# CHAPTER I

# INTRODUCTION

## 1.1. Background

Mathematics is a knowledge that has an important role in the development of science and technology. Along with its important role, mathematics also has links with other sciences. Mathematics is given to students starting from elementary school to college, so that mathematics has many abilities to equip students in education. Through learning mathematics students begin to be taught to have the ability to think logically, critically, analyze, systematically, and the ability to work together in a group.

One of the objectives of learning mathematics in the 2013 Curriculum used by the Ministry of Education and Culture in school learning starting from elementary school (SD) to high school (SMA) is so that students have the ability to communicate ideas with symbols, tables, diagrams, or other media to clarify the situation or problem. The purpose of this ministerial regulation is certainly in line with one of the objectives of learning mathematics according to the National Council of Teachers of Mathematics or NCTM (2000), which is learning to communicate in mathematics (mathematical communication).

According to Baroody (in Lim & Cheng Meng Chew, 2007), there are two important reasons that make communication the focus of attention in learning mathematics, namely: first, mathematics is a language, mathematics is not only a thinking aid that helps us find patterns, solve problems, draw conclusions, but mathematics is also a good tool for communicating various ideas so that they are clear, precise, and concise, and secondly, learning mathematics is a social activity, both between teachers and students and between students themselves. He also stated that there are five aspects of communication, the five aspects are: (1) Representation, (2) Listening, (3) Reading, (4) Discussing, (5) Writing.

Communication is a key part of students learning. The communication ability the students learn now can benefit them in the future. According to the national council of Teacher of Mathematics (NCTM), “Changes is the workplace increasingly demand teamwork, experiment, collaboration and communication” (NCTM, 2000, p. 348). Students need to be able to communicate with their teacher and their peers. Understanding vocabulary can help to become better communicators. It is important that as an educator I am able to understand my students knowladge of a mathematical concept. One way to do this is by asking open-edded questions. “Teachers can stimulate students growth of mathematical knowledge through the ways they ask and respon to the question” (Piccolo, et.al. 2008).

Sumarmo (in Rizka and Surya, 2014) states that abilities classified as mathematical communication include (1) the ability to express a situation, figure, diagram, or real object into language, symbols, ideas, or mathematical models, (2) explain oral or written mathematical ideas, situations and relations, (3) listening to, discussing and writting about mathematical representation, (5) making conjectures, formulating definitions, and generalizations, and (6) restate a mathematical description or paragraph in its own language.

Likewise the results of field observations conducted by Deswita et.al. (2018) show that students have not been able to communicate mathematical ideas well, convey their ideas, compose arguments well, and state a mathematical problem in the form of symbols, diagrams, or models. mathematical. Similar results were also obtained by Lubis and Rakhmawati (2017) which stated that students had difficulty writing what they knew and solutions to solve story problems, students also had difficulty representing the information contained in questions into language and mathematical symbols in helping solve mathematical problems.

One of the factors that can affect mathematical communication abilitys is the learning process, in which to improve this ability, learning is needed that can invite students to actively discuss because students will be accustomed to

optimal learning process using models, methods, or approaches that can enable students to rediscover mathematics based on their own efforts and the need for good learning device in the process of improving students mathematical communication ability.

In Permendikbud No. 22 of 2016 concerning Basic and Secondary Education Process Standards states that the preparation of learning device is part of learning planning. Learning planning required in learning includes the preparation of a, Silabus, Learning Plan (in Indonesian is RPP), preparation of learning media and resources, and learning assessment device. The principles in compiling lesson plans that need to be considered are the individual differences of students, active participation of students, student centered, developing a culture of reading and writing, providing feedback and follow-up lesson plans, emphasizing the linkage and integration between lesson plans components in a whole learning experience. , accommodate thematic-integrated learning, application of information and communication technology in an integrated, systematic, and effective manner according to the situation and conditions. Therefore, teachers from each education unit are obliged to develop learning device.

In addition, teachers also need a learning model that can deliver the learning device that have been arranged to students. One learning model that can help students improve their mathematical communication ability is the Problem Based Learning (PBL) learning model. The PBL learning model requires students to be actively involved, where students work independently such as formulating problems, identifying problems, looking for material related to these problems before reporting problems. While the teacher only facilitates, so that the material obtained by students is easy to understand. This is in line with the main objective of the curriculum implemented in schools, namely students are more active in digging up information on their own.

From the results of research conducted by Nur Artika, et al (2020) which is based on the lack of learning device that can improve students 'Mathematical

Communication Ability and aims to produce learning device by applying the Problem Based Learning (PBL) model to improve students mathematical communication ability. The development stage they are doing is using the ADDIE development model with the stages of Analysis, Design, Development, Implementation and Evaluation. The results of the learning device they compiled showed very valid criteria with the respective percentages 91, 30%, 89.09%, and 87, 15% with the results of the effectiveness test stated that the students mathematical communication ability using learning device with the PBL model is better than the mathematical communication ability of students who use conventional learning models.

The same thing was done by Voni (2018) at SMP N 1 Gunung Malela with the instrument used, namely a test of students mathematical communication ability in the form of descriptions. The development of these learning device is in the form of designing mathematics learning materials for one variable linear equations and inequalities starting from the Learning Implementation Plan (RPP), Teacher's Book (BG), Student's Book (BS), and Student Activity Sheets (LAS). The research design that was designed was the Pre-test and Post-test Group. From the results of these studies, students mathematical communication ability based on problem-based learning have increased from posttest trial I to posttest trial II. This can be seen the percentage of achievement classically and the average value of the indicator of students mathematical communication ability from the first trial to the second trial, from 17.82 to 19.10. From the results of the study, students responses to the components in the problem-based learning process have shown a positive response. Researchers suggest that problem-based learning is an alternative for teachers in improving students mathematical communication ability

From the above, it is found that the learning model and learning device have a great influence in increasing students mathematical communication ability. The same is the case with the learning process that is applied in the classroom. The processes carried out really require appropriate interaction between students and teachers or other fellow students. Teachers are expected to be able to help

students develop their own knowledge by being actively involved in the learning process and students can also train their independence in learning so that students can improve their understanding because they have found concepts and conclusions in learning independently. This learning process must be developed and implemented in the classroom.

In a study conducted by Zahira, et.al. (2020) which was motivated by the difficulty of teachers in implementing the 2013 curriculum for grade VIII junior high school students, especially in preparing learning devices. The type of research used is Research and Development with a 4-D model or based on Problem Based Learning (PBL) with data collection instruments namely validation sheets, practicality sheets and tests of students mathematical communication ability. From the results of the research through the effectiveness test, it can be seen from the percentage of achievement of students 'mathematical communication abilities, which is 92% fulfilling the effective criteria and from the average difference test (t test) with a significance level of <0.05 which shows that the learning device developed are effective in improving students mathematical communication ability. .

Because there are various research results, it is necessary to do an analysis to produce a synthesis of various research results on the development of learning device with the PBL model to improve student's mathematical communication ability or what is called metasynthesis.

Metasynthesis is a literature review method that integrates the amount of information presented by previous researchers, identifying differences in study results between one researcher and the study results of other researchers so that other researchers are younger in knowing the overall results or conclusions of research on learning device development.

Initially, researchers will collect sources in the form of several relevant journal articles as a comparison for data accuracy. Then the researcher selects the relevant research results according to the questions that have been compiled by

the researcher and is extracted from individual studies to obtain important findings. Furthermore, the researcher synthesizes (summarizes) the results of qualitative research or what is commonly referred to as meta synthesis by integrating the data on the results of the research to obtain new theories or concepts or a deeper and more comprehensive understanding of the topics that have been determined. The final process, the researcher draws conclusions from the data that has been analyzed and performs the presentation of the results. Thus, this research report is not a duplication of previous studies.

Starting from or related to the previous explanation, namely the number of similar studies regarding the development of PBL model learning device to improve students mathematical communication ability, the authors found gaps in results that occurred from various studies, therefore researchers conducted research related to "Metasynthesis of Learning Tool Development with Models. PBL to Improve Students Mathematical Solving Ability "to get new results in the form of new concepts or understandings and conclusions through summarization, elaboration for further researchers and readers.

## 1.2. Problem Identification

As for the identification of problems in this research which is obtained from the background description are:

a. Student's mathematical communication ability in learning mathematics are still low.
b. Mathematics learning is still teacher-oriented or the method used is conventional so that students are passive in learning activities.
c. There are differences in the results of research regarding the development of PBL model learning device to improve students mathematical communication ability, causing differences in perceptions of researchers and readers.
d. The number of similar studies related to the development of learning device with the PBL model to improve students mathematical communication ability that need to be synthesized.

## 1.3. Problem Limitation

Based on the identification of the problems above, the focus of this research problem is the results of research on the development of problem based learning device to improve students mathematical communication ability. The results of the research used are research journal articles for the last 10 years, namely articles in 2010-2019 at the junior high school level.

## 1.4. Problem Formulation

Based on the identification and limitation of the problem above, the problem formulations in this study are:

1. How does the improvement student's mathematical communication ability after using learning device development based on PBL from previous research?
2. How is metasynthesis about the development of learning device to improve students mathematical communication ability?

## 1.5. Research Objective

Based on the formulation of the problem above, the research objectives to be achieved are as follows:

1. Describe the increase in student's mathematical communication ability after using learning device developed from previous research.
2. Describe the metasynthesis of developing device to improve student's learning mathematical communication ability.

## 1.6. Research Benefit

This research is expected to:

1. For the author, this study is expected to provide benefits to increase the author's knowledge of how to improve student's mathematical communication ability after using the learning device that have been developed.

2. For readers, it is hoped that they can add knowledge and insight regarding the improvement of students mathematical communication ability after using learning device that have been developed through previous research that has been metasynthesized.
3. For the State University of Medan, the results of this study can be used for library materials.

## 1.7. Operational Definition

To reduce differences or lack of clarity of meaning, the operational definitions in this study are:

**1. Development**

Development in this study is the development of learning device based on the PBL learning model to improve students mathematical communication ability.

**2. Learning Device.**

The learning device is an activity plan prepared by the teacher so that the learning process can be carried out systematically. Learning device are part of learning planning which includes the preparation of lesson plans (RPP) and preparation of learning media and resources, learning assessment device and learning scenarios. In this study, the learning device that will be developed consist of: Learning Implementation Plan (RPP), teaching materials, Student Activity Sheets (LKPD), and evaluation sheets.

**3. Learning Model Problem Based Learning.**

PBL learning model is one of the learning models where students learn actively in solving real-world problems. The PBL model steps are:

a) Learning activities begin with giving a problem
b) The problem presented are still related to the real life of the students
c) Organize discussions around problems, not disciplines
d) Student are given maximum responsibilityin carrying out the learning process directly

e) Students are divided into several small groups, collaborations occurs.
f) Students must demonstrate the performance that has been learned.

**4. Quality of Learning Tool Development**

The quality of learning device development refers to the quality criteria of a product, namely valid, practical and effective. However, in this study the criteria for the quality of learning devices were limited to validity and practicality.

**5. Metasynthesis**

Meta synthesis, also known as *systematic review,* is a research method for identifying, evaluating and interpreting similar research results to answer research questions on certain topics or phenomena that are of contemporary concern.