

# CHAPTER I

## INTRODUCTION

### 1.1 Background

In order to develop a sustainable quality that is targeted at the realization of the human figure for the future, and is anchored in the country's cultural values and Pancasila, Sujana (2019) claims that education is a continual and never-ending process. The nation's philosophical and cultural ideals must be fully and thoroughly cultivated through education. Since a deeper understanding of education is required, it is beginning to be examined philosophically, which relates to clarity on the fundamentals of education itself. Education, of course, does not only prioritize cultivation, but also the cultivation of the national character in question, which has also been regulated in the Indonesian state law. This is done to provide direction for implementation and development.

The Covid-19 pandemic has taken many things and then formed a new order of things. This pandemic is also like giving a new path to a new transformation in life. (Wekke & Saleh, 2020). All things are required to be able to transform and adapt to new habits and new living arrangements. Not only has an impact on life in general, but also has an impact on education.

On March 24, 2020, the Ministry of Education and Culture of the Republic of Indonesia issued Circular No. 4 of 2020 on the implementation of educational policies in the emergency situation caused by the spread of the novel coronavirus. The circular explains that the entire learning process, originally conducted face-to-face in schools, will shift to learning that takes place at home through online learning or online learning (Dewi, 2020). According to the Law of the Republic of Indonesia on the National Education System Year 20, 2003, learning is the process of interaction between students and educators and learning resources that takes place in a learning environment. But now it can't be done face to face anymore. Schools are also the center of interaction between teachers and students in improving knowledge, skills and inculcation of attitudes and character, also can no longer be felt by students and

teachers because of the sudden pandemic that forced schools to close temporarily and all policies recommending work, school and activities from home.

The purpose of this policy is to save students from virus threats, but it also has several implications, especially for students, teachers and parents. The students themselves feel that they are forced to study at home, where in reality there are not enough opportunities for that, which makes learning difficult, which should be before the start of the studies, above all, support tools must be at hand. Next is the process of learning adaptation, where students who previously sought interaction in direct learning need different learning adaptations and understand network model learning, so the given policy can stop students' learning understanding. The transition from face-to-face to online learning has an indirect impact on student learning (Dewi, 2020). Therefore, students must use different learning experiences to make online learning more flexible (Zapalska and Brozik, 2006).

In 2022 the Ministry of Education and Culture of the Republic of Indonesia again issued Circular Letter No. 2 of 2022 concerning the implementation of learning, namely Limited Face-to-face Learning (PTMT) of 50%. In practice, this limited face-to-face learning makes physics learning in schools less than optimal. The limited time that exists makes the interaction of students and teachers in the classroom limited and all the material to be taught by the teacher cannot optimally be conveyed to students during teaching. In addition, teachers are required to be more creative and innovative in packaging learning by utilizing technology. Because the implementation of PTMT makes teachers and students have to be able to learn and teach even if they don't meet face to face in the next time.

Based on the results of observations through PLP II teaching experience in class XI SMAN 10 Medan on the subject of temperature and heat, it can be seen that: (1) Students' mastery of the concepts in the material being taught is weak, (2) the tasks given are not completed on time, (3) The learning process does not attract the attention of students, (4) Lack of activeness and interest of students in the physics learning process, (5) Lack of students' critical and creative thinking skills in solving problems in the material provided.

Learning is essentially a process of interaction and communication between teachers and students (E Mulyasa, 2007). The learning process plays an important role

in supporting student learning outcomes and goals, so the quality of the learning process really needs to be considered. There are many factors that can affect the quality of the learning process both internally and externally. One of the factors that affect the quality of learning is the availability of adequate teaching materials. The availability of sufficient study material is very important for students. Teaching materials that meet the requirements of the curriculum and the needs of students help create effective communication between teachers and students, so that learning is more interactive. In addition, the availability of sufficient learning materials can support students' independence in learning. One of the teaching materials often used in learning is textbooks. However, although they can be found easily, textbooks have not fully supported students' understanding of the material being studied. Textbooks only focus on presenting material so that they ignore the motivations and activities of the users. Textbooks also cause students to be less motivated to learn independently, meaning that the existence of textbooks is not able to increase children's motivation to learn. This has an impact on the low student learning outcomes. So here it is still necessary to develop an interesting module in order to increase student learning outcomes (Rahmi, 2014).

According to Taufik (2017) The development of science and technology that is increasingly rapidly in the present and where the current era is increasingly modern is very real. It can be seen from the advanced technologies that help us in various aspects of life. The up-to-date technology that we have in helping our daily lives indicates that it cannot be separated from the development of human abilities in the field of science. This is the reason for the need for the development of learning activities that can include science, technology, engineering and mathematics which is commonly abbreviated as STEM. STEM education currently plays an important role in modern education for the country to stay abreast of the competition in the global economy. With the application of STEM education can develop students' scientific thinking processes towards problems that must be solved, STEM is also good for children's development in the future. Students will be trained to think logically, creatively, and disciplinedly. This is what makes the e-module used is expected to increase student motivation and be easier to understand. Entering the digital era, learning modules that used to be print-based innovate into digital forms (e-modules) which are more practical

for students to use for independent study through the help of communication tools they have anywhere and anytime.

Based on the results of a survey at SMA Negeri 10 Medan through student questionnaires, it was found that 74,3 % students experienced of the physics learning process was still less attractive, because most students considered physics to be a difficult subject and also the methods used by teachers still used conventional methods such as lectures, question and answer and discussion. Plus, since the COVID-19 pandemic that hit the country, students had to adapt to new conditions and made students' enthusiasm in learning physics decrease. Teachers also use limited teaching materials, namely textbooks and worksheets given from schools, apart from that teachers do not have other sources or teaching materials to support learning. The teacher occasionally provides material in the form of handouts or a summary of the material in PDF form when online learning takes place. Students' interest in learning has also decreased since online learning was implemented, students rarely ask questions and are less active in class because distance learning makes students and teachers only able to connect through Google Classroom or WhatApps Groups and build virtual communication through the application so there is not much direct interaction between teachers and students which makes it difficult for teachers to monitor student progress. The assignments given by the teacher are also not done by most of the students. This makes it difficult for teachers to know the level of students' understanding of the material that has been delivered.

In online learning, assistance from communication tools is needed to support the online learning process. So through the questionnaire distributed, it is known that most of the students in the school have a communication tool in the form of a cellphone. There are also those who have mobile phones, laptops and computers. In the use and utilization of these communication tools, 97,1 % students use more of communication tools for entertainment purposes (social media). There are 2,9% students who use their communication tools to help them understand the material and do physics assignments, especially on temperature and heat material and also look for related information to increase knowledge and learning. Material temperature and heat are physical materials that we often see in everyday life. Its application is also easy to get in everyday life. Through the questionnaire distributed, 62,9 % students found it

difficult to understand the temperature and heat material so that in this study, the temperature and heat material was chosen in the development of this e-module based on STEM in the hope that it would be a solution to the problems experienced by students in learning physics and help students to understand the material temperature and heat and can apply it in their daily lives.

Based on interviews with physics subject teachers, information was obtained that the availability of variations in the teaching materials used was still very small. Even for e-modules or the modules themselves are rarely used when studying, schools still only provide physics textbooks as a guide and source for learning physics at school. Meanwhile, in the era of Industrial Revolution 4.0, the responsibility to create intelligent, responsible and adaptable people lies mainly in the education of science learning (Arnyana, 2018). It is believed that mastering the basics of science and mathematics also belongs to every individual living in the 21st century. Mastery of the fundamentals of science and mathematics can be obtained through STEM education (Science, Technology, Engineering and Mathematics). STEM education is a global movement in the field of education that combines different integration models to develop the quality of human resources according to the skill requirements of the 21st century. Learning based on STEM is a form of learning that is compatible with the applicable curriculum system in Indonesia (Rustaman, 2016).

The development of the e-module based on STEM was carried out based on the shortcomings of the previous e-module based on STEM. The developed e-module based on STEM is expected to: increase the interactivity of the STEM e-module and students so that it can be seen the level of students' abilities when studying independently, the resulting STEM e-module can help students to train and improve critical thinking skills by providing practice and evaluation questions along with answer keys with indicators of critical thinking skills, providing appropriate e-module based on STEM needed by teachers and students so as to improve students' critical thinking skills. These characteristics are expected to be added value so that the resulting STEM e-module is feasible, practical, and effective. STEM focuses on problem-solving activities that are encountered in real terms so that students practice finding innovative solutions. The use of STEM in educational activities in the form of educational materials, in the form of modules, can have a good effect. These effects include the ability to improve

students' reasoning, improve creative thinking and improve students' conceptual understanding and critical thinking, present information in an interesting and believable way, facilitate information interpretation and summarize information to improve understanding of basic concepts (Lestari et al. al., 2018). One of the characteristics of a module that provides corrective feedback will be successful in helping students with learning difficulties, because students will know the reasons for the incorrect answers completely (Tazkiyah et al., 2020).

Based on the description of the problems above, the researchers are interested in conducting research "The Development of E-Module based on STEM in Temperature and Heat Materials".

### **1.2 Identification of Problems**

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

1. Physics learning teaching materials used in the classroom are less varied.
2. The physics module based STEM approach has not yet been developed.
3. The unavailability of teaching materials that use a STEM approach according to the 2013 curriculum.
4. In online learning, students need online teaching materials that are arranged according to the material at school in order to understand the concept of the material being studied.
5. Lack of student interest in online learning.
6. Lack of student interest in independent learning which causes low learning outcomes.

### **1.3 Scope of Problem**

So that the research does not deviate from the research objectives, the problem is limited, including:

1. The material discussed in the e-module is the material of temperature and heat in class XI.
2. The developed e-module is based on STEM.
3. The research uses a 4-D model which includes the stages of define, design, develop, and disseminate.



4. The developed e-module will be validated by material experts, media experts, physics teacher responses and student responses.

#### **1.4 Formulation of the Problem**

Based on the background, the formulation of the problems in this study are:

1. How is the validity level of e-module based on STEM in temperature and heat materials?
2. How is the practicality level of e-module based on STEM in temperature and heat materials?
3. How is the effectiveness of e-module based on STEM in temperature and heat material in improving student learning outcomes?

#### **1.5 Research Purposes**

1. To find out the validity level of e-module based on STEM in temperature and heat materials
2. To find out the practicality of e-module based on STEM in temperature and heat materials
3. To find out the effectiveness of e-module based on STEM in temperature and heat material on student learning outcomes

#### **1.6 Benefits of Research**

The development of electronic modules based on STEM (Science, Technology, Engineering, and Mathematics) in physics learning can provide the following benefits:

##### **1.6.1 Theoretical Benefits**

1. The results of this study are expected to be used as a reference for students in research and development of further learning resources for physics.
2. Can enrich insight and knowledge, especially innovation in physics learning resources.

##### **1.6.2 Practical Benefits**

1. For teachers
  - a) This research is expected to be able to increase knowledge and provide information about the development of electronic modules based on the

STEM approach and can be used as an alternative for teachers in choosing teaching materials that can improve students' thinking skills.

- b) With this e-module, it can facilitate the work of educators in preparing teaching materials for the teaching and learning process.
  - c) Learning facilities are the choice of educators to increase student enthusiasm in learning.
2. For students
    - a) The results of this study are expected to be used as a source of learning for students so that they are more motivated and interested in participating in the process of teaching and learning physics, especially in temperature and heat materials.
    - b) Provide a different learning experience and a pleasant learning atmosphere so that it is expected to improve students' thinking skills.
    - c) Improving students' independent learning abilities in studying temperature and heat material using STEM-based e-modules so that they can improve student learning outcomes
  3. For School

This research is expected to provide input and contribution of ideas for schools for their teachers in an effort to improve the quality of the learning process in schools.
  4. For Researchers
    - a) The results of this study can be used as a reference for further research in developing teaching materials such as electronic physics modules based on the STEM approach to improve other skills.
    - b) As an additional scientific insight to design an innovative learning resource that is integrated with the STEM approach and is relevant to the development of the world of science and technology.



### 1.7 Operational Definition

In order to avoid mistakes in the use of the terms contained in this proposal, the authors need to provide an explanation of these terms, including:

1. According to Trianto (2011) research and development is a method or research strategy that can be used to improve education. Research and development is the process of developing a new product or improving an existing product so that it can be accounted for. The product to be made in this research is a STEM-based electronic module for temperature and heat materials.
2. According to Wijayanto (2017), an electronic module, also known as an e-module, is a presentation of data in the form of a book that is electronically delivered on a hard drive, floppy disk, CD, or flash drive and may be read using a computer or electronic book reader.
3. The STEM (Science, Technology, Engineering, Mathematics) learning approach is learning that combines several fields, namely science, technology, engineering (ideas engineering) and mathematics into a single unit (Farah, 2017).

