

## CHAPTER I

### INTRODUCTION

#### 1.1 Background

One of the scientific disciplines that deals with goods and procedures is physics. Physics is the product of human endeavors in the form of organized knowledge, ideas, and conceptions about the natural world that are gathered through a number of experiences and the scientific method. Physics discusses physical concepts and physical laws as products and makes observations, experiments and investigations as a process. According to (Rokhmawati et al., 2016), physics is important to learn to make it easier for humans to follow technological developments because technological advances are often based on physics. Physics also trains students to have problem solving skills. Students need these skills to help individuals in dealing with every change and adjustment in life.

Problem solving skills are a person's skills to find solutions through a process that involves obtaining and organizing information. Problem solving involves finding feasible ways to achieve goals (Phumeechanya & Wannapiroon, 2013). Problem solving is able to help understand, apply and analyze physics skills based on curiosity about phenomena. Problem solving is also needed to process, reason and present in the concrete and abstract domains related to the development of physics that students learn.

The reality in the field, the problems faced in the physics learning process is one of them is still low problem solving ability. Based on initial observations made in class XI SMA N 1 Merbau by giving a questionnaire, many students are not interested in learning physics so that there is no student motivation in the learning process which also has an impact on students' problem solving skills. This is also supported by the results of interviews with teachers who say that students' problem solving skills are still low. In addition, in the interview the teacher also explained this problem was caused in the learning process, the teacher rarely exposes students to physics problems that often occur and are experienced in everyday life, so students think that physics is not interesting and difficult to learn.

The low level of students' thinking skills is also caused by the learning process

Carried out by the teacher is conventional, where the center of the learning process is which results in students feeling bored during the learning process. So that students look passive in doing learning, tend to only listen and do questions without expressing their opinions. In this case there is no encouragement or motivation of students in the learning process so that students also get bored quickly and tend to be sleepy.

This is supported by (Supiandi & Julung, 2016), the factors that cause low problem solving skills are: 1) the learning process at school still uses conventional learning so that it is less able to develop student potential in the form of thinking skills including problem solving skills, 2) students who tend to be passive and teachers who only provide information and learning models that are still inappropriate in the learning process, 3) other problems exist in the learning process, namely in delivering material that is still theoretical. Physics learning should use facts or real problems in everyday life.

Supporting factors in the field are also the lack of student interest in learning physics due to the absence or low motivation of students in learning physics. Educational progress cannot be separated from student learning motivation. Learning is the process of changing behavior. This means that a person learns to be able to do something he has never done before. In the classroom, the accurate use of learning media by teachers not only stimulates student learning processes and outcomes, but also student motivation and interest in the content being taught. (Sanjaya, 2008) states that motivation is an important aspect in student learning. Without motivation, students cannot be motivated to learn.

States that all behavior, including learning, is driven by one or more motives (Sudjana, 2007). Motivation or what is commonly referred to as drive or need is a force within a person or student that encourages him or her to take action to achieve a goal. A person's drive or motivation is so great that he or she can do something without external motivation. For other people and students, this driving force is so weak that it requires external motivation - from teachers, parents, friends, books, etc.

In addition, problem-solving ability can help students to navigate through problems in the real world, where problem-solving and problem formulation are essential skills. Therefore, effective physics education should pay special attention to the development of students' problem-solving ability. He also stated that teaching

students how to solve problems facilitates the development of an analytical approach to problem solving in life. This is a reference that students are required to have problem-solving skills to improve their quality of learning.

There are several things that can increase students' ability in problem solving, one of which is student learning motivation as a strong support to influence their ability to solve problems. Learning motivation is an essential component in higher education, encouraging students to be actively involved and independent in learning. With high motivation, students are more persistent and focused in facing academic challenges, seeing learning as an opportunity for personal and professional growth. It encourages initiative and curiosity, triggering students to explore beyond class material through independent research. This motivation makes students set high standards for themselves, use resources effectively, and persevere against failure. The importance of this motivation increases in educational contexts requiring critical thinking, collaboration, and lifelong learning, all of which require strong motivation for maximum academic success.

Absence of motivation can lead to students' lack of enthusiasm in the learning process. Individuals who have a strong learning drive tend to be more driven to overcome obstacles in problems, understand complex concepts, and strengthen capacity in handling problems. On the other hand, when a student has a low learning drive, it can result in difficulty in understanding the material and a reduced tendency to improve problem-solving skills. Findings from the research of Azizah Tri Rahmah, Aniswita Aniswita, and Haida Fitri (2020) revealed that student learning motivation has a significant effect on students' ability to overcome difficulties in the 2018/2019 school year.

The effect of this inspiration is around 48.78%. In line with that, research conducted by Dian Endang Lestari, Amrullah, Nani Kurniati, and Syahrul Azmi (2022) revealed that learning motivation has a significant influence on the ability to solve math problems, with a magnitude of about 0.598. Problem solving ability is the capacity that students have to overcome problems and apply solutions in everyday situations (Suryani & Jufri, 2020). Motivation is defined as an effort that can bring a

person or group of people to do something they want, whether it is to achieve their desired goals or get satisfaction from what they do. So, motivation is a process within oneself that activates, directs, and maintains certain behaviors within a certain period of time (Lomu, 2018).

One solution to overcome the above problems is to use a learning model that can attract students to want to learn physics which will trigger students to understand physics concepts and can develop problem solving skills that will also result in student learning outcomes. The model must also be adapted to the learning objectives and learning materials to be taught. The learning model that can be applied is a collaborative learning model. The use of collaborative learning models is based on the problems of students who need more encouragement in order to learn physics in accordance with the expectations of the curriculum that continues to grow. Researchers offer collaborative learning models or different learning styles. In this case, motivation is used as a reference that has existed from the beginning. motivation that has been distinguished from the beginning, namely students with high motivation and students with low motivation, will be treated with the same learning model to see if there is an effect on problem solving ability.

Cooperative learning involves group collaboration by assigning tasks and responsibilities to each student in the group to achieve a common goal. In addition, the author also suggests that this learning model in its implementation is technology-based, so that there is a balance between learning and technology that is increasingly advanced. In the era of digitalization, education and technology are inseparable and interdependent. Technology has great potential to change the way we think about teaching and learning (Suryani, 2016). In fact, integrating technology into education is necessary, especially when using technology as a tool to enhance student learning, improve students' understanding of the material, and develop students' higher-order thinking skills (Akturk & Ozturk, 2019).

Based on the results of preliminary observations at SMA N 1 Merbau, several problems were identified in the implementation of classroom learning, among others, the learning process was dominated by the teacher using the lecture method, students

were less active, physics lessons were difficult to understand and boring and the low average score of students' daily exams. Therefore, based on the explanation above, the researcher is interested in raising the research title **“The Effect of TPACK-based Differentiated Collaborative Learning Model to in Crease Motivation and Physisc Problem Solving Ability at SMA N 1 Merbau”**.

## **1.2 Identify the Problem**

Based on the background description above, the authors identify the following problems:

1. Students think physics is a difficult subject.
2. Lack of student motivation to learn physics.
3. Problem solving skills in students are still low.
4. The learning model used in learning is not appropriate.
5. Students are less able to work on problems if they vary in difficulty.
6. Students lack confidence in their abilities.

## **1.3 Scope**

Given the broad scope of the problem as well as the limited ability and time. So this research has the following scope:

1. This research will be conducted at SMA N 1 Merbau. The population of this research is class XI students.
2. This research applies the TPACK-based Differentiated Collaborative learning model.
3. This research is oriented to increase the motivation and influence of students' problem solving.

## **1.4 Problem Limitation**

In order for this research to be more focused and not too broad, this writing is limited to the problems to be studied in order to be carried out. The problem restrictions on the research are as follows:

1. To determine the problem-solving ability of students, in this study, researchers used a TPACK-based differentiated collaborative learning model.
2. Physics material in this study is limited to the material wave.

3. The subjects in this study were students of class XI SMA N 1 Merbau T.A 2024/2025.

### **1.5 Problem Statement**

Based on the background that has been described above, the problem formulations in this study are:

1. How is the difference in problem solving ability of physics students with using differentiated collaborative learning model based on TPACK and student on Conventional learning in SMA N 1 Merbau?
2. How is the difference in problem solving ability of physics students who have high motivation and student who have low motivation in class XI SMA N 1 Merbau?
3. How is the interaction of TPACK based differentiated collaborative learning model and student motivation on student problem solving ability on the subject matter of wave in class XI SMA N 1 Merbau?

### **1.6 Research Objectives**

The objectives of this research are:

1. To ascertain whether varied collaborative learning approaches have a substantial impact on raising student motivation for learning.
2. To ascertain whether the differentiated collaborative learning paradigm significantly affects the capacity for problem-solving
3. To ascertain the learning activities using tpack.

### **1.7 Benefits of Research**

Based on the description above, the benefits obtained in this study are as follows:

1. Theoretical benefits

In general, the research is expected to theoretically contribute to physics learning, especially to increase students' learning motivation and problem solving ability through differentiated collaborative learning models.

## 2. Practical Benefits

- For schools, as a consideration in order to improve learning to improve the quality of education.
- For teachers, as information and also one of the alternative learning models at SMA N 1 Merbau to increase student learning motivation and problem solving skills.
- For researchers, as a contribution to the world of education and as an input for researchers in adding insight into knowledge in choosing the right learning model and one of the requirements for completing lectures at Medan State University.
- For students, it is expected to be more motivated and able to master problem solving skills through the track based differentiated collaborative learning model.