

## CHAPTER I

### INTRODUCTION

#### 1. 1. Background

The learners of the 21<sup>st</sup> century face tons of challenging responsibilities. Learning is focused on the total development of an individual in all aspects of his life; that is the gist of 21<sup>st</sup> century education – preparing the future generation to face the challenges of real life situations to sustain the development of the world and make it a better place to live in. Enabling the students to think critically is the fundamental goal of education (Marjorie, 2015).

The facts of students' thinking skills in Indonesia are still relatively low in the fields of mathematics, reading and science. This can be seen from the results of the PISA (*Program for International Students Assessment*). From the latest PISA results in 2015, the average scores of Indonesian students' achievement for mathematics, reading and science were ranked 63<sup>rd</sup>, 61<sup>st</sup> and 62<sup>nd</sup> out of 70 participating countries with an average score of 403, which was still below than international average score 493 (OECD, 2015). The results of the PISA study show that students' thinking skills are still low and students do not have the skills to become creative thinkers and problem solvers yet.

Education is a sector that contributes to improving human resources. Based on the results of the Human Development Index (HDI) published in 2018, the value of Indonesia's HDI for 2017 is 0.694 which is a country categorised in middle human development. Indonesia is ranked 116<sup>th</sup> out of 189 countries and regions, Indonesia's HDI rate increased from 1990 to 2017 with a value of 0.528 to 0.694 which increased by 31.4 percent (UNDP, 2018). HDI is a comparative measure of life expectancy, literacy, education and standard of living of all countries in the world. HDI is used to classify whether a country belongs to developed, developing or underdeveloped countries and also to measure the impact of economic policies on quality of life (Sukasni, et al, 2017).

Permendikbud No. 65 Tahun 2013 about Standar Proses Pendidikan Dasar dan Menengah has decided that the importance of the learning process by using

scientific approaches. In line with this, Zaim (2017) states that the scientific approach is a learning strategy using scientific steps in each learning material. The scientific approach has a characteristic that is "doing science" which requires teachers to improve the learning process with activities that are as detailed as possible which can function as instructions during the learning process takes place.

Scientific approach of the learning process result shows a significant effect on student achievement. The implementation of a scientific approach must be integrated with attitudes, skills and knowledge and a learning process that focuses on students. Student-centred learning process can make students more active, creative, effective and fun learning. The key of success in learning adheres to the efforts and creativity of the teacher to prepare learning material or other facilities that support learning and adequate school facilities. (Hasan, 2018).

Along with the demands of science and technology development era, curriculum in Indonesia has been changed, started from 1984 until now. Curriculum 2013 is Indonesia's newest curriculum made to complement the previous curriculum, namely the Curriculum 2006. Curriculum 2013 aims to encourage students to be individuals who are able to make observations, question and answer, reasoning and communication that they obtain during the learning process takes place. There are two fundamental changes found in the 2013 Curriculum, namely changes in the learning system and changes in the grading system (Natsir, et al, 2018).

Changes of curriculum requires teachers to carry out learning according to the applicable curriculum. Therefore, there is a need for learning devices that actively develop students. Students Worksheet (LKPD) is also one of the teaching materials that plays an important role in the learning process. LKPD is a worksheet containing tasks carried out by students, containing instructions, steps to complete a task in the form of theory or practice. LKPD can be used to improve students' skills involving hands-on activities such as investigations and thinking activities such as analysing data from investigations. Based on the explanation, it means that we can develop a teaching material, especially LKPD, by analysing the learning objectives to be achieved, arranging learning plans by selecting an appropriate

learning model and pouring the syntax of the learning model into the developed LKPD (Aldila, 2017).

LKPD that prepared by teacher must be LPKD that is beneficial for students and in accordance with the progress of this era. Now we live in a society where education in Science, Technology, Engineering and Mathematics (STEM) plays a very important role in all aspects of life. Overcoming increasing social problems requires innovations that may involve basic science research, along with their applications and implications, environmental concerns and technological development. In addition, innovation in education is also important, because education is a significant tool for developing not only knowledgeable citizens but also responsible and creative individuals who will ensure the continuation of scientific investigation with sustainable results (Miskeyanni, et al, 2018).

STEM approach has been widely applied in developed and developing countries. In Indonesia, STEM approach has not been widely used. The application of the STEM approach in each country differs according to the needs of the country itself. STEM can train students' abilities and talents to face 21<sup>st</sup> century problems. In addition, STEM is expected to produce final results in the form of products and designs made by students related to design. The development of STEM approach in education in developed countries shows that STEM is needed for education in Indonesia because STEM is a paradigm that creates interdisciplinary learning and provides achievements in Science, Mathematics, Engineering and Technology (Milaturrahmah, et al, 2017).

This STEM approach is an approach that refers to the four components, namely science, technology, engineering and mathematics. In harmony with this based on research that shows the application of STEM can help develop knowledge, help answer questions based on inquiry, and can help students to create new knowledge. The application of the STEM approach can improve students' thinking skills. STEM approach by integrating four components is able to produce student's thinking activities that are useful to help bring out various student skills characterized by problem solving skills, making decisions, analysing assumptions, evaluating, and conducting investigations. In line with this, Chien (2016) states that

using STEM approach in learning can improve students' skills compared to the usual learning approach.

The development of LKPD was conducted using the *Research and Development* (R&D) method with the 4D instructional development model (define, design, develop and disseminate). This 4D model is carried out with various analyses that will support this LKPD development which will also involve expert assessment to provide assessment, advice and input so that the LKPD is feasible to be used in learning (Sugiyono, 2016).

Based on interview and observation results carried out in SMA Negeri 1 Perbaungan, teaching materials used in learning activities are not varied because they only use modules, while facilities and infrastructure to support learning activities such as libraries already exist and laboratories owned by schools can be said complete but rarely used. Based on interview and observation result, it is necessary to develop Student Worksheets (LKPD) with STEM approach. These needs are reinforced by interview results with students in SMA Negeri 1 Perbaungan. It is known that teachers have not used LKPD with STEM approach to develop the student skills. Besides that, some teachers still use the old method or lecture so that students do not have good learning skills especially learning that guides students to become creative thinkers and problem solvers.

Therefore, LKPD developed with STEM approach in Sound Wave material in an interesting, logical, systematic, innovative and easy-to-use manner so that it could be beneficial for students. Thus, this study can be titled with: ***"STEM Approach Students' Worksheet Development with 4-D Model on Sound Waves Topic in Class XI MIA SMAN 1 Perbaungan"***.

## **1. 2. Problem Identification**

Based on the background described previously, the problem identification from this study is as follows:

1. The LKPD used does not match to Curriculum 2013 criteria.
2. The LKPD used is only in the form of multiple choices and essays.
3. LKPD used by schools is generally not the result of development from the teacher, but is obtained from public publishers.

### 1.3. Problem Limitation

So that this study does not deviate from the research title and based on the problem identification stated above, the problem scope in this study are:

1. Development of LKPD is developed by using 4D instructional development model which includes define, design, develop and disseminate stages. This research is limited to the develop stage, namely the testing phase to determine the teachers and students assessment on the developed LKPD. The fourth stage (disseminate) is expected to be carried out by the next researcher.
2. This LKPD assessment is an assessment of the results of validation by a team of experts, physics teacher responses and student responses.
3. This LKPD will develop with the STEM approach.
4. This LKPD will contains Sound Waves material.
5. This LKPD will show for Class XI MIA in SMA Negeri 1 Perbaungan.

### 1.4. Problem Formulation

In this study, researchers have several questions, as follows:

1. How LKPD can be developed by using STEM approach?
2. How is the attractiveness, convenience, usefulness and effectiveness of student worksheets (LKPD) developed with STEM approach?
3. How is the student's response to the LKPD containing Sound Waves material?

### 1.5. Research Objectives

The objectives of this research is to make LKPD with the STEM approach in Sound Wave material. The purpose of the questions in this study are as follows:

1. Describe LKPD developed by using STEM approach.
2. Describe attractiveness, convenience, usefulness, and effectiveness of student worksheet (LKPD) developed with STEM approach.
3. Knowing student responses to LKPD that contains Sound Waves material based on student responses from the results of product trials.

### 1.6. Research Benefit

By implementing above research purposes, it is expected that the benefits obtained after this research are as follows:

1. For School: The results of this study can be used as a support or reference for the provision of teaching materials in the form of Physics LKPD with the STEM approach for SMA Negeri 1 Perbaungan students, especially in Sound Waves material.
2. For Teachers: LKPD produced from this development research can be used as teacher guidance in teaching to apply STEM approach to learning Physics.
3. For Students: LKPD produced from this development research can be used as a learning resource, so it can motivate students to learn independently, creatively and efficiently in the learning process.
4. For Researchers: LKPD produced from this development research can be used as experience in applying learning using LKPD with the STEM approach to students directly in the classroom.
5. For other Researchers: the results of this research product can be used as material for the application of experimental research in four-D models (4D) which will then enter into the dissemination stage.

#### 1. 7. Operational Definition

Operational definition is a definition given to a variable by giving meaning or needed to measure variables. The operational definitions in this study are as follows:

1. The development of this LKPD uses *Research and Development* (R & D) method with a 4-D development model but this research is limited to the stage 3-D (develop) only. This research is expected to produce a product that is feasible to use in the learning process. The LKPD developed only arrived at product testing with a limited scale that was assessed by a team of experts, teachers and student responses.
2. LKPD is a printed material in the form of sheets containing material, summaries and instructions for implementing learning tasks that must be done by students in accordance with the learning objectives to be achieved.
3. STEM (science, technology, engineering and mathematics) is an interdisciplinary learning approach between science, technology, engineering and mathematics.