

MATHEMATICAL COMMUNICATION: A SURVEY OF MATHEMATICAL CONCEPTS IN GEOMETRY PROBLEMS IN RIAU PROVINCE PUBLIC MIDDLE SCHOOL

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Abstract

One of the main goals in learning mathematics is to produce students who have a complete understanding of the mathematical concepts they are learning. This paper is the result of an initial study of a research that will be carried out in depth on this matter, which aims to explore oral and written mathematical communication skills in geometry problems in junior high schools in Riau Province. This research is an exploratory research with an ethnographic approach. The data collection techniques used were observation, interviews and literature study. The results of the research show that: 1) Mathematical communication skills students on flat wake material, in general it is said to be moderate. Because most students have not been able to fulfill all indicators; 2) Students with high mathematical abilities are able to achieve almost all indicators of mathematical communication skills; 3) Students with moderate mathematical ability do not master several indicators of mathematical communication ability; and 4) Students with low mathematical abilities have not been able to master the indicators of mathematical communication skills.

Keywords: mathematical communication, mathematical concepts, geometri problem

INTRODUCTION

In the process of learning mathematics, the teacher acts as a facilitator to understand and adapt to students in building reasons and helping students build arguments related to problems faced by students when working on math problems (Biesta, 2015; Collins et al., 2018; Teledahl, 2017). One of the skills to build the argumentation is mathematical communication skills. This is in line with one of the goals of learning mathematics which is to provide opportunities for students to demonstrate their abilities and motivate students to solve mathematical communication skills problems (Sedaghatjou, 2018; Simamora & Saragih, 2019; Surya & Putri, 2017). Learning mathematics as a communication tool to help think, find patterns, solve problems, or draw conclusions to communicate various ideas clearly, precisely, carefully so that students are able to understand the context of the problem (Angriani et al., 2021; Benton et al., 2017; Darto, 2021; Hsu, 2018; NoprianiLubis et al., 2017). Thus, it can be understood that mathematical communication ability is a student's ability to convey mathematical ideas both orally and in writing.

Oral and written mathematical communication skills of students are needed in solving mathematical problems through discussion and writing activities both verbally and in writing (Maulyda et al., 2021; Sa'dijah et al., 2022). Learning Mathematics in the 21st century is a skill to improve mathematical communication skills both orally and in writing through mathematical exploration, context, discussion and reflection (Hatisaru, 2020; Ismayani & Kusumah, 2017; Sembiring et al., 2008). The activities of the mathematics learning process in

the aspects of students' mathematical communication can be rediscovered through discussion and writing (Hidayat & Iksan, 2015; Prendergast et al., 2018). However, students did not understand the process of getting answers on aspects of oral and written mathematical communication skills. This is because students are not given the opportunity to express their opinions in solving math problems (Collins et al., 2018; Laurens et al., 2017; Lince, 2016; A. Wijaya & Doorman, 2021). The reality on the ground shows that the teacher's limited knowledge and students' learning habits in class are carried out in conventional ways and this cannot optimally improve students' mathematical communication abilities. (Deng et al., 2020; Evendi et al., 2022; Umbara et al., 2021).

Regarding the importance of oral and written communication in learning mathematics, many researchers have focused on this. Some of them, Research (Hikmawati et al., 2019) relating to students' written mathematical communication skills in solving geometric cube and block problems, then (Nirmalasari et al., 2021) conducted an exploratory study related to Banten culture, namely the roof of the Baduy traditional house, the Leuit Cikadu Pandeglang batik motif, the typical Banten gate, the Kasunyatan mosque gate, the Baduy totopong, the Baduy weaving thread, and the roof of the Banten Grand Mosque against the Pythagorean concept. Whereas (Hakiki & Sundayana, 2022) conduct research on mathematical communication skills on cube and block material based on learning independence, and also (Akalili, 2021) reveals that visualization students are able to explain how to describe geometric transformations orally and are able to use notation and terms in presenting data. Besides that, (Adawiah et al., 2021) revealed that the Flipped Blended Learning model can help improve students' mathematical abilities as evidenced by the improvement in every aspect of students' communication skills, namely 1) aspects of the ability to convey mathematical ideas both orally and in writing are classified as good; 2) On the aspect of the ability to transmit stimuli or opinion stimuli in the delivery of material orally it is classified as good; 3) On the aspect of the ability to sort ideas and students' thoughts that are conveyed both orally and in writing are classified as good.

Although the studies mentioned above are related to the understanding of mathematical concepts in geometry, this illustrates that the phenomenon of students' incomplete understanding of mathematical concepts is a real thing and requires more serious handling. This research is an initial study within the framework of an in-depth research starting point on exploring students' understanding of geometry problems. This is part of a series of efforts to develop learning with understanding in order to find out how complete their understanding of these concepts is.

Therefore, theoretically, research can provide a basic picture of the completeness of junior high school students' understanding of basic mathematical concepts, especially in the concept of geometry. In addition, the results of this study can also be used as a basis for more in-depth research on students' understanding of mathematical concepts in general, as well as research that will be carried out by the author as a follow-up to the results of this study.

RESEARCH METHOD

This type of research is using a survey method with a quantitative approach. The location of this research was carried out at SMPN 3 Pangkalan Kuras, Pelalawan Regency, which had been designated as the sample. The subjects of this research were students of class VII. Meanwhile, the sampling technique used was stratified random sampling. The data collection technique used in this study is a test. Test data collection is carried out by providing mathematical test questions that measure mathematical ability which includes indicator 7 in writing. Students are asked to answer questions along with the steps to solving the problem. After that, student answer sheets were collected and recapitulated. Furthermore, an analysis was carried out on the student answer sheets in completing the test questions as well as the assessment of student answer sheets in accordance with the established scoring guidelines.

The math test questions that measure students' mathematical ability were tested on 7 essay test questions. Data in This research is in the form of students' mathematical ability scores. After that, the categorization of students' mathematical abilities is carried out through an estimate or an estimate for the population average. There are two types of estimation made on the population average, namely point estimation and interval estimation. Point estimation uses the average sample value while interval estimation uses the following t formula.

Information:

μ : Population average

\bar{x} : Sample average

$t_{\alpha/2}$: t value with degrees of freedom ($n - 1$)

n : Sample size

s : Sample standard deviation (Anderson et al., 2018)

The next stage is to provide justification for point estimation and interval estimation to find out the achievement categories of students' mathematical communication abilities in Table 1.

Table 1: Categories of Students' Mathematical Ability Scores

Category	Score Intervals
Very high	$80 < X < 100$
High	$60 < X < 80$
Medium	$40 < X < 60$
Low	$20 < X < 40$
Very Low	$0 < X < 20$

Source: Ebel & Frisbie (1991)

RESULT

A description of the data on the results of the mathematical ability test for class VII junior high school students at SMPN 3 Pangkalan Kuras, Pelalawan Regency, can be seen in Table 2.

Table 2: Point Estimation of the Average Mathematical Ability Score

Indicator	Score obtained (%)	Information
Express everyday events in language or symbols	47.59	Medium
Declare the image into a mathematical model and solve it	45.93	Medium
Connecting real objects, pictures and diagrams into mathematical ideas	51.48	Medium
Explain mathematical ideas, situations and relationships with real objects, graphs and algebra	47.78	Medium
Read with understanding a written mathematical presentation	42.78	Medium
Declare an image to be an idea related to the area of the square	35.37	Low
Stating an image becomes an idea related to the circumference of a square	31.67	Low
Means	43.23	Medium

Based on Table 2, it can be seen that the average communication ability is 43.23% in the medium category. In terms of each indicator of mathematical communication ability, it shows that the indicator of connecting real objects, pictures, and diagrams into mathematical ideas ranks the best with the highest average score (51.48%). Then the indicator stating that an image becomes an idea related to the circumference of a square is the achievement of the lowest average score (31.67%). The results of this study are supported by the results of previous studies which say that students have good mathematical communication skills (Bronkhorst et al., 2020; Tong et al., 2021; T. T. Wijaya & Afrilianto, 2018; Babbar & Amin, 2018; Towers et al., 2020; Zollhöfer et al., 2018; Stacey, 2015; Sumirattana et al., 2017).

DISCUSSION

With mathematical communication skills students can express it in pictures, writing, mathematical symbols or algebraic forms. In line with opinion (Ata Baran & Kabael, 2021; Fay et al., 2022; Rohid & Rusmawati, 2019) suggests that the development of mathematical symbols and mathematical language is aimed at communicating mathematics, one of which is that students can explain and reflect on thoughts about mathematical ideas and relationships, express mathematical ideas or ideas both orally and in writing. aside from that, (De Lange, 1996; Sfard, 2001; Sinaga et al., 2020) expressing real objects, situations and everyday events in the form of mathematical models either with pictures, tables or mathematical expressions is an indicator of mathematical communication ability.

Models in mathematics are a process of moving from the real world to the world of symbols (Jupri & Drijvers, 2016; Laurens et al., 2017; Stacey, 2015). Modeling is a component of contextual learning. Mathematical models are a bridge in solving mathematical problems in the real world (Gazzola, 2015; Kertil & Gurel, 2016; Yilmaz & Tekin-Dede, 2016). According to

Theo et al. (2017) & Verschaffel et al. (2020) mathematical models represent a situation symbolically, graphically, and or numerically to strengthen an important aspect and to be studied by putting aside things that are less important. The use of mathematical modeling will make it easier for students to solve math story problems, because this mathematical modeling is in accordance with students' concrete-semi-concrete, enticing-iconic or concrete-pictorial ways of thinking. (Geiger et al., 2018; Yang et al., 2020).

CONCLUSION

Based on the results of the research and discussion, it can be concluded that the mathematical communication abilities of students at SMP Negeri 3 Pangkalan Kuras as a whole are included in the MEDIUM category. Judging from the indicators of mathematical communication ability, namely the indicator connecting real objects, pictures and diagrams into mathematical ideas ranks the best with the highest average score (51.48%), while the achievement of the lowest average score of students, on the indicator stated an image becomes an idea related to the circumference of a square is the achievement of the lowest average score (31.67%). Mathematics learning on the aspect of students' mathematical communication skills needs to be given mathematical communication questions both written and orally. Students' mathematical communication skills both orally and in writing can help students understand mathematical material and increase mathematical knowledge.

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