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Junior High School Students' Mathematical Communication in Contextual Problem Solving

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Abstract: This research aims to describe students' mathematical communication in solving mathematical problems using contextual problems with curved-sided geometric material. This is motivated by the lack of habituation of junior high school students in solving various mathematical problems, especially contextual problems. It is important to provide contextual problems to improve problem-solving abilities in the learning process. If through solving mathematical problems, it is hoped that students will be able to implement their skills and knowledge in solving daily life problems. The research method uses qualitative methods based on the results of answers to contextual test questions which are analyzed by adjusting mathematical communication indicators. The research subjects were 3 students while the research instrument used was contextual test questions. The research results show that students in the low category are still unable to communicate mathematically in students who are categorized as being less able to communicate mathematically. Students in the high category are good at communicating mathematically. Recommendations for further research are to develop contextual problem-based learning designs that focus on improving students' mathematical communication.

Keywords: mathematical communication, junior high school students, contextual problems

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A. INTRODUCTION

One focus of mathematics learning is improving mathematical abilities, especially the ability to communicate mathematically. The aim of providing mathematics lessons at school is to provide provisions for students to understand mathematics learning material in the process of solving mathematical problems and relate mathematics learning material to everyday life, this is stated in the decision of the head of the Educational Standards, Curriculum and Assessment Agency No. 8 Year 2022 (BSKAP, 2022). Thinking about mathematics in the use of mathematics in everyday life is one way to provide provisions for students.

The National Council of Teachers of Mathematics (NCTM) discusses five basic mathematical abilities, namely problem solving, reasoning and proof, communication, connection, and representation (NCTM, 2000). In global competition, PISA has an important role in problem-solving, and according to the results of the PISA survey, mathematics learning in Indonesia is still in the deficient category, therefore one of the important aspects that students must understand is the problem-solving process (Sudrajat, 2022). The problem-

solving process is an important thing that cannot be separated from the mathematics learning process. According to Polya (1973) In the problem-solving process, there are 4 steps, namely understanding the problem, making a plan, implementing the plan, and checking again.

Learning mathematics helps someone learn to think logically, systematically, critically, and rationally and work together. Improving students' abilities in learning mathematics, especially the ability to communicate mathematically, is one of the focuses of learning mathematics. At every level of education, mathematics must be taught because this aims to help students learn how to use mathematical ideas to describe situations or problems (Domo & Mujib, 2022). Mathematical communication is a student's ability to describe mathematical ideas orally and in writing, apart from that, through mathematical communication, mathematical ideas can be discussed, improved, and changed through communication.(Arina & Nuraeni, 2022; Domo & Mujib, 2022). During the mathematics learning process, giving students problems related to everyday life is one way to improve their problem-solving abilities (Astuti, ERP, and Amin, 2019). Contextual mathematics problems are all problems related to the context of mathematics and problems related to everyday life (Ekayana et al., 2020). This can be interpreted as if through solving mathematical problems, it is hoped that students will be able to apply the skills and knowledge they already have in solving contextual problems.

This research was motivated by the lack of orientation of junior high school students in solving various mathematical problems, especially contextual problems. It is important to provide contextual problems to improve problem-solving abilities in the learning process. The contextual problem that will be used is the contextual problem of curved-sided building materials at the class IX junior high school level. Contextual problems will be packaged into questions which also include mathematical communication indicators. From the results of the work done by students, an analysis of students' mathematical communication in solving contextual problems will be carried out. This research aims to describe students' mathematical communication in solving mathematical problems using contextual problems with curved-sided geometric material.

B. METHOD

This research is research that uses a qualitative approach, the role of the researcher is as the main instrument and the research results prioritize meaning over generalization (Abdussamad, 2021). Data sourced from selected research subjects is then described descriptively which discusses students' mathematical communication in solving contextual problems. The data collection techniques used in this research were written mathematical communication tests and interviews to determine oral mathematical communication. Meanwhile, the instruments used are written mathematical communication tests and oral mathematical communication tests. The research instrument used refers to mathematical communication indicators.

Data analysis in this study used a qualitative approach. Researchers analyzed the results of written mathematical communication tests that had been completed by students. Meanwhile, researchers analyzed oral mathematical communication by conducting interviews

with students who had been designated as subjects. The interview guide was prepared based on indicators of verbal mathematical communication and analyzed using a scoring rubric. Then, it is classified by looking at written mathematical communication criteria. Mathematical communication data analysis techniques use the formula:

$$P=\frac{\sum Xi}{\sum X} \times 100\%$$

Information :

P = percentage of mathematical communication

$\sum Xi$= total number of marks obtained

$\sum X$= maximum score

Below are guidelines for classifying the value of students' mathematical communication(Rusmini, 2019).

Table 3. Mathematical Communication Percentage Table

Value scale	Mathematical Communication Criteria
$0\% < X \leq 60\%$	Low
$60\% < X \leq 75\ \%$	Medium
$75\% < X \leq 100\%$	Good

C. RESULTS AND DISCUSSION

Based on the results of research at SMP MUHAMMADIYAH 8 BATU which was carried out face to face and within 7 days when mathematics learning took place. This research began by distributing a mathematical communication test using curved-sided spatial figures with a processing time of 30 minutes. Furthermore, in this research, an interview process was carried out with 3 students who had been designated as subjects to analyze students' oral mathematical communication. Then the researcher analyzed the results of the essay tests that had been carried out and the results of the interviews.

1. Written Mathematical Communication

The results of the written mathematical communication test which was carried out on 28 students are presented in the following diagram.

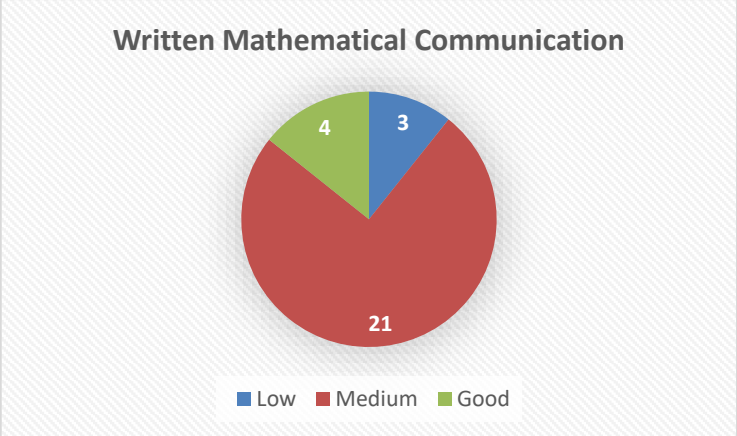

Diagram 2. Written Mathematical Communication Test Results

Based on Diagram 2, it can be seen that students' written mathematical communication in solving contextual problems has various results, but the results are the same as the results of the relational thinking process which is dominant in the medium category. This means that written mathematical communication still needs to be improved.

2. Oral Mathematical Communication

From the results of tests that had been carried out previously, 1 student was taken from the results of written mathematical communication, each of which was categorized as low, medium, and good, to be assigned as a subject in oral mathematical communication. The following are the results of the interview where the questions refer to indicators of verbal mathematical communication and the results of the tests that have been carried out are as follows.

a. Students with low written mathematical communication category

The percentage of written mathematical communication is 38%. The following is an analysis of students in the low mathematical category, namely Written Mathematical Communication Indicators: 1) Create mathematical situations by providing ideas and information in written form; Students do not write down the length of the radius and height of the tube in the problem. 2) Describe the problem situation; Students do not write down the problems in the questions or what is asked in the questions. 3) Using a comprehensive representation to express a mathematical concept and its solution; Students work on the questions correctly and completely, using the formula for the surface area of a tube without a lid to solve the problems in the questions. 4) Use mathematical language and symbols appropriately; Students work on questions using symbols and mathematical language correctly. 5) Expressing solutions to problems using pictures, tables, and charts algebraically; Students do not use pictures to solve the problem. 6) State the results in written form; Students do not write conclusions from the results of the work they have done.

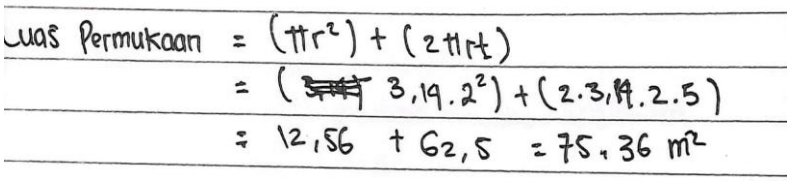

Figure 1. Results of Student Work in the Low

After conducting the interview, the results were obtained, namely that students had a percentage of 75% and were in the medium category for oral communication. The results of the interview were to determine students' oral mathematical communication abilities, namely indicators of oral mathematical communication: 1) Presenting a solution to a problem; Students state the length of the radius and the height of the tub;. 2) Using tables, pictures, models, etc. to convey the answer to a problem; students use the formula for the surface area of a tube without a lid that has been studied previously, but do not use pictures to convey the answer; 3) Choose the most appropriate way to

present the answer to a problem; At first, students find out what shape the geometric shape is in the problem, then students work using the previously known formula for the surface area of a cylinder without a lid; 4) Provide suggestions or other opinions to answer an easier question; The student said that there was no other way to solve the problem; 5) Responding to a statement or problem from the audience in the form of a convincing argument; students said that the main points of the question were things that were known and asked about in the question; and 6) Able to interpret and evaluate ideas, symbols, terms, and mathematical information; students convey the surface area that must be painted by farmers.

b. Students with moderate written mathematical communication category

The percentage of written mathematical communication, namely 63%. The following is an analysis of students in the moderate mathematical category, namely Written Mathematical Communication Indicators: 1) Create mathematical situations by providing ideas and information in written form; Students write down the length of the radius and height of the cylinder in the problem; 2) Describe the problem situation; Students write about the problems in the question or things asked about in the question; 3) Using a comprehensive representation to express a mathematical concept and its solution; Students work on the questions correctly and completely, using the formula for the surface area of a tube without a lid to solve the problems in the questions. 4) Use mathematical language and symbols appropriately; Students work on questions using symbols and mathematical language correctly; 5) Expressing solutions to problems using pictures, tables, and charts algebraically; Students do not use pictures to solve the problem; and 6) State the results in written form; Students do not write conclusions from the results of the work they have done.

After conducting the interview, the results were obtained, namely that students had a percentage of 92% and were categorized as good in oral communication. The results of the interview were to determine students' oral mathematical communication abilities, namely indicators of oral mathematical communication: 1) Presenting a solution to a problem; Students state the length of the radius and height of the tube as well as the formula for the surface area of the tube; 2) Using tables, pictures, models, etc. to convey the answer to a problem; students use the formula for the surface area of a cylinder without a lid that has been studied previously, but do not use pictures to convey the answer; 3) Choose the most appropriate way to present the answer to a problem; At first, students find out what geometric shape is in the problem, then students understand what is being asked in the problem, then students work using the previously known formula for the surface area of a cylinder without a lid; 4) Provide suggestions or other opinions to answer an easier question; The student said that there was no other way to solve the problem; 5) Responding to a statement or problem from the audience in the form of a convincing argument; students said that the main points of the question were things that were known and asked about in the question; and 6) Able to interpret and evaluate ideas, symbols, terms, and mathematical information; students convey the surface area that must be painted by farmers.

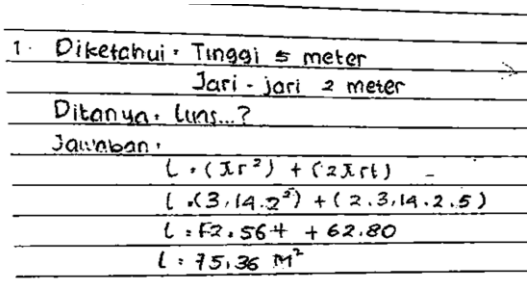

Figure 2. Results of Student Work in the Medium Category

c. Students in the mathematical communication category write good

The percentage of written mathematical communication is 94%. The following are the results of the analysis of students' mathematical communication, namely Written Mathematical Communication Indicators: 1) Creating mathematical situations by providing ideas and information in written form; Students write down the length of the radius and height of the cylinder in the problem; 2) Describe the problem situation; Students write about the problems in the question or things asked about in the question. 3) Using a comprehensive representation to express a mathematical concept and its solution; Students work on the questions correctly and completely, using the formula for the surface area of a tube without a lid to solve the problems in the questions; 4) Use mathematical language and symbols appropriately; Students work on questions using symbols and mathematical language correctly; 5) Expressing solutions to problems using pictures, tables, and charts algebraically; Students use pictures to solve the problem; and 6) State the results in written form; Students write conclusions from the results of the work they have done.

After conducting interviews, the results were obtained, namely that students had a percentage of 96% and were categorized as good in oral communication. The results of the interview were to determine students' oral mathematical communication abilities, namely indicators of oral mathematical communication: 1) Presenting a solution to a problem; Students state the length of the radius and height of the tube as well as the formula for the surface area of the tube; 2) Using tables, pictures, models, etc. to convey the answer to a problem; Students use the formula for the surface area of a tube without a lid that they have learned previously, and use pictures to convey their answers; 3) Choose the most appropriate way to present the answer to a problem; At first, students find out what geometric shapes are in the problem, then students understand what is being asked in the problem, then students work using the formula for the surface area of a cylinder without a lid that has been studied previously; 4) Provide suggestions or other opinions to answer an easier question; The student said that there was no other way to solve the problem.; 5) Responding to a statement or problem from the audience in the form of a convincing argument; students said that the main points of the questions were things that were known and asked about the questions, as well as the

results of the work; and 6) Able to interpret and evaluate ideas, symbols, terms, and mathematical information; students convey the surface area that must be painted by farmers.

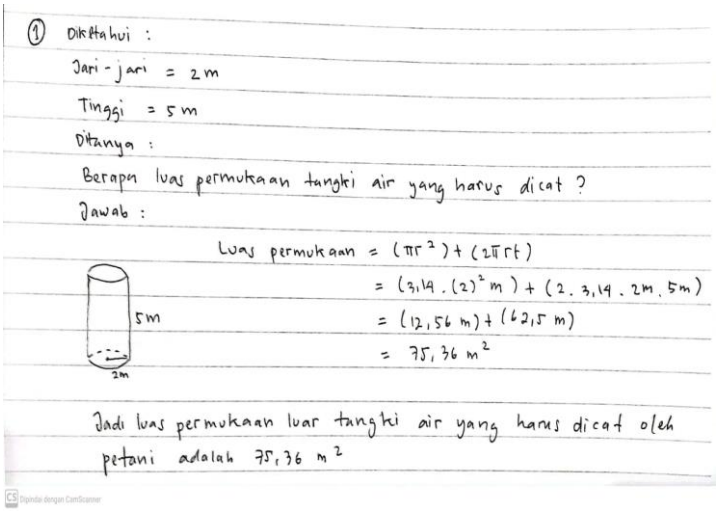

Figure 3. Well Category Student Work Results

Based on the research results, students in the written mathematical communication category are low. This is in line with research (Pane et al., 2018) which states that students with low abilities are less able to communicate mathematical concepts in other forms such as pictures and everyday language, and will not be able to use terms, symbols, notation, and mathematical structures well. Overall, students' written mathematical communication is in the medium category. This is in line with research (Maryati et al., 2022) which states that most can understand, interpret, and evaluate mathematical ideas verbally, written, and visually. The results of the students' mathematical communication category are in the good writing category. This is in line with research (Septian et al., 2020) which states that all students have good abilities. able to understand, interpret, and evaluate mathematical ideas verbally, written, and visually.

D. CONCLUSIONS AND SUGGESTIONS

The research results show that students in the low category are still unable to communicate mathematically. Meanwhile, students in the medium category are less able to communicate mathematically. Students in the high category are good at communicating mathematically. Educators are expected to be able to implement innovative learning as an effort to improve students' mathematical communication and pay more attention to groups of students in the low category so that these students are not left behind in achieving learning goals. Recommendations for further research are to develop contextual problem-based learning designs that focus on improving students' mathematical communication.

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