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Research Article

Analysis of Student's Mathematical Representation Abilities on Plane Figures Subject in the New Normal Era

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Abstract.
This study aims to analyze the mathematical representation ability of junior high school students on plane figures subject in the new normal era. To prevent the spread of Covid-19 in schools, learning was carried out alternately with 50% face-to-face learning and 50% independently at home. This research is a qualitative descriptive study. The subjects of this study were 20 students studying in seventh-grade students, in the second semester, at Dharmasraya West Sumatra for the academic year 2020/2021. The instruments used in this study were tests of students' mathematical representation abilities and interviews. The indicators measured are visual representation, expression representation, and word representation. Based on the research conducted, it was found that the level of students' mathematical representation ability was still low (52.65). In general, students still experience problems in using their mathematical representation skills; therefore, students must be able to hone their representation skills in visual, symbol, and verbal representations. Mastering mathematical representation skills can make it easier for students to solve mathematical problems, and there will be fewer conceptual errors. Moreover, it is necessary to conduct additional research to enhance students' mathematical representation skills.

Keywords: mathematical representation abilities, new normal era, plane figures subject

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1. INTRODUCTION

Education is a human need to acquire knowledge or skills to achieve the highest safety and happiness. The existence of education is very important so that every human being has the right to education. Education is obtained by every human being since he was born even still in the womb which lasts throughout his life. Education has a role in influencing the development of human resources in every country. In Indonesia, education is contained in the 1945 Constitution article 31 paragraph 1 which states that every citizen has the right to education. In paragraph 2 it is explained that every citizen is obliged to attend basic education and the government is obliged to finance it. Education can be done formally or non-formally.

Mathematics subjects need to be given to students to equip students with the ability to think logically, analytically, systematically, critically, creatively, as well as the ability to work together [1]. Mathematics is one of the subjects that have an important role in education. It was explained that without the help of other sciences mathematics can grow and develop because of its knowledge, mathematics also serves to serve the sciences in other branches such as biology, chemistry, physics, and others, so that mathematics is called the queen of science [2]. Mathematics is also a language of symbols about various ideas using carefully defined, clear, and accurate terms [3]. The National Council for Mathematics Teachers (NCTM), sets standards for mathematical abilities, namely problem solving, reasoning and proof, communication, connection, and representation [4]. The standard of mathematical ability expected by students is not only obtained from learning that has been in school so far, such as providing theories and definitions, sample questions and being given exercises without actively involving students in learning, thus making students not develop and be more motivated [5]. While the main purpose of learning mathematics is to improve student learning outcomes, and can improve various mathematical abilities of students. One of the mathematical abilities that need to be mastered by students is the ability to represent, because basically mathematics is a symbol that is efficient, organized and capable of quantitative analysis. This is not good for students because it will make students less creative, critical, and logical [6].

Judging from the results of the Trends International Mathematics and Science Study (TIMSS) in 2003, Indonesia was ranked 35th out of 46 participating countries with an average score of 411, while the international average score was 467 [7]. In the results of the 2007 TIMSS study, Indonesia was ranked 36th out of 49 participating countries with an average score of 397 while the international average score was 500 [8]. In the results of the 2011 TIMSS study, Indonesia was ranked 38th out of 42 participating countries with an average score of 386, while the international average score was 500 [9]. The results of the 2015 TIMSS study, Indonesia was ranked 44th out of 49 participating countries with an average score of 397, while the international average score was 500 [10]. From these results, it can be seen that the ability of Indonesian students is still below the international average. As seen from the TIMSS 2011 math topic, there are four topics related to students' mathematical representation abilities including numbers relating to representation, comparing, sorting and counting with integers, algebra deals with the representation of functions as sequential pairs, tables, graphs, words, or equations, geometry deals with the relationship between three-dimensional shapes and their two-dimensional representations, lastly data and probability deals with reading and

displaying data using tables, pictographs, bar graphs, pie charts, and line graphs [11]. Meanwhile, the international benchmarks for mathematics achievement in TIMSS 2011 are divided into four groups, namely low benchmarks with 400 benchmarks, intermediate benchmarks with 475 benchmarks, high benchmarks with 550 benchmarks, and advanced benchmarks with 625 benchmarks. low benchmark with representation ability achieved by students, namely students can read and complete simple graphs and bar tables. Whereas in the intermediate benchmark, the representation ability achieved by students is that students can visualize three-dimensional shapes from two-dimensional representations, interpret bar graphs, pictographs, and tables to solve simple problems. Based on this, it can be concluded that the mathematical representation ability of Indonesian students is assumed to be low. One of the students' abilities in mathematics that must be possessed is the ability of mathematical representation. Representation is presentation. Symbols, charts, graphs, and diagrams are excellent methods for presenting ideas and relationships in mathematics. Symbols, along with visual aids such as charts and graphs, should be understood by students as a way to communicate ideas in mathematics to others. Symbols, graphs, charts, and other teaching aids are also very useful learning media. Converting one presentation into another form of presentation is important to improve the understanding of an idea which is part of the mathematical representation ability. Mathematical representation ability consists of 3 aspects that are considered, namely visual representation, symbolic representation, and verbal representation.

Visual representation is a presentation in the form of pictures or illustrations to make it easier to understand a problem. Mastery or indicators that must be mastered in this aspect are presenting data or information from a representation, using visual representations to solve problems, describing in words or verbally and in writing to explain problems and facilitate their completion and communicate mathematical ideas into picture [12].

Symbolic representation is presenting mathematical symbols that have certain functions that can be distinguished from one another. Mastery or indicators that must be mastered in this aspect are making mathematical equations or models (mathematical ideas) from the representations that have been made, making relationships from a number pattern, and completing tasks involving mathematical equations or models.

Verbal representation is the presentation of words that explain the steps, findings, or results we get. Mastery or indicators that must be mastered in this aspect are creating problem situations based on the data or representations provided, writing

representations of mathematical problem solving in words, and answering questions using words or written text.

According to Jones, there are several reasons for the need for mathematical representation, namely providing fluency to students in building a concept, thinking mathematically, and having strong and flexible ability and understanding of concepts [12]. Likewise, according to Dahlan & Juandi, representation does not show results or products that are embodied in new and different configurations or constructions, but thoughts that are made to be able to express and understand the concepts, operations, and mathematical relationships of a configuration [13]. In line with Candra, students' mathematical representations will also determine whether or not the strategy used in solving the problem is correct, if the representation presented is correct, then the strategy used to determine the answer is also correct, but when the representation presented is wrong, the strategy and final answer are found. also incorrect [2]. Students' mathematical representation abilities can solve mathematical problems, especially on flat-shaped materials, because flat-shaped materials are one of the materials that have a variety of representations of completion and are suitable for current learning.

Currently, face-to-face learning has been carried out again since early 2021 with several provisions for the prevention and spread of COVID-19 in schools. One of the provisions of the face-to-face learning process is in class conditions with a maximum capacity of 18 students from the standard 36 students. With these provisions, learning is carried out alternately, about 50 percent face-to-face learning and 50 percent independently at home. In one class students are divided into 2 shifts, the first week will be face-to-face for the first shift while the second shift will do independent learning at home. For next week there will be a shift change and so on. Learning is carried out for 30 minutes in 1 hour which was previously 45 minutes in 1 hour. Based on the description above, the authors are encouraged to carry out research related to students' mathematical representation abilities with flat shapes. Flat shape is one of the prerequisite materials to go to higher material, one of which is building space. Building space is also one of the materials that are often found in everyday life. This study aims to describe how students' mathematical representation skills on flat material in the new normal era.

2. RESEARCH METHOD

This research is a qualitative descriptive study that aims to determine the ability of students' mathematical representation on the flat material on the new normal area. The

material of flat shapes in this study is devoted to square and rectangular shapes that are related to everyday life. This research was conducted on even semester students of the 2020/2021 academic year at one of the junior high schools in Dharmasraya, West Sumatra. The sample in this study was 20 students. The instrument used is a mathematical representation ability test and interviews that have been adjusted to indicators of mathematical representation ability.

This research begins by preparing a test instrument for students' mathematical representation abilities with flat-shaped material that is adjusted to the indicators of students' mathematical representation abilities to be assessed. This test instrument had previously gone through several stages of research instrument validity. Then the mathematical representation ability of students measured in this study consisted of 3 aspects, namely visual representation, symbolic representation, and verbal representation. After testing the students' mathematical representation abilities, then interviews were conducted with students who had answers that could describe the students' mathematical representation abilities. The following rubric of assessment in analyzing students' mathematical representation abilities used in providing scores is presented in Table 1 as follows:

guidelines for assessing students' mathematical representation abilities using the percentage formula are as follows:

$$Student\ score = \frac{score\ obtained\ by\ students}{total\ score} \times 100\%$$

There are criteria for grouping mathematical representation abilities presented in Table 2.

3. RESULTS AND DISCUSSION

Based on the analysis, the achievement of students' ability mathematical representation of the results of tests the ability of the mathematical representation flat material can be seen in Table 3.

Based on the data above, the average mathematical ability of students is 52.65% in the low category. In the following, we will discuss how the mathematical ability of the material is flat based on the level of the questions given.

Question no1: Mr. Jupri's essay is in the form of a rectangle with a size of 24 m × 18 m. Around the yard, lamp posts will be installed to decorate and explain Mr. Jupri's yard with a distance of 3 m between the poles. Many of the lampposts installed are...

Example of students' answer showed in Figure 1 and 2.

Table 1: Rubric for assessing students' mathematical representation abilities.

Score	Visual Representation	Symbolic Representation	Verbal Representation
4	Make flat figures correctly, completely, and systematically	Making mathematical models correctly, but calculating mathematical expressions is not precise	Write the steps or strategies to solve the problem clearly and logically. However, in interpreting the results, it is not in accordance with the problem
3	Make a picture of a flat object correctly but the description is incomplete	Make a mathematical model correctly, but wrong in calculating mathematical expressions	Write steps or strategies to solve problems correctly, but are incomplete, and the interpretation of the results is not in accordance with the problem
2	Makes the picture wake up correctly but no description	Less precise in mathematical models and wrong in calculating mathematical expressions	Only a few write steps or strategies to solve problems and misinterpret the results. At least make what is known or students only make the calculation process without explanations of words and formulas.
1	Making flat figures but not in accordance with mathematical problems	Making mathematical models correctly, but calculating mathematical expressions is not precise	Write the steps or strategies to solve the problem clearly and logically. However, in interpreting the results, it is not in accordance with the problem
0	There is no answer, even though the answer is found, it shows ignorance of the concept and therefore the information provided is not significant		

Table 2: Criteria for mathematical representation ability.

Score	Criteria
86-100	Very High
71-100	high
56-70	enough
41-55	low
0-40	very low

Table 3: Criteria for mathematical representation ability.

Score	Criteria	Frequency (Student)	Persentase
86-100	Very High	0	0%
71-100	high	3	15%
56-70	enough	5	25%
41-55	low	9	45%
0-40	very low	3	15%
Total Students Average Value		20 52.65	100%

In question no. 1, all students have presented the answers in the form of pictures correctly. Based on the results of student answers above, it can be seen that students

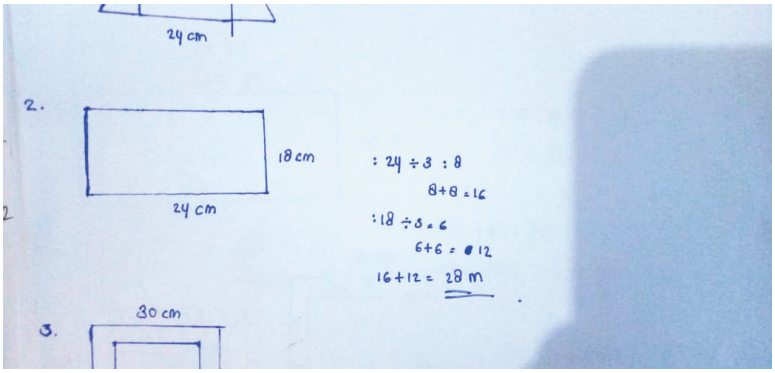

Figure 1: Student answers to question number 1.

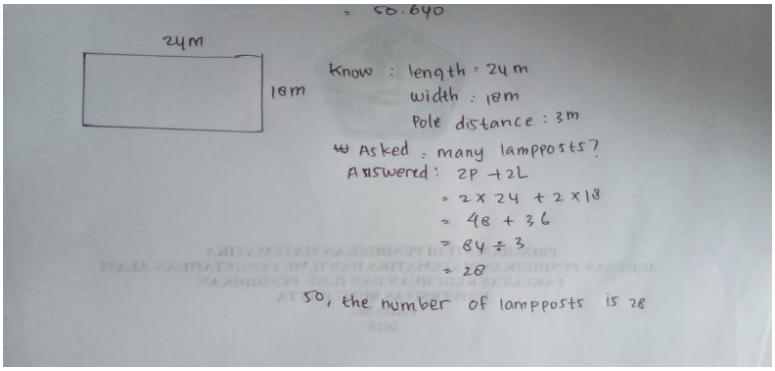

Figure 2: Student answers to question number 1.

can answer questions correctly along with the explanation components in the picture. For students' Figure 2 visual representation indicators are met. However, in Figure 1 the students answered the questions without the steps or conclusions explained on the answer sheet made, as for the error in cm which should be m. After conducting interviews with students, the first impression when explaining the results of students' answers was confused, it took a few minutes to explain the results of their answers. While in Figure 2 students answer the questions well, take pictures with the right explanatory components, make steps in answering questions even though there are still some stages that are not too explained, and make conclusions from the answers obtained. After the interview, the students smoothly explained the results of the answers they made.

From question no 1, it is illustrated that the students in Figure 2 still have not mastered the ability to represent the results of the answers made. Indicators of representational abilities that have not been mastered are symbols and verbal representations. Meanwhile, the students in Figure 2 can represent visual and verbal representations. But still lacking in symbol representation. As explained by Dahlan & Juandi, the representation does not show results, but the thinking is done to be able to express and understand mathematical concepts, operations, and relationships [9].

Question no 2: A photo measuring 30 cm × 40 cm will be pasted on cardboard. On the left, right, top, and bottom of the photo, there is a cardboard 3 cm wide. Determine the area of cardboard needed...

Example of students' answer showed in Figure 3 and 4.

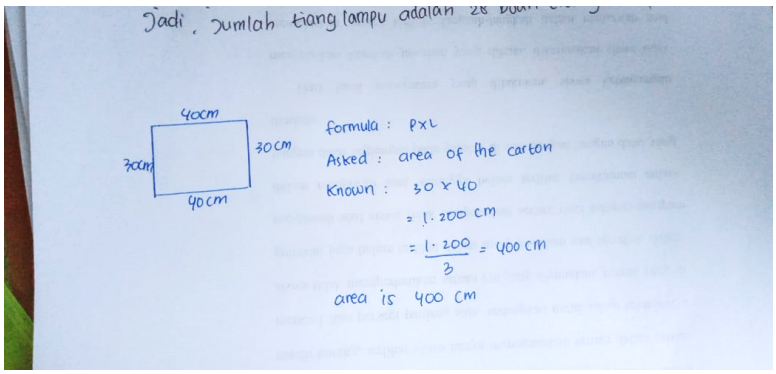

Figure 3: Student answers to question number 2.

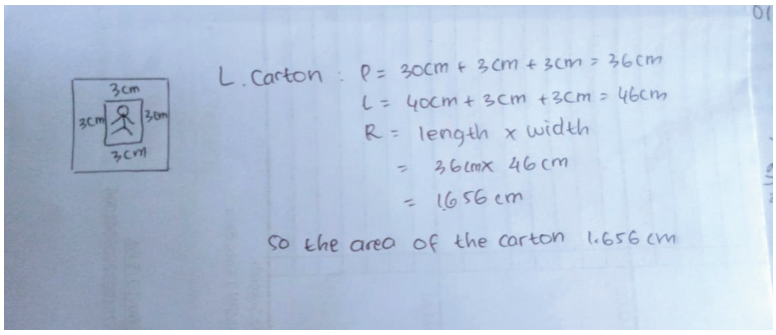

Figure 4: Student answers to question number 2.

In question number 2, it can be seen from the picture above that there are two different types of answers. Figure 3 of the questions given does not present an overall picture following the presentation in the problem, so there are errors in the concept of problem solving. While picture no. 4, make a presentation of the problem in the form of a picture in accordance with the explanation of the problem even though there is still a lack of explanation in the picture, can use symbols even though it is still not consistent, make conclusions on the questions Based on the results of interviews, students in Figure 3 and Figure 4 understand the questions given, can explain the answers made and correct the mistakes made. From the results of answers and interviews, students have mathematical representation skills both visually and verbally,

Question no 3: In a rectangular garden measuring 20 m × 18 m, there is a pond measuring 12 m × 12 m, and the remainder will be planted with grass. Then the area of the lawn is...

Example of students' answer showed in Figure 3 and 4.

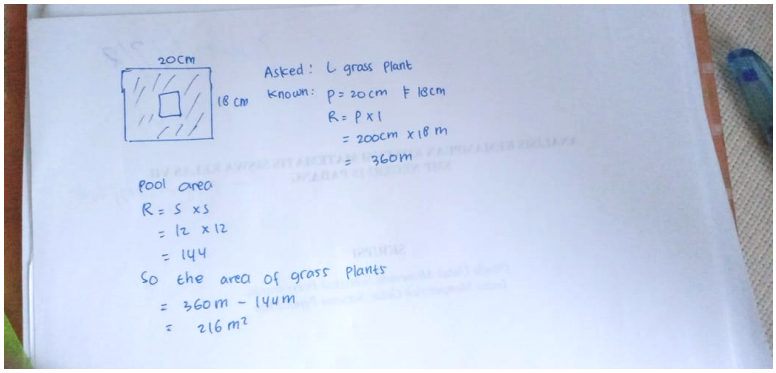

Figure 5: Student answers to question number 2.

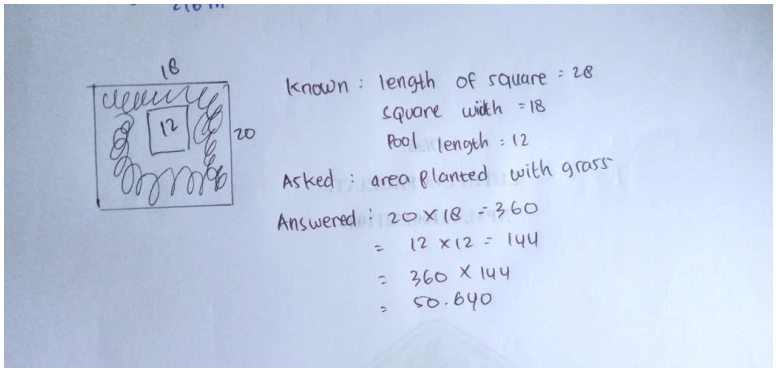

Figure 6: Student answers to question number 2.

In question no. 3. It can be seen from the results of the students' answers above, students present in the form of pictures with components that explain the image, make what is known, asked, and the answers are good even though the answers are different. However, in presenting solutions students still do not present symbols, Problem solving steps are not explained in words, students tend to get to the point. Figure 5 only shows errors in the units used, while Figure 6 shows conceptual errors, there are no units in answering the questions, and there are no conclusions from the results obtained. Based on the results of the two interviews, the average student was able to re-explain the solution that was made but there were still some confusing explanations so it took time to understand again.

Based on the analysis of students' mathematical representation abilities based on the questions above [12]. The ability to represent visually, some students have been able to describe the contents of the questions along with the components of the image explanation. Ability in symbol representation, students can get answers correctly but tend to be wrong in units, have not been consistent in using symbols, and are less in using symbols in solving mathematical problems. While the verbal representation ability, students can explain directly in solving problems, but in explaining on the answer sheet students feel confused tend to get to the point with the results obtained

without explaining the steps taken to solve the problem. Meanwhile, students who have mathematical representation skills will be able to understand concepts that involve mathematics [11].

4. CONCLUSION

From the results of the study in one junior high school in Dharmasraya, West Sumatra. The average mathematical representation ability of students is 52.65 which is categorized as low, in general students still experience problems in using their mathematical representation abilities, students must be able to re-honed their representation skills both in visual representation, symbol representation, and verbal representation. By mastering mathematical representation skills, it can make easier for students to solve mathematical problems and at least conceptual errors will occur. The limitation of this research is only from the students' mathematical representation ability, so further research is needed to improve students' mathematical representation ability which includes three indicators, namely visual representation, symbolic representation, and verbal representation.

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