Analysis of Mathematical Representation Ability on Data Presentation Material Based on Student Learning Interest

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Abstract. The representation ability of students at the junior high school level has not shown a significant increase, this is due to various factors, one of which is interest in learning. The purpose of this study is to determine the analysis of mathematical representation ability and learning interest of students at the Islamic junior high school on data presentation material. The research method used is descriptive qualitative method. The main group of this research amounted to 58 students. The selection of subjects in this study was based on the results of the learning interest questionnaire and one representative from each of the three levels of learning interest, namely high, medium, and low. The selected subjects were given mathematical representation ability instruments and interviews. The results of the analysis explained that students' mathematical representation ability and students' learning interests were directly proportional, which means that students who have high learning interests will have high mathematical representation ability as well. Vice versa, students who have low learning interest will also have low mathematical representation ability.

Keywords: Mathematical Representation Ability, Learning Interest, Data Presentation.

1 Introduction

Mathematical representation ability refers to the ability of students to express mathematical ideas (including meaning, explanation, problems, etc.) to convey their work using unique strategies to find solutions to existing problems as a result of student thinking [1]. Representation is at the heart of learning mathematics. Students can develop and deepen their understanding of mathematical concepts and relationships as they create, compare, and use a variety of representations and help in identifying errors or untruths in a mathematical concept or understanding. Representations also help students communicate their thinking [2]. Mathematical representation can be defined as an ability to combine learned material, logic, communication, and problem-solving. In the context of learning mathematics, mathematical representation skills play an important role in developing students' thinking skills. This skill includes the ability to connect mathematical ideas or ideas in a variety of ways.

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According to the results of research conducted by [3], the average representation ability of junior high school students who are the subject of their research is quite good because students can work on the problems given even though they are not perfect. However, this is not in line with the research conducted by [4]. His research states that the mathematical representation skills of junior high school students in Indonesia are still far from satisfactory. This is because Indonesia ranks 36th out of 49 countries. Students in Indonesia are still unable to solve problems related to mathematical representation skills.

Efforts that teachers can make in developing students' mathematical representation skills are to foster students' interest. Learning interest in learning is a cognitive-affective arrangement that expresses positive affective experiences and passionate attention to activities related to mathematics. Thus, interest in learning mathematics can affect students' effectiveness in learning mathematics [5]. Someone who has a good interest in something will pay more attention to the object. When students are interested, they have relatively high self-efficacy, more attention, and control over the goals and strategies to be used compared to students who are less interested [6]. To attract students' interest in learning mathematics, using animated films can be one of the ways used. As said by [5] in his research, although it can only slightly increase students' interest in learning, using animated films in learning can be an alternative to attract students' interest in learning.

Therefore, in fact, many students do not like learning mathematics. Interest in learning mathematics can be influenced by external factors, such as teachers' use of teaching methods in the classroom. Lack of interest in learning is caused by the number of students who are not involved in the learning process. There are still some students who talk to their friends when the teacher explains and often leave the class when learning takes place, and there are still some students who do not convey ideas when the teacher asks about learning math [7].

The first research on mathematical representation ability was conducted by [8]. The result of this study said that the improvement in mathematics representation skills of students who gain CPS learning is significantly higher than students who obtain conventional learning. Meanwhile, students with a moderate level of learning motivation are still less cautious in working on problems. The second study was conducted by [9], the decision of this study exposed that first, the design of problem-based worksheet development has valid criteria. Second, the average increase index of the student's mathematical representation ability using a problem-based spreadsheet is higher than that of the average increased rate of the ability to represent mathematics-based learning in improving their representation abilities.

In the third relevant research by [10], the research results showed that interactive mathematical learning multimedia based on iSpring presentations has met the requirements that should be said to be fit for use in the learning process and suitable to be used as a learning support medium to enhance student interest in learning through diverse learning activities. The fourth study conducted by [11]. The outcome of this study showed increased interest, as well as high achievements in mathematical learning from the initial condition of students. A few of the conclusions obtained are along these lines. First, PBL has increased students' interest in learning and learning achievement, after

two cycles of action. Second, increased student interest in learning is because student positions at PBL are no longer passive.

There is a deficiency in the aforementioned studies, where no one has researched mathematical representation ability on student learning interest in data presentation material. Therefore, the novelty of this study is the relationship between mathematical representation ability and student learning interest in one of the junior high schools in Jakarta with data presentation material. The aim of this research was to determine the analysis of mathematical representation ability and student learning interest in data presentation material.

2 Method

In this research, a qualitative descriptive method was used. This method involves observing phenomena or object conditions in a natural way, with the researchers as the main instrument in data collection and analysis [12]. In other words, this research whose results are in accordance with the words of the researcher [13].

This research was conducted in May 2023. As the initial stage of this research is to create description questions based on indicators of mathematical representation ability. Based on the indicators of representation ability, there are three aspects, namely explaining, drawing, and mathematical expression/models [14]. This instrument was validated by three validators, namely two lecturers and one teacher. After going through the revision stage, the three validators stated that the instrument was suitable for use.

Table 1. Example of Before and After Validity

Indicator	Before Change	After Change
Explaining	The following is a bar chart showing data onthe favorite foods of Jaya Makmur villagers:  Looking at the barchart above, what are the most and least favored foods among Jaya Makmur villagers?	The following is a bar chart showing data onthe favorite foods of Jaya Makmur villagers:  Looking at the pie chart above, explain which foods are most and which foods are least favored by residents of Jaya Makmur Village when the total number of residents is 305?

Table 1 above is the final result after passing the revision stage and being declared feasible by the validators. The changes that occur in the instrument image above are the initial instrument diagram image used was a bar chart and was changed to a pie chart

to further vary the diagram used in the instrument. The subjects in this study were 8th grade students at an Islamic Junior High School Jakarta and only two classes were selected with a total of 58 students. The data obtained were compiled and presented with the Rasch Model using WinSteps software. The Rasch model is only used for targeting because it wants to see linear measurement and accuracy estimates between representation ability and student learning interest [15].

3 Result and Discussion

3.1 Explaining Indicator

In questions with indicators of explaining S1 can explain with mathematical understanding, although it is not logically arranged or there are few language errors. Based on interviews conducted by researchers, these students usually answer math problems using everyday language. The following are excerpts from interviews that researchers conducted with S1.

P : "Why do you answer using non-formal language?"

S1 : "The problem is that I think it's okay to use everyday language, Sis."

In the question with the indicator of explaining, the explanation given by S2 was mathematicaland reasonable but incomplete and incorrect.

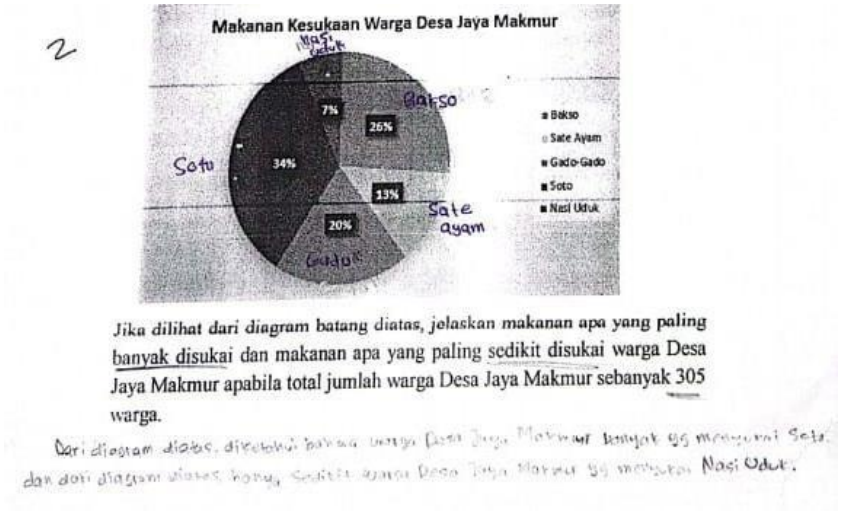

Fig 2. S2's Answer for Explaining Indicator

From Fig 2, it can be seen that S2 was not complete and correct in answering the question. Based on the interview that the researcher conducted with S2, according to S2, the answer given was sufficient to solve the problem given. The following are excerpts from interviews that researchers conducted with S2.

P : "Why did you answer incompletely?"

S2 : "My answer yesterday is still lacking, right? I think it's complete, Sis"

On questions with indicators of explanation, S3's explanation was only a little.

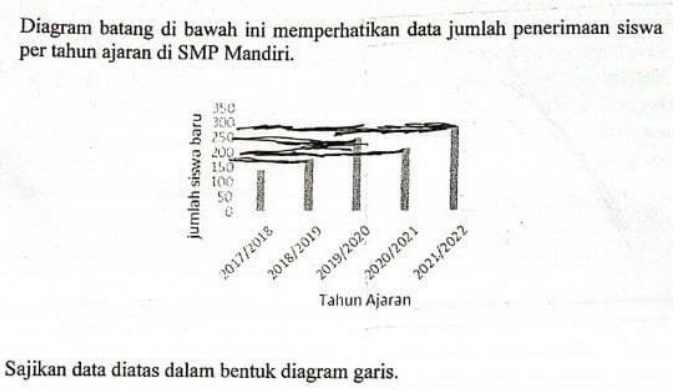

Fig 3. S3's answer for explaining indicator

From Fig 3 it can be seen that S3 only provides a little explanation to answer the question given. Based on interviews that researchers conducted with S3, the student claimed to have difficulty writing explanatory statements or sentences. The following are excerpts from interviews that researchers conducted with S3.

P : "Why did you explain a little bit?"

S3 : "It's hard, Sis. I'm confused about how to write the sentence."

In the indicator of explaining S1, S2, and S3 have difficulty explaining the problems given, this is in line with research conducted by [16]. The use of word representations or written text is a form of representation that students have not mastered. Students do not make problem situations and steps in words or written text because students were not used to it, were unable to, and there were students who were able but lazy to write it down. Also corroborated by research conducted by [17], in their research, it was concluded that lack of accuracy when reading story problems can make students feel difficult when they want to make pictures to clarify problems.

3.2 Drawing Indicator

On questions with drawing indicators, S1's answer was correct. Students understand the content of the data presented in the problem and convert the data into a line diagram.

On questions with drawing indicators, S2 drawn a diagram or a picture completely, correctly, and systematically.

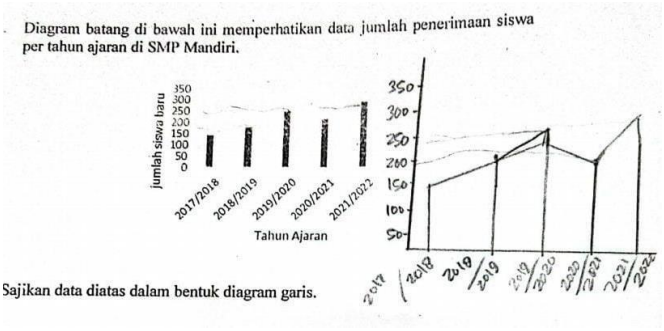

Fig 4. S1's answer for drawing indicator

From Fig 2 it can be seen that S3's drawing was less neat, and from the interview that researchers conducted, the researcher found that on that day S1 did not bring a ruler so the drawings made were less neat. The following are excerpts from interviews that researchers conducted with S3.

P : "Why is your drawing not symmetrical?"

S3 : "I didn't bring a ruler."

This is in line with the study [17] that S1 solved the problem correctly, while S2 and S3 were not able to understand the problem correctly. Furthermore, this research is related to research [18], namely students with low ability are still confused about drawing tables, students with middle-skill are able to draw tables well, and students with high ability are able to understand problems and draw appropriately.

3.3 Math Model /Expression Indicator

In the problem with the mathematical expression/model indicator, S1 managed to find the right mathematical model then performed calculations and got the solution correctly, completely, and systematically.

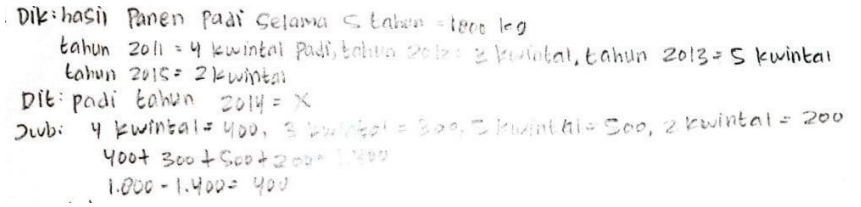

Fig 5. S1's for expression/model indicator

S1 explained all the information obtained, wrote down what was known and asked, and described the solution so as to get the solution to the problem given. In the problem with the expression/mathematical model indicator, S2 did not succeed in providing an answer or solution to the problem. The following are excerpts from interviews that researchers conducted with S2.

P : "Why did you explain a little bit?"

S2 : "It's hard, Sis, I'm confused about how to write the sentence."

From Figure 5 it can be seen that S3 only gives a sign of the problem in the form of a line. Based on interviews conducted by researchers, S3 admitted that he thought the line diagram only gave a line to the existing image. In the problem with the expression indicator/mathematical model, S3 wrote a few correct mathematical models. Based on interviews conducted by researchers, S3 said that he did not understand what was meant by mathematical models. The following are excerpts from interviews that researchers conducted with S3.

P : "Why is there only a few answers?"

S3 : "It's hard, Sis. I don't understand what kind of math model it is, Sis"

The lower the student's mathematical representation skill on the mathematical model/expression indicator, the more difficult it is for the student to understand or make the mathematical model/expression. In this study on the math model/expression indicator S1 was at a high score of mathematical representation ability, S3 was at a middle score of mathematical representation ability, and S2 was at a low score of mathematical representation ability. This research is in line with [19] students who have high scores are able to use mathematical expression well, as well as being able to translate information into mathematical symbols, to make mathematical models. Students in the medium category are also able to make inferences, mathematical models, and perform calculations correctly. On a low score, students were considered not to understand the concept. This is because students do not see the translation at the beginning so mistakes occur. The cause of the error is that students do not understand the use of translating information into mathematics symbols at the beginning of the work. In learning mathematics, it is expected that teachers can provide an understanding to students regarding the importance of understanding expressions or symbols in mathematics. This is in line with research conducted by [20], learning mathematics is very important to emphasize to students the importance of symbols.

4 Conclusion

Mathematical representation ability is directly proportional to learning interest for S1, S2, and S3. The results showed that with the ability of mathematical representation on the indicators of explaining and drawing, S1 obtained the highest score of three for explaining and 4 for drawing. While for the drawing indicator, S2 obtained the highest

score from S1 and S3, namely getting a score of four. This study provides new information about the ability of mathematical representation and asks for learning in students. This is in accordance with the results of research from [21], which states that the results of data analysis show that there is a comparable relationship between student interest and mathematical connections. Students who are interested will understand mathematical concepts, the relationship between mathematics and other subjects, and the relationship between mathematical concepts and real life. On the other hand, students with low interest only understand the relationship between mathematical concepts.

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