CHAPTER I
INTRODUCTION

1.1 Background

In Indonesia, a number of policies have been released to resolve the growth of the Covid-19 spread, such as the cancelation of the national examination (UN), the modification of school examinations, the introduction of distance learning, and an electronic approach to the student registration process in compliance with Circular Letter 4 of 2020 on the implementation of Education Policy in Emergency During Covid-19 Spread (Kemendikbud, 2020). Surprisingly a disease that emerged in the Wuhan region of China spread very quickly across China and other parts of the world (Sintema, 2020). Medics are trying to discover a medical solution to that epidemic in the laboratories. Economists are working on ways to manage the economic impact of this epidemic on country economies because businesses are dying every day, and there are limitations on human mobility within and across borders. Everyone takes them the part to solve this problem using their own expertise. Since the problem-solving experiences in everyday life are typically ill-structured, complex, and multifaceted, the reason for the inability of students to solve problems outside of the classroom is that they lack adequate problem-solving and opportunities for application of knowledge in real-life contexts (Johnson et al., 2011). Due to the obvious growth of technology, we should be able to prepare our future generation to solve the problem of the real-world by investigating the phenomena, using their knowledge and adapting to the current modifications in conditions. It would never happen, though, because we have never made any changes in the way that learning activity is performed.

The International Student Assessment Program (PISA) is measured against the quality of international education. PISA 2018 was the seventh round of global assessment since the curriculum was initiated in 2000. Every PISA assessment tests students ' awareness and abilities in reading, math and science; every assessment focuses on one of those topics and provides a brief review of the other two. The 15-year-olds average performance in science is 396 points, compared to an average of 489 in OECD countries (OECD, 2019). Based on the results of

observations and the data presented above, it shows that students are not encouraged to develop their thinking skills. Students have only great memorization, while they will not be able to apply what they have learned to the real-world questions (Arisanti, Widodo, Sopandi, 2016). Science learning will get of inferior quality when science educators do not encourage innovation themselves and compete with the educational rating of a nation on a global scale.

The National Academy of Sciences reports that the need for more scientists, technicians, engineers, and mathematicians in the future (the supply pipeline); the need for more skilled staff (a competent population) educated in science, technology, engineering, and mathematics; and suggestions on what schools should do to resolve the shortage. Their overarching purpose is to address (1) societal requirements for new advances in technology and science; (2) economic necessities for national security; and (3) personal needs to become a satisfied, productive, educated citizen. This should not be seen as a area of content but should consist of expertise, knowledge of data, processes, principles and metacognitive skills for further learning (Zollman, 2011). The assumption shows that STEM literacy is one of the skills that ought to be promoted in the 21st century. This refers to an individual's ability to apply an interpretation of how intense competition is operating in the real world, involving interrelated science, technology, engineering and math. It can be determined that STEM literacy is a capability of people need to take an effective part in the current working environment (National Research Council, 2012).

Similar to other thinking skills, human beings should have strong problem-solving skills in order to solve their problems (Deniz, 2004). Problem-solving is defined as the methods used to get the best answer to an unidentified, or a decision subject to certain constraints. Problem-solving is a special case of meaningful learning according to Ausubel's learning theory; thus, any instructional program aimed at improving problem-solving skills should be built in such a way as to facilitate meaningful learning. Maydeu and D'Zurilla (1997) describes problem-solving as a cognitive-affective-behavioral mechanism involving discovering the best ways to deal with the challenges of everyday life. In order to solve the problems they encounter, individuals need problem-solving

skill (Berkant & Erent, 2013). Development of problem-solving includes the willingness to take part with such a situation to achieve one's potential as a constructive and reflective citizen, so problem-solving skills are also fostering better citizenship as Problem Solving Expert Group (PEG) meeting held in Melbourne from 10–12 February 2010 stated that. The importance of problem-solving skills is also reflected while in 2012 OECD develops PISA 2012 problem-solving assessment which has objective to measure individual problem-solving competency of the students as one of basic competency that should belong to students (OECD, 2012)

Indonesia has to cope with the possibility of volcanic eruption, earthquake, flooding, and tsunami because Indonesia is located on the Pacific Ring of Fire within the zone of the Australian plate, the Eurasian plate, the Pacific plate, and the Philippine plate creates the country become the most seismically active country in the world. Around 120 million people live in the shadow of more than 30 volcanoes on Java Island itself. Based on earthquaketrack.com (2020) over 677 earthquakes in the past 365 days happened in Indonesia. Of 1,628 disasters, 60 people have died, 545 thousand have been evacuated, more than 9 thousand have been damaged, and hundreds of public buildings have been damaged in these past six months (BNPB, 2020). This number is considered for disaster; therefore, efforts must be made in Indonesia to reduce and resolve the risk of disaster, It is very important to have knowledge which includes the correct ways to save ourselves when disasters happen and how to prevent avoidable accidents during the earthquake.

Indonesia Curriculum called National Curriculum 2013, unlike the previous curriculum, it gave little room for teachers to modify the content and adjust lessons, because it is organized in a way that given the content, the time allotment, and the teaching approaches (Lim & Widodo, 2018). It is needed an effors to do to combine issues related to natural disasters with socio-scientific issues in the learning process (Yenni, Hernani & Widodo, 2017). Triggered by mathematics and science's reported low-performance levels, a new educational approach is developed and named as STEM education. Conducting STEM education in Indonesia education system will be a good step forward (Gustiani,

Widodo, & Suwarma, 2017). It's focused on the need to deliver higher standard of education. STEM itself includes science, technology, engineering, and mathematics. The purpose of STEM education is not limited to teaching separate and discrete knowledge of science, engineering, and mathematics. Alternatively, the aim of STEM education is to promote the students ' creative spirit and practical capacity by combining the knowledge and spirit of each subject and applying it to real life (Lou et al, 2017). Through STEM learning students can review and combine their understanding and STEM applications more meaningfully (Mayasari et al, 2016).

It is important to note that the need for a professional STEM workforce is dynamic that all young people in an increasingly science and technical world have the STEM literacy and skills they need to be an educated citizen, regardless of their potential career pathway (Gustiani, Widodo, & Suwarma, 2017). One way to satisfy the need for STEM Education with meaningful activity is by implementing STEM Project-Based Learning, which refer to the learning model based on the STEM Education approach and integrated with the project-based curriculum design (Lou et al, 2013). The main aspects that make STEM Project-Based Learning special are the method of design and the interdisciplinary preparation. STEM Project-Based Learning design process starts with the well-defined planning of the project outcome by setting the objective and planning the summative assessment. Then, the next steps of STEM Project-Based Learning is giving the students ill-defined task that lead students to express ideas from complex problem in different solution (Carparo & Slough, 2013). STEM Project-based Learning requires students to develop concept knowledge and creative thinking skills, in accordance with the principle of lifelong learning which refers to the four pillars of universal education, namely learning to know, learning to do, learning to live together and learning to be (Arisanti, Widodo, & Sopandi, 2016). STEM Project-based learning also combines the concepts of engineering design with the science curriculum, the infusion of design principles enhances applicability in the real world and helps prepare students for post-secondary education, with emphasis on connecting with what STEM professionals are actually doing in their jobs.

Many studies have been conducted regarding the implementation of STEM Project-Based Learning to see its effectiveness including investigated on STEM Literacy, and Problem Solving Skills such as researches conducted Luthfiyani, Widodo, and Rochintaniawati (2019) on student's technology literacy and decision making skills by using STEM Based Learning. Sofi, Wijaya, and Winarno (2019) also research on improving student's creativity by using STEM Project Based Learning. Apriyani, Ramalis, and Suwarna (2019) have also researched on analyzing the student's Problem-Solving Skills using STEM-based learning on direct current electricity topic. Another study was done by Yasin, Prima, and Sholihin (2018) researched using Arduino-android based games to increase STEM literacy. The research on development and validation of science, technology, engineering, and mathematics (STEM) based in instructional material already carried by Gustiani, Widodo, and Suwarma (2017). The study using STEM Project-Based Learning on student concept mastery and Creativity skill also have done by Arisanti, Sopandi, and Widodo (2016). Nonetheless, there have not been several studies on STEM Project-Based Learning research found to investigate student's Problem-Solving Skills and STEM literacy. In addition, there is no research on the topic of the earth layer and disaster, usually only focused on the earthquake topic.

Due to the pandemic of COVID-19 in all around the world, this research may be carried out online, in contrast to previous research, which often conducted directly in the classroom. This research initiates to investigate on the STEM Project-Based Learning in the topic of earth layer and disaster and uses STEM Project-Based Learning as the variable that is being implemented and being measured. Due to the demand for improving students' STEM literacy and problem-solving skills in the Earth layer and disaster topic, the researcher decided to conduct the research titled "The Implementation of STEM Project-Based Learning towards student's STEM Literacy and Problem-Solving Skills"

1.2 Research Problem

The research problem can be formulated as "How is the effect of STEM Project-Based Learning towards student's STEM Literacy and Problem-Solving Skills in earth layer and disaster topic?" Based on the research problem, the research attempts to investigate the following questions:

1. How is the effect STEM Project-Based Learning on students' STEM Literacy in learning earth layer and disaster topic?
2. How is the effect STEM Project-Based Learning on students' Problem-Solving Skills in learning earth layer and disaster topic?

1.3 Research Objective

According to the problem that has been proposed, the objectives of this research are:

1. To investigate the effect of STEM Project-Based Learning on student' STEM Literacy in the earth layer and disaster topic
2. To investigate the effect of STEM Project-Based Learning on student' Problem-Solving Skills in learning earth layer and disaster topic

1.4 Research Benefit

1. Teacher

The result of this study is beneficial for teachers by providing teachers with an understanding of how to make connections between Science, Technology, Engineering, and Mathematics in the learning activity and provide them with materials to enhancing students' knowledge through problem-solving. This study also provides teachers with ideas on how to measure students' STEM literacy and Problem-Solving Skills to thoroughly apply this strategy for their learning.

2. Student

The result of this study is beneficial for students by providing them with an understanding of how to link Science, Technology, Engineering, and Mathematics to solve a real-life problem. This research will explain how to link and encourage students to be STEM-literate citizens.

3. Researcher

The outcome of this study is helpful for researchers by providing them with additional materials and data for those in STEM Project-based learning who has the same focus. This analysis also supports researchers as it offers data which can be used for further reference in future studies.

1.5 Organizational Structure of Research Paper

The structure of this research paper consists of five chapters:

1. Chapter I: Introduction

   This chapter contains the background of the research, research problem, research objectives, research benefits, the organizational structure of research paper, and the limitation of problems.

2. Chapter II: Literature Review

   This chapter contains the literature review about the independent variable, which is STEM Project-Based Learning, and the other variables, which are students' STEM Literacy, Problem Solving Skills, and Earth layer and disaster topic.

3. Chapter III: Research Methodology

   This chapter contains the method that is used to finish this research paper, which are research method and research design, population sample, operational definition, research instrument, instrument analysis, data collection, data analysis technique, research procedure, and research scheme.

4. Chapter IV: Result and Discussion

   This chapter contains the result as well as the discussion and explanation about the result of this research paper.

5. Chapter V: Conclusion and Recommendation

   This chapter contains the conclusion of the research paper as well as the recommendation for the future or next research.

1.6 Limitation of Problem

In order to clarify the focus of this research, the research problem is limited as follows:

1. The stages of STEM Project-Based Learning implemented in this research is based on the study of Lou et al. (2017), there are five stages of STEM Project-Based learning, there are The stage of preparation, The stage of implementation, The stage of presentation, The stage of evaluation, and the stage of correction. In this research, the implementation of STEM Project-Based Learning is limited to only four stages without the stage of correction.
2. STEM literacy is measured according to Zollman (2012), which consists of four components such as Scientific Literacy, Technology Literacy, Engineering Literacy, and Mathematical Literacy.
3. Problem Solving Skills are the competency which is important to have by each individual in facing daily life situation where knowledge that they have should be involved with the problems of daily, which generally have an unclear solution. Problem-solving skills are limited to the problem related to earthquakes in Indonesia.
4. In this research, the learning topic is Earth Layers and Disaster for grade 7, particularly in the Curriculum 2013. Based on the content analysis, the topic learned by the student will cover Earth Layers consist of Atmosphere, Lithosphere, and Hydrosphere, also Natural Disaster includes earthquake, volcano, and tsunami.