

Analysis of Students' Mathematical Literacy Ability in Solving Linear Equations of Two Variables

Siti Maysarah^{*1}; Sahat Saragih²; Dian Armanto³

¹Department of Mathematics Education, State Islamic University of North Sumatra, Medan

^{2,3} Postgraduate Mathematics Education Doctoral Program, State University of Medan

sitimaysarah@uinsu.ac.id^{*1}, saragihpps@gmail.com², dianarmanto@unimed.ac.id³

Abstract

The purpose of this study was to analyze students' mathematical literacy ability in solving problems related to the material of a two-variable system of linear equations. This type of research is descriptive qualitative research. The results of this study are in the form of a description of indicators of mathematical literacy ability, namely: (1) identifying facts mathematically, (2) formulating problems mathematically, (3) using mathematical concepts to solve problems, (4) carrying out calculations based on certain procedures, and (5) draw conclusions. The sample in this study were 10 students of MTs Nurul Khairiyah Deli Serdang. Based on the results of the study, it was found that the average score of students' mathematical literacy abilities per indicator in solving linear equations of two variables, namely (1) identifying facts mathematically obtained 22.5%, (2) formulating problems mathematically obtained 90%, (3) using mathematical concepts to solve problems obtained 93.75%, (4) carrying out calculations based on certain procedures 92.5%, and (5) drawing conclusions obtained 83.75%.

Keywords: *Mathematical Literacy Ability; Linear Equations of Two Variables.*

Abstrak

Tujuan penelitian ini untuk menganalisis kemampuan literasi matematika siswa dalam menyelesaikan masalah sistem persamaan linear dua variabel. Jenis penelitian ini adalah penelitian kualitatif deskriptif. Hasil penelitian ini berupa deskripsi mengenai indikator kemampuan literasi matematika, yaitu: (1) mengidentifikasi fakta-fakta secara matematis, (2) merumuskan masalah secara matematis, (3) menggunakan konsep matematis untuk memecahkan masalah, (4) melaksanakan perhitungan berdasarkan prosedur tertentu, dan (5) menarik kesimpulan. Sampel dalam penelitian ini adalah 10 orang siswa MTs Nurul Khairiyah Deli Serdang. Berdasarkan hasil penelitian diperoleh skor rata-rata kemampuan literasi matematika siswa per indikator dalam menyelesaikan soal persamaan linear dua variabel, yaitu (1) mengidentifikasi fakta-fakta secara matematis diperoleh 22,5%, (2) merumuskan masalah secara matematis diperoleh 90%, (3) menggunakan konsep matematis untuk memecahkan masalah diperoleh 93,75%, (4) melaksanakan perhitungan berdasarkan prosedur tertentu 92,5%, dan (5) menarik kesimpulan diperoleh 83,75%.

Kata Kunci: Kemampuan Literasi Matematika; Persamaan Linear Dua Variabel.

*Correspondence:

Email: sitimaysarah@uinsu.ac.id

INTRODUCTION

Mathematics is one of the branches of science that plays a role in improving students' critical, logical and mathematical thinking ability. This is because in the process of learning mathematics students are required to be able to solve the problems given by thinking critically and logically.

In relation to mathematics, the objectives of learning mathematics listed in the 2013 Curriculum are so that students can: 1) understand mathematical concepts; 2) using patterns as conjectures in solving problems, and being able to make generalizations based on existing phenomena or data; 3) using reasoning on properties, performing mathematical manipulations both in simplification, and analyzing existing components in problem solving in the context of mathematics and outside mathematics; 4) communicate ideas, reasoning and be able to compile mathematical evidence using complete sentences, symbols, tables, diagrams or other media to clarify the situation or problem; 5) have an attitude of appreciating the usefulness of mathematics in life; 6) have attitudes and behaviors that are in accordance with the values in mathematics and learning; 7) perform motor activities using mathematical knowledge; 8) using simple teaching aids and technology results to carry out mathematical activities (Kemendikbud, 2014).

The implementation of the 2013 revised 2017 curriculum is strengthening character education, strengthening literacy, and 21st century education. Of the three important agendas of the 2013 curriculum, strengthening literacy culture is one that is in the spotlight. Furthermore, currently mathematical literacy is needed by students to develop their knowledge and potential, as well as to fulfill the requirements in the independent curriculum. Literacy is a set of individual abilities and skills in reading and writing and in solving problems in everyday life.

Mathematical literacy is an important factor in the learning process. Mathematical literacy is able to help students succeed in their lives, because mathematics is not just a science but a mastery of mathematical skills by understanding the mathematics around it (Jannah, et al: 2021: 227). Mathematical literacy is knowledge in understanding and applying mathematics in everyday life. People who are mathematically literate are able to make estimates, interpret data,

solve everyday problems, reason in numerical situations, graphs and geometry, and communicate with mathematics.

Mathematical literacy ability are needed by students to face and solve various challenges of today's life. Mathematical literacy ability is an individual's ability to formulate, use, and interpret mathematics in various contexts, including the ability to reason mathematically and use concepts, procedures, facts as a tool to describe, explain, predict a phenomenon or event (OECD, 2003). The transformation of the principles of mathematical literacy, there are three major components identified by the PISA study, namely the components of content, process, and context. One of the content components includes: space and shape. There are several process components in the PISA study. The process components according to the Organization for Economic Co-operation and Development (OECD, 2012), include (1) Communication, (2) Modeling or Mathematising, (3) Representation, (4) Mathematics Reasoning and Argumentation, (5) Problem Posing and Solving , (6) Symbols and Formalism, and (7) Mathematics Tools. While the context component focuses on the personal context (personal), work (occupational), social context (social), the context of science (scientific).

Reported through the website <https://www.oecd.org>, the results of the 2018 PISA survey which focused on the categories of reading, science, and mathematics, stated that Indonesia's score, especially mathematical literacy, was low because it was ranked 72th out of 79 countries that registered with score 379. Meanwhile, the PISA 2022 results for mathematics literacy ranking have increased while the score has decreased, namely ranking 66th with a score of 366 (Kemendikbudristek, 2023).

From the data above, it is known that the mathematical literacy ability of students in Indonesia is still low. Indonesia's achievements are still far compared to other countries. From the PISA test questions, it shows that Indonesian students have difficulty in mathematical literacy ability. If this is allowed, it will certainly have a bad effect on students in Indonesia.

Meanwhile, another fact obtained from the Third International Mathematics Science and Study (TIMSS), reports that Indonesia's competition for

science and mathematics learning outcomes is very concerning. Student achievement in mathematics has never been in the top rank and even tends to be below. This can be seen from TIMSS-R-1999 where Indonesia is ranked 34th out of 38 countries with a score of 403, TIMSS-R-2003 is ranked 35th out of 46 countries with a score of 411, TIMSS-R-2007 is ranked 36th out of 49 countries with a score of 397, TIMSS-R-2011 is ranked 38 out of 42 countries with a score of 386 and TIMSS-R-2015 is ranked 44 out of 49 countries with a score of 397 (OECD, 2017).

Several factors that influence the achievement of mathematical literacy in Indonesia include personal factors, instructional factors and environmental factors (Mahdiansyah & Rahmawati, 2014). The personal factors studied were students' perceptions of mathematics and students' beliefs about their mathematical abilities. Instructional factors related to the intensity, quality and teaching methods. The characteristics of teachers and the availability of learning media in schools are environmental factors. This is in line with the results of Sezgin's research (2017) regarding the factors that influence mathematical literacy, including the relationship between students and teachers and students' views on mathematics.

Based on the results of initial observations made by researchers with several mathematics teachers at SMP/MTs Deli Serdang, it was found that the problem was that teachers had rarely implemented learning that involved student activity. Learning that is often done is still teacher-centered, not student-centered. Teachers rarely involve the surrounding environment as a means of learning in understanding the mathematics material being taught. In addition, so far, teachers rarely give questions that require higher-order thinking processes or known as Higher Order Thinking Skills (HOTS). Teachers are used to giving questions that are abstract and rarely give contextual questions, for example in learning the material for a two-variable linear equation system (SPLDV). SPLDV is a mathematical equation consisting of two linear equations, each of which has two variables, for example the variable x and the variable y . The discovery of the x and y variables can be solved in four ways, namely: elimination, substitution,

combination (elimination and substitution), and graphs. Many of the questions in the SPLDV can be presented in contextual problems, not only in abstract questions. The teacher's ability to make contextual questions is a concern now so that students are able to improve their mathematical literacy ability.

Based on the description above, the purpose of this study is to analyze and describe students' mathematical literacy ability in solving two-variable system of linear equations.

RESEARCH METHODS

This type of research is a qualitative research that uses a descriptive research methodology. This research was conducted at MTs Nurul Khairiyah Deli Serdang, North Sumatra in the odd semester of 2022. The sample of this study was 10 students at MTs Nurul Khairiyah Deli Serdang. The instrument of this research is a test of mathematical literacy ability and interview guide. The grid of mathematical literacy ability test instruments is presented in the following table:

Table 1. Mathematical Literacy Ability Test Instrument Grid

Topic	Mathematical Literacy Indicator	Question Number
Two	Be able to identify the facts mathematically	1,2
Variable	Formulate the problem mathematically	1,2
Linear	Using mathematical concepts to solve problems	1,2
Equation	Carry out calculations based on certain procedures	1,2
System	Draw a conclusion	1,2

RESULTS AND DISCUSSION

The research data can be seen from the scores of students' mathematical literacy ability in answering questions of linear equations in two variables. The problems given are as many as 2 description questions with the following problems:

Problem 1:

Look at the following picture!



Figure 1. Problem Illustration (www.google.com)

The price of 4 notebooks and 4 pens is Rp. 18,000.00. If Lina buys 3 books and 2 pens at a price of Rp. 12,000. How much will Tina have to pay if she buys 3 notebooks and 3 pens?

To answer the questions above, consider the following sequence:

- a. Write down what is known and asked in the question!
- b. Write the problem in a mathematical model or symbol!
- c. What method will you use to solve this problem?
 - d. Write down the process of solving the answer using the method you chose!
- e. What can you conclude from this problem?

Based on the analysis of the answers of 10 students of MTs Nurul Khairiyah to the first problem, the mathematical literacy ability were obtained as follows: (1) For the first indicator, namely being able to identify facts mathematically, the average score obtained by students is 37.5%. Of course this is still in the very low category. Here, many students do not make what is asked and known in the question. Students directly make into mathematical modeling in the form of equations. (2) For the second indicator, namely formulating problems, the average score of students reaches 90% and is already in the very good category. On average, students are able to make an equation of two variables from the given problem. (3) For the third indicator, which is using mathematical concepts to solve problems, the average score of students reaches 95% and is already in the very good category. The average student is able to determine the best solution method to solve the problem. On average, students use mixed methods (elimination and substitution) in solving problems of a two-variable linear equation system. (4) For the fourth indicator, which is carrying out calculations based on certain procedures, the average score of students reaches 95% and is already in a very good indicator. Overall, students are able to carry out the calculation process properly and correctly according to the solution method they

choose. (5) For the fifth indicator, drawing conclusions reached 95%, the average score obtained by students reached 95% and was in the very good category. Overall, students are able to make conclusions from the problems given. Although there are still a small number who do not make conclusions even though the answers are correct.

Problem 2

The tour boat manager sells tickets for a family group consisting of 2 adults and 1 child at a ticket rate of IDR 170,000.00. Not long after, a family group consisting of 1 adult brought their 3 children and paid Rp. 185,000.00 for a ticket. What is the fare for a family group consisting of 3 adults and 3 children?



Figure 2. Problem Illustration (www.google.com)

To answer the questions above, consider the following sequence:

- Write down what is known and asked in the question!
- Write the problem in a mathematical model or symbol!
- What method will you use to solve this problem?
- Write down the process of solving the answer using the method you chose!
- What can you conclude from this problem?

Based on the analysis of the answers of 10 students of MTs Nurul Khairiyah to the first problem, the mathematical literacy ability were obtained as follows: (1) For the first indicator, namely being able to identify facts mathematically, the average score obtained by students is 7.5%. Of course this is still in the very low category. Here, many students do not make what is asked and known in the question. Students directly make into mathematical modeling in the form of a linear equation of two variables. (2) For the second indicator, namely formulating problems, the average score of students reaches 90% and is already in

the very good category. On average, students are able to make an equation of two variables from the given problem. (3) For the third indicator, which is using mathematical concepts to solve problems, the average score of students reaches 92.5% and is already in the very good category. The average student is able to determine the best solution method to solve the problem. On average, students use mixed methods (elimination and substitution) in solving problems of a two-variable linear equation system. (4) For the fourth indicator, namely carrying out calculations based on certain procedures, the average score of students reaches 90% and is already in a very good indicator. Overall, students are able to carry out the calculation process properly and correctly according to the solution method they choose. (5) For the fifth indicator, drawing conclusions reached 72.5%, the average score obtained by students reached 95% and was in the very good category. Overall, students are able to make conclusions from the problems given. Although there are still some students who do not make conclusions even though the answers are correct.

Overall, the average achievement of mathematical literacy ability based on the indicators on the two-variable linear equation system problem can be seen in the following table.

Table 2. The Average Achievement of Mathematical Literacy Ability Based on the Indicators on the Two-Variable Linear Equation System Problem

Mathematical Literacy Indicator	Average Score
Identify the facts mathematically	22,5%
Formulate the problem mathematically	90%
Using mathematical concepts to solve problems	93,75%
Carry out calculations based on certain procedures	92,5%
Draw a conclusion	83,75%

Based on the table above, information can be obtained that the achievement of the lowest indicator of students' mathematical literacy ability is the indicator of identifying facts mathematically. The average score of students only reached 22.5% and was in the very low category. Of course, this is still very far from what was expected. Students are not used to making what problems are

known and asked in the questions. Meanwhile, the second highest achievement indicator of students' mathematical literacy ability is the indicator of using mathematical concepts to solve problems. Most of the students have been able to solve the problem of a system of linear equations with two variables using the method of elimination and substitution. However, there are no students who use the graphical method. This is because students are accustomed to using the easiest way to solve problems, namely the combined method. From the combined method, students can do two ways, namely elimination and substitution. After that, the average achievement of students' mathematical literacy ability on the indicators of formulating problems and carrying out calculations according to procedures was also in the very good category, namely 90% and 92.5%. Meanwhile, the indicators draw the conclusion that the average student score reaches 83.75% and is in a good category. Some students are not used to writing conclusions from the problems they are looking for.

CONCLUSION

Based on the results of the data analysis carried out, it can be concluded that the achievement of the average score of mathematical literacy ability in solving linear equations of two variables in terms of overall indicators, namely: (1) identifying facts mathematically obtained 22.5%, (2) formulating problems mathematically obtained 90%, (3) using mathematical concepts to solve problems obtained 93.75%, (4) carrying out calculations based on certain procedures 92.5%, and (5) drawing conclusions obtained 83.75%. Overall, students at MTs Nurul Khairiyah have good mathematical literacy ability, although there is still one indicator that needs to be improved. The suggestion from the researcher is that it is necessary to conduct continuous research and development to determine the level of development of students' mathematical literacy.

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