CHAPTER I
INTRODUCTION

1.1 Background

In the Indonesian education system, mathematics is the only subject that is taught explicitly from kindergarten to university. Math subjects should be instructed to all understudies beginning from primary school to outfit understudies with the capacity to think coherently, efficiently, systematically, fundamentally and inventively as well as cooperatively. These competencies are necessary to enable students to obtain, organize and utilize information to survive in an ever-changing, erratic and competitive environment. Through learning mathematics, the nation is expected to be able to renew the quality of human resources so that the next generation of the nation can stand up straight for the development of their nations (Nahdi, 2017). Mathematics is the foundation for modern science and technology development, and is an academic discipline that enhances human thought. Understanding mathematical concepts and being able to apply them in everyday life is very important. The importance of mastering mathematics is recognized in RI Law no. 20 of 2003 related to SISDIKNAS Article 37 which emphasizes that mathematics is a compulsory subject for elementary and middle school students (Febriani et al., 2020).

National Council of Teachers of Mathematics (2000) declared that math learning from elementary to high school requires learning standards that produce students with the ability to think, reason mathematically, and have useful basic knowledge and skills. The standard process in mathematics learning includes *problem solving* ability, *connection* ability, *communication* skills, *reasoning* skills, and *representation* ability. According to Depdiknas (2008) math learning should develop several aspects, one of which is understanding mathematical concepts. Understanding the concept will help students solve problems. Students can connect

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and resolving these problems based on the concepts they already understand. Conversely, if students' understanding of concepts is still lacking, they will experience difficulties in problem solving and reasoning. Therefore, it is essential for students to acquire specific mathematical ability in order to achieve learning goals.

As one of the math skills that students should master, representation ability is a key component that is developed in every mathematics learning activity. According to Jones and Knut (1991), there are several reasons for the need for representational abilities, one of which is to develop good concepts that can be used in problem solving. Using different representations can develop students' skills and understand mathematical concepts in depth. The ability of mathematical representation will simplifying and clarifying in solving mathematical problems to turn abstract ideas into concrete concepts, for example with symbols, graphs, pictures, words, tables and others. So that complex problems can be seen more simply and can be presented more easily. Representational abilities used in learning mathematics such as images, graphics, physical objects, symbols and other objects will help students to communicate and think (Mulyati, 2016).

Based on TIMSS *(Trends in International Mathematics and Science Study)* results in mathematics, Indonesia is still below the international level. In the 2003 TIMSS study, Indonesia obtained an average score of 411 while the international average score was 467 so that Indonesia ranks 35th out of 46 countries. Then the results of the 2007 TIMSS study, Indonesia ranks 36th out of 49 countries with an average score of 397. Based on the results of the 2011 TIMSS study, Indonesia ranks 32nd out of 49 countries with an average score of 386, while the average score international is 500. TIMSS 2015 study results Indonesia was ranked 46th out of 51 countries with an average score of 397. Based on this it can be concluded that from 2003 – 2015, Indonesia's ranking in TIMSS continued to decline. Whereas in 2019 based on the results of the TIMSS study, Indonesia did not participate in the study (Prastyo, 2020). In addition to TIMSS, a survey of international student abilities was conducted by PISA *(Program for International Student Assessment)*. This survey was conducted to assess students' ability to solve problems, reason, and

communicate. Based on a survey from PISA in 2018, it was found that Indonesia was ranked 73 out of 79 participating countries or ranked 6th from the bottom, with a math ability score of 379 (Tohir, 2019). This score is still far below the OECD average score of 487. This score has also decreased from 2015 where the math ability score in 2015 was 386. Wardhani and Rumiati (2011) stated that TIMSS questions more specifically measure students' abilities in selection, representation, modeling, application, and problem solving. Based on the characteristics of the TIMSS questions, it can be seen that students' mathematical representation ability in Indonesia is still low compared to other countries.

Many factors cause low or lack of students' ability to learn mathematics, one of which is the learning approach used by teachers, for example learning that is oriented towards traditional approaches that place students only as listeners. As a result, students are bored in learning mathematics and are not motivated to explore mathematics as a fun and challenging lesson (Nurbadriah, 2018). In the learning process there is still a tendency to minimize the role and involvement of students, although we have long realized that learning requires the active involvement of the learner, the reality still shows a different trend. The current conditions, in mathematics learning activities at school, teachers usually use conventional learning methods. Learning activities begin by explaining and giving examples of questions and then proceed with giving practice questions to students. Learning is only centered on the teacher while the students just sit quietly and listen to the teacher's explanation. As stated by Slameto (2010) that:

"Teachers usually teach by lecture method only. Students become bored, sleepy, passive and just take notes".

Almost the majority of students experience difficulties in learning and mastering mathematics so that mathematics is considered a difficult, uninteresting and unpleasant subject, even students are pessimistic about mathematics. Abdurrahman (2012) reveals that:

"From the various fields of study taught in schools, Mathematics is a field of study that is considered the most difficult by students, both those who are

not learning disabled and especially for students who have learning difficulties".

In connection with the above it is not surprising that today's students are very difficult to learn mathematics.

Based on the results of the pre-observation conducted at SMP Negeri 37 Medan on Wednesday, 16 November 2022, information was obtained from the results of an interview with Mr. Aritonang, who is a class VII mathematics teacher, that the learning model applied at the school is still teacher centered, where the teacher play an active role in explaining the material in front of the class. He also stated that the mathematical representation abilities of class VII students at the school were still low. Students are less able to translate mathematical sentences into mathematical models or vice versa, especially when given story problems. This is in line with what was stated by Abdurrahman (2009) that: "In solving story problems, many children experience many difficulties. These difficulties appear to be related to teaching which requires children to make mathematical sentences without first giving instructions about the steps that must be taken". Difficulties in learning mathematics resulted in low students' mathematical representation abilities. Students tend to memorize mathematical concepts while their application to problems is still lacking. Students are only oriented to the use of formulas and counting. Students will find it very easy to calculate using formulas that they memorize, but to direct questions at the stages of solving mathematical problems is still very difficult. As stated by Trianto (2010) that:

"The reality in the field is that students only memorize concepts and are less able to use these concepts if they encounter problems in real life related to the concepts they have. Furthermore, even students are less able to define problems and formulate them".

Students are also unable to explain the meaning of a graph in the context of everyday life problems or abstract ones. Then, students tend not to be able to answer questions that are not in accordance with the examples given by the teacher in

learning, so in the end they only guess answers. These indicators show a low mathematical representation.

Several studies that have been conducted explain the mistakes students have made in representational abilities. Legi (2008) states that students with low abilities have difficulty creating and using symbolic representations and images. In addition, Suryowati (2015) also revealed that students still do not understand how to represent real-world problems into representative mathematical problems.

This was also proven by the results of the student diagnostic tests given on Saturday, 3 December 2022, students were not able to solve problems with sets, squares and rectangles, in which these materials had previously been studied. Not much different from the results of interviews with the mathematics teacher at SMPN 37 Medan, it was concluded that from the results of the tests given there were still many students who answered the test incorrectly, and some students even left the answer sheet blank because they did not understand how to answer the question. From the results of examination of student sheets obtained difficulties or student errors as follows:
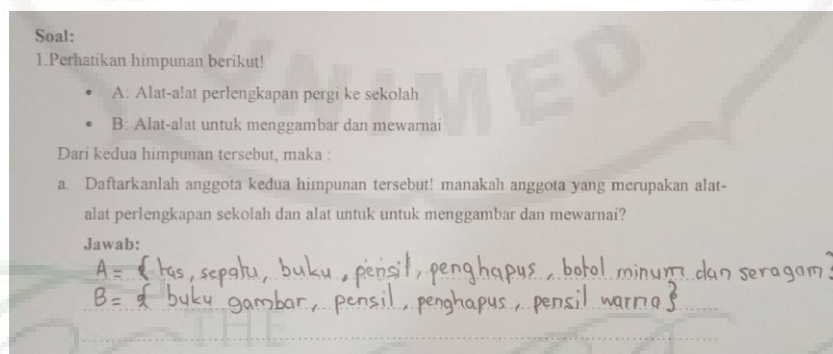

Figure 1.1 Results of student answers (1a)

From the students' answers to the first question, it can be seen that students can already name the members of the two given sets using set notation. However, the student did not mention which member is the intersection of the two sets. The student also did not write the notation of intersection on the answer sheet. This proves that students have not fully met the representation ability indicators on the aspect of symbolic representation.

The next problem is that students are less able to solve problems using visual representations (image representations). As seen in the following student answers:
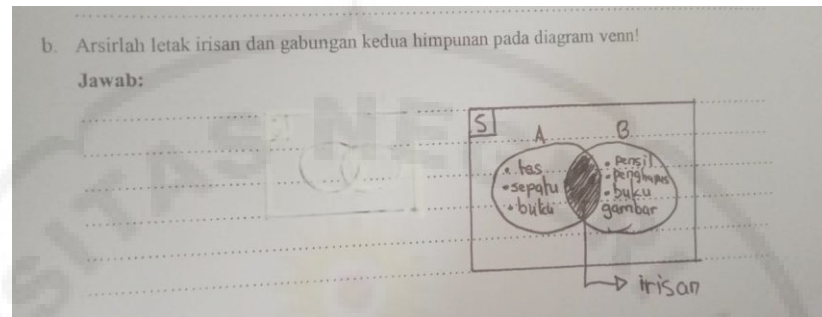

Figure 1.2 Results of student answers (1b)

From the students' answers above, it can be seen that the student knows the location of the intersection but does not include the intersection members in it, the student also only shading the intersection, while what is asked in the question is to shade the intersection and joints. This proves that students do not understand the questions and do not meet the indicators of visual representation (presenting data or information presented in the form of pictures, diagrams, graphs or tables to solve problems).

The next problem is that students are less able to answer questions with words or written text. It can be seen in the student's answers below, where students register members from the difference between the two sets but do not provide an explanation as requested in the question. This also proves that the student has not met the verbal representation ability indicator.
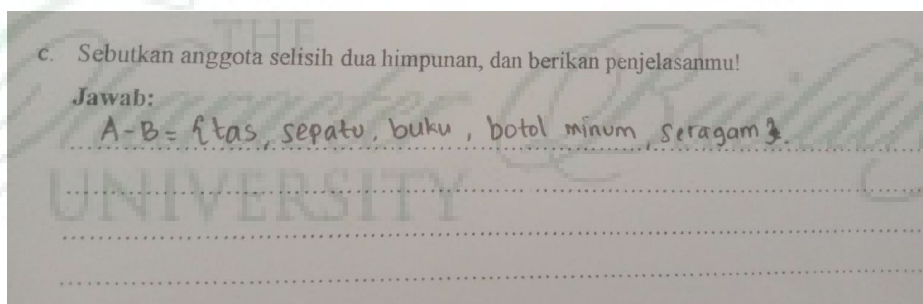

Figure 1.3 Results of student answers (1c)

This mathematical representation diagnostic test was given to 32 students in class VII-B of SMP Negeri 37 Medan. This diagnostic test item is designed to be

able to measure three aspects of representation indicators, namely: visual, symbolic (mathematical equations or expressions), and verbal (words or written tests). Based on the results of the tests given, it was found that 7 students had representation abilities in the medium category (21,8%), 6 students had representation abilities in the low category (18,75%), and 19 students had representation abilities in the very low category (59,37%).

Based on the problems above, it is necessary to improve the teaching and learning process in order to improve students' mathematical representation abilities. This improvement can be in the form of implementing a learning model that is active learning, where teachers are expected to implement a learning that prioritizes student involvement in learning and provides opportunities for them to construct their knowledge. In line with what was revealed by Legi (2008) and Suryowati (2015), these two studies recommend efforts that can be made by teachers so that students have representation ability by choosing and using the right learning approach, so that the learning process takes place optimally and is able to develop mathematical representation ability. Teachers and educators always need innovative teaching methods. Cooperative learning is one type of learning that is in accordance with the characteristics of mathematics subjects to improve mathematics learning outcomes by mastering standardized mathematics learning processes. Cooperative learning is also student-centered. One of the effective cooperative learning models to improve students' mathematical representation abilities is the *Reciprocal Teaching* model. Through the *Reciprocal Teaching* model, students are expected to learn through experience not memorizing.

Reciprocal Teaching is a learning model that is implemented so that learning objectives are achieved appropriately through an independent learning process and students are able to present them in front of the class. This is in accordance with the opinion of Palinscar (1984) that in *Reciprocal Teachin*g four strategies are used, namely generating questions *(question generating),* clarifying terms that are difficult to understand *(clarifying)*, predicting further material *(predicting),* and *summarizing*. In the *Reciprocal Teaching* model, students are required to always be active in learning activities. The implementation of the *Reciprocal Teaching* model

will be more effective in being able to create learning that can create student learning independence (Susiyati, 2018).

Related to this description, the writer wants to apply the Reciprocal Teaching cooperative learning model to improve students' mathematical representation abilities. Therefore, the authors are interested in conducting research with the title: **"Implementation of *Reciprocal Teaching* Learning Model to Improve Students' Mathematical Representation Ability in Grade VII at SMP Negeri 37 Medan T.A 2022/2023".**

1.2 Problem Identification

Based on the background of the problems described above, several problems that occur in learning mathematics at school can be identified, including the following:

1) Mathematics is a field of study that is considered difficult and unpleasant for students.
2) The ability of students' mathematical representation in learning is still low.
3) Students tend to memorize mathematical formulas, but find it difficult to lead to problem solving.
4) The learning model used by mathematics teachers is still teacher-oriented so that learning activities do not involve students actively.

1.3 Problem Limitation

To avoid misunderstandings and problem expansion, in this study the problem was limited to improving students' mathematical representation ability using the *Reciprocal Teaching* learning model (reverse learning) on the subject of Data Presentation in class VII SMP Negeri 37 Medan T.A 2022/2023.

1.4 Problem Formulation

Based on the background of the problems that have been described, the problems formulated in this study are as follows:

1) How the improvement of students' mathematical representation ability of class VII through the *Reciprocal Teaching* learning model at SMP Negeri 37 Medan T.A 2022/2023?

2) How is the classical completeness of class VII students of SMP Negeri 37 Medan through the *Reciprocal Teaching* learning model on mathematical representation ability?

1.5 Research Objectives

Based on the formulation of the problem stated above, the research objectives are as follow:

1) To find out the improvement of students' mathematical representation ability of class VII through the *Reciprocal Teaching* learning model at SMP Negeri 37 Medan T.A 2022/2023.

2) To find out the classical completeness of class VII students of SMP Negeri 37 Medan through the *Reciprocal Teaching* learning model on mathematical representation ability.

1.6 Research Benefit

This research is expected to provide benefits, especially:

1) For students, by applying the *Reciprocal Teaching* learning model it is expected that students can improve student learning outcomes, especially in mathematics at SMP Negeri 37 Medan.

2) For teachers, applying the Reciprocal Teaching learning model can be used as input material in terms of designing learning models in order to achieve optimal results.

3) For school, to be used as one of the input materials in order to improve the quality of education.

4) For researchers, it is hoped that the results of this study will serve as a reference basis for writers as future teacher candidates in determining the use of learning models, especially on students' mathematical representation abilities in learning mathematics.