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Analysis of Mathematical Communication Ability in Flat Side Room Building Materials Reviewed from Students' Learning Interests

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ABSTRACT

This study investigates the mathematical communication ability of eighth-grade students in solving flat-sided geometry problems, focusing on the influence of their learning interest. The research underscores the importance of mathematical communication for understanding and expressing geometric concepts, which supports cognitive development and problem-solving skills. The aim is to analyze how varying levels of learning interest (high, medium, low) impact students' proficiency in representing, explaining, and solving geometry problems. A descriptive qualitative method was employed, collecting data from 32 students through questionnaires, written tests, and interviews. Results showed that while over 90% of students expressed interest in the material, their mathematical communication abilities differed notably. Students with high interest excelled in representing ideas and using appropriate mathematical language, though they still faced issues with precision and depth of understanding. Those with medium interest demonstrated partial mastery, often able to explain concepts but with some lack of clarity. Students with low interest struggled with basic concepts and had difficulty articulating their reasoning. The study concludes that learning interest correlates with mathematical communication ability, but all groups require targeted interventions to address gaps in understanding and accuracy. The findings suggest that creative teaching strategies, such as integrating technology like GeoGebra, can enhance student engagement and improve conceptual clarity in geometry education.

KEYWORDS *Mathematical Communication, Learning Interest, Build Flat Side Space*

INTRODUCTION

Communication facilitates the exchange and understanding of ideas, helping generate meaning and retain concepts so they can be shared (Nufus, 2022). In mathematics education, this is known as *mathematical communication skills*, which are essential for learning (Fisher et al., 2019; Gunawan, Ni Made Yeni Suranti, 2020; Irviana, 2020; Matsuo et al., 2022). According to Kusumah (Nufus & Ariawan, 2017), communication in mathematics allows exploration from various perspectives, improves cognitive processes, assesses comprehension, organizes thought, constructs knowledge, enhances reasoning, and fosters effective discourse. *Mathematical communication ability* refers to articulating ideas and engaging in logical, clear discussion of mathematical topics (Lamibao et al., 2016).

In geometry—especially *flat-sided geometry*—these skills are crucial for mastering concepts and expressing reasoning using symbols, diagrams, and language (Rizal et al., 2021). Qohar (2011) outlines four aspects: representation, conversation, reading, and writing, while Sumarno (2012) details skills such as translating situations into mathematical models and explaining concepts both orally and in writing.

A key factor influencing students' *mathematical communication ability* is their *learning interest*. Interest fosters curiosity, engagement, and active participation, which support concept mastery (Khasanah & Nugraheni, 2022; Awaliyah & Fitrianna, 2018). However, many students still struggle to express mathematical ideas clearly, especially in abstract topics like *flat-sided geometry* (Nufus & Ariawan, 2017).

This study addresses the gap by analyzing how different levels of *learning interest* (high, medium, low) affect students' *mathematical communication skills* in *flat-sided geometry* at SMP N 2 Kartasura. The findings aim to inform differentiated instruction and targeted interventions, ultimately improving geometry education and fostering both engagement and communicative competence.

METHOD

Descriptive qualitative research was used in this study. The researcher directly observed the evaluation of students' mathematical communication ability in relation to learning interest in the classroom during the learning of flat-sided spatial geometry material in grade VIII of SMP N 2 Kartasura. This research activity complied with the standard phases of qualitative descriptive research. There were three phases, namely the preparation phase, the implementation phase in the field, and the post-field phase.

The design of a one-group pretest-posttest was used as the research sample. At this stage, data collection was carried out with pre-defined equipment. The post-field stage involved the analysis of data collected from the field. Data analysis was carried out descriptively based on information collected from the instruments used. Data collected from the earliest observations to the end of the study were analyzed.

The data sources for this study came from questionnaires, interviews, observations, documents, and written tests given at SMP N 2 Kartasura. Participants in this study were educators and students. The subjects of this study were 32 students from class VIII G SMP N 2 Kartasura during the 2023/2024 school year, with data collected through validated questionnaires and written assessments.

Questions and questionnaires were used for research. The tests given were in the form of Pre-Test and Post-Test. Students received a description before and after learning the flat-sided geometry material for the Pre-Test and Post-Test. The Pre-Test and Post-Test results are shown in the table below.

Table 1. Pre-Test and Post-Test Grids

Achievement Indicators Competence	Question Indicator	Number Question
Students can name the elements of the cube.	Presented with a picture of building a flat side room, students were asked to write down the elements of building the space.	1
Students can determine the surface area of the block.	Given the problem of the surface area of the flat side room, students were asked to determine the surface area of the building space.	2
Students can determine the volume of the prism.	Given the problem of building volume of flat side rooms, students were asked to determine the surface area of the building space.	3
Students can determine the volume of limas.	Given the problem of building volume of flat side rooms, students were asked to determine the volume of building the space.	4

The student learning interest questionnaire tests students' interest in polygonal shapes in mathematics learning. Several metrics evaluate learning interests. Hudaya (2018) lists pleasure, curiosity, involvement, and focus as indicators of interest in learning. The

questionnaire of this study had 30 questions. The following is the framework for student learning interest questionnaires.

Table 2. A Survey of Students' Interest in Learning

Aspects	Indicator	Question		Total Items
		Positive	Negative	
Feeling Happy	Students' views/opinions about mathematics lessons on flat side room building materials.	1, 2	3, 4	4
	The feelings of students during mathematics lessons on the building material of flat side spaces.	5, 7	6, 8	4
	Students' opinions about math teachers.	9, 10	11, 12	4
Students' Interest in Learning	Activeness while learning mathematics.	13, 15	14, 16	4
	Awareness of learning mathematics in school.	17, 19	18, 20	4
Engagement while Learning	Student response to the material/assignment given.	21, 23	22, 24	4
	Curiosity about math lessons.	25, 27	26, 28	4
Showing Mindfulness While Learning	Teaching students if they do not understand the assignments given.	29	30	2

This student response questionnaire is compiled based on learning interest markers. In addition, the questionnaire data was examined with descriptive statistics, namely calculating the average, followed by the application of percentages according to the relevant level category (Riduwan & Sunarto, 2013). The validation results showed that the student response questionnaire, which consisted of thirty questions and was given to thirty-two students, achieved a validity rate of 90.75% in three categories.

This instrument is designed to collect data regarding the level of validation of test question instruments and student response questionnaire instruments. The improvements implemented in accordance with the validator's recommendations and benchmarks for % validation, combined with their interpretation, make the instrument appropriately configured for use.

RESULTS AND DISCUSSION

Student Interest in Learning Survey Results

Based on the results of the research data of students in class VIII G SMP Negeri 2 Kartasura which was taken using questionnaire data on each student with the aim of taking data on the results of learning interests. After the data of the student learning interest questionnaire was processed, the data in Table 3 was obtained.

Table 3. Results of the Learning Interest Survey

Limitation	Criterion	Number of Students
$x < 87$	Low	5
$87 \leq x < 100$	Keep	20
$100 \leq x$	Tall	7

Analysis of student learning interest questionnaires revealed that 20 students expressed interest in learning to build flat side spaces, 7 students showed high interest, and 5 students showed minimal interest. As many as 84% of students showed high and moderate interest in learning to build flat side spaces.

To analyze the results of the student questionnaire, the researcher used mathematical communication indicators to analyze the questionnaire that had been filled, then the results were categorized into 3 groups based on the range of scores obtained, namely students with high, medium, and low learning interests.

Student Learning Interest Results

This study discusses students' learning interests in solving flat-sided geometry problems. To evaluate students' responses, one must use test and interview results by using mathematical communication markers. Student responses were evaluated and then classified into three categories according to their range of scores: high, medium, and low learning interest. The next results related to the learning interest in each category, which was obtained from the random selection of two students. The student response papers were analyzed, resulting in the following findings:

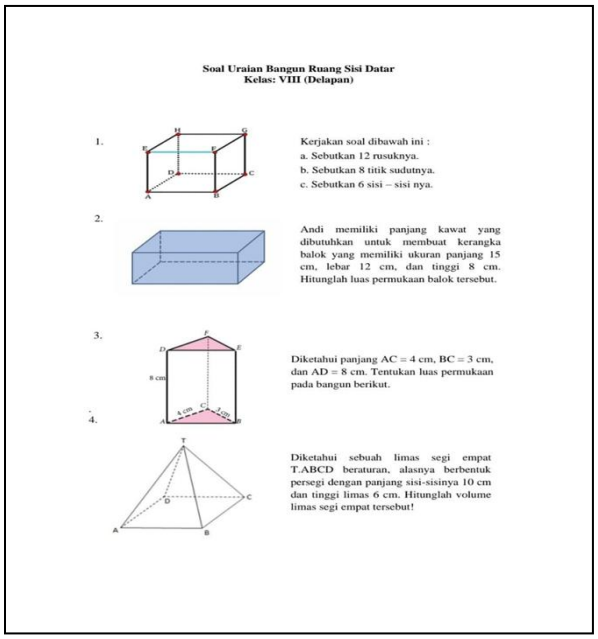
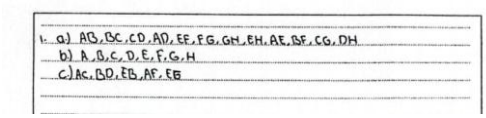
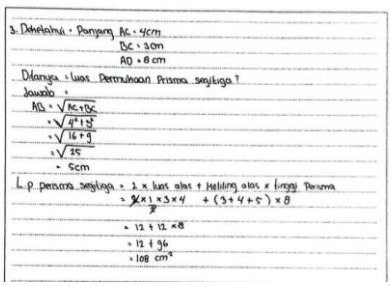


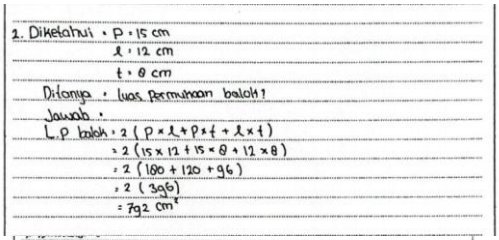
Figure 1. Post-test question instruments

High Learning Interest

The following are the results of student work that are included in the criteria of high learning interest.







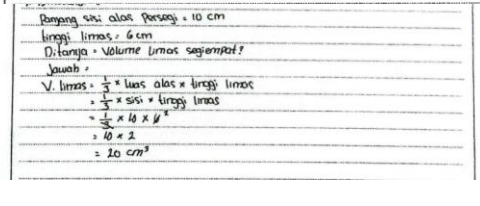


Figure 2. Student 1 with a High Interest in Learning

The graph above illustrates that both students who showed a strong interest in learning managed to meet the four markers of mathematical communication when working on post-test questions related to flat-sided geometric shapes. The results of the analysis are based on mathematical communication indicators, namely being able to meet the four indicators that student 1 can present the building of space, be able to explain the description of the problem in writing and orally, be able to understand the questions presented, and be able to rewrite the description given by the researcher to the student. The results of the interview of student 1 show that *"I can distinguish the shape of the building space and mention the building of the space in the problem", "I can mention the formula of the surface area of the block and explain the flow of the answer to question number 2 in writing and orally", "I can understand the work of the problem of finding the surface area of the triangular prism contained in question number 3", and "I can rewrite the answer to question number 4 about finding the volume of the square five".*

Based on the results of the students' answers above, students are very good at working on problems about building spaces and are careful in working on up to the volume and surface area.

The results of the questionnaire on student 1 showed that students with high interest in learning sometimes had difficulty understanding mathematical concepts related to the spatial structure of the flat side accurately. This is in line with the statement of Sari et al. (2017) that the challenges faced by students in overcoming mathematical difficulties can be observed in the relationship between problem solving and understanding basic concepts.

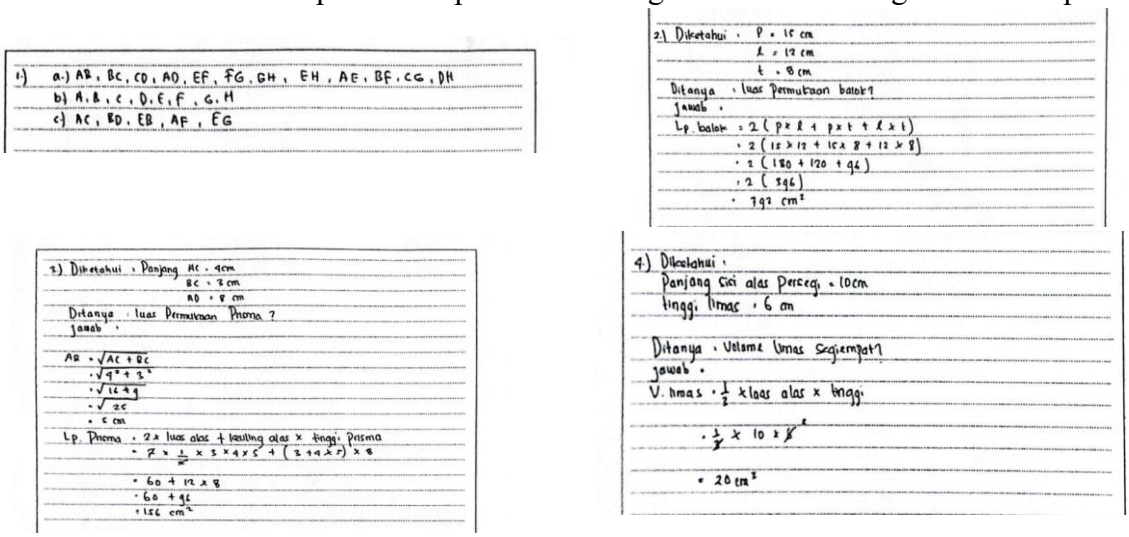


Figure 3. 2 Students with High Learning Interest

Likewise, student 2 met three indicators, namely being able to represent the construction of space, being able to explain the description of the question in writing and

orally, not understanding the questions presented, and being able to rewrite the description given by the researcher to the student. *The results of the interview of student 2 showed that "I can distinguish the shape of the building space and mention the building space in the problem", "I can mention the formula of the surface area of the block and explain the flow of the answer to question number 2 in writing and orally", "I am not able to understand the work of the part of finding the surface area of the triangular prism contained in question number 3", and "I can rewrite the answer to question number 4 about finding the volume of the square five".*

The students' responses showed proficiency in turning the problem into a mathematical model; However, they show a lack of accuracy in calculating the circumferential surface area of a triangular prism base.

The results of the questionnaire in student 2 showed that students with high learning interest criteria rarely completed the exercises given by the teacher due to a lack of understanding of the solutions. According to Choridah (2013), students need to acquire mathematical knowledge, because mathematics functions as a means of communication that is strong, accurate, and not confusing.

Interest in Learning Sedanng

The following are the results of student work that is included in the criteria of moderate learning interest.

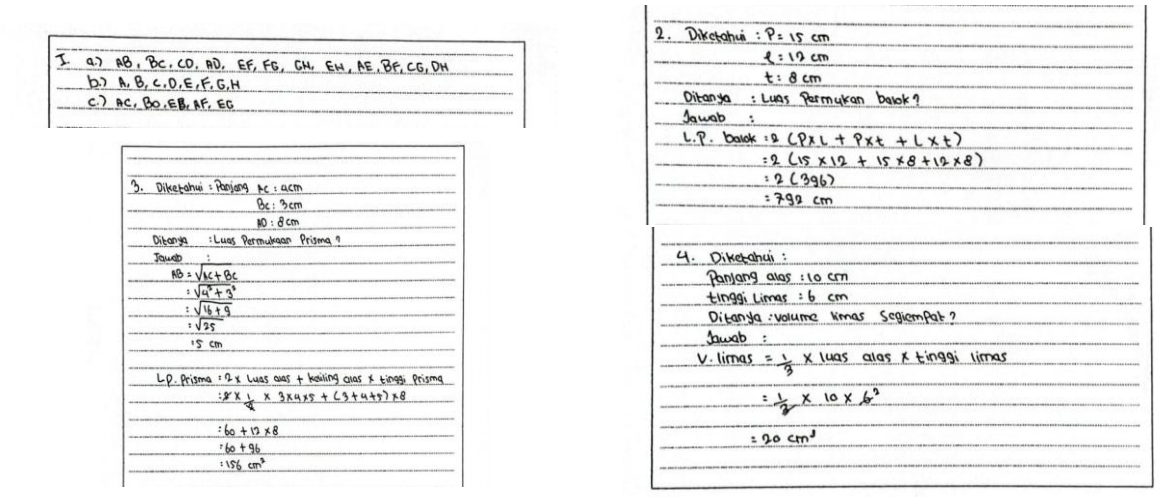


Figure 4. Student 1 with Medium Learning Interest

The figure above shows that the two students with moderate learning interests did not meet the four indications of mathematical communication in their responses to the post-test question regarding flat-sided geometry builds. The results of the analysis are based on mathematical communication indicators, namely being able to meet three indicators that student 1 can present building spaces, be able to explain written and oral problem descriptions, be less able to understand the questions presented, and be able to rewrite the description given by the researcher to students. The results of the interview of student 1 showed that *"I can distinguish the shape of the building space and mention the building of the space in the problem", "I can mention the formula of the surface area of the block and explain the flow of the answer to question number 2 orally and in writing", "I am not able*

to understand the work on the problem of finding the surface area of the triangular prism contained in question number 3", and "I can rewrite the answer to question number 4 about finding the volume of the square five".

Analysis of students' responses showed that they excelled at translating problems into mathematical models; However, they show a lack of precision in showing the unit of surface area for the cuboid and show a misunderstanding of how to calculate the circumference surface area of a triangular prism base.

The results of the questionnaire for student 1 showed that students with moderate learning interests rarely completed the exercises given by the teacher due to a lack of understanding of the solutions. This is in line with Asikin's statement in Wijayanto et al. (2018) about the importance of mathematical communication skills in mathematics education, particularly in improving students' cognitive abilities, serving as a metric to evaluate comprehension, facilitate the construction of mathematical knowledge, refine problem-solving skills, advance reasoning skills, foster personal development, and improve social competence, all of which contribute to the formation of a mathematical community.

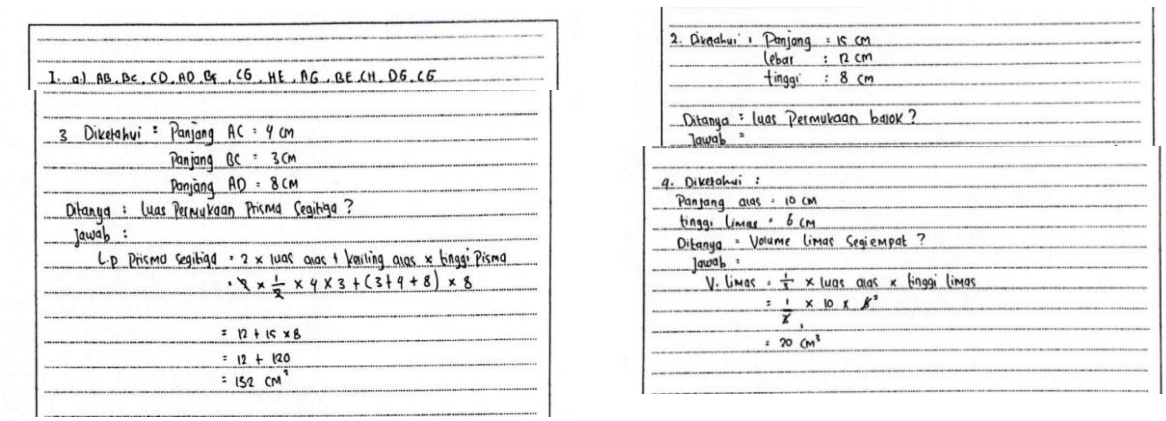


Figure 5. 2 Students with Moderate Learning Interests

Likewise, students 2 met two indicators, namely less thorough in presenting the building of space, being able to explain the description of the questions in writing and orally, not being able to understand the questions presented, and being able to rewrite the descriptions given by the researcher to students. The results of the interview of student 2 showed that *"I am not able to distinguish the shape and types of spatial construction", "I can mention the formula of the surface area of the block and explain the flow of the answer to question number 2 in writing and orally", "I am not able to understand the work on the part of finding the surface area of the triangular prism contained in number 3", and "I can rewrite the answer to question number 4 about finding the volume of the square square".*

The students demonstrated proficiency in turning the problem into a mathematical model; However, they showed a lack of precision in identifying the sides of the cuboids, which resulted in inaccuracies, and they had not succeeded in calculating the surface area of the triangular prism.

The results of the questionnaire for student 2 showed that individuals with moderate learning interests rarely asked questions when they did not understand the material presented by the teacher and showed poor understanding of mathematical concepts associated with

flat-sided geometry builds. This is in line with Isnaeni and Maya (2014), who stated that learning mathematics and improving mathematical communication are outcomes that foster strong motivation in students to engage with mathematical concepts.

Low Interest in Learning

The following are the results of student work that is included in the criteria of low learning interest.

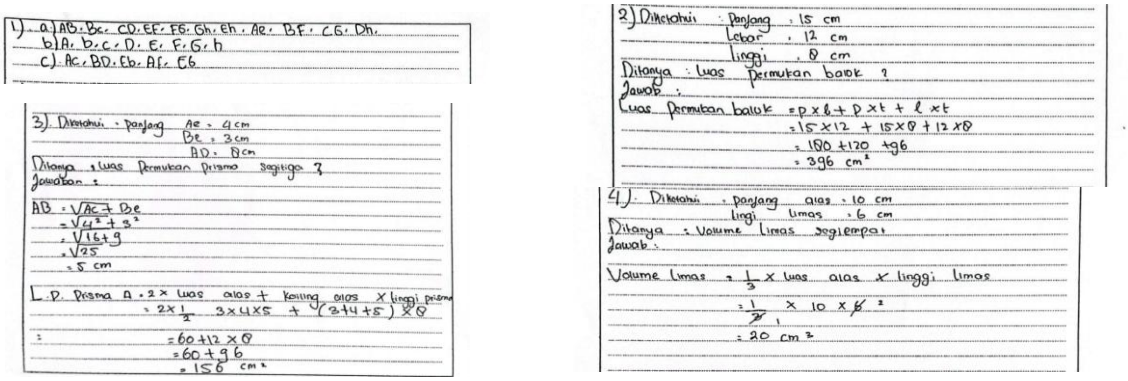


Figure 6. Student 1 with Low Learning Interest

As seen above, both students with low learning motivation failed to meet the four indications of mathematical communication when answering *post-test questions* on flat-sided geometry builds. The results of the analysis are based on mathematical communication indicators, namely being able to meet two indicators that student 1 can present the building of space, is less able to explain the description of written questions, is less able to understand the questions presented, and can rewrite the description given by the researcher to students. The results of the interview of student 1 show that *"I can distinguish the shape of the space building and mention the space building in the question", "I cannot mention the formula of the surface area of the block and explain the answer flow of question number 2 orally and in writing", "I am not able to understand the work of the problem looking for the surface area of the triangular prism contained in question number 3", and "I can rewrite the answer to question number 4 about finding the volume of the square five".*

The students' responses show proficiency in turning the problem into a mathematical model; However, they show a lack of precision in articulating the cube surface area formula and show a lack of diligence in dealing with the surface area problem associated with the circumference of a triangular prism base.

The results of the questionnaire for student 1 showed that students with low learning interest criteria showed deficiencies in understanding mathematical ideas related to flat bodies and showed a lack of understanding of the geometry content delivered by the instructor. Research by Nuraeni (2018) shows that mathematical communication skills are essential for students because they facilitate the expression of diverse ideas in a clear, accurate, and concise manner.

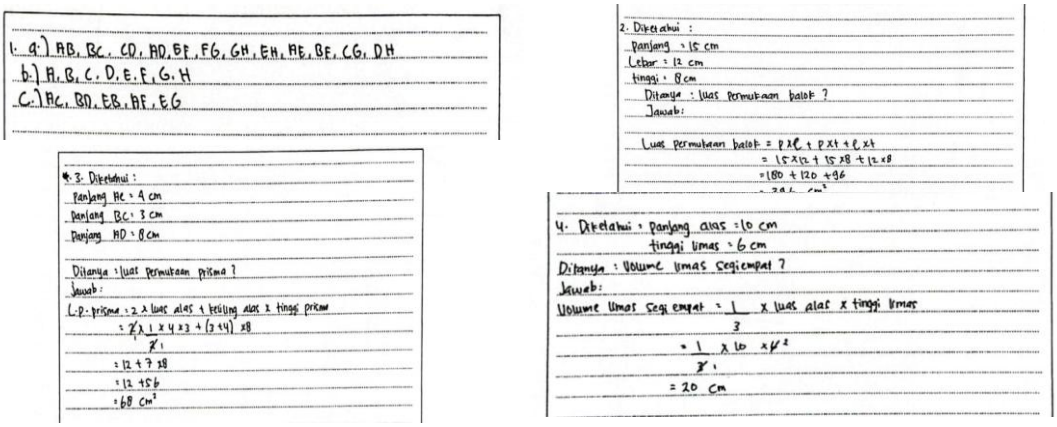


Figure 7. 2 Students with Low Learning Interest

Likewise, students 2 meet one indicator, namely being thorough in presenting the building of space, being less able to explain the description of written questions, less able to understand the questions presented, and being able to rewrite the descriptions given by the researcher to students. The results of the interview of student 2 showed that *"I can distinguish the shape of the building space and mention the building of the space in the problem", "I cannot mention the formula of the surface area of the block and explain the flow of the answer to question number 2 orally and in writing", "I am not able to understand the work of the problem looking for the surface area of the triangular prism contained in question number 3", and "I can rewrite the answer to question number 4 about finding the volume of the square five".*

The students' responses showed deficiencies in their ability to translate the problem into mathematical models, lack of precision in formulating the cuboid surface area and its solution, negligence in calculating the perimeter of the base for the surface area of the triangular prism, and failure to accurately indicate the unit of volume of the rectangular prism.

The questionnaire on student 2 showed that students with low learning interest did not understand flat wake math. When students don't understand the geometry topics the teacher is presenting, they rarely ask questions. Qohar, (2013) suggests that students be encouraged to provide reasoned answers to questions and comment on their peers' mathematical statements to improve their mathematical communication skills and deepen their understanding of mathematical concepts.

CONCLUSION

The study found that students' *mathematical communication ability* in *flat-sided geometry* varied according to their level of *learning interest*, which was categorized as high, medium, or low. Students with high interest were actively engaged but still struggled to fully understand and meet the communication indicators for flat-sided geometry. Those with

medium interest demonstrated incomplete understanding and accuracy, while students with low interest were often passive and showed significant difficulties in both comprehension and communication, rarely seeking clarification when confused. Overall, students across all interest levels faced similar challenges, particularly in understanding and accurately communicating about flat-sided geometry, despite more than 90% expressing interest in the material. Future research should explore targeted interventions or instructional strategies that address these persistent gaps, possibly by integrating technology or differentiated instruction, to enhance both understanding and *mathematical communication ability* in geometry.

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