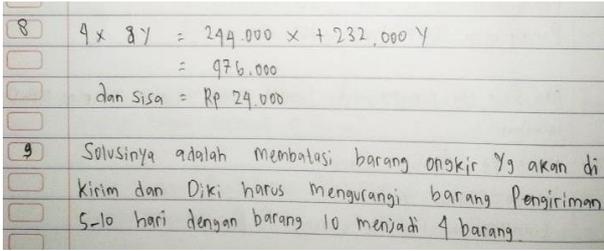


Figure 4 Good category student test results

Based on the picture above, students have been able to complete the stages of mathematical modeling properly and correctly until the final stage, but in question number 8 students do not fill in the table given correctly and only determine directly so that in interpreting the results of the solution students are not as they should be. This happened because of the students' inaccuracy in reading the questions and understanding what was asked on the questions so that the students did not answer according to the instructions. In the research of [12] they state that if the mathematical model is not appropriate, it will have an impact on final decision making or have an impact on interpreting the results and determining inappropriate solutions.

This third student is a student with less ability. Students do the modeling stage until the end, but there are some errors in answering the questions so that the modeling stage. The following is the result of the student's work.

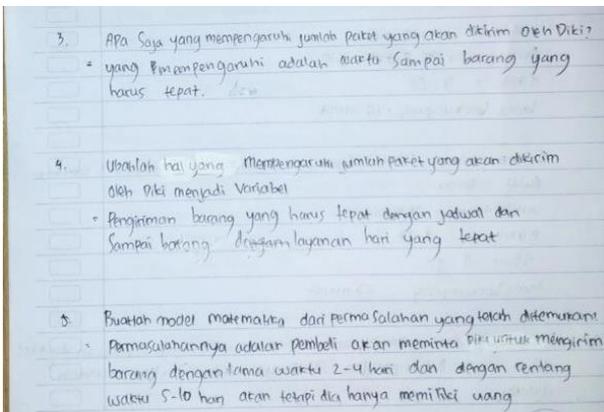


Figure 5 Student test results in the category of less

Based on the results of the student's work on question number 3 students answered but did not match what was asked. In question number 4 students were asked to make an mathematical model, but this student was not able to make a mathematical model so that he experienced errors in answering the following questions. the other is to translate the problem into a variable form. This learning process is carried out online so that these students may have difficulties in learning or are not ready for the learning process. This is in accordance with the opinion of [13] that students' mistakes in working on mathematical modeling problems are influenced by several factors, namely cognitive

development, student readiness in learning or tests/exams.

Research on students' mathematical modeling abilities with Blended Learning approach on linear inequalities of two variables aims to get an idea of the mathematical modeling abilities of students in class X IPS 4 at SMAN 14 Palembang, which is done through the test questions given.

Based on the results of the review, there were 5 indicators of students' mathematical modeling abilities, namely identifying problems, determining assumptions (making variables), determining models, solving problems with mathematical models, and interpreting and re-examining the results. Table 3 shows the results of the achievement of mathematical modeling for students of class X IPS 4 who took a test consisting of 19 students.

Table 3. Achievement of students' mathematical modeling abilities based on indicators

No	Indicator	Percentage	Category
1	Identifying Problems	68,42%	Good
2	Determining assumptions (making variables)	77,89%	Good
3	Determining the mathematical model	65,26%	Good
4	Solving problems with mathematical models	47,89%	Fair
5	Interpret results and re-checking	26,31%	Poor

Based on Table 3 The achievement of the first indicator of mathematical modeling ability is to identify problems, this indicator is included in the good category, which means that on average, students of class X IPS 4 are able to identify problems well and students can understand the information that has been given. This is in accordance with the opinion of [13] namely that students are able to determine problems or identify problems well because of the use of correct learning methods. This is in line with the opinion of [14] which explains that Blended Learning is able to increase independence and improve student learning outcomes.

The second indicator of mathematical modeling ability is included in the good category, namely students are able to determine assumptions (make variables) which means that some students are able to make assumptions correctly based on the information that has

been given and correctly make variables based on the assumptions that have been found. The information provided in the test questions can be in the form of pictures or descriptions of a story. This is in line with the opinion of [11] in their research that students are good at determining variables based on the pictures given. Ramsyah [10] also explained that in the Blended Learning stage there are steps where students can determine information based on the sources that have been given.

The third indicator of mathematical modeling ability is that students are able to make mathematical models. The indicator is included in the good category, meaning that some of the students of class X IPS 4 are able to form mathematical models based on the information that has been obtained, namely based on assumptions and variables that have been made in the second indicator. [12] state that in changing the problems of everyday life into the form of mathematical modeling, skills are needed so that the model that has been created is interpreted correctly. This is also in line with the opinion of [15] which states that blended learning is one of the appropriate learning models to develop students' mathematical communication skills where students can develop knowledge by discussing or exchanging opinions.

In the fourth indicator, the indicator of solving mathematical problems with the model, it turned out to be in the sufficient category, which means that some X IPS 4 students have not been able to solve math problems with the mathematical concepts they already have. This is in accordance with the opinion of [3] that students find it difficult to solve math problems because students are not able to define the mathematical concepts they have. According to [9] the use of Blended Learning is the most effective way and has a positive effect on mathematical competence, one of which is understanding concepts.

The fifth indicator of modeling ability is that students are able to interpret the results of the problem into mathematical language. This category includes less, which means that almost all students in class X IPS 4 are unable to interpret the mathematical results. Based on [12] research which states that the error in interpreting the results is that students do not understand the questions given and students' inaccuracy in reading and understanding the problem so that they experience conceptual errors and cannot interpret the results correctly.

The results of the research by [16] stated that the students' error in interpreting the results was 9.4%, the error in answering a problem was 27.2%, and the calculation error was 22.8%. However, overall the students of class X IPS 4 at SMAN 14 Palembang in solving linear inequalities of two variables related to everyday life are categorized as fair. This is because the

use of the Blended learning approach can help students' learning process and build students' independent nature in the learning process and improve students' mathematical communication to find ideas and discuss together in groups [15].

4. CONCLUSION

Based on the results of research in class X IPS 4 at SMAN 14 Palembang, it was concluded that the mathematical modeling ability of students with the Blended Learning approach was categorized as sufficient with details 15.78% in the very good category, 42.10% in the good category, 15.78% in the moderate category, and 26, 31% are categorized as less with an average acquisition of 56.73.

The Blended Learning approach helps students in solving mathematical modeling problems where Blended learning affects students' critical thinking and builds students' independent nature in the online learning process. From the results of these studies, it is recommended to use the Blended Learning approach with material related to modeling.

AUTHORS' CONTRIBUTIONS

All authors have significant contribution in this research and article writing.

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