

CHAPTER I

PRELIMINARY

1.1. Background

Mathematics is a subject that has an important role in education. Mathematics has an important role in various scientific disciplines and in advancing human thinking. Therefore, mathematics is taught to students at all levels of education from primary to secondary education (Ulya, 2016).

Seeing that mathematics has an important role, students must understand mathematics well. The standard of mathematical ability that must be achieved is mathematical reasoning, mathematical representation, mathematical communication, linking mathematical ideas, problem-solving (NCTM, 2000). So, it can be said that mathematical problem-solving ability is an important mathematical ability that must be achieved by students.

Problem-solving ability is very important for students to have for achieving curriculum goals (Husna et al., 2013). In line with that, NCTM (2000) also said that problem solving is also important because it can serve as vehicle for learning new mathematical ideas and skills.

The development of students' mathematical problem-solving ability is needed so that students can better interpret mathematics, not only as learning in school but as a useful thing in helping solve the problems they are facing in everyday life. This is in line with what Rezeki said that problem-solving ability is an important component in learning mathematics because this ability can make students have basic abilities which are meant more than just thinking skills (Rostika & Junita, 2017).

Mathematical problems is defined with two types, namely problems to find (ie to find, determine or get the value of a certain object that cannot be known in the problem and give the appropriate answer) and problems to prove (ie with

procedures to determine which statement is true or not) (Polya, 1973). Meanwhile, the understanding of mathematics problem will be used in this study is the understanding of mathematics problem by Polya that mathematical problems is defined with two types, namely problems to find (ie to find, determine or get the value of a certain object that cannot be known in the problem and give the appropriate answer) and problems to prove (ie with procedures to determine which statement is true or not) (Polya, 1973). Meanwhile, Kesumawati stated that mathematical problem – solving ability is the ability to be able to identify what things can be known, what is asked, and what is needed is sufficient, can create or compile mathematical models, can choose and develop solving strategies, be able to explain and check the answers that obtained is correct (Mawaddah & Anisah, 2015).

Students' mathematical problem-solving ability is related to the stages of solving mathematical problems. According to Polya (1973) in solving mathematical problems, it goes through 4 stages of problem-solving, namely: understanding the problem, devising a plan, carrying out the plan and looking back. For the purposes of this research, I use this stage as an indicator to measure problem-solving abilities. It is further explained as follows:

1. Understanding the problem, namely understanding the problem by knowing things that are not known, what data is in the problem, how the condition of the problem is. To find out whether you understand the problem well, you can do it by drawing a figure then introduce Suitable Notation. Then separate the various parts from the existing conditions. If you can write this down, then this indicator is fulfilled.
2. Devising a plan, namely finding the relationship between data and things that are not known or additional problems if it is not found directly. To know that devising a plan is well can be done by looking at these problems and previous problems, if you can use the results, the methods used, and additional elements also can restate the problem being asked in a different way, then this indicator is met.

3. Carrying out the plan, that is, carrying out the solution plan that has been created by examining each step. To know that this has been done well by seeing the steps that have been taken are correct and can prove that the steps are correct.
4. Looking back, that is, examining the solutions carried out earlier. To know that this has been done well is to make sure that you can check the results and check the arguments given, can get different results even if you look at them in one way, and can use the results or methods for other problems.

The ability to solve math problems is one of the important ability in mathematics. However, the fact is that in the field the students' mathematical problem-solving ability is still low and not as expected. This can be seen from the results of an international survey that was followed by Indonesia, namely TIMSS (Trends in International Mathematics and Science Study). Based on the results of the survey conducted by TIMSS in 2015 in the field of mathematics, Indonesia was ranked 45th with a score of 397, which is still far from the standard score given, which is 500. In the survey, the cognitive indicators assessed were: know, apply, and reason. In the field of mathematics, only 4% of all students surveyed could answer correctly in application questions. In solving problems, the application is closely related to the ability to solve problems. From this data, it can be seen that the mathematical problem-solving ability of Indonesian students is in a low category (Lailiyah et al., 2019).

Various studies also show the same results regarding the low ability of mathematical problem-solving. One of them is the results of field observations conducted by Rusnilawati (2016) who conducted a preliminary test on 2 classes, namely grade XIII-F and VIII-G. Grade VIII-F which is the superior class consists of 26 students and grade VIII-G which is a heterogeneous class consisting of 28 students. This initial test was given with limited material, namely circle material that was given to measure students' mathematical problem-solving ability. The average value of the mathematical problem-solving ability obtained from the two classes is 28.1, which is in the low criteria.

Similar research was also carried out by Simanungkalit (2016) on grade VII-2 and VII-3 students at SMP Negeri 12 Pematang Siantar. The results of the pretest on the first trial were obtained that of the 36 students who took the initial test, there were 0 students (0%) who obtained a score of more than or equal to 2.66 (minimum B-) that is with moderate criteria while the pretest results in the second trial It was found that out of 34 students who took the initial test, there was 1 student who scored more than or equal to 2.66 (minimum B-). Based on the results of this study, it can be seen that the students' mathematical problem-solving ability is still in the low category or have not been able to meet the required criteria.

Prastiwi (2018) also do the same research and it shows that students' ability to solve problems was low, this was because students were not used to finding and solving problems independently. The results of his observations are supported by observational data obtained from tests with problem-solving indicators. The percentage of students who have difficulty understanding the problem is 51.61%, difficulty in preparing problem formulation plans is 80.65%, difficulties in implementing problem-solving plans 48.39%, and difficulties in re-checking the results obtained by 51.61%.

From the various research results previously described, it can be seen the fact that until now the students' mathematical problem-solving ability is still low. Realizing the importance of problem-solving ability, the teacher must prepare and plan good and thorough preparation. One form of preparation is a learning device. The learning device has a very important role, as stated by Suparno (2002) that in the preparation stage carried out by the teacher before teaching it is expected to prepare the material to be taught, the props/practicum used, questions or directions that can provoke students to actively learn, learn the condition of students, understanding the weaknesses and strengths of students, as well as learning students' prior knowledge, where all of this will be broken down in the implementation of the learning device. This is also in line with what was expressed by Brata that learning devices are a form of preparation made by teachers before they carry out the learning process (Komalasari, 2011). The purpose of developing

learning device is to produce a product that aims to help students in the learning process in the classroom, with the aim of achieving the desired learning objectives, namely improving students' mathematical abilities (Siregar, 2019). The learning device to be studied in this study are limited to the Lesson Plan (RPP) and Student Worksheets (LKPD).

The Lesson Plan (RPP) in the Regulation of the Minister of Education and Culture Number 22 of 2016 is a plan of learning activities that are carried out face-to-face for every once or more meetings where this activity plan is developed from a syllabus into direct learning activities with the aim of achieving basic competencies. It was further explained that a good lesson plan required at least the following components, namely: (a) school identity, (b) subject identity, (c) class/semester, (d) subject matter, (e) time allocation, (f) learning objectives, (g) basic competencies and competency achievement indicators, (h) learning materials, (i) learning methods, (j) learning media, (k) learning resources, (l) learning steps, and (m) assessment of learning outcomes (Depdikbud, 2016).

The student worksheet is a printed teaching material in the form of sheets containing material, summaries, and instructions that must be implemented by students (Prastowo, 2012). The student worksheet usually contains a collection of activities that must be carried out by students and usually, these are basic activities to assist students in maximizing their understanding so that they can form basic abilities according to the learning achievement indicators that must be taken. (Siregar, 2019).

In improving students' mathematical problem-solving ability, an approach is needed in learning mathematics. By applying an approach in developing learning device can improve students' mathematical problem-solving ability. This is in accordance with the results of research conducted by Rusnilawati (2016) which explains that students' mathematical problem-solving ability is better or more effective after the scientific approach is applied with an average posttest result on the first test, namely 87.4 and the average initial ability test, namely 28.1, while the average posttest result on the second test was 93.7 and the initial ability average

was 28.2. The results of this study indicate that students' problem-solving ability improves after using an approach, which is using scientific research.

Research conducted by Simanungkalit (2016) shows that mathematics learning device developed based on problem-based learning have met the criteria of being valid, practical, and effective. The results of his research also showed that there was an increase in students' mathematical problem-solving ability after using the learning device that was developed. This is evidenced by the results of the average gain value of students' mathematical problem-solving ability in the first trial of 0.57 and in the second trial of 0.66 which means they are in the medium category.

Suryaningtyas (2017) also conducted research on the development of learning device based on a realistic mathematics approach that obtained classical completeness percentages of more than 70% with an average posttest score of 83.25 (high category). Previously, the average pretest score was 73.49, meaning that the value increased by 9.76, so it can be concluded that the learning device it developed reached the effective category and was proven to improve students' mathematical problem-solving ability.

Given the importance of students' mathematical problem-solving ability, the teacher must make a learning device in order to improve students' mathematical problem-solving ability. Previous researchers have conducted research on the development of learning device to improve students' mathematical problem-solving ability with various approaches. However, the large number of studies that gave different and varied results resulted in differences in the perceptions of both researchers and readers. Because of the various research results, it is necessary to synthesize (summarize) the results of a qualitative descriptive study using a qualitative systematic review approach. A systematic review is used which means a research method that summarizes the results of primary research to present more comprehensive and balanced facts, one of which is by using metasynthesis techniques (Hadi et al., 2020). From such data will be identified, analyzed, and interpreted to produce conclusions (Kitchenham, 2004). Identification is carried out

by locating relevant papers by searching for topics to be used with the research database published in journals, including determining the inclusion and exclusion criteria for the research. Evaluation is done by making the following checklist with the criteria used in assessing the study. It will be presented how the research results of each article used as a research source and then compare them, starting from the students' initial abilities at the school and also how the research instruments used were then compared between the articles. For interpretation, it is done by give meaning or construe the results of research from each of the primary sources (Walsh & Downe, 2005).

The procedure used in conducting this metasynthesis consists of 7 steps, namely background and purpose, research questions, searching for the literature, selection criteria and procedure, quality checklist and procedure, data extraction strategy, and data synthesis strategy. Initially, the researcher identified by defining the research questions the researcher intended to answer. After that, conduct a literature search whose strategy has been determined, namely literature that has been published with a maximum published year limit of the last 6 years using English or Indonesian by means of electronic searches. Furthermore, the selection of study criteria was determined by establishing inclusion criteria, including the type of development research methodology. Following the evaluation, the researcher develops a quality checklist to assess individual studies with the intention of guiding checklist development. After that, determine how the information needed from each study is obtained for further interpretation by synthesizing the extracted data. At this stage, a synthesis strategy is needed which must explain that this metasynthesis technique is used (Kitchenham, 2004).

Nuraini et al. (2018) conducted research using the metasynthesis method. They do research on mathematics error in elementary school. The results of their metasynthesis show that there were eight mathematics errors and alternative solutions to minimize are using appropriate learning methods, appropriate learning media, settlement method, drill methods, Realistic Mathematics Education (RME), the Polya settlement method. The same research was also conducted by Berry and

Thunder (2012) who conducted research using metasynthesis. This metasynthesis discusses how black students negotiate their experiences with mathematics over time. Then get the results that these learners negotiated through self-exploration of their values, their perceptions of success, their awareness of and access to opportunities, and forms of images to enact their sense of agency. Azman and Ismail (2013) also conducted research with a qualitative methodology approach which research on learning differential equations where the results the study said that there is one method of teaching that still does not try by any researcher, which is learning differential equations by online learning such as discussion and e-learning.

Based on the above, it is necessary and important to conduct metasynthesis research on the development of learning device to improve students' mathematical problem-solving ability. Furthermore, it will be carried out examining the results of research on the development of learning device to improve students' mathematical problem-solving ability. Furthermore, data integration will be carried out on the results of these studies to obtain new theories or concepts or a deeper and more comprehensive understanding of the topic.

1.2. Identification of Problems

Based on the background of the problems above, several problems can be identified as follows:

1. The ability of students to solve mathematical problems in learning mathematics is still low.
2. There has not been a comprehensive study of the results of similar research related to learning device development to improve the mathematical problem-solving ability of junior high school students.
3. Various and different results of research on learning device development to improve students' mathematical problem solving ability.

1.3. Problem Boundaries

Based on the identification of the problems described above, the things that will be the focus of the problem for researchers in this study are as follows:

1. The problems that will be studied in this study are limited to the results of research on learning device development to improve students' mathematical problem-solving ability.
2. The results of the research used in this study are articles in research journals for the last 6 years, namely articles from 2015 - 2021 at the junior high school level and have been indexed by Sinta, Garuda, or Google Scholar.
3. The results of the research used in this study were articles that used Polya's problem-solving indicators, namely: understanding the problem, devising a plan, carrying out the plan, and looking back.
4. The results of the research used in this study were articles that contained valid, practical, and effective criteria in developing learning devices.
5. The mathematics learning device to be studied in this study are limited to the Lesson Plan (RPP) and Student Worksheets (LKPD).

1.4. Problem Formulation

Based on the identification and problem boundaries above, the problem formulations in this study are as follows:

1. How is the tendency of learning device development to improve students' mathematical problem-solving ability?
2. How is the metasynthesis about learning device development to improve students' mathematical problem-solving ability?

1.5. Research Objectives

The objectives of the research to be carried out are as follows:

1. Describe the tendency of learning device development to improve students' mathematical problem-solving ability.

2. Describe the metasynthesis of learning device development to improve students' mathematical problem-solving ability.

1.6. Research Benefits

The benefits of writing this thesis include:

1. Practical Benefits

This metasynthesis research is expected to summarize the results of primary research to present more comprehensive and balanced facts and to integrate (compare and contrast) what other research has done or said.

2. Theoretical Benefits

This research is expected to provide benefits to increase knowledge and insight regarding the improvement of students' mathematical problem-solving ability after using learning device and can be an addition to library material.

1.7. Operational Definitions

To avoid different interpretations, it is necessary to explain some of the terms that will be used in this study. Some of the concepts or terms used in this study are:

1. Learning devices are a form of preparation made by teachers before they carry out the learning process.
2. Mathematical problems is defined with two types, namely problems to find (ie to find, determine or get the value of a certain object that cannot be known in the problem and give the appropriate answer) and problems to prove (ie with procedures to determine which statement is true or not).
3. Mathematical problem – solving ability is the ability to be able to identify what things can be known, what is asked, and what is needed is sufficient, can create or compile mathematical models, can choose and develop solving strategies, be able to explain and check the answers that obtained is correct.

4. Metasynthesis is one part of the systematic review method. A systematic review is a research method that summarizes the results of primary research to present more comprehensive and balanced facts, one of which is by using metasynthesis techniques. From such data will be identified, analyzed, and interpreted to produce conclusions. Identification is carried out by locating relevant papers by searching for topics to be used with the research database published in journals, including determining the inclusion and exclusion criteria for the research. Evaluation is done by making the following checklist with the criteria used in assessing the study. It will be presented how the research results of each article used as a research source and then compare them, starting from the students' initial abilities at the school and also how the research instruments used were then compared between the articles. For interpretation, it is done by give meaning or construe the results of research from each of the primary sources.

