Analysis Of Mathematical Communication Ability In Term Of Students' Initial Mathematics Ability

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Abstract. This study aims to determine the extent of mathematical communication abilities in terms of Students' Initial Mathematics Ability and to examine students' mistakes in solving mathematical communication ability test questions. The subjects of this study were 24 students of SMA Al Ma'shum. The method used in this research is descriptive method with a qualitative approach. The research instrument is a test instrument consisting of 5 questions describing mathematical communication skills. The results of data analysis show that students' mathematical communication skills are still relatively low. The students' mathematical communication ability corresponds to their initial level of mathematical ability, that is, students in the upper group have 69.44% mathematical communication ability, 64.77% in the middle group and 52.77% in the lower group. The mistake that many students make in solving mathematical communication problems is an error in the indicator when writing a picture problem into a mathematical idea.

Keywords: Mathematical Communication Ability, Initial Mathematical Ability, Student.

1. Introduction

Mathematics education is essential to the intellectual and cognitive development of students[1]. Mathematical communication abilities are a fundamental component of mathematics education (2,3) . This ability encompasses not only comprehension of mathematical concepts, but also the ability to articulate mathematical understanding and reasoning in a clear and structured manner.

AISTEEL 2023, September 19, Medan, Indonesia

DOI 10.4108/eai.19-9-2023.2340570

Mathematical communication abilities are essential for students to comprehend mathematical concepts (4) , develop critical thinking skills and prepare students to confront the mathematical challenges of everyday life and the future (5,6) . Nonetheless, several facts indicate that mathematical communication skills remain inadequate. According to the findings of Rohaeti's study (Nopiyani, Turmudi, & Prabawanto, 2016), the majority of Indonesian students continue to lack mathematical communication abilities (7) . (Ahmad Marzuki and Dwi Putri Nasution, 2018) Based on a diagnostic test given to students at one of the Junior High Schools in Medan City, as well as tests of the mathematical communication abilities of students administered in one class at the school, it is evident that students' mathematical communication abilities are inadequate (8) . Siti Aminah et al 2018 Based on the findings of a study conducted at Cimahi City Middle School and a discussion of the findings, it was determined that each indicator of mathematical communication ability remained relatively low(9) sirait and elfira, 2020 based on the conclusion that student errors were viewed from students' mathematical communication indicators, specifically, students' inability to relate pictures to mathematical ideas, inability to write mathematical ideas into mathematical models, inability to explain procedures for solving trigonometry problems, and inability to write mathematical ideas using their own words (10) .

Indicators of communication skills include the following: (1) Defining situations or mathematical concepts in images, charts, or graphs; (2) Translating real-world situations, images, or objects into language, symbols, or mathematical models; and (3) Describing concepts, situations, and mathematical relationships in writing, constructing arguments, or expressing opinions and justifying answers. (11) [12]

One of the factors posited to exert an influence on mathematical communication abilities is the initial mathematical aptitude of students. The concept of initial ability in mathematics pertains to the comprehension and proficiency in fundamental mathematical principles that serve as the foundation for acquiring advanced mathematical knowledge (13) . The acquisition of proficient mathematical abilities at an early stage can establish a strong basis for the enhancement of students' aptitude in mathematical communication (14) . Nevertheless, there remain several unresolved inquiries pertaining to the magnitude of the correlation between pupils' initial mathematical aptitude and their proficiency in mathematical communication..

In this context, this study aims to analyze in depth the relationship between students' prior mathematical abilities and their mathematical communication abilities. By comprehending this correlation, one can discern the variables that lead to proficient mathematical communication abilities, as well as devise enhanced pedagogical approaches to enhance students' ability to communicate mathematical skills. The anticipated outcome of this research is to make a significant contribution towards the enhancement of mathematics curriculum and instructional approaches. By enhancing our comprehension of the impact of early mathematical skills on

mathematical communication abilities, we may facilitate students in surmounting obstacles to acquiring mathematical.

2. Method

This research is a descriptive research with a qualitative approach. This study aims to analyze and describe students' ability to solve mathematical communication questions (KKM) based on Initial Mathematical Ability (IMA). The subjects of this study were students of class VIII A at SMP Al Ma'shum in Asahan District. The research subjects were divided into 3 math ability groups based on the test results given from the school exam questions for the 2022/2023 school year which had been validated. The test given is in the form of an objective test which consists of 25 questions. The test results obtained are then sorted from the student who gets the highest score to the lowest. From the order of students it is divided into 3 categories, namely students who have upper IMA, middle IMA and lower IMA. The IMA grouping criteria are as follows (14) (A, Anim and Margaretha, 2018):

Table 1 Criteria for grouping students' abilities Based on IMA

Category	Criteria
upper	The self who has a value of IMA $\geq \overline{X} + SD$
Intermediate	Students who have IMA scores ($\bar{X} - SD <$ value IMA $< \bar{X} + SD$)
Lower	Students who have IMA scores $\leq \overline{X} - SD$

Information :
IMA: Initial Mathematical Ability
$\overline{X}$: The average value of IMA
SD : Standard deviation of IMA value

The main instrument in this research is the researcher himself, where the researcher is the planner, executor, data collector, analyzer and interpreter. In this study also used a test instrument in the form of questions of mathematical communication ability. From the results of the A test obtained, it is classified into 3 categories of high , medium and low. The process of categorizing students is carried out referring to the category process determined by the school.

Table 2 Criteria for Grouping Mathematical communication abilities

Category	Criteria
Upper	The swa that has value$80 \leq$ value ≤ 100
Currently	Students with grades$65 \leq$ value < 80
Low	Students who have a value of $0 \leq$ value 65

(Marzuki Ahmad, Dwi Putria Nasution. 2018) (8) .

The indicators of mathematical connection ability used in this study are (a Explaining in writing a picture into mathematical ideas (b) Writing situations or mathematical ideas into pictures and (c) Rephrasing a mathematical description or paragraph in one's own language .

The data obtained through the tests were then analyzed based on the students' initial mathematical abilities. Furthermore, an analysis of the answers of students who were selected randomly was carried out.

3. Results and Discussion

As previously described, the IMA grouping of students was obtained from the test results given with the questions used being school exam questions for the 2022/2023 school year which have been validated. From the results of the calculation of 24 students, there were 6 students belonging to the upper IMA group, 12 students had middle IMA and 6 students had lower IMA. The six students in the upper IMA group had high mathematical communication Abilities , 6 students had low mathematical communication Abilities from the middle and low IMA groups, 12 other students had moderate mathematical communication abilities. The grouping of students' mathematical communication Abilities based on IMA can be seen in the following table:

Table 3. MCA Categories of Students in Each IMA Group at Al Ma'shum Middle School

	Category	Thurs			Total
		Upper	Intermediate	Lower	
Mathematical	Tall	2	0	0	2
Communication	Currently	4	7	2	13
Abilities	Low	0	5	4	9
Total		6	12	6	24

The percentage of each indicator of students' mathematical communication Abilities based on the IMA group can be seen in the following table:

Table 4. Percentage of Each Indicator of Students' Mathematical Communication Ability Based on IMA Group

No question	Indicator of Mathematical Communication Ability	IMA category		
		upper	Intermediate	Lower
1 2	Explain in writing pictures into mathematical ideas	68.75	64,77	60,41
3 4	Write mathematical situations or ideas into pictures	68.75	62.5	31.25
5	Restate a description or paragraph of mathematics in your own language.	70,8	67.04	66,66
Average Mathematical communication Abilities		69,44	64,77	52,77

Based on the table above, students who belong to the IMA above obtain the highest percentage score of 70.8% and are able to rephrase a description or paragraph of mathematics in their own language , but there are 68.7% who are able to recognize Explain in writing pictures into ideas mathematics and Write mathematical situations or ideas into pictures . Likewise for students in the middle IMA group, 67.04% were able to rephrase a mathematical description or paragraph in their own language , but only 62.5% wrote mathematical situations or ideas into pictures . For students in the lower IMA group, 66% were able to rephrase a mathematical description or paragraph in their own language , but only 31%,25 were able to write mathematical situations or ideas into pictures . From the table above it can also be seen that, both students in the upper, middle or lower IMA groups, the three of them obtained the highest percentage on the indicator of being able to rephrase a mathematical description or paragraph in their own language . The smallest percentage of the three IMA groups is in questions no. 3 and 4, namely the indicator of writing mathematical situations or ideas into pictures. Furthermore, for the average value obtained from each IMA group, it describes students' mathematical communication abilities according to their initial ability categories. Students in the upper IMA group had high mathematical communication Abilities (MCA) of 2 students, the middle IMA group had 4 students high and medium KKM 10 students and students in the lower IMA group had 2 students in the medium category KKM and 4 low students. However, the percentage of MCA for each IMA is less than 75%, meaning that students' mathematical communication Abilities are still relatively low. Next, an analysis of the results of students' answers to the test of mathematical communication Abilities will be described. The first test item is a question with indicators Explaining in writing pictures into mathematical ideas . The questions can be seen in the following image:

Question no1

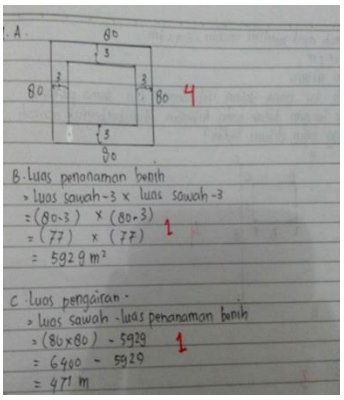

Fig. 1. Sample the answer to question no1

Students are less able to explain the completion procedure to questions no. 1b and 1c, so the answers produced are incorrect and incomplete.

Question no2

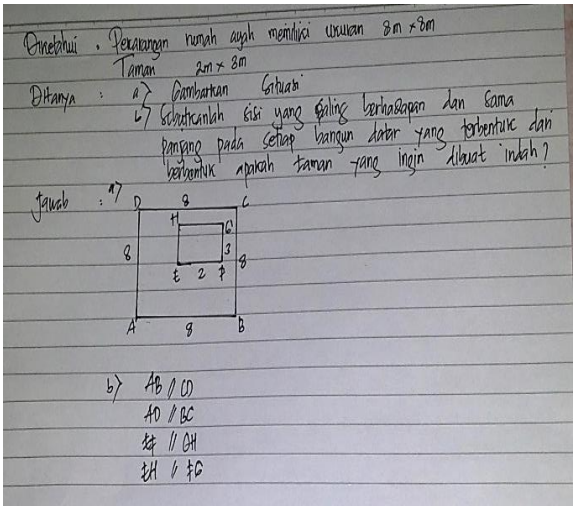

Fig. 2. sample the answer to question no2

For question no 2, students are able to express the mathematical situation well in pictures, but students are less able to understand point b, so the answers given are incomplete

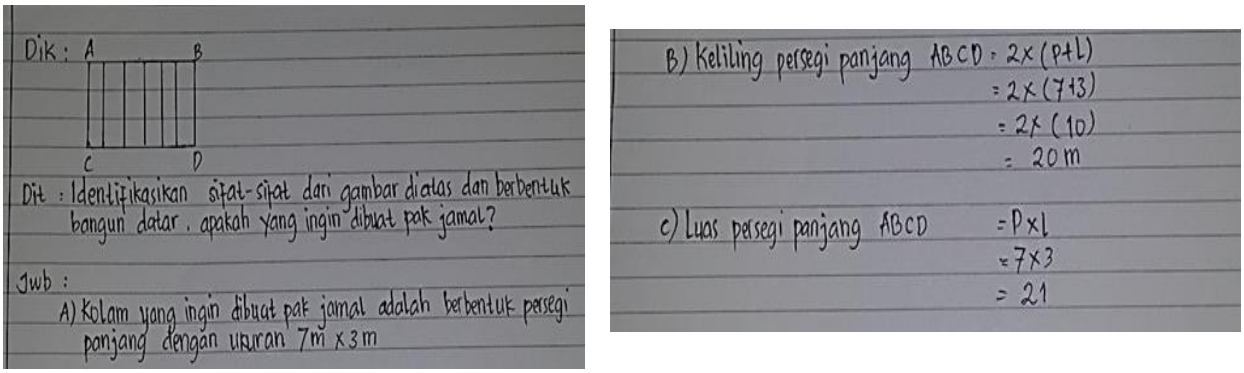

Fig. 3. sample the answers to questions no 3 and 4

- For question number 3 students are less able to understand the meaning of the question, it can be seen that students are not able to correctly solve the picture problem into mathematical ideas
- For question no 4 which continues from question no 3 , students have been able to solve the problem well even though it is not complete by using the formula for the perimeter and area of a rectangle
- It can be concluded that students are only able to solve problems, but do not understand what is expected of the questions

For the completion of question number 5 most of the students were able to complete the problem given, "write your opinion about the concept of area and perimeter based on question number 3"

4. Conclusion

Subjects with low and medium initial abilities did not know the characteristics of a rectangular shape, such as opposite sides that are the same length. Even though this is a support in solving various mathematical problems on flat material. This causes the subject to be unable to solve the picture problem into mathematical ideas correctly and vice versa . Subjects with high initial ability understand well the three indicators. Subjects have good knowledge of terms in mathematics, and can use them in understanding and explaining mathematical concepts. This research is limited to the description of students' mathematical communication skills internally, namely among the mathematics topics themselves. Subsequent research can review mathematical communication skills externally, namely between mathematics and other topics or between mathematics and everyday life. This is done by considering the characteristics of the material to be studied.

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