

CHAPTER I

INTRODUCTION

1.1. Background

The purpose of learning science is so that students can have mastery of concepts, process skills, and attitudes, this applies universally. Learning activities must be designed or selected so that they can relate to students' daily needs and experiences, to foster curiosity by actively involving them in learning and trying to solve problems that occur in real life (Komyadi and Derlina, 2015). Learning is a form of interaction between the individual and the environment that will give the experience of the real situation. This interaction leads to a series of learning experiences. Learning will provide a powerful learning experience. Powerful learning experience will make it possible to improve the interpersonal, intrapersonal and knowledge-related competencies. (Utami et al, 2016)

In accordance with Permendikbud No. 36 of 2018 concerning the Curriculum in Senior High Schools, physics is part of the specialization subject in Mathematics and Natural Sciences. The objectives of learning physics include fostering scientific attitudes, scientific thinking, and scientific communication of students. In essence, the purpose of learning physics is to lead students to develop experiences to be able to formulate problems. Students can master the concepts of physics and their relationship and be able to use scientific methods based on scientific attitudes to solve related problems in everyday life. Physics must make students not only knowing and memorizing about physics concepts but must make students to understand and understand these concepts, and connect the relationship of a concept with other concepts. (Kulsum and Nugroho. 2014)

The problem faced by the world of education today is the low quality of graduates with high quality Megawanti (2012). This can be seen from the low average student achievement in each subject, one of which is physics. Based on research from Gunawan and Siregar (2016), students' daily learning outcomes are still low, students only get test results with an average below the Minimum Completeness Criteria (KKM) that have been set at school, namely 70,

this is because in the process teacher learning often uses the lecture method and occasionally uses the discussion method. Through the distribution of questionnaires it was also known that students were less interested in learning physics itself, so that their ability to understand and apply physics concepts was lacking. The learning that is conveyed is very monotonous, most students in solving a problem only memorize the formula so that the formula in the book is immediately absorbed without being analyzed first and the physical meaning of the physics equation is not conveyed. According to Wahyuni et al. (2019), in general teachers still teach conventionally by explaining concepts, then working on relevant questions. Students' interest in physics learning emerges when the material studied is directly related to its application. Students expect not only to be required to memorize material and solve mathematical problems but are given the opportunity to conduct experimental activities so that learning is more meaningful.

The finding concept process that involves basic skills through scientific experiments can be implemented and improved through practicum activities in the laboratory. Physics is a subject that must be balanced between theory and experiment. Experimental activities are one of the learning activities that support students' understanding of the theories and concepts obtained (Prastowo. 2011). Experimental activities aim to give students the opportunity to test and apply theories using laboratory facilities or outside the laboratory. Physics is the base one of technology development. The study in physics requires a learning activity that provided opportunities for students to discover and apply the knowledge they obtain. Efforts to cultivate the skills of students can be done through practicum-based learning in the laboratory. Learning laboratory activities can train students' way of thinking and way of working. In laboratory activities, students are actively involved in the processes of observing the object, analyzing, proofing and concluding by themselves about the object or some processes. (Bakri et al. 2020).

In general, experimental activities in schools are still in the form of conventional activities such as testing theory. While in the 21st century, education is designed for students to master technology. Teachers are required to be able to design learning that can deliver students to meet the needs of the 21st century. There are many weaknesses in the conventional use of experiments. For example, what happened in SMA Negeri 10 Medan. Based on the results of interviews with physics teachers at SMAN 10 Medan, not all practicum activities at schools were carried out. This is due to insufficient time, poorly maintained laboratory conditions and incomplete equipment and materials.

Based on the interview with physics teacher in SMAN 10 Medan, the researchers tried to provide alternative solutions, namely in the form of virtual laboratory activities using the use of technology, namely assisted by PhET Simulation. PhET Simulation is one of media that needed to overcome difficulties in conducting experiments in the laboratory or the classroom. The use of PhET in learning should be combined with other teaching materials, so that students' understanding related to learning materials will be better. Teaching materials play an important role in ensuring the effectiveness of teaching and learning activities (Mahtari et al. 2020).

PhET Simulation has the following advantages: (1) it has an attractive animation appearance; (2) very easy to operate; (3) free to download (free download); (4) can adjust laptop/PC specifications because it provides download of simulation packages, Java, and flash; (5) can be used in both online and offline situations; and (6) present physical conceptual models that are easy for students to understand. The weaknesses of PhET Simulation include: (1) the applications and games it runs are very limited, namely for files in the ".Jar" format; and (2) need to update the flash player for flash that does not update automatically.

The use of PhET Simulation needs to be supported by the existence of an alignment device, namely Student Worksheets (LKPD). The thing should be considered is the teaching materials. Teaching materials are the resources a teacher uses to deliver instructions. Each teacher requires a range of tools to draw upon in order to assist and support student in learning. These materials play a large role in making knowledge accessible to a learner and can encourage a

student to engage with knowledge in different ways. The teaching materials that are still a favorite used in the international world are in the form of Students worksheet. Worksheet is a kind of printed instructional material that is prepared and used by teachers. Worksheets are written materials related to the activities (Riyadi et al. 2018). Student Worksheet (LKPD) is a teaching material that contains instructions, a list of tasks, and guidance to carry out activities that are arranged in such a way that it can be one of the means to help and facilitate learning activities, so that interactions will be formed effective between students and teachers, and can increase the activities of students in increasing learning achievement, especially to improve science process skills (Pariska et al. 2012).

In Physics teaching, students are required to understand the appropriate concepts of material contained in the applicable curriculum. In order not to cause a sense of saturation of learning and referring to the curriculum 2013 current teaching process in Indonesia, it takes the creativity of teachers in strategizing and planning teaching models in order to foster the creative thinking ability of students, work and be scientific which is an important aspect that must be owned by students. The fact that occurred in the field, the process of teaching and learning in Physics learning on the habit is run by conventional methods that are only done by relying on lectures. This makes the teacher's function the only source of learning and indirectly makes it difficult for students to get good learning outcomes in building knowledge to make learning meaningful. In addition, students also feel bored if treated as passive respondents who only get knowledge from teachers only. The learning process requires the arrival of knowledge or information to students. The information or content of the lesson can use media. The use of interesting learning media in addition can be used to improve student motivation in learning. (Apriyanti, et al. 2020).

Wahyuningsih et al. (2014) revealed that the LKPD available on the field does not refer to the current curriculum, namely the 2013 Curriculum. LKPD generally only contains material summaries, sample questions and is followed by evaluation so that it does not refer to scientific activities. The LKPD which has practicum activities only contains direct instructions so that students carry out practicum according to the instructions contained in the LKPD without thinking

about the reasons for the progress carried out step by step. In some LKPDs, there were no examples of concept application in everyday life.

LKPD is not a new tool for educators in the learning process. LKPDs that are circulating in schools only contain material summaries and contain question exercises compiled and designed by several publishers. This LKPD does not train students in the scientific approach process because it only contains a collection of questions that must be answered and does not find concepts from the material. This will also burden the educators to correct the results of the work of students. Good LKPD should be made by educators. (Sari, et al. 2016)

The completeness of teaching materials for physics subjects greatly supports the learning of students, but there is no availability (LKPD) that is effective and efficient for students. The availability of LKPD in accordance with the characteristics of students is very important (Nurliawaty et al. 2017). The experimental LKPD used in SMA Negeri 10 Medan is still conventional based. Conventional-based LKPD is a LKPD that provides work information in the form of instructions that must be carried out by students. The LKPD usually contains material summaries, practice questions and there are practicum procedures, but the structure does not meet the demands of the 2013 curriculum where students discover a concept by themselves. In addition, conventional LKPD has difficult language to understand and does not guide students in taking steps of science process skills that make students discover facts or concepts of physics for themselves, so that the LKPD is less effective to use.

Conventional student worksheets applied in schools had not been effectively improved the student creativity because the students were not trained science process skills in most lab practical activities. Practical works were only confirmation of lab procedure. The conventional worksheet has not accommodated constructivism learning. The students just follow the fix laboratory procedure without activity of drilling students to do science skill process even in basic level. The basic science skill process these are hypothesizing, identifying tools and materials, analyzing data, and summarizing the results of the investigation. (Mahyuna et al. 2018)

The LKPD that students need is a LKPD that is attractive and invites students to be more active and be able to find a concept through the activities they do. Therefore, it is necessary to develop LKPD that can help teachers and students in carrying out the learning process so that it runs effectively. (Rahayu et al. 2016)

The use of LKPD with PhET Simulation will not be carried out optimally without using a learning model in the learning process. Learning model applied in the learning process must be in accordance with the needs and conditions of students at a school and must be adjusted to students. Just like the subjects of Physics if it is taught using lectures method, it will actually make the students difficult to understand when it is compared using a scientific way (Riyadi et al. 2018). Learning in the 2013 curriculum prioritizes a scientific approach. Guided inquiry is a learning model that applies a scientific approach.

Student worksheet will not produce satisfactory results without the use of learning model in the learning process. One of the learning models that can be used is the inquiry learning model. The type of inquiry that is suitable for high school level is guided inquiry, since guided inquiry provides more direction for students who are not ready to solve problems with inquiry without assistance due to lack of experience and knowledge. This student worksheet has been used for in-class activities and for laboratory activities. Activities in the classroom is the activity to find the concept by exploring the model of images, graphics, and tables that represent a concept. While the activity in the labor in question is the activity to find the concept of data obtained during practicum activities. Activities in the laboratory are very important in science learning. Students will be better understood when involved in laboratory activities (Repdayani et al.2018). Mulyasa (2015), states that guided inquiry is the process of investigating a problem. This learning model is applied in accordance with physics learning. In the learning process, students are always used to helping and providing explanations from the teacher to solve problems. Therefore, to be more active in improving students in the learning process, it is necessary to use a guided inquiry-based PhET Simulation LKPD.

Based on Carlin and Sund cit Bell and Smetana in Maguire and Lindsay (2010) state that guided inquiry is a learning model that can train students' skills in

the process. Guided inquiry collects fact data and processes these facts so that students are able to draw conclusions independently to answer questions or problems raised by the teacher. The role of the teacher in the learning process must be able to create learning conditions that are expected to encourage students to find out from various sources through observation, and not just being told. The learning model that can guide students to find out their own information is inquiry learning. Inquiry learning model is a series of learning activities that emphasize the independence of students to find and find. This learning model is divided into four levels namely confirmation inquiry, structured inquiry, guided inquiry and open inquiry. One of the most effective inquiry learning models is guided inquiry. Guided inquiry learning process is student-centered learning, students work in small groups with individual roles to ensure that all students are fully involved in the learning process.

In the guided inquiry learning model students are required to learn in acquiring knowledge by finding themselves. Guided inquiry learning will be effective if it is supported by a teaching material. One teaching material that facilitates students to be more active in the teaching and learning process is student worksheets. Based on the results of research conducted by Bilgin and Myers in Yani et al. (2019), it was concluded that students who learn by using guided inquiry strategies more easily understand and understand the concept of lessons and increase the effectiveness of interaction, team building, learning, and interest through group work.

Based on this background, one of the strategies that will be used to facilitate and to assist students in learning physics, the researchers conducted a study entitled "**The Development of Experiment Student Worksheets Based on Guided Inquiry Assisted by PhET Simulation in Work and Energy Material in Class X SMAN 10 Medan**". By raising this title, the researcher hopes that in the future teachers can develop LKPD that is in accordance with the curriculum and also the conditions of the school and can make students more active. Besides being able to develop it, researchers also hope that LKPD can be used as effectively as possible.

1.2 Problem Identification

Based on the background that has been stated previously, the identification of the problem in this study is:

1. The physics learning process often uses conventional methods.
2. Students are less active in learning because all information from teachers and students is only as recipients of information.
3. The rare of laboratory activity for experiment, and there is only one laboratory for all level classes so sometimes not all conventional experimental learning activities are carried out
4. The LKPD used only contains questions and materials.
5. Student need the right LKPD to stimulate the investigation process
6. The absence of LKPD based on guided inquiry assisted by PhET Simulation was developed into physics teaching materials on the topic of Work and Energy.

1.3 Problem Formulation

Based on the problem boundaries that have been stated previously, the formulation of the problem is:

1. Does the Experiment Worksheet Based on Guided Inquiry Assisted by PhET Simulation in Work and Energy Topic developed by the researcher meet the eligibility criteria in accordance with the BNSP eligibility standards based on the assessment of material experts and media experts?
2. What is the feasibility level of the Experiment Worksheet Based on Guided Inquiry Assisted by PhET Simulation in Work and Energy Topic developed by researchers according to teacher and students?

1.4 Problem Limitation

Based on the identification of problems that have been stated previously, with limit time, energy and research funds, the problems in this study are limited. Therefore, the scope of the problem in this study is:

1. This research was conducted on class X semester II SMAN 10 Medan in the academic year 2020/2021.

2. LKPD based on guided inquiry assisted by PhET simulation which will be developed in physics learning only for Work and Energy topic.
3. The development of LKPD is developed using the 4D learning development model which includes the stages of define, design, develop and disseminate. This research is limited to the development stage, namely the testing stage to determine the teacher and student assessments of the developed LKPD. The fourth stage (disseminate) is expected to be carried out by further researchers.

1.5 Research Objectives

Based on these problem boundaries, the objectives of this study are as follows:

1. Knowing the level of LKPD the Experiment Worksheet Based on Guided Inquiry Assisted by PhET Simulation in Work and Energy Topic feasibility in accordance with the BNSP eligibility standards based on the assessment of material experts and media experts.
2. Knowing the level of LKPD the Experiment Worksheet Based on Guided Inquiry Assisted by PhET Simulation in Work and Energy Topic feasibility in accordance with the BNSP eligibility standards based on the assessment of teacher and students.

1.6 Research Purposes

1. For Physics Teachers
 - a. LKPD based on Guided Inquiry assisted with PhET Simulation on Work and Energy materials to assist teachers in delivering physics learning material.
 - b. LKPD based on Guided Inquiry assisted with PhET Simulation on Work and Energy materials can be used by teachers as a reference for 21st century physics learning that is interesting, fun, effective and efficient.

2. For Students

- a. LKPD based on Guided Inquiry assisted with PhET Simulation on Work and Energy materials can improve science process skills in learning physics.
- b. LKPD based on Guided Inquiry assisted with PhET Simulation on Work and Energy materials can foster motivation and interest of students to learn physics
- c. LKPD based on Guided Inquiry assisted with PhET Simulation on Work and Energy material can make it easier for students to understand the concepts in learning physics.

3. For Schools

LKPD based on Guided Inquiry assisted with PhET Simulation on Work and Energy material can be an alternative choice as teaching material in improving the quality of learning in physics subjects in the 21st century.

4. For Researchers

- a. As a consideration for prospective educators to be more creative in using LKPD in learning physics as an effort to improve learning outcomes.
- b. Provide references for future researchers to carry out further research

1.7 Operational Definition

Student Worksheet development is expected to increase the learner activity in the learning process by way of learning process is accompanied by the rules of scientific approach. The development of learning materials Student Worksheet is indispensable in the world of education. The development of learning materials needed to facilitate the achievement of learning objectives expected. One of the advantages of developing Student Worksheet is can be designed in accordance with the circumstances of learners and school characteristics. (Julianti, 2018)

Student Worksheets (LKPD) based on guided inquiry assisted by PhET Simulation are learning materials or worksheets that contain assignments

performed by students, accompanied by instructions, steps to carry out a task in both theoretical and practical form based on learning models that can train students' skills in the investigative process to collect fact data and process these facts so that students are able to draw conclusions independently to answer questions or problems raised by the teacher assisted by the PhET Simulation application, namely teaching and learning based on virtual laboratory simulation physics to make it easier for teachers and students to use in classroom learning.



THE
Character Building
UNIVERSITY