CHAPTER I

INTRODUCTION

1.1. BACKGROUND

Education is a nation's primary asset for enhancing the quality of its human resources. Therefore, education must be managed and executed effectively to achieve this goal. Based on the PISA (Program for International Student Assessment) results, Indonesia has consistently ranked bottom. This has been the case since the PISA assessments began in 2000 and continued through 2018. In 2018, Indonesia was positioned 73rd out of the 79 participating countries regarding mathematical ability (Hewi & Shaleh, 2020). Mathematics is an essential subject in education. It is widely used in many areas of life. Mathematics is recognized as a crucial science in advancing knowledge and technology (Kartikasari et al., 2018). The critical role of mathematics is recognized (Cockcroft, 1982); for example, he writes: "*It would be very difficult – perhaps impossible – to live a normal life in many parts of the world in the twentieth century without using some mathematics*."

It would be difficult or even impossible for someone to live in the 20th century without applying mathematics to their lives (Kusmaryono, 2014). The significance of mathematics in human life underscores the necessity to learn and proficiently master it. Through mathematics education, students are expected to become human beings who can think logically, carefully, accurately, critically, creatively, innovatively, imaginatively, and hardworking. With these hopes, mathematics education becomes an essential aspect of education for achieving educational progress in Indonesia. The National Council of Teachers of Mathematics or NCTM determines that there are 5 (five) process standards that students must master through learning mathematics, namely: (1) problem-solving, (2) reasoning and proof, (3) connection, (4) communication; and (5) representation". These five process standards are called Mathematical Power

(Allen et al., 2020). These process standards constitute the basic skills and understanding students need in the 22nd century.

In teaching and learning mathematics, there will inevitably be situations where students ask questions or communicate with their classmates or the teacher. In this communication, the teacher also conveys and explains mathematics material, and students will try to accept and understand the material presented by the teacher. The conventional perspective on communication posits it as an interaction embedded in a social setting. Ordinarily, it involves a sender (source) and a receiver participating in the interchange of signals. These signals may take various forms, such as verbal, graphic, gestural, or visual (photographic) (Fatimayin, 2018). Communication is a crucial element in the learning journey and can breathe life into the process, representing a key objective in learning mathematics (Samawati, 2021). Mathematical communication skills play a vital role in mathematics education. Through mathematical communication, students can solve mathematical problems and better understand the mathematical concepts they have learned (Hariati et al., 2022). Student's ability to communicate their mathematical ideas when solving problems or conveying the process and results of problem-solving is also a capacity that can create high-level scientific considering capacities such as coherent, explanatory, precise, essential, inventive, and profitable (Asnawati, 2017). According to (Afiani, 2017), there is a significant influence of Mathematics Communication Skills on Mathematics Learning Achievement. According to Sumarmo (2012 the Indicators of Mathematical Communication Skills are shown in Table 1.1

Table 1.1. Mathematical Communication Indicator

INDICATOR	DEFINITION
Drawing	Express mathematical ideas in the form of drawings, diagrams, or graphs.
Written Text	Provide mathematical explanations and reasons for every step taken to solve the problem.
Mathematical Expression	Express situations, tables, or images

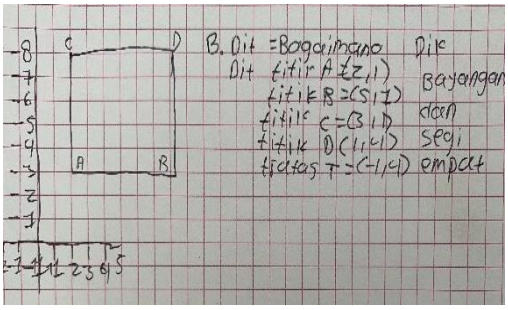
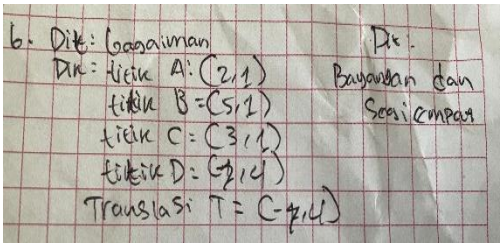
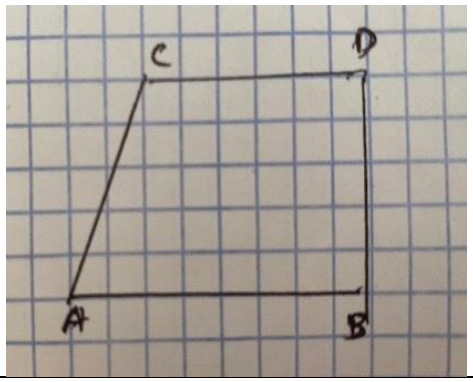
	to language, symbols, ideas, or mathematical models
Discussing	Listen, discuss, and write about mathematics
Conclusion	Re-express a description or conclusion of mathematics in their language

Nevertheless, empirical evidence indicates that students' mathematical communication skills are still low. One of the reasons for students' low mathematical communication skills is the inadequate understanding of the concepts in the subject matter, resulting in misconceptions and errors in comprehending what is being asked in the problems (Zaditania & Ruli, 2022). This is also consistent with the interview conducted by the researcher. The researcher interviewed Mr. Hutahaean, one of the mathematics teachers at SMP Negeri 37 Medan. He stated that the teaching model he uses is still teacher-centered. However, he also mentioned using Problem-Based Learning, although it has not been effectively implemented. During the observation, the researcher found that the learning model used in the class is the direct Instruction Learning model and also students were not actively participating in the learning activities. Students also lack focus in the learning process. When the researcher asked the students their opinion about mathematics, they answered that math is complex, complicated, full of formulas, hard to understand, and boring. However, some students said that math is exciting and fun.

In addition to the interviews, the researcher also administered a diagnostic study test to the ninth-grade students (class IX-E) at SMP Negeri 37 Medan on Monday, November 13, 2023. The test focused on the core topics of quadratic equations, functions, and geometric transformations. The diagnostic test given to the students was open-ended questions aimed at assessing the students' initial mathematical communication skills. The diagnostic test consisted of 2 questions, each with three sub-questions. From the 6 indicator mention above, there are 18.75% students who can express the mathematics idea in the form of drawing, there are 15.625% students who can provide mathematical explanation and reasons, there are 25% student who can do mathematical expression, there are

62.5% student who discuss, listen and write about mathematics with their friend while doing the diagnostic test, and there are 46.875% student who can make the conclusion from the solution they give. Based on the initial diagnostic test results, it can be concluded that the students' mathematical communication skills are still low at drawing, writing, and mathematical expression, as evident in Table 1.2.

Table 1.0.2 Diagnostic Test Results for Students

Mathematical Communication Indicator	**Student's Answer**	**Analysis of Student Error Results**
Drawing	 *Figure 1.1 Student Diagnostic Test Answer Sheet 1*	Students cannot express mathematical ideas through drawings, diagrams, or graphs. This is evident in Figure 1, where students could not draw ABCD according to what was written in the "known" section of the answer sheet. In the second figure, it is also apparent that students were unable to write the positions of points ABCD as described in the question, where A(2,2),
	 *Figure 1.2 Student Diagnostic Test Answer Sheet 2*	
		

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<td></td>
<td>Figure 1.3 Student Diagnostic Test Answer Sheet 3</td>
<td>B(5,2), C(2,6), and D(5,6). Additionally, in the third figure, it is noticeable that students could not draw the shadow of ABCD correctly, which should ideally form a rectangular shape.</td>
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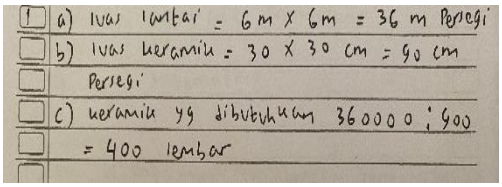
<tr>
<td rowspan="2">Mathematical Expression</td>
<td> 

Figure 1.4 Student Diagnostic Test Answer Sheet 4</td>
<td rowspan="2">Students cannot express mathematics. This is evident from students not accurately incorporating mathematical models. Figures 4 and 5 show that students only expressed their answers in plain language without utilizing mathematical expressions. It can also be seen that students can not express mathematics correctly, where it can</td>
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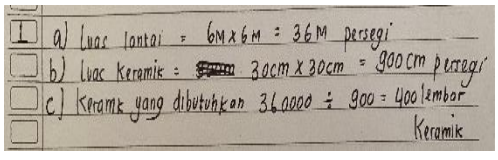
<td> 

Figure 1.5 Student Diagnostic Test Answer Sheet 5</td>
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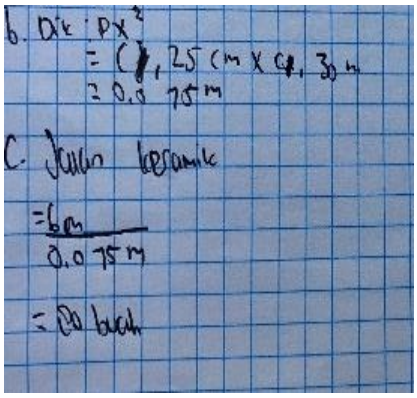
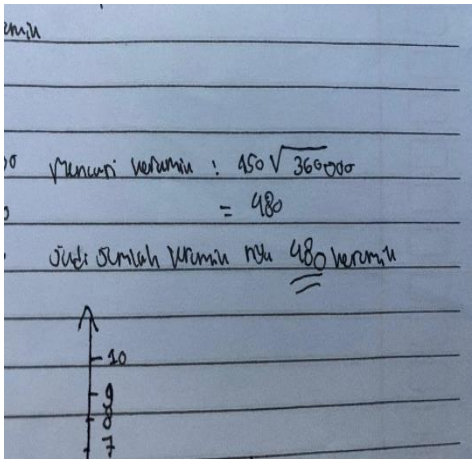
		be seen that they write the area of the tiles = 30 cm x 30 cm, which should be 25 cm x 30 cm because the shape of the tiles is rectangular.
Written Text	 *Figure 1.6 Student Diagnostic Test Answer Sheet 6*	Students cannot provide mathematical explanations and reasons for the solutions they give. This is illustrated in Figure 6, where the student could not write the area formula correctly, which should have been $p \times l$. The student also did not solve the given problem accurately, and the solution process was incorrect. Ideally, the student should have calculated the living room's
	 *Figure 1.7 Student Diagnostic Test Answer Sheet 7*	

		area first and then divided it by the area of one tile to determine the quantity needed. In Figure 7, it is also evident that when calculating the number of tiles required, the student incorrectly used mathematical expressions, using the square root symbol instead of the division symbol.

Therefore, teachers need to select an appropriate teaching model to influence the enhancement of students' communication skills. One of the teaching models that can be applied is the Jigsaw cooperative learning to achieve the desired learning objectives. The Jigsaw Cooperative Learning Model is a collaborative approach that emphasizes teamwork, active participation, and shared responsibility among students. The Jigsaw method aims to promote students' responsibility for their learning and that of their peers. Rather than just absorbing the provided content, students must be ready to share and teach others within their group. This establishes a mutual dependence among students, requiring collaborative endeavors in understanding the assigned material. Through active participation, effective communication skills development, peer teaching, and creating a positive learning environment, this model equips students with the tools needed to express and comprehend mathematical ideas. This model is chosen because the Jigsaw Cooperative Learning Model is an instructional approach that

encourages students to be active and collaborate in mastering the subject matter to attain the maximum learning objectives (Aziz et al., 2019). This will foster student interaction within the group, enhancing communication skills. This is further supported by the findings of a study conducted by (Pertiwi et al., 2020), which demonstrated the influence of the Jigsaw cooperative learning model on improving students' mathematical communication skills. Hence, the researcher is keen to delve deeper into this subject through a literature review to sharpen the theoretical foundation for future researchers. This will ultimately inform and guide the research titled: "The Effect of Jigsaw Cooperative Learning Model on Students' Mathematics Communication Skills."

1.2 PROBLEM IDENTIFICATION

Based on the background information previously outlined, several issues can be identified, including:

1. Students' mathematics communication skills in SMP Negeri 37 Medan are still low.
2. The lack of student engagement in the classroom.
3. The lack of student focus in learning
4. Students have difficulty interpreting problems in mathematics models.
5. The learning model implemented in the classroom has not been effective.
6. Mathematics is perceived as a challenging and dull subject.

1.3. PROBLEM LIMITATION

To overcome such a broad discussion of the researchers restricted their study on:

1. The indicator of mathematical communication skills: Drawing
2. The indicator of mathematical communication skills: Writing
3. The indicator of mathematical communication skills: Mathematical Expression
4. The indicator of mathematical communication skills: Conclusion

5. The use of the Jigsaw Cooperative Learning Model in SMP Negeri 37 Medan in Cylinder, Cone, and Sphere Subject.

1.4. PROBLEM FORMULATION

Based on the problem identification and limitations mentioned above, the problem formulation in this research is:

1. Does the Jigsaw cooperative learning model affect students' mathematical communication skills?
2. How effective is the jigsaw-type cooperative learning model on students' mathematical communication skills?

1.5. RESEARCH PURPOSE

Based on the problem formulation above, the purposes of this research are:

1. Finding whether the Jigsaw Cooperative Learning model affects students' mathematical communication skills
2. Finding how effective is the jigsaw-type cooperative learning model on students' mathematical communication skills

1.6. BENEFIT OF RESEARCH

The expected benefits of this research are as follows:

1. For mathematics, teachers can expand their knowledge by improving mathematical communication skills using the jigsaw-type cooperative learning model.
2. For researchers, it is information and guidance material for them to carry out their teaching duties as prospective teaching staff in the future.
3. As information material for readers or researchers who want to conduct similar research.