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Mathematical Representation Ability of VIII Grade Students in Linear Equation Using Math Literacy-Based E-Module

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Abstract: This study aims to describe mathematical representation ability of 8th grade students in learning linear equation using mathematical literacy-based e-module. This research is a descriptive research with a quantitative approach. This research was conducted on VIII.4 grade students of SMP Negeri 45 Palembang with 29 students in total. Data was collected using written tests and interviews. Based on mathematical representation ability test results, students abilities are as follows: 13.79% of high-ability students, 68.96% of medium-ability students and 17.24% of low-ability students. The mathematical representation ability of students after learning using e-module is in low category with 55,17 as average score.

Keywords: Mathematics Representation Ability; Literacy Based E-Module; Linear Equation

Kemampuan Representasi Matematika Siswa Kelas VIII dalam Persamaan Linear Menggunakan E-Modul Berbasis Literasi Matematika

Abstrak: Tujuan penelitian ini adalah untuk mendeskripsikan kemampuan representasi matematis siswa kelas VIII dalam pembelajaran materi persamaan garis lurus setelah melakukan pembelajaran dengan menggunakan e-modul berbasis literasi matematika. Penelitian ini merupakan penelitian deskriptif dengan pendekatan kuantitatif. Penelitian dilaksanakan kepada siswa kelas VIII.4 SMP Negeri 45 Palembang dengan jumlah 29 siswa. Data dikumpulkan dengan menggunakan tes tertulis dan wawancara. Berdasarkan data hasil tes kemampuan representasi matematis, kemampuan siswa yaitu sebagai berikut: 13,79% siswa berkemampuan tinggi, 68,96% siswa berkemampuan sedang dan 17,24% siswa berkemampuan rendah. Kemampuan representasi matematis siswa setelah melakukan pembelajaran dengan menggunakan e-modul termasuk dalam kategori rendah dengan nilai rata-rata 55,17.

Kata Kunci: Numerasi; E-modul terintegrasi; Statistika.

INTRODUCTION

Mathematics is the basic science of various branches of science, so it needs to be provided to every student from elementary school, even from kindergarten to college (Rochaini & Maarif, 2019). In every mathematics lesson, carried out aims to develop students' abilities until it meets the established standards. Based on Programme for International Student Assessment (PISA) in 2022 shows that Indonesian ability in mathematics is in a low ranking. For Mathematics, Indonesia score is 366 (O.e.c.d, 2023). Individual's mathematical ability influenced by the ability to perform mathematical representations (Oktaria et al., 2016). NCTM (2000) states that there are five capabilities that must be fulfilled by students in

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standard processes for learning mathematics, namelyproblem solving, reasoning and proof (reasoning and proof), communication, connection and representation (representation).

Each mathematical ability stated by NCTM has its own role in solving mathematical problems (NCTM, 2000). One of these abilities is mathematical representation. The representation standard emphasizes the use of symbols, charts, graphs and tables in connecting and expressing mathematical ideas (Syafri, 2017).

To solve math problems, one must be able to represent mathematics. According to Damayanti & Afriansyah (2018) with good representation skills, individuals can develop and deepen understanding of concepts and their relationship with other mathematical concepts. This means that students' success in solving mathematical problems depends on their ability to make representations that can make students understand and relate to other mathematical concepts a concept with other mathematical concepts. Presenting mathematical problems in the form of images, graphs, tables, charts (image representation); using words (verbal representation); and using equations, models and mathematical symbols (symbolic representation) (Sabrina & Effendi, 2022). Awantagusnik (2022) stated that using diverse mathematical representations can help improve students' understanding of a mathematical concept they are learning. Furthermore, according to Hijriani et al. (2018) stated that the foundation or basis of how students understand and use mathematical ideas in solving a problem isinfluenced by mathematical representation.

Hutagaol (2013) stated that although mathematical representation has been established as one of the process standards that must be achieved by students through learning, its implementation is not a simple matter. Khoerunnisa & Maryati (2022) mentioned that the situation in the field shows that most educators still do not prioritize mathematical representation skills as a foundation for mathematics learning. In the teaching and learning process that occurs in schools, there is a gap between teacher knowledge and student learning habits that still do not maximize the development of representation power so that students often still have difficulty representing visually, symbolically or verbally.

Linear equations is listed in the content standards set for the Merdeka Curriculum, this material is located in phase D, precisely in the algebraic element with learning outcomes such as Students can distinguish several nonlinear functions from linear functions graphically; They can solve linear equations and inequalities of one variable. They can present, analyze, and solve problems using relationships, functions and linear equations (Kementerian Pendidikan, 2023). In a study conducted by Putri & Hakim (2019), it was found that students had been able to convert problems into mathematical expressions but there were still errors in the calculation process; students were not able to understand the meaning and draw in cartesian coordinates; students have not understood the problem so that the students make mistakes in placing the points; students have not made the right conclusions from the problems that have been given because they lack verbal representation skills. Amieny & Firmansyah (2021) shows that students mathematical representation skills are still relatively low because students are still unable to extract information from given problems at image, symbol and verbal representations. Students representation abilities based on the results of research that

has been done previously show that students still experience problems in solving mathematical problems related to the linear equation material. The low ability of students to make mathematical representations, especially in the material of linear equations, is a challenge for educators. For this reason, according to Derudinansyah & Suparman (2021), educators can utilize new innovations in educational technology, namely learning media in the form of electronic modules (e-modules) which can be used independently and have easy access for students.

E-modules are teaching materials that are uniformly designed and packaged in the smallest learning units based on a specific curriculum and related to electronic learning (Derudinansyah & Suparman, 2021). E-modules can be created using applications that support design and publication activities, namely Canva and Flip Builder. Both applications can be accessed by the public, making it easier for educators to create creative and innovative E-modules.

The use of E-modules in mathematics learning can be based on students' mathematical literacy skills. OECD (2019) states that mathematical literacy is the ability of individuals to formulate, apply and interpret mathematics in the form of context. Then according to Wati et al. (2019) is the ability of individuals to formulate, use, and make mathematical interpretations in various life contexts so that they can predict a phenomenon. This means that the use of e-modules based on mathematical literacy in learning linear equation can familiarizes students with being able to carry out mathematical reasoning, use mathematical concepts, procedures, facts and tools in describing, explaining and concluding events/phenomena with or without the presence of the teacher.

Based on the description above, there is previous research on "Representation of Junior High School Students on the Concept of Linear Equations" conducted by Putri & Hakim (2019) which shows that there are still many difficulties in performing mathematical representations. For this reason, the researcher will conduct a study with the title "Mathematical Representation Ability of Grade VIII Students Using Mathematical Literacy-Based E-Modules on LinearEquation Material" to see the mathematical representation ability of grade VIII students on linearequation material after learning using mathematical literacy-based e-modules.

METHOD

This research is a descriptive study with a quantitative approach that uses instruments in the form of test questions in the form of essay questions and interview guidelines The research was conducted in VIII.4 classin odd semester of the 2023/2024 school year at SMP Negeri 45 Palembang, South Sumatra. The research subjects totaled 29 students and will conduct learning of Linear Equation material using Mathematical Literacy-based E-Modules.

This study using triangulation data collection techniques. According to Alfansyur & Mariyani (2020) the triangulation method is one of the methods used to test the validity of information. So this study used several instruments, E-Modules based on mathematical

literacy, test and interview guidelines. E-Modules are used as learning media for linearequation material. Test are used as a measuring tool for students' mathematical representation abilities on linear equation material and interview guidelines are used as a reference for conducting interviews to match support the results of his mathematical representation ability based on the learning outcomes on the mathematical representation ability test. In this study, questions were used to measure students' mathematical representation ability in solving linear equation test questions after learning using mathematical literacy-based E-modules.

The data analysis technique applied in this research is quantitative and qualitative. The results of test answered by students will analized by quatitative and the interviews result will analized by qualitative. Interviews were conducted by following the interview guidelines to the research subjects selected after conducting the previous data reduction. The questions to be given to students were prepared with the aim of finding out more about students' representation skills. The interview was conducted in a semi-structured type so that students can give their ideas about problem solving and can find problems more openly. The subjects selected to be interviewed regarding further mathematical representation ability were 6 students from class VIII.4, SMP Negeri 45 Palembang in the 2023/2024, with 2 students each in each type of high, medium, and low categories.

RESULT AND DISCUSSION

This study produces data on the results of the mathematical representation ability test which is collected through a test instrument in the form of a description question consisting of 3 questions. This test is done by 29 students individually with 60 minutes. Students are directed to work on test questions after learning linear equation using mathematical literacy-based E-Modules. The purpose of this question is to determine students mathematical representation ability.

Based on the results of the analysis of the answer sheets of test questions, data can be categorized into 5 groups and presented into Table 1 below.

Table 1. Category Grouping of Test Result

Value	Category	Frequency	Precentage
$80 \leq x$	Very Good	4	10,34%
$60 \leq x < 80$	Good	8	27,58%
$40 \leq x < 60$	Simply	11	37,93%
$20 \leq x < 40$	Less	6	20,68%
$x < 20$	Very Less	0	0%

Based on the test results that have been described in Table 1, there are 4 students with very good abilities in working on representation ability test questions, 8 students with good abilities in working on representation ability test questions, 11 students with sufficient abilities in working on representation ability test questions and 6 students with poor abilities in working on mathematical representation ability test questions.

Table 2. Precentage of Student Ability Per Indicator

Category	Precentage of Student Ability		
	Symbolic	Visual	Verbal
High	88%	88%	88%
Medium	51%	55%	64%
Low	28%	42%	42%

In table 2 above is the percentage of student ability based on the answer score in table 1. According to student ability category, high ability students have been able to do mathematics representation by fulfilling 88% of the indicators of symbolic representation ability, 88% meet the indicators of visual representation ability, and 88% meet the indicators of visual representation ability. verbal representation ability. Students with moderate ability are quite capable of doing mathematical representation by fulfilling 51% of indicators of symbolic representation ability, 55% fulfill indicators of visual representation ability, and 64% fulfill verbal representation ability. And low ability students are less able to perform mathematical representations because they reach 28% of indicators of symbolic representation ability, 42% meet indicators of visual representation ability, and 42% meet verbal representation ability.

Table 3. Student Ability Categories

Category	Formula
Low	$X < 37{,}69$
Medium	$37{,}69 \leq X \leq 72{,}66$
High	$X \geq 72{,}66$

The table above is a consideration in the selection of subjects who will be further analyzed and interviewed regarding students' mathematical representation abilities. Each category will be randomly selected as many as two students who will be selected as research subjects.

The results of this study show that students have different answers in answering the same problem and students use a variety of mathematical representations in solving problems. Based on table 1 It can be seen that students have different levels of ability in using mathematical representations in solving problems.

Based on the results of the written test and the results of interviews that have been conducted to research subjects who have a high level of ability, the results of the written test are the same as the results of the interview. The test results of the representation ability of subjects who have high abilities show that students have been able to use mathematical representations in working on problems.

From the research conducted, research subjects who have high abilities have been able to use visual, verbal and symbolic representations in solving math problems in line with research conducted by Syabaniah (2022). Visual representation ability in high ability students is in accordance with the indicator, namely restating data from a form of representation to

another form of representation. Students answer questions that have indicators of visual mathematical representation ability correctly and do not experience great difficulty when converting one form of representation to another. Students are also able to find out information from a pictorial representation and answer correctly. Then in the aspect of verbal representation ability, high ability students are able to fulfill the indicators of answering questions with words. Based on the test questions given, it is known that high ability students are able to provide answers and answer the questions correctly. the right reason in completing the given problem. The reason is written in the form of a mathematical process and students are able to explain the thought process in solving the problem during the interview. In the aspect of symbolic representation ability, high ability students have been able to fulfill the indicators of making equations or mathematical models to solve problems. High ability students are able to combine visual representation skills to draw the information needed to carry out a mathematical process in forming a linear equation.

Then the visual representation ability of students with moderate representation ability, fulfills the indicator of restating data from a form of representation to another form of representation. However, in this case, some students experience errors in mapping points on the cartesian plane. From the problem given, students experienced confusion in determining the data to be represented by the x-axis or y-axis. In the aspect of verbal representation ability, moderate ability students are quite capable of fulfilling the indicators of answering questions with words. In line with research conducted by Huda et al. (2019) students have been able to answer math problems using words in writing but not in full, through the interview process it is known that students are able to explain the answers completely. This is influenced by students having difficulty in stringing the words. In the aspect of symbolic mathematical representation ability, students who have moderate ability have been able to fulfill the indicator of making equations or mathematical models to solve problems. Students have been able to answer questions 1a, 1b and 2a well but have little difficulty understanding and answering questions number 3a and 3b.

Furthermore, students who have low ability in performing mathematical representations are known to have difficulty in using mathematical representations when answering the questions given. In the aspect of visual representation ability, students have not been able to fulfill the indicator of restating data from one form of representation to another. Students have not been able to map determine the coordinate points and the visual representation, mapping it on the cartesian plane. In the aspect of verbal representation ability, they have not been able to fulfill the indicator of answering questions in words. In this case, some students only answered briefly and did not provide reasons and some students answered the questions correctly but were unable to provide reasons. In the aspect of symbolic representation ability, students have not been able to fulfill the indicator of symbolic representation ability, namely using equations or mathematical models to solve mathematical problems. Through interviews, low ability students stated that they experienced confusion in answering mathematical representation test questions. This is in line with research conducted by Mulyaningsih et al. (2020) which states that most students do not really understand the

material provided. This means that students who have low abilities have several obstacles, namely not understanding the concept, not understanding the formula that must be used so that students only do what they know in accordance with research conducted by Herdiman et al.

CONCLUSION

Based on research conducted in class VIII.4 at SMP Negeri 45 Palembang, it can be concluded that the mathematical representation ability of the class students after learning the linear equation material using mathematical literacy-based E-modules is in the low category with an average score of 55.17. Based on the data from the mathematical representation ability test results, students' abilities are as follows: 13.79% of students with high ability, 68.96% of students with medium ability and 17.24% of students with low ability.

Then the results of the mathematical representation ability test show the indicators of mathematical representation ability based on the categories are as follows:

1. Students who have high mathematical representation ability are able to fulfill 88% of the indicators of visual representation ability, 88% of the indicators of verbal representation ability and 88% of the indicators of symbolic representation ability so that it can be concluded that students with high ability are able to perform mathematical representation very well.

2. Students who have moderate mathematical representation ability are able to fulfill 51% of the visual representation ability indicators, 55% of the verbal representation ability indicators and 64% of the symbolic representation ability indicators so that it can be concluded that students with moderate ability are quite capable of performing mathematical representation well.

3. Students who have low mathematical representation ability are able to fulfill 28% of the visual representation ability indicators, 42% of the verbal representation ability indicators and 42% of the symbolic representation ability indicators so it can be concluded that students with low ability are less able to perform mathematical representation well.

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