CHAPTER I
INTRODUCTION

1.1 Background

The dynamics of education issues in Indonesia are always interesting to discuss. The quality of education is required to always be integrated with the progress of the times. Education is the source of all sources of national progress of a nation because the quality of a nation's human resources can be improved by education. No developed country in the world does not focus on the education sector in developing the country and nation. Developed countries have proven that education has a very important contribution to improving the quality of their nation. In UU RI No.20 Pasal 1 Tahun 2003 about Nasional Education Systems states that with education, students can actively develop their potential and skills which will later be needed to carry out life in society, nation and state. Education can also be interpreted as a conscious and systematic effort in developing all the potential that exists within humans to achieve a better standard of living or progress where in education there is a learning process to be able to understand and make humans more critical in thinking.

Mathematics is one of the sciences that has an important role in developing the ability to think, solve problems and challenges of science and technology progress. Therefore, mathematics is a subject that is given at every level of education from elementary to tertiary education. The skills resulting from studying mathematics develop the skills to think logically, systematically, innovatively, creatively (Vernia, 2019) and others which are the basis for creating innovations in the development of science and technology. As stated by Hasratuddin (2015) that mathematics is very important for everyone to learn because mathematics can develop logical, systematic, objective, critical and rational thinking tools and is very competent in shaping one's personality so that

human resources can also develop forward.

One of the goals of mathematics in the 2013 curriculum as contained in the attachment to Permen No. 58 Tahun 2014 section of the Mathematics Subject Guidelines is to understand mathematical concepts which are competencies in explaining interrelationships between concepts and using concepts and algorithms in a flexible, accurate, efficient and precise way in solving problems (Permendikbud, 2014). Based on these objectives, it can be concluded that mathematics is a discipline that can improve thinking and argumentation skills, contributing to solving problems in everyday life. To be able to understand a subject in mathematics, students are expected to have mathematical abilities that are useful for facing global challenges. The ability needed is the ability to solve students' mathematical problems which is the ability needed to solve life's problems and face today's global (Suraji, et al, 2018). The ability to solve problems in learning mathematics is one of the results to be achieved, so it must be considered by teachers and given special attention, given its role in developing students' intellectual potential. At school, one of the goals of learning mathematics is for students to have the ability to solve mathematical problems. This goal makes problem solving an important part of the mathematics curriculum. Furthermore, Purwaningrum & Ahyani (2016) explain that the ability to solve mathematical problems is an example of high-level mathematical thinking skills because when students use these abilities to solve non-routine math problems, they indirectly also use other mathematical abilities such as mathematical connection skills, mathematical communication skills, creative thinking skills and others in an effort to solve the problem. Because the ability to solve mathematical problems is one of the main goals of mathematics education, knowing each student's mathematical problem solving abilities in solving various mathematical problems in depth is an important part for teachers. A student is said to have the ability to solve problems in learning mathematics when students achieve certain criteria or commonly known as indicators. There are four indicators of solving mathematical problems according to Polya, namely understanding the problem, devising a plan, carrying out the plan, and looking back.

Based on facts in the field, students' problem-solving ability is still low. As stated by Astuti (2016) in their research, namely the performance of students in solving mathematical problems is still in the low criteria. Many students do not like mathematics because most of the problems given can only be solved with higher-order thinking skills. As stated by Purbaningrum (2017) which states that students still find it difficult when asked to solve non-routine math problems. This is partly because they are more accustomed to working on routine questions in textbooks so they are not used to working on everyday problems with certain topics. Ifut Riati (2015) in his research stated that many students had difficulty solving questions, students tended not to understand the problems in the questions in advance, so they only answered briefly. Whereas before students solve a problem, they must understand the existing problem, be able to identify and determine the right way to solve it. In other words, students are not able to understand the problem, formulate what is known from the problem, the student's settlement plan is not directed and the calculation process or settlement strategy from the answers made by students is not correct. In addition, the teacher only explains the material through examples, not giving concepts so that students tend not to understand concepts in learning mathematics, students only understand examples and similar questions. As stated by Dwi, et al (2018) in their research that students tend to memorize formulas without understanding concepts and work on math problems carelessly. Students prefer to use short methods without paying attention to the correct completion process. Teachers still use the lecture method where learning is still centered on the teacher, so that the teacher dominates the process of learning activities in class compared to students. The exercises given are Lower Order Thinking Skills (LOTS), the lack of opportunity for students to ask questions to the teacher so that they do not train students' reasoning power in problem-solving. Low learning outcomes and passive teaching and learning processes are the results of several of these factors. In fact, the achievements of Indonesian students at the international level are also low. Based on the results of the Trends in International Mathematics and Science Study (TIMMS) from 1999, 2003, 2007, 2011 and 2015, Indonesia is still below the international level. The

results of the latest research by TIMSS in 2015 showed that Indonesia was ranked 46th out of 51 countries with an average score of 397 (Retnowati, P. & Ekayanti, A., 2020). Comparable results were also obtained from the 2018 PISA study report, placing Indonesia ranked 73 out of 79 countries for mathematics ability with a score of 379 while the average international score was 489. The factor that causes the low achievement of Indonesian students in PISA is weak ability in non-routine or high-level problem-solving. Students in Indonesia are only used to routine questions at a low level. Based on the results of the PISA study, it can be concluded that the achievements of Indonesian students at the international level are still lagging behind compared to other countries.

In addition, the researcher also conducted an interview with Mr. Zulkifli, a mathematics teacher at SMA Negeri 8 Medan on February 25th, 2023 where he explained that the problem-solving abilities of students at SMA Negeri 8 Medan were still low. Many students have difficulty in solving the questions given. Students are only able to solve questions that are almost the same as the examples that have been described. From the results of the interviews it is known that the process of learning mathematics is still carried out by direct learning using the lecture and question and answer method. The media used is also limited, namely textbooks provided from schools. So, it can be said that during the learning process it is still teacher center learning, while students are not yet active in the process of solving problems. In addition to conducting interviews with teachers, the researchers also conducted diagnostic tests on Saturday, February 25th, 2023 for grade X SMA Negeri 8 Medan with the material they had studied. This diagnostic test was conducted to determine students' initial mathematical problem-solving abilities. The diagnostic test given is in the form of a problem solving ability test which consists of 3 questions in the form of an essay. The following are the diagnostic tests given.

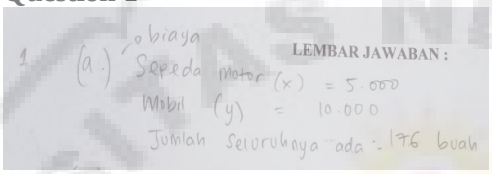
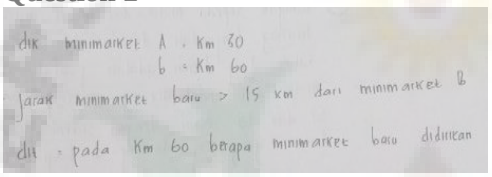
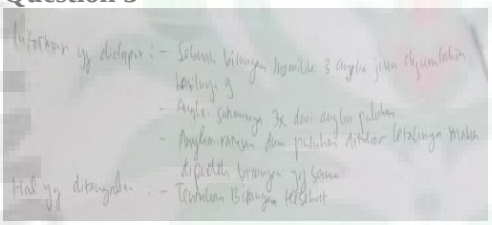
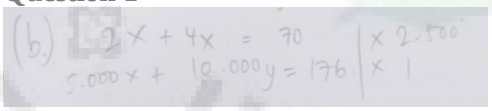
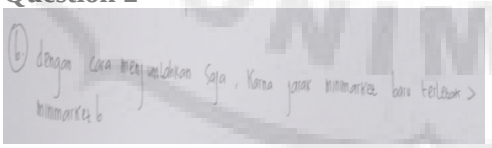
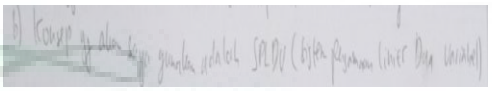
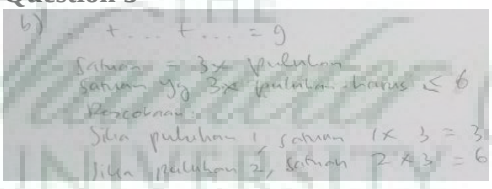
1. Mr. Ucok's parking lot at that time accommodated 70 vehicles consisting of 2-wheeled motorbikes and 4-wheeled cars. The total number of motorcycle and car wheels was 176. If the parking fee for a motorbike is Rp. 5,000.00 and a car is Rp. 10,000.00, how much did Mr. Ucok’s income at that time?

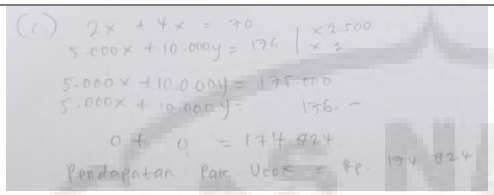
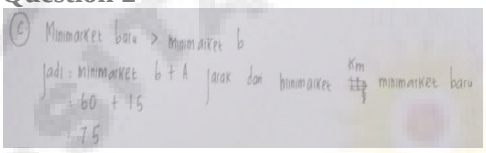
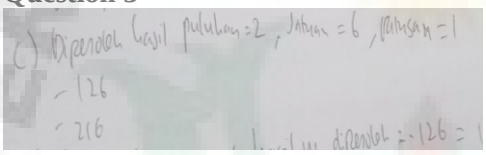
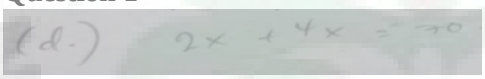
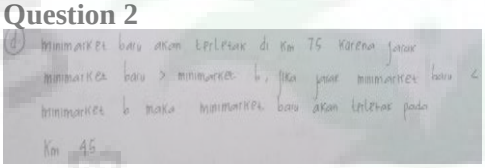
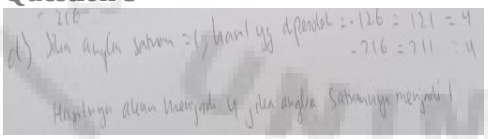
a. Write down what information you got and what was asked.
b. Let's say a motorcycle is x and a car is y. Set up a system of linear equations according to the problem above.
c. Solve the problem. Is the information provided sufficient to calculate Pak Ucok's income?
d. Check whether the number of motorcycles and cars respectively 44 and 26 is the solution to the problem? Explain!

2. A company has built minimarket A at the 30th kilometer of a road and minimarket B at the 60th kilometer of the same road. The company wants to build another minimarket on that road. If the company wants the new minimarket to be more than 15 km from minimarket B, at what kilometer will the new minimarket be built?
   a. Write down what information you got and what was asked.
   b. What is the solution plan that you will use to solve the problem? What concept will you use?
   c. Solve the problem.
   d. Can a new minimarket be built at the 45th kilometer or the 75th kilometer? Give your reasons.
3. A number consists of three digits that add up to 9. The units are three more than tens. If the hundreds and tens are swapped, the same number is obtained. Determine the number.
   a. Write down what information you got and what was asked.
   b. Create a mathematical model..
   c. Solve the problem.
   d. What if the units digit of the number is 1? What results were obtained? Give your reasons.

Some student mistakes in solving the above questions based on the stages of problem solving can be seen in Table 1.1

Table 1.1 Analysis of Student Errors in Solving Problems

No	Student Answers	Student Error Analysis
1.	Understanding The Problem **Question 1**  **Question 2**  **Question 3** 	Students have not been able to understand the problem in questions where the student does not write down the required information correctly. An example of an error in question 1 is that the student did not write down the information about the question completely and did not write down what was asked in the question. In questions 2 and 3, students did not understand the information provided so that it had an impact on making a settlement plan.
2.	Devising A Plan **Question 1**  **Question 2**   **Question 3** 	In the previous stage, students were not able to understand the problem, so students were wrong in preparing a settlement plan. Students have not been able to change the questions into mathematical models and determine what concepts will be used.
3.	Carrying Out The Plan **Question 1**	The process of completing student answers is not directed. Students use inappropriate solving steps because they use inappropriate formulas so that the solution is wrong.

	 **Question 2**  **Question 3** 	
4.	Looking Back **Question 1**  **Question 2**  **Question 3** 	Students do not try to re-check the completion of the problems that have been done even though the student's completion is not correct.

Based on the results of the diagnostic test given to 36 class X students who took the test at SMA Negeri 8 Medan, it was obtained a score of achievement of mathematical problem solving based on the level of students' abilities in several criteria, namely as many as 4 students were in high criteria, 6 students were in medium criteria, 11 students are in the criteria, and 15 other students are in very low criteria or as many as 91.66% of students do not complete. Based on the results of the diagnostic test, the percentage of students' ability to understand the problem reached 56.17% and belonged to the "moderate" category where students were not able to understand the problem as seen from students not writing down what was known and asked in the questions, the percentage of students' ability to plan solving strategies problems reached 36.57% and belonged to the "very low" category where students were not yet able to plan problem solving or write mathematical models,

the percentage of students' ability to solve problems reached 37.04% and belonged to the "very low" category where students were not able to solve problems based on the plan that has been made, the percentage of students' ability to interpret solutions/check back reaches 23.15% and belongs to the "very low" category where students do not re-check answers and provide conclusions or reasons for the answers given. The class average score obtained from 36 students on the diagnostic test was 39.91 on a scale of 0-100 with a completeness level of 8.33% (3 people) and 91.66% (33 people) who did not complete, KKM value ≥ 70. So, it can be concluded that the mathematical problem-solving ability of grade X students of SMA Negeri 8 Medan is low. The researcher identified several student weaknesses, namely students often had difficulty understanding questions, determining concepts and solving plans, and students were also not careful in doing calculations.

To anticipate this problem, a teacher must be able to choose the right learning model so that it can facilitate the needs of the process of teaching and learning activities that train students' mathematical problem-solving ability and can create a pleasant atmosphere and make students more active and more courageous in expressing their opinions, namely by using a problem-based learning model. Ngalimun (2017) says that Problem-Based Learning is an innovative learning model that can provide active learning conditions to students. PBL is a learning model that involves students solving a problem through the stages of the scientific method so that students can learn knowledge related to the problem and at the same time have the skills to solve problems. Problem-Based Learning can improve students' ability to solve mathematical problems. The research results of Panjaitan & Rajagukguk (2017) suggest that problem-based learning models can improve students' mathematical problem-solving ability. This learning model begins with presenting problems that can be raised by students or teachers, then students deepen their knowledge of what they already know, and what they need to know to solve these problems through investigation using a problem-solving approach. By implementing the Problem Based Learning model, it is hoped that it can improve students' mathematical problem-solving ability.

In addition to using the right learning model, mathematical problem-solving ability can be overcome by using effective learning media. In accordance with the times, learning mathematics in high schools has also experienced changes with the integration of technology and computers (ICT) in learning. The use of ICT media can help teachers in terms of conveying material that is abstract to be concrete. One of the software that can be developed as a media for learning mathematics is Geogebra. Geogebra was developed by Markus Hohenwarter in 2001 from Australia and released as open source software so it can be used for free and is free to develop. Nur'aini, et al (2017) stated that: "With Geogebra students can improve the experimental process, be problem oriented, and find mathematical concepts. Geogebra can solve problems such as drawing geometric objects easily and precisely. Geogebra can be used on computer or mobile media. Geogebra can be used to discover concepts in geometry, algebra, trigonometry, calculus or other concepts. Geogebra can help construct students' knowledge independently. This is because the tools in Geogebra are easy to use as a visualization and computing tool (Fatimah, et al, 2017).

Based on the background of the problems above, the author is interested in conducting research entitled **"The Implementation of Problem Based Learning Model Assisted by Geogebra Software to Improve Students' Mathematical Problem-Solving Ability in Grade X of SMA Negeri 8 Medan".**

1.2 Problem Identifications

Based on the background of the problems described above, the problem identification are as follows:

1. Mathematics is still considered a difficult subject for students.
2. Problem-solving ability of students is still low. An overview of the level of students' mathematical problem solving abilities was obtained with the following specifications: the percentage of students' ability to understand the problem reached 56.17% and belonged to the "medium" category where students were not able to understand the problem as seen from students not writing down what was known and asked in questions, the percentage of

students' ability to plan problem-solving strategies reached 36.57% and belonged to the "very low" category where students were not yet able to plan problem solving or write mathematical models, the percentage of students' ability to solve problems reached 37.04% and belonged to the "very high" category. low" where students have not been able to solve problems based on plans that have been made, and the percentage of students' ability to interpret solutions/check back reaches 23.15% and belongs to the "very low" category where students do not re-check answers and provide conclusions or reasons for answers which are given.

3. Students are not used to solving problems according to problem-solving procedures.
4. The learning model used by the teacher is less precise and less effective. The model applied is still teacher-centered. The learning model used is still limited to the lecture method and the teacher has never applied a problem-based learning model so that students become passive during the learning process.

1.3 Scope

The scope of this research focuses on improving students' problem-solving ability by applying the Problem Based Learning model assisted by Geogebra Software. This research is classroom action research which is characterized by the existence of research stages in the form of cycles that are carried out with the aim of improving students' ability in solving students' mathematical problems through the implementation of Problem Based Learning models. The subjects of this research are students of grade X IPA 3 at SMA Negeri 8 Medan. The data used by researchers are primary data obtained directly and collected by researchers from data sources obtained. Other psychological states of the research subjects are not the focus of this research.

1.4 Problem Limitation

Based on the problems that have been described, the researcher needs to provide limits to the problems to be studied so that this research is more focused and directed. The problems studied in this research are limited to the

implementation of problem based learning model assisted by geogebra software to improve students' mathematical problem-solving ability in grade X of SMA Negeri 8 Medan.

1.5 Problem Formulations

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

1. How is the improvement of problem-solving ability of class X students at SMA Negeri 8 Medan after using problem based learning model assisted by Geogebra?
2. How is the classical completeness of class X students at SMA Negeri 8 Medan through the problem based learning model assisted by Geogebra on problem-solving ability?

1.6 Research Objectives

Based on the formulation of the problem above, the objectives of this study are as follows:

1. To find out the improvement of problem-solving ability of class X students at SMA Negeri 8 Medan after using problem based learning model assisted by Geogebra.
2. To find out the classical completeness of class X students at SMA Negeri 8 Medan through the problem based learning model assisted by Geogebra on problem-solving ability.

1.7 Research Benefits

Based on the above objectives, the expected research results will provide the following benefits:

1. For students, as information material to determine appropriate learning methods in studying mathematics and it is hoped that problem-based learning models can assist students in improving students' mathematical problem-solving ability through the multiplication of Problem Based Learning models.
2. For mathematic teachers, as an alternative to doing variations in teaching by

using the Problem Based Learning learning model and providing input in carrying out the learning process so that the quality of learning is better.

3. For the school, as input material to school managers in the context of improving learning models and improving the quality of education.
4. For researcher, as information material as well as a provision for researchers as prospective mathematics teachers in carrying out teaching practices in real formal institutions.
5. For other researchers, this research can be used as material for consideration by researchers and readers who are interested in studying more deeply the application of the Problem Based Learning learning model.