CHAPTER I
PRELIMINARY

1.1 Background of the Problem

The 21st century is a digital era marked by the rapid development of technology and information. The development of technology and information affects all aspects of life, including education. The world of education requires information or knowledge insight that aims to gain broader knowledge in the fields of science, social, computer and other fields. It is hoped that the field of education can also keep up with developments in the 21st century. One alternative for the educational process to synergize with technological developments in the 21st century is learning that prioritizes scientific analysis skills followed by the ability to use today's technology.

Learning in the 21st century is different from learning in the past. To adapt to the globalization era marked by developments in the field of technology, teachers should support technology-based education to expand the power of education and develop the potential of teachers, students and schools. In realizing this, teachers are required to provide a strong response to this technology. Because indirectly the 21st century teaching profession focuses on a broad field. Where educators focus on the use of technology in the learning process (Agustina, Sahidu, & Gunada, 2020).

In this case the teacher plays an important role in guiding and directing the potential of students so that they become better at channeling their porence. In an effort to improve the quality and quality of education the role of the teacher is very important. Teachers have responsibility for the implementation of the teaching and learning process and create a good and comfortable learning atmosphere for teachers and students. The success of the process of teaching and learning activities in physics learning can be measured from the success of students who can participate in these learning activities.

The teacher hopes that in the learning process in class students can absorb the subject matter well, this is indicated by student learning outcomes. To get the expected learning outcomes, it must be supported by quality learning materials, learning models, evaluation systems, supporting facilities and administrative systems that can make a maximum contribution to the learning process (Lovisia, 2018).

There are many factors that influence students' low learning outcomes regarding physics concepts, including the learning methods applied by teachers not scientific inquiry in accordance with Permendiknas Number 22 of 2006. Teachers tend to apply conventional learning methods where learning is teacher-centered. Efforts that can be

made to improve the quality of learning is through the selection of innovative learning models, which can help students achieve learning objectives (Rizal & Danial, 2014).

In classroom learning, teachers often carry out demonstrations due to the limited tools available in the laboratory so that in practice students are not directly involved which results in students tending to be passive. While in essence physics is a learning based on experimental observation for that, the appropriate learning is using the experimental method. Sinardi argued that in order to give greater emphasis on aspects of the learning process, students need to be given science skills such as observing, classifying, measuring, communicating, interpreting data, and experimenting gradually according to the level of students' thinking skills and materials that are in accordance with the learning curriculum (Rizal & Danial, 2014).

In achieving the objectives of learning physics, the existence of a laboratory is very influential in the learning process. Laboratory activities are important things to do in physics learning, because through laboratory activities aspects of products, processes and attitudes of students can be further developed. This is reinforced by the results of interviews with teachers in the field of physics studies, and several students at SMAN 2 Medan that limited tools are also the thing that underlies students' lack of activity when learning is carried out in the laboratory. Students will be more active if learning is carried out in the laboratory supported by the availability of the tools and materials needed.

Laboratory activities are important things to do in physics learning, because through laboratory activities aspects of products, processes and attitudes of students can be further developed. Students will be more interested if the media delivered can be interactive with them. Designing a virtual-based learning must be prepared carefully, which invites active and constructive involvement of students in the learning process of media. Based on the description above, it is clear that the purpose of learning physics at the SMA/MA level is as a vehicle for developing students' critical thinking skills (Junaidi, Gani, & Mursal, 2016).

Practicum activities can not only be done through real laboratories, but also through virtual laboratories so that it will make it easier for students to improve critical thinking skills. One of the virtual laboratory media that can be utilized in practical learning is PhET media.

PhET (Physics Education Technology) is an example of learning media in the form of a simulation developed by the University of Colorado, there are theoretical and experimental simulations that actively involve users. Users can manipulate the activities related to the experiment. Besides being able to build concepts, PhET can also be used to

improve student learning outcomes. The use of PhET media can improve student learning outcomes because by using PhET media the formation of concepts in students becomes strong and durable (Ekawati & Yuniar, 2017).

PhET simulations are user-friendly simulations. PhET simulations are moving images (animated), interactive and made like a game where students can learn by exploring. These simulations emphasize the correspondence between real phenomena and computer simulations and then present them in physical conceptual models that are easy for students to understand (Jauhari, Hikmawati, & Wahyudi, 2016).

PhET is considered to be highly effective in lectures, in class activities, practicums and homework. They are designed with minimal text so they can be easily integrated into every aspect of the course. So that the selection of PhET media is considered suitable to be able to improve learning outcomes and critical thinking ability in students (Nur, Saputra, & Purnomo, 2017).

Facts in the field were found based on the results of initial observations at SMAN 2 Medan, through questionnaires distributed to 36 students and direct interviews with physics teachers at SMAN 2 Medan, information was obtained that the minimum completeness criteria (KKM) in class XI SMA Negeri 2 Medan is 75, and the student achievement score when carrying out daily tests is still quite low. Beside that, the physics learning process was still teacher-centered with conventional methods. The use of learning media that can make it easier for teachers and students is still underutilized, while schools have used an independent curriculum, but the facts on the ground are that learning is still conventional so that it makes students less able to maximize students' learning outcomes in learning. As a result, students are less able to understand, apply and analyze physics material both in everyday life and in solving problems in teaching materials so that it triggers low student learning outcomes in physics subjects.In this case the learning process of students only takes notes, listens to explanations from the teacher and works on problems, resulting in students becoming passive thereby affecting the low learning outcomes in students. In addition, the information obtained by researchers is that students' learning outcomes in learning physics at SMA N 2 Medan are still relatively low. This can be seen from the questions given by the teacher, students have not been able to solve the problems given by the teacher properly.

This conditions happened due to several factors, such as there are still many students who have the perception that physics is a subject that is difficult to understand. The low ability of students' learning outcome can be seen from the lack of activity of students in the

learning process, the inability of students to make correct conclusions from the results of investigating the problems studied, and the lack of understanding of students in the material being studied. This can be seen from the number of students who are still confused in working on the questions given and there are even some students who do not submit assignments. Efforts to make students' physics critical thinking skills develop better, one of the ways is to develop a learning model towards a better, effective, conducive, fun or different from what is usually done in these schools, namely conventional learning where learning activities are still dominated by the role of the educator (Sukarno, Kafrita, Hasanah, & Farisi, 2022).

One learning model that can be applied to improve students' critical thinking skills for the better is the guided inquiry learning model. This is because guided inquiry learning is in accordance with the characteristics of science learning which emphasizes the process of discovery (inquiry) of a concept so that a scientific attitude emerges and students can solve the problems they face well. Students generally have curiosity when discovering new things. This curiosity can be used for knowledge in students. Inquiry-based learning is more effective in increasing understanding of physics content. Guided inquiry learning is also considered to be able to attract students' interest to be active during the learning process. The inquiry learning model is expected to help students more easily understand physics concepts and can improve students' learning outcomes (Pahriah, 2016). Therefore in the learning process, teachers are required to be able to create fun learning situations, be able to encourage motivation and interest in learning students, so that from these demands the researcher intends to carry out learning using the guided inquiry learning model assisted by PhET media through research entitled **The Effect of Guided Inquiry Model Assisted by the PhET Media on Students' Learning Outcomes.**

1.2 Problem Identification

Based on the description of the background above, there are several problems that can be identified, including :

1. The ongoing physics learning process is still centered on the teacher so students are less active.
2. Conventional physics learning.
3. Lack of student involvement in learning.
4. Limited physics laboratory to support learning.
5. Students' learning outcomes are low in physics learning.

1.3 Scope of the Problem

The scope of the problems discussed in this study is the Effect of the Guided Inquiry Learning Model Assisted PhET Media, Students' Learning Outcomes and Mechanical Wave Material

1.4 Limitation of the Problem

The limitation of this research to :

1. The learning model used is guided inquiry with learning steps which include: (1) orientation; (2) formulate the problem; (3) formulate hypotheses; (4) collect data; (5) testing the hypothesis; (6) formulate conclusions.
2. The media used is PhET.
3. Learning outcomes that are measured are cognitive domains.
4. The physics material studied is mechanical wave material.

1.5 Problem Formulation

Based on the limitations of the problem above, the formulation of the problem in the research process is:

1. How the learning outcomes of students who are given treatment using the PhET-assisted guided inquiry learning model on the subject matter of Mechanical Waves in class XI SMA Negeri 2 Medan?
2. How the learning outcomes of students who are given treatment using conventional learning models on the subject matter of Mechanical Waves in class XI SMA Negeri 2 Medan?
3. Is there any influence of the PhET – assisted guided inquiry learning model on student learning outcomes?

1.6 Research Objectives

The research objectives in this research are :

1. Knowing the learning outcomes of students who are given treatment using the PhET-assisted guided inquiry learning model on the subject matter of Mechanical Waves in class XI SMA Negeri 2 Medan.
2. Knowing the learning outcomes of students who are given treatment using conventional learning models on the subject matter of Mechanical Waves in class XI SMA Negeri 2 Medan

3. Knowing the effect of the PhET- assisted guided inquiry learning model on student learning outcomes in the subject matter of Mechanical Waves in class XI SMA Negeri 2 Medan.

1.7 Research Benefits

The uses of this research are:

1. It is hoped that this PhET can be used by teachers as an alternative in order to develop students' learning outcomes in the material being taught.
2. It is expected to improve students' learning outcomes, interest, motivation, and students' understanding related to the concept of mechanical waves.
3. It is hoped that this research can provide experience to researchers as prospective educators in applying simulation media to improve students' learning outcomes.
4. As a consideration for future researchers.