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Mathematical Communication Skills of Junior High School Students: Challenges and Opportunities in Triangle Material

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Abstract

Mathematical communication skills are crucial for developing students' critical thinking in mathematics learning; however, many students still struggle in this area. This study aims to analyze students' mathematical communication skills on the topic of triangles. The research employed a descriptive qualitative method with six students as the research subjects. Data were collected through essay tests and interviews. The results show that overall, students' mathematical communication skills are categorized as high, with one indicator classified as very high, namely the ability to create models of situations or problems using oral, written, concrete, graphical, and algebraic methods. Three indicators are categorized as high: reflecting real objects, images, and diagrams into mathematical ideas; reading and understanding mathematical representations; and making conjectures, constructing arguments, and generalizing. One indicator is categorized as low, namely the ability to express daily events in mathematical language or symbols. Students tend to have difficulty connecting contextual problems to mathematical symbols. These findings highlight the importance of enhancing students' mathematical communication skills in the learning process.

Keywords: Challenges and Opportunities; Mathematical Communication Skills; Triangle Material.

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1. Introduction

Education is a fundamental pillar of human development, serving as a conscious and systematic effort to cultivate individuals' potential, skills, and character. As outlined in the 2016 Minister of Education and Culture Regulation Number 21, education aims to create a conducive learning environment that enables students to actively develop their spiritual, emotional, intellectual, and social capacities. The regulation emphasizes that education should foster individuals who are not only knowledgeable but also possess noble morals, self-discipline, creativity, independence, and a sense of responsibility toward society and the nation.

Mathematics, as a core discipline within the curriculum, plays a vital role in achieving these educational goals. Mathematics develops students' intellectual abilities through logical reasoning, problem-solving, and critical thinking—skills that are essential for navigating an increasingly complex and dynamic world. Through mathematical learning, students are trained to approach problems systematically, think analytically, and make reasoned decisions, fostering both independence and creativity. Furthermore, mathematics promotes discipline and persistence, as students are required to follow structured processes and persevere through challenging tasks. In this way, mathematics not only contributes to the development of cognitive skills but also shapes the character traits that are central to the vision of national education.

Mathematics, as a core subject in the educational curriculum, plays a pivotal role in achieving these objectives. It is a discipline that transcends mere calculation, offering a structured framework for logical reasoning, systematic thinking, and problem-solving. According to the National Education Standards Agency (2006), mathematics education is essential at all levels, from elementary to tertiary education, as it equips students with the ability to think logically, analytically, and creatively. These skills are indispensable for preparing students to face real-world challenges and adapt to rapid global changes.

Mathematics fosters critical and applicable thinking patterns by training students to approach problems methodically, analyze information deeply, make reasoned decisions, and apply theoretical concepts to practical situations. Through problem-solving activities, students learn to connect abstract mathematical principles with everyday experiences, encouraging adaptability and innovation. However, despite the crucial role of mathematics, Indonesian students face significant challenges in mathematical literacy, particularly in applying mathematical concepts to solve complex everyday problems that require higher-order reasoning (Khaesarani & Ananda, 2022). The results of the study by Ramalia et al. (2024) indicate that most junior high school students have low mathematical literacy skills. Strengthening students' mathematical literacy is thus essential for developing the critical, creative, and practical thinking skills needed in today's rapidly evolving world.

One of the critical areas where Indonesian students lag is mathematical communication skills (MCS). Mathematical communication involves the ability to express mathematical ideas clearly, both orally and in writing, and to interpret and evaluate mathematical arguments. As highlighted by Dewantari & Udara (2017), MCS is a cornerstone of effective mathematics learning, as it enables students to organize and articulate their mathematical thinking. Unfortunately, Indonesian students' performance in this area is significantly lower compared to their peers in countries like Singapore, Korea, and Taiwan. For instance, only 5% of Indonesian students successfully answered questions requiring advanced mathematical communication skills, whereas more than 50% of students in the aforementioned countries achieved the same (Johar et al., 2017).

Several factors contribute to these difficulties. Indonesian students often struggle to translate abstract mathematical concepts into coherent verbal or written explanations. They tend to focus solely on obtaining the final answer without being able to describe the reasoning process behind it. Moreover, limited classroom opportunities for discussion, collaboration, and mathematical argumentation further inhibit the development of these skills. Students may also experience anxiety or a lack of confidence when asked to explain their thought processes, which in turn hampers their ability to communicate ideas effectively.

The relationship between mathematical communication skills and academic achievement is significant. Students who can articulate mathematical concepts and justify their solutions tend to develop a deeper understanding of the material, leading to better problem-solving abilities and higher overall academic performance. Conversely, weak mathematical communication often correlates with superficial understanding and lower achievement levels. Therefore, strengthening MCS is not only vital for improving mathematical literacy but also for fostering broader academic success among Indonesian students.

The importance of communication in mathematics cannot be overstated. As Umar (2012) notes, communication serves as a medium for exchanging ideas, clarifying understanding, and consolidating knowledge. Through communication, students can refine their thinking and engage in collaborative problem-solving (Rahmi et.al, 2024). These skills are particularly crucial in topics like geometry, where students are required to explore concepts, derive principles, and apply formulas to solve problems. For example, the study of triangles demands not only computational proficiency but also the ability to connect mathematical concepts to real-world scenarios (Chisara et al., 2019; Syarifuddin et al., 2019).

Mathematical communication is closely linked to students' depth of understanding and their ability to apply mathematical concepts in varied contexts. When students articulate their thought processes—whether through verbal explanations, written arguments, or visual representations—they are actively organizing and internalizing mathematical ideas. This process helps students to uncover relationships between concepts, identify underlying structures, and solidify their conceptual understanding. Consequently, students who are adept at mathematical communication are more capable of transferring knowledge across different problems and applying concepts flexibly in unfamiliar situations.

Conversely, students who struggle with mathematical communication often exhibit fragmented or superficial understanding. They may memorize formulas and procedures without truly grasping the underlying principles, leading to difficulties when faced with novel or non-routine problems. As empirical evidence suggests, students frequently encounter challenges in transferring their mathematical knowledge to practical situations, especially when problems differ from the examples routinely practiced in class (Syarifuddin et al., 2019). This indicates that improving students' mathematical communication skills is essential not only for enhancing their comprehension but also for empowering them to tackle complex, real-world problems with confidence and creativity.

4 To address these challenges, it is imperative to adopt pedagogical strategies that emphasize mathematical communication and problem-solving. By fostering an environment where students are encouraged to articulate their reasoning, engage in collaborative discussions, and apply mathematical concepts to diverse contexts, educators can enhance both conceptual understanding and practical application. This approach aligns with the broader goals of Indonesia's national education system, which seeks to develop well-rounded individuals capable of contributing to society and navigating the complexities of the modern world.

In the context of triangle material, students often face specific challenges in applying 37 mathematical communication effectively. One of the key difficulties is that students frequently struggle to visualize and represent geometric concepts in a clear and logical manner. Many students face challenges in constructing mathematical arguments in geometry. While they can perform calculations, they often struggle to provide clear explanations or justifications for their solutions (Herman & Prahmana, 2017). This lack of communication can hinder students' ability to connect different concepts within geometry, such as understanding the relationship between angles and sides in various types of triangles, or applying these concepts to real-world problems, such as in architecture or engineering (Chisara et al., 2019).

To overcome these challenges, it is crucial to incorporate active pedagogical strategies that encourage students to articulate their reasoning, visualize geometric figures, and explain the process of problem-solving in detail. For instance, using visual aids such as diagrams, interactive software, or physical models can help students better understand the spatial properties of triangles. Additionally, fostering collaborative problem-solving activities where students discuss their approaches with peers can enhance their ability to communicate their reasoning and refine their understanding. Moreover, providing opportunities for students to apply triangle-related concepts to real-world scenarios can deepen their appreciation for the practical relevance of geometry and strengthen their ability to transfer knowledge to new situations (Syarifuddin et al., 2019).

By adopting these pedagogical approaches, educators can significantly improve students' mathematical communication skills and their ability to apply geometric concepts, thus enhancing both their academic performance and their preparedness for real-world challenges.

This research offers several innovations that aim to address the challenges faced by Indonesian students in mathematical communication, particularly in the study of triangle material. One novel aspect of this research is the proposed pedagogical approach that combines the use of visual aids, collaborative problem-solving, and real-world applications of geometry. While traditional teaching methods in mathematics often focus on rote memorization and procedural understanding, this study suggests an alternative approach that emphasizes the articulation of reasoning, peer collaboration, and practical application. By incorporating interactive tools such as dynamic geometry software or physical models, students can better visualize and communicate geometric concepts, thereby enhancing both their conceptual understanding and communication skills. Additionally, this research offers a new perspective on how mathematical communication can be integrated into specific topics such as triangle material, offering teachers and educators concrete strategies for improving students' ability to express, justify, and apply their mathematical thinking in real-world contexts. This approach has the potential to foster a more engaging and effective learning environment, equipping students with the skills necessary to navigate the complexities of modern life.

2. Methods

This study employed a qualitative research design using a case study approach. A case study approach was chosen because it allows researchers to explore in-depth the mathematical communication skills of students within a real-life context and a clearly bounded system. As Creswell (2016) explains, a case study is a qualitative approach in which the investigator explores a bounded system (a case) over time through detailed, in-depth data collection involving multiple sources of information.

The research method used was a descriptive qualitative method, which aims to systematically and factually describe the observed phenomena. This method is considered appropriate for the purpose of the study, which is to analyze and describe students' mathematical communication skills in solving triangle problems and contextual problems. According to Moleong (2017), qualitative descriptive research seeks to understand the meaning of a phenomenon experienced by the research subjects holistically and naturally, presented in the form of words and language.

The subjects of this study were six seventh-grade students from a private junior high school in Kampar Regency, Riau. The subjects were selected using a purposive sampling technique, which is commonly used in qualitative research to select individuals who are especially knowledgeable or experienced with the phenomenon being studied (Palinkas et al., 2015). In this case, the subjects were chosen based on specific criteria to ensure that the data collected would be rich and relevant for analyzing students' mathematical communication skills.

The selection criteria for the student subjects included:

- Mathematical ability level, determined based on previous mathematics test scores and teacher recommendations. Two students were selected from each category: high, medium, and low ability levels.
- Gender representation, with consideration given to including both male and female students to capture different perspectives.
- Willingness to participate in both the written test and follow-up interview sessions.
- Regular attendance and active participation in mathematics classes, to ensure familiarity with the material being tested (triangles and contextual problems).

This sampling approach ensures that the selected subjects provide a representative cross-section of the student population relevant to the research objectives.

The instruments used in this study consisted of written tests and interviews, specifically designed to assess students' mathematical communication skills (MCS) on the topic of triangles. The selection of triangle-related material was based on its potential to elicit various mathematical representations—verbal, symbolic, and visual—which are highly relevant for exploring aspects of students' mathematical communication. Descriptive questions were used to encourage students to express ideas, justify reasoning, and appropriately use mathematical symbols and representations.

Each test item was designed to assess one or more of the three MCS indicators: (1) the ability to express ideas using mathematical language, (2) the ability to write and explain problem-solving steps, and (3) the ability to visually represent mathematical information. The development of the test items involved review and validation by mathematics education experts to ensure alignment with the curriculum and the assessment objectives.

The study utilized descriptive questions administered to Grade VII students on the topics of quadrilaterals and triangles. Data collection was carried out through a diagnostic test developed based on MCS indicators to assess students' abilities in solving contextual problems.

Data collection was conducted over a two-week period. The written test was administered in the classroom under the supervision of both the teacher and the researcher to ensure uniform testing conditions and data accuracy. Interviews were conducted after the written test using purposive sampling to select students based on their test results (categorized as high, medium, and low performers). This sampling approach aimed to obtain deeper insights from different levels of MCS proficiency.

The interviews followed a semi-structured approach. Each interview began with general questions regarding the students' experiences learning about triangles, followed by specific questions prompting students to explain their reasoning or the steps they took to solve particular test items. Each question was designed to explore MCS indicators more thoroughly, including the use of mathematical language, clarity of reasoning, and visual representation.

All interviews were recorded and transcribed for analysis. The transcripts were used to identify patterns in mathematical communication that were not fully captured in the written responses.

Quantitative data from the MCS test were analyzed using descriptive statistics, including calculation of the average scores for each indicator and their conversion into percentages. Scoring was conducted based on a rubric developed and validated beforehand, with assessment criteria covering completeness of answers, conceptual accuracy, and clarity of communication.

Meanwhile, qualitative data from the interviews were analyzed using thematic analysis. Each student's statement was coded according to the MCS indicators, and emerging themes were analyzed to support and enrich the quantitative findings from the written test.

This research was conducted using a test in the form of descriptive questions. The study was conducted by providing a mathematical communication ability test on the material of quadrilaterals and triangles in class VII. Data collection techniques to determine students' mathematical communication abilities in solving contextual-based problems based on diagnostic tests according to these indicators

Table 1 - Guidelines for Scoring Mathematical Communication Skills

Score	Assessment	Indicator
Reflecting real objects, pictures,	No answer	0
	Mathematical images or reflections of real objects, drawings and diagrams with incorrect elements.	1

Score	Assessment	Indicator
and diagrams in mathematical ideas	Mathematical images or reflections of real objects, pictures and diagrams with their elements are correct, but incomplete or some parts of the image are wrong.	2
	A mathematical image or reflection of real objects, pictures and diagrams accompanied by correct, complete and clear elements.	3
Creating models of situations or problems using oral, written, concrete, graphic, and algebraic methods	No answer	0
	In writing a mathematical model of a given problem, one of the	1
	In writing the mathematical model of the given problem, it is correct, but incomplete or there is a part of the answer that is wrong.	2
	In writing a mathematical model of the given problem, it must be correct, complete and clear.	3
Expressing everyday events in language or mathematical symbols	No answer	0
	In writing down the elements contained in questions using incorrect mathematical symbols or language	1
	In writing down the elements contained in questions using mathematical symbols or language are correct, but incomplete or some answers are wrong	2
	In writing down the elements contained in questions using symbols or mathematical language are correct, complete and clear	3
Reading with understanding of a written mathematical representation	No answer	0
	Wrong in rewriting what is known and asked from a written mathematical representation	1
	In rewriting what is known and asked about from a written mathematical representation, it is correct, but incomplete or there are some answers that are wrong	2
	In rewriting what is known and asked about from a written representation, it is correct, complete and clear	3
Make conjectures (conjecture), compose argument, and make generalization	No answer	0
	The argument or conclusion written is wrong	1
	The argument or conclusion written is correct, but incomplete or there are some wrong answers	2
	The arguments or conclusions written are correct, complete and clear	3

Calculate the average percentage of students' mathematical communication abilities.

$$average\ percentage = \frac{sum\ of\ student\ score\ for\ all\ indicators}{maximum\ score\ for\ all\ indicators} \times 100\%$$

Determine the Benchmark Assessment (PAP) to interpret data on students' mathematical communication ability scores. The PAP in this study is as follows:

Table 2 - Percentages and Categories of Levels of Mathematical Communication Skills

No.	Student mathematical ability test results	Ability category
1.	0 - 25	Very low
2.	25 - 50	Low

3.	50 - 75	Tall
4.	75 - 100	Very high

These categories were used to interpret students' ability to communicate mathematical ideas. For example, students in the "High" category generally demonstrated clear explanations, accurate use of symbols, and effective visual representations. In contrast, those in the "Low" category tended to write procedures without explanation and were less capable of expressing reasoning or understanding explicitly.

This interpretation provides a comprehensive overview of students' strengths and weaknesses in mathematical communication, which can serve as a foundation for improving instructional strategies in the future.

3. Results and Discussion

3.1. Results

The subjects in this study were 6 students of class VII of Al-Faruqi Middle School. Then the researcher gave 2 test questions with the details of the questions being mathematical communication skills. Based on the results of students' answers related to the problems that had been solved, the data was obtained and then analyzed by referring to mathematical communication skills. To be clearer, it can be seen in the table.

Table 3 - Results of Students' Mathematical Communication Skills for Each Indicator

Question no	Indicator					Total score
	1	**2**	**3**	**4**	**5**	
1	0	16	9	11	13	46
2	13	12	6	9	9	56
Amount	13	28	15	20	22	102
Ideal score	18	36	36	36	36	162
percentage	72,22	77,77	41,66	55,55	61,11	62,96

Based on table 3, the results of the percentage of achievement based on the indicators of students' mathematical communication skills are obtained, namely Indicator 1: Reflecting real objects, images, and diagrams in mathematical ideas, from 6 students of Al-Faruqi Middle School in class VII, the total score obtained from the indicator is 13 with an ideal score of 18 and achievement of 72.22 with a high category. Indicator 2: Creating a situation or problem model using oral, written, concrete, graphic, and algebraic methods, the total score obtained from the indicator is 28 with an ideal score of 36 and achievement of 77.77 with a very high category. Indicator 3: Stating everyday events in mathematical language or symbols, the total score obtained from the indicator is 15 with an ideal score of 36 and achievement of 41.66 with a low category. Indicator 4: Reading with understanding a written mathematical representation, the total score obtained from the indicator is 20 with an ideal score of 36 and achievement of 55.55 with a high category. Indicator 5: Making conjectures, constructing arguments, and generalizing, the total score obtained from the indicator is 22 with an ideal score of 36 and achievement of 61.11 with a very high category.

3.2. Discussions

The following are the results of students' work in solving problems on the triangle material.

Table 4. Results of the Analysis of Students' Mathematical Communication Skills on Question 1

Student	Ability	Indicator 1	Indicator 2	Indicator 3	Indicator 4	Indicator 5
1	T1	-	Students can create problem models.	Students can state events in mathematical symbols	Students can enter known values correctly	Students can draw conclusions
2	T2	-	Students can create problem models correctly	Students can express events in mathematical symbols	Students can enter known values correctly	Students can make conclusions correctly
3	S1	-	Students can create problem models but they are incomplete	Students can express events in mathematical symbols	Students cannot enter known values	Students can make conclusions
4	S2	-	Students can create problem models completely	Students can express events in mathematical symbols	Students can enter known values	Students cannot make conclusions
5	R1	-	Students can create problem models correctly	Students can express events in mathematical symbols	Students cannot enter known values correctly	Students cannot make conclusions correctly
6	R2	-	Students do not create problem models	Students can express events in mathematical symbols	Students can enter known values	Students cannot make conclusions

Based on table 4 above, it can be concluded that the mathematical communication skills of grade VII students based on the level of difficulty, it was found that in indicator 2 out of 6 students, 4 students were able to create a problem model, while 2 students were unable to create a problem model. In indicator 3 out of 6 students, there were 5 students who were able to state events in mathematical symbols, while 1 student was unable to state events in mathematical symbols. In indicator 4 out of 6 students, there were 3 students who were able to enter known values correctly, while 3 students were unable to enter known values correctly. In indicator 5 out of 6 students, there were 5 of them who were able to draw conclusions from the questions asked, while 1 student was unable to draw conclusions from the questions asked.

Table 5. Results of Analysis of Students' Mathematical Communication Skills on question 2

Student	Ability	Indicator 1	Indicator 2	Indicator 3	Indicator 4	Indicator 5
1	T1	Students can reflect images into mathematical ideas	Students can create problem models	Students can express events in mathematical symbols	Students can enter known values correctly	Students cannot make conclusions
2	T2	Students can reflect images into mathematical ideas	Students can create problem models correctly	Students can express events in mathematical symbols	Students can enter known values correctly	Students can make conclusions correctly
3	S1	Students can reflect images into mathematical ideas	Students can create problem models but they are incomplete	Students can express events in mathematical symbols	Students do not enter known values	Students can make conclusions that are less accurate
4	S2	Students can reflect images into mathematical ideas	Students can create problem models correctly	Students can express events in mathematical symbols	Students can enter known values correctly	Students can make conclusions completely
5	R1	Students can reflect images into mathematical ideas	Students cannot create problem models correctly	Students can express events in mathematical symbols	Students cannot enter known values correctly	Students cannot make conclusions correctly
6	R2	Students can reflect images into mathematical ideas	Students do not create problem models	Students can express events in mathematical symbols	Students can enter known values	Students cannot make conclusions

Based on table 4 above, it can be concluded that the mathematical communication skills of grade VII based on the level of difficulty, it was found that in indicator 1 out of 6 students, all 6 students were able to reflect the image into a mathematical idea. In indicator 2 out of 6 students, there were 3 students who were able to create a mathematical problem model, while 3 students were unable to create a mathematical problem model. In indicator 3 out of 6 students, there were 2 students who were able to state events in mathematical symbols, while 4 students were unable to state events in mathematical symbols. In indicator 4 out of 6 students, there were 5 students who were able to enter known values correctly, while 1 student was unable to enter known values correctly. In indicator 5 out of 6 students, there were 4 of them who were able to draw conclusions from the questions asked, while 2 students were unable to draw conclusions from the questions asked. From the tables above, the following are the results of the student worksheets and interview results which are described as follows:

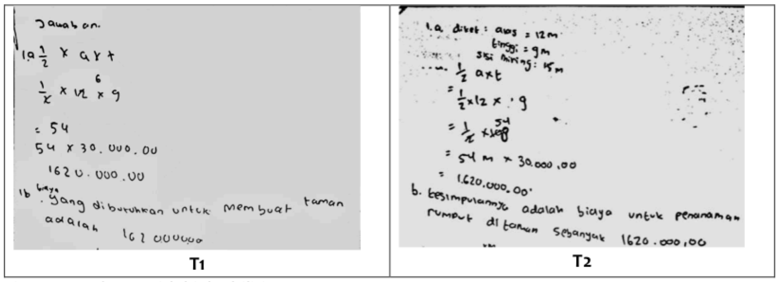


Figure 1 Students with high abilities

In figure T1 with a student with high mathematical communication ability in class VII with the initials SN, it can be seen that the student is able to state events in mathematical symbols, but the student cannot write what is known and what is asked but the student is able to make conclusions correctly from the answers he has worked on. The results of this study are in line with the research conducted by Rosita, Nopriana, & Silvia (2019), which stated that students still struggle to articulate the ideas required in the problems. While in figure T2 with a student with high mathematical communication ability in class VII with the initials SY has been able to solve the questions given, the student is able to work on the questions well and correctly.

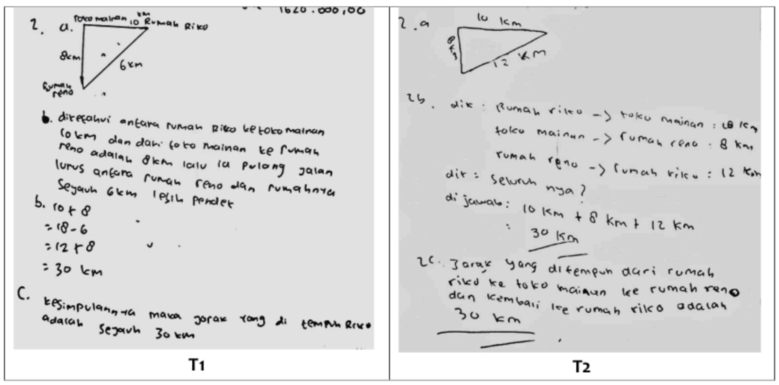


Figure 2 Students with high abilities

In Figure T1 with a student with high mathematical communication skills in class VII with the initials SN, it can be seen that the student is able to understand the questions given but not completely, the student is able to state events in mathematical symbols but not quite right. While in Figure T2 with high mathematical communication skills in class VII with the initials SY has been able to solve the questions given, the student is able to state events in questions using mathematical symbols and the student is able to write conclusions from the answers he has worked on. The following is an interview with the student:

> *P: Do you find it difficult to do the written test?*
> *Sy: No, because the questions are easy to understand and the questions are also clear*
> *P: Can you explain the picture into a mathematical idea to complete the written test?*
> *Sy: Yes, because what is known and what is asked from the question is clear, so it makes it easier to answer the question*
> *P: Based on what is known, it is asked how do you complete the written test*
> *Sy: How to do it for question number 1*
> *Given: base = 12 m,*
> *height = 9 m*
> *hypotenuse = 15 m*
> *Asked: How much does it cost to plant the garden?*
> *P: What is the conclusion in completing the written test?*
> *Sy: For question number 1, the conclusion of the solution is that the cost of planting grass in the garden is 1,620,000.00.*

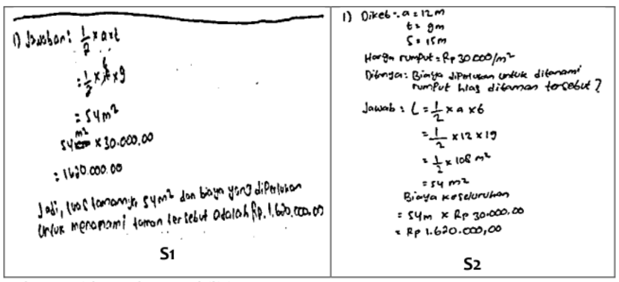
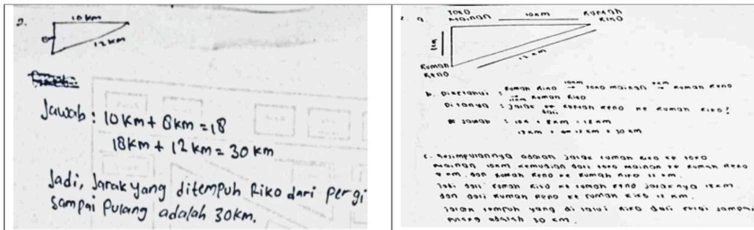


Figure 3 Students with moderate abilities

In Figure S1 with a student with moderate mathematical communication ability in class VII with the initials RK, it can be seen that the student can state events with mathematical symbols, but the student does not write what is known and asked but the student can state the conclusion of the answer that was worked on. While in Figure S2, it can be seen that a student with moderate mathematical communication ability in class VII with the initials TI, the student can solve question no. 1 well and correctly, but the student does not write the conclusion of the answer that has been worked on.

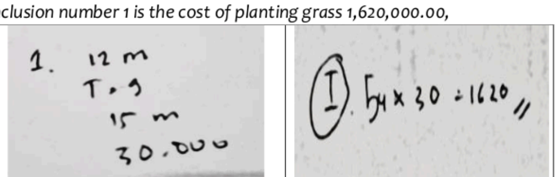


S1 S2

Figure 4 Students with moderate abilities

In Figure S1 with a student with moderate mathematical communication skills in class VII with the initials TI, it can be seen that the student is able to reflect the image into a mathematical idea, the student is able to create a problem model but it is incomplete, but the student does not write what is known and asked. But the student can write a conclusion from the answer he worked on. While in Figure S2 with a student with moderate mathematical communication skills in class VII with the initials RK, it can be seen that the student can reflect the image into a mathematical idea, and is able to create a problem model correctly and the student is able to write the known value and write a conclusion from the answer he worked on. The following is an interview with the student:

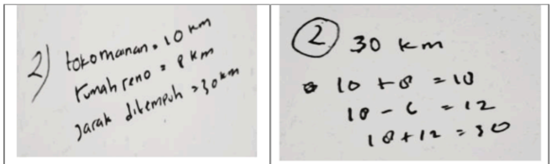
P: Do you find it difficult to do the written test?
Rk: It's a bit difficult, because it took a long time to understand the questions
P: Can you explain the image into a mathematical idea to complete the written test?
Rk: I can, but I don't understand what is known and what is asked from the question, so it's a bit difficult to answer the question
P: can you explain the problem in question 1
Rk: the problem in question number one is about finding out how much it will cost to plant the garden
P: based on what is known, it is asked how do you complete the written test
Rk: question number 1
Given: base, height, hypotenuse
Asked: How much does it cost?
P: what is the conclusion in completing the written test?
Rk: conclusion number 1 is the cost of planting grass 1,620,000.00,



R1 R2

Figure 5 Students with low abilities

In Figure R1 with a student with low mathematical communication skills in class VII with the initials SP, it can be seen that the student is lacking in stating events with mathematical symbols, but the student does not write what is known and asked, then the student can state the conclusion of the answer that was worked on. While in Figure R2, it can be seen that a student with low mathematical communication skills in class VII with the initials jT, the student cannot solve question no. 1 properly and correctly, but the student does not write the conclusion of the answer that has been worked on.



R1 R2

Figure 6 Students with low abilities

In Figure R1 with a student with low mathematical communication skills in class VII with the initials SP, it can be seen that the student is lacking in stating events with mathematical symbols, but the student does not write what is known and asked, then the student can state the conclusion of the answer that was worked on. While in Figure R2, it can be seen that a student with low mathematical communication skills in class VII with the initials TI, the student cannot solve question no. 2 properly and correctly, but the student does not write the conclusion of the answer that he has worked on.

The following is an interview with the student:
P: Do you find it difficult to do the written test?
JT: It's difficult, because I don't understand the questions
P: Can you explain the picture into a mathematical idea to complete the written test?
JT: No, because I don't understand what is known and asked from the question, so I can't answer the question
P: Can you explain the problem of question 1
JT:: The problem of question number 1 is about the cost of the park.
P: based on the known asked how do you complete the written test
JT:: question number 1
Given: triangle image
Asked: how many?
P: do you find it difficult to answer verbally?
JT:: it's difficult, sis, because I don't understand

4. Conclusions

Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential. National education aims to educate the nation and develop the potential of students. Mathematical reasoning and communication skills are very important in mathematics learning and everyday life. Many Indonesian students have difficulty in solving mathematical problems and linking everyday problems with mathematical language, so research is needed on students' communication skills in solving mathematical problems. The results of the study showed that students' mathematical communication skills ranged from high to low. Some students were able to model problems, state events in mathematical language or symbols, and make good conclusions, but there were also those who still had difficulties. This study provides a useful overview of students' mathematical communication skills.

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Conflict of Interest
The authors declare no conflicts of interest.

References
Chisara, C., Hakim, D. L., & Kartika, H. (2019). Implementasi pendekatan Realistic Mathematics Education (RME) dalam pembelajaran matematika. *Prosiding Sesiomadika*, *1*(1b).
Creswell, J. W. (2016). *Research Design: Pendekatan Kualitatif, Kuantitatif, dan Mixed*. Yogyakarta: Pustaka Pelajar.
Dewantari, A., & Udara, M. T. (2017). Desain Blended Learning Dengan Model Assure Pada Mata Kuliah Pengantar Ekonomi Makro. *Jurnal Manajemen Dirgantara*, *10*(2), 15–25.
Herman, T., & Prahmana, R. C. I. (2017, December). The students' mathematical argumentation in geometry. In *Journal of Physics: Conference Series* (Vol. 943, No. 1, p. 012026). IOP Publishing. http://doi.org/10.1088/1742-6596/943/1/012026
Johar, Rahmah, Diandita, Elly R., dan Abidin, Taufik F. (2017). Kemampuan Komunikasi Matematis dan Metakognitif Siswa SMP Pada Materi Lingkaran Berdasarkan Gender. *Jurnal Pendidikan Matematika*. 11(2), 79-97.
Khaesarani, I. R., & Ananda, R. (2022). Students' mathematical literacy skills in solving higher-order thinking skills problems. *Al-Jabar: Jurnal Pendidikan Matematika*, *13*(1), 81-99. https://doi.org/10.24042/ajpm.v13i1.11499
Moleong, L. J. (2017). *Metodologi Penelitian Kualitatif*. Bandung: Remaja Rosdakarya.
Rahmi, C. N., Jailani, J., & Chrisdiyanto, E. (2024). Improving communication, problem-solving, and self-efficacy skills grade-10 students through scientific approach based on discovery learning . *JRAMathEdu (Journal of Research and Advances in Mathematics Education)*, *9*(1), 56–65. https://doi.org/10.23917/jramathedu.v9i1.2448
Ramalia, T., Effie Efrida Muchlis, Edi Susanto, & Cheng, A. Y. (2024). Exploration of Students' Abilities in Solving Mathematical Literacy Problems on Geometry Material Using Polya's Steps. *International Journal of Geometry Research and Inventions in Education (Gradient)*, *1*(2), 83–93. https://doi.org/10.56855/gradient.v1i2.1269
Rosita, C. D., Nopriana, T., & Silvia, I. (2019). Design of learning materials on circle based on mathematical communication. *Infinity Journal*, *8*(1), 87-98. https://doi.org/10.22460/infinity.v8i1.p87-98
Sugiyono. (2018). Penelitian Pendidikan. Bandung: Alfabeta.
Syarifuddin, Nusantara, T., Qohar, A., & Muksar, M. (2019). The Identification Difficulty of Quantitative Reasoning Process toward the Calculus Students' Covariation Problem. Journal of Physics: Conference https://doi.org/10.1088/1742-6596/1254/1/012075
Umar, W. (2012). Membangun Kemampuan Komunikasi Matematis Dalam Pembelajaran Matematika. *Infinity Journal*, *1*(1), 1. https://doi.org/10.22460/infinity.v1i1.p1-9

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