

# CHAPTER I

## INTRODUCTION

### 1.1. Background of The Problem

According to Sundayana (2016) mathematics is one component of a series of subjects that have an important role in education. Mathematics is one of the fields of study that supports the development of science and technology. It causes mathematics to be always studied by students regardless of their majors. So that to be able to keep up with technological developments, students must have sufficient mathematical abilities.

Mathematics is also a useful science for other sciences. Apart from being often referred to as the queen of knowledge, mathematics is also considered the servant of science. Suherman (2001) said that apart from growing and developing for itself as a science, mathematics also serves the needs of other sciences in its development and operations. We can see this from other disciplines that use mathematics, both natural sciences such as Physics, Chemistry, Biology, and social sciences such as Economics, Language, and others. Mathematics is also often a tool for calculating and abstracting events and phenomena studied in science. So we need to have good math skills.

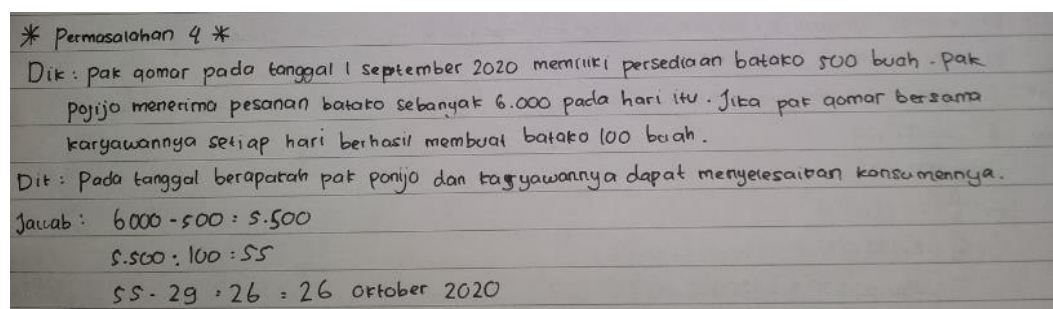
Mathematical ability is not just a matter of counting and just talking about numbers but how we can interpret mathematical ideas and demonstrate them in mathematical models, which are often called mathematical communication skills. The NCTM (*National Council of Teachers of Mathematics*) recommends mathematical communication skills as a principle of learning mathematics in addition to problem-solving abilities, reasoning abilities, and mathematical connection abilities. In Indonesia, based on Permendikbud No. 22 of 2016 regarding the objectives of learning mathematics, one of the objectives of learning mathematics is to communicate arguments or ideas with diagrams, tables, symbols, or other media to clarify problems or clarify problems circumstances. For this reason, having good communication skills is very important in learning mathematics.

However, recently Indonesian students' mathematical abilities have been very low. According to Tohir (2019), in the Program for International Student Assessment (PISA), there was a decline in the mathematics scores of Indonesian students from 2015 to 2018. In 2015, Indonesian students' mathematical abilities reached 386 scores, while in 2018, it fell to 379. This resulted in the category Of mathematics, Indonesia being ranked 73rd or 7th from the bottom. The decline in students' mathematical abilities also means a decline in students' mathematical communication skills. Based on research conducted by Wijayanto et al. (2018) found that the mathematical ability of one junior high school in the city of Cimahi is low. Of the 5 items given, the results of mathematical communication skills obtained are below 33%. In addition, students also find it difficult to solve problems related to some of the indicators seen. In addition, according to Khadijah et al., (2018), who examined 22 grade VIII SMP students in Cidaun, the mathematical communication skills produced were not good enough. Of the five indicators given, only 1 indicator is fulfilled properly.

Mathematical communication skills have several indicators as a benchmark for someone to have good communication skills or not. The indicators, according to Ansari (2018) , include: 1) Expressing mathematical ideas by speaking, writing, demonstrating, and describing them in visual form. 2) Understand, interpret, and evaluate mathematical ideas presented in written, oral or visual form. 3) Using vocabulary/language, notation, and mathematical structure to express ideas, describe relationships, and build models.

In the author's Teaching Assistance activities at SMK Negeri 14 Medan, many students do not have good mathematical skills, including their mathematical communication skills. Syarifuddin, a Mathematics teacher at SMK Negeri 14, said that in addition to the decline in learning outcomes, students were also weak in communicating the results of their work. This can be seen in every assignment and exercise carried out by students where students can work on questions that are similar to those in the sample questions given. However, if given a problem and a solution, students are asked to explain again, and many students are overwhelmed. It can be seen that doing work imitates the process, and using formulas was not a very difficult thing for students besides; some students cannot do this. However, to communicate the results of their work, many students are unable.

Furthermore, in the author's evaluation results in the Teaching Assistance activities at SMK Negeri 14 Medan, many students whose answers did not meet the standard indicators of mathematical communication skills based on NCTM. The following are some of the results of student answers in tests conducted by the author when conducting Teaching Assistance:



**Figure 1. 1** Student's Answer in test when Teaching Assistance

From the test results of class X SMK students with the topic of series and sequence, students have written the correct answers, but the completion steps do not meet the indicators of mathematical communication skills. Students do not write models that follow existing mathematical concepts, so they do not present good communication between students in their writings and the teacher who checks answers. Students do not write answers using symbols and mathematical language but only write what they think with numbers.

In the author's observation, the mathematical communication skills of students in SMK Negeri 14 is not good. Based on the results of an interview with one of the teachers in mathematics at the school, there were many students who did not meet the indicators of mathematical communication skills according to the NCTM. Students are still less able to organize their mathematical thinking through communication and less able to explain their mathematical ideas to others. Then from the results of the diagnostic test, it was found that there were still students who only wrote answers in the form of numbers and were not good solutions. Of course, the student's answer does not meet the indicators of good mathematical communication skills.

**Table 1. 1** Diagogic Test Instrument

Petunjuk :

1. Bacalah soal dengan seksama!
2. Tulislah Jawaban pada bagian yang tersedia dengan runtut dan jelas!
3. Gunakanlah simbol matematika yang sesuai dalam mengerjakan soal ini!

Soal :

1. Jika Diketahui sebuah matrix memiliki persamaan sebagai berikut :

$$\begin{bmatrix} a & 4 \\ -1 & c \end{bmatrix} + \begin{bmatrix} 2 & b \\ d & -3 \end{bmatrix} = \begin{bmatrix} 1 & -3 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$$

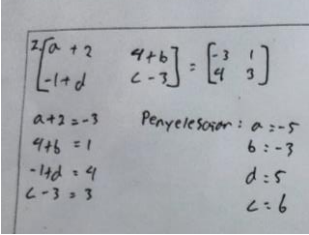
Maka tentukanlah nilai dari  $a + b + c + d = \dots$

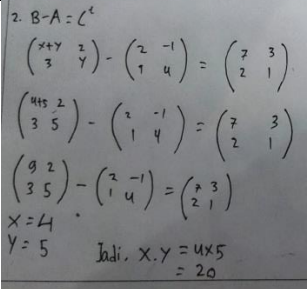
2. Diketahui persamaan matrik A, B, dan C :

$$A = \begin{bmatrix} 2 & -1 \\ 1 & 4 \end{bmatrix}, B = \begin{bmatrix} x + y & 2 \\ 3 & y \end{bmatrix}, C = \begin{bmatrix} 7 & 2 \\ 3 & 1 \end{bmatrix}$$

Jika  $B - A = C^t$  dan  $C^t$  merupakan transpose matriks C, maka nilai  $x \cdot y = \dots$

Table 1. 2 Diagnostic Test Analysis

No	Result	Analysis
1		<p>Indicator :</p> <p>Expressing mathematical idea by writing and describing them in visual form.</p> <p>Analysis:</p> <p>Students do not express mathematical ideas well through their writing, but instead directly carry out calculations to solve the problem. Students do not write down what they know and are asked about the question.</p> <p>Understand, Interpret, and Evaluate mathematical ideas presented in written, oral or visual form.</p> <p>Analysis :</p> <p>From the student's answer, the student understands the mathematical ideas used to solve the problem, but the student does not write down how he interprets and evaluates the idea. Students only write down the values of a,</p>

No	Result	Analysis
		<p>b, c, and d without showing the process of getting these values. Students should indicate which equations are substituted or eliminated.</p> <p>Using vocabulary, notation, and mathematical structure to express ideas, describe relationship, and build model</p> <p>Analysis: Students already use mathematical notation such as matrix symbols well. However, because students immediately write down calculations and final answers, the use of mathematical language and symbols is very minimal.</p>
2		<p>Indicator :</p> <p>Expressing mathematical idea by writing and describing them in visual form.</p> <p>Analysis: Students also do not express mathematical ideas well through their writing, but instead directly carry out calculations to solve the problem. Students do not write down what they know and are asked about the question.</p> <p>Understand, Interpret, and Evaluate mathematical ideas presented in written, oral or visual form.</p> <p>Analysis :</p> <p>In this question, student also did not show how he interpreted and evaluated the problem. Student did the operation of the matrix in until row two, but we don't know what happened in row three so that we see the value of <math>x+y</math> changed into <math>4 + 5</math> and the value of <math>y</math> changed into <math>5</math></p> <p>Using vocabulary, notation, and mathematical structure to express ideas, describe relationship, and build model</p> <p>Analysis: Students already use mathematical notation such as matrix symbols well. However, because students immediately write down calculations and final answers, the use of mathematical language and symbols is very minimal.</p>

The low mathematical communication ability is caused by less than optimal teacher teaching. Many teachers do not pay attention to the learning process and only prioritize student results. Ruhayat (in Khadijah et al., 2018) said that many teachers still use conventional learning. Conventional learning patterns with the lecture method will make students less motivated to communicate during the teaching and learning process. This causes students only as listeners, and learning is centered on the teacher. Conventional learning also results in cutting the learning hierarchy. According to Hamzah & Muhlisrarini (2014), learning must be arranged from top to bottom, starting with placing abilities, and prerequisite abilities that must master first to master the abilities or skills above. Often teachers do not take this prerequisite ability and mostly teach directly with example questions and formulas. As a result, students can only copy the steps and formulas given by the teacher without knowing further.

The COVID-19 pandemic has also worsened students' mathematical communication skills. Some many problems and challenges occur in education. In line with what Syah (2020) stated, schools need to force themselves to use online media. However, this also has several problems that hinder the effectiveness of online learning. The problems include 1) Limited use of technology by teachers and students, 2) Inadequate facilities and infrastructure, 3) Limited internet access, 4) Unprepared budget provision. Syarifudin as a teacher at SMK Negeri 14, also explained that online learning methods, which often have problems with facilities and internet access, are very inefficient. Teachers can only give lessons by sending materials and videos to students without knowing whether students understand or not. Learning is also continued by giving assignments to be done by students at home without knowing whether students do assignments based on the results of their own understanding or not. Then, The teacher does not provide any tools to facilitate the learning process, such as student worksheets or other media. This makes the students less independent in their learning, both individually and collaboratively.

Student worksheets are a valuable resource for teachers to facilitate the learning process. They are an uncomplicated yet effective tool that can boost student engagement in learning. According to Kristyowati (2018) student worksheets serve the purpose of delivering teaching materials that promote active interaction between students and the subject matter. Additionally, they aid in developing students' self-

sufficiency and assist teachers during instruction. With the help of student worksheets, students can learn autonomously by following the instructions and steps provided, rather than relying solely on the teacher's guidance.

For that we need a student worksheet that can be used to catch up, especially in students' mathematical communication skills, such as using learning media with the Think Talk and Write (TTW) approach. Isrok'atun & Rosmala (2019) explained that the TTW learning model is a constructivist learning design through self-communication activities between students and teachers that encourage students to think, speak, express opinions, and write down the results. In this case, students express mathematical ideas using their own language. Furthermore, writing skills are applied by directing students to pour the mathematical ideas they have obtained into mathematical language, namely symbols, or mathematical concepts and rules. Based on the various descriptions explained, the researcher will develop and conduct research with the title **“The Development of Mathematics Student Worksheet to Increase Mathematical Communication Skills in SMK Negeri 14 Medan”**

## **1.2. Problem Identification**

Based on the background of the problem, the problem can be identified as follows:

1. Mathematical communication skills of students in SMK Negeri 14 is very low.
2. Student just copy the pattern and formula when do mathematical tasks.
3. Student cannot express the mathematical idea when solve the problem
4. Student cannot interpret and evaluate the mathematical idea when solve the problem
5. The SMK Negeri 14 Medan still use Conventional Method in mathematics learning process.

## **1.3. Scope of Problem**

Based on the identification of the problem above, the researcher limits the scope of problem to maintain the research focus as follows:

1. Develop the Mathematical Student Worksheet to increase Student Mathematical Communication Skills and limited in Transformation topic in 12<sup>th</sup> grade student
2. This student worksheet will designed to offline learning
3. Field test student worksheets will be carried out for one meeting

#### **1.4. Research Question**

Based on the description above, the problem can be formulated as follows:

1. How is the Validity of Mathematics Student's Worksheet to increase student's communication skills?
2. How is the Practicality of Mathematics Student's Worksheet to increase student's communication skills?
3. How is the Effectiveness of Mathematics Student's Worksheet to increase student's communication skills?

#### **1.5. Research Purpose**

Based on the description above, the problem can be formulated as follows:

1. Knowing the Validity of Mathematics Student's Worksheet to increase student's communication skills.
2. Knowing the Practicality of Mathematics Student's Worksheet to increase student's communication skills.
3. Knowing the Effectiveness of Mathematics Student's Worksheet to increase student's communication skills.

#### **1.6. Benefit of Research**

The results of this research are expected to provide benefits to teachers and students in general and researchers in particular. The benefits that can be obtained from this research include the following:

1. For Teachers

This research produces Mathematics Student Worksheet as a learning medium that teachers can use to teach while improving students' mathematical communication skills



## 2. For Students

The Mathematics Student Worksheet with the Think Talk and Write (TTW) approach is expected to encourage students to think, speak, express opinions, and write down the results. In other word, this worksheet can increase student's mathematical communication skills.

## 3. For Researcher

This research can add insight of the researcher in developing the Student Worksheet and improving the student's mathematics communication skills by this worksheet. This research also can give the experience for the researcher in the education world.

### **1.7. Operational Definition**

It is necessary to present several operationally defined terms so that this research becomes focused and there is no misunderstanding of the interpretation of the term used. The term used in this study are as follows:

1. Development is a process to produce a product that is describe as accurately as possible to get the ideal product.
2. Mathematical Communication Skill is is one of the skills that students must have in conveying or explaining mathematical ideas or ideas to solve a problem orally or in writing in the learning process
3. Think Talk and Write is a learning model that can develop students' understanding and communication skills
4. Student Worksheet is a learning material that trains students' independence, creativity, critical thinking, and designed according to the competency in educational institutions
5. PISA is the OECD's Programme for International Student Assessment
6. NCTM (National Council of Teachers of Mathematics) is the world's largest mathematics education organization