CHAPTER I
INTRODUCTION

1.1 Background

The changing times necessitate that people acquire 21st-century abilities in all aspects of their lives, particularly in education. A shift in learning activities is the result of the influence. Education no longer teacher-centered activity but students are required to find their concept of learning and it's called student-centered learning. Learning in the twenty-first century should ensure that students acquire 21st-century abilities such as life skills, thinking skills, work habits, and character traits that are seen to be necessary for a successful life (Anazifa & Djukri, 2017). The learning process now is for problem-solving, logical thinking, and learning to learn (Akinoğlu & Tandoğan, 2007). There are a lot of 21st-century skills, one of the skills required for a student is problem-solving skills. Problem-solving is a basic ability that students should have to use knowledge, facts, and data to effectively solve the problem in daily life as well as critical thinking (Bruning, Schraw, Norby, & Ronning, 2004). Students' problem-solving abilities is the essence of learning objectives that become students' needs in facing real-life by paying attention to the characteristics and stages of intellectual development and the ability to think abstractly so that students can become innovative problem-solvers in their future lives (Sastiawan, Ruyani, & Karyadi, 2019). According to the previous research by Ardiyaningrum, Retnowati, Jailani; & Trisniawati (2019) reported the findings to show that the state of students' problem-solving abilities is highly diverse, with skills below 0 nevertheless being quite high. This suggests that students' problem-solving skills in elementary schools can still be enhanced.

Problem-solving is essential for students to learn how to solve problems using both of these skill sets to analyze and make judgments, finding effective answers requires logic and a problem-solving strategy (Bruning et al., 2004). Students' problem-solving skills aid in the acquisition of new knowledge and the support of scientific activities in the classroom (Wulandari, Agustina, Hidayati, & Tsulutsya, 2019). The Polya model is one paradigm that

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can be used to help students improve their problem-solving abilities (Sipayung & Anzelina, 2019). According to Polya (1956) there are several indicators of problem-solving ability that can be used as a reference in measuring student problem-solving skills, including 1) understanding the problem, 2) planning for problem-solving, 3) implementing problem-solving, 4) check or reviewing the solution (Havill & Havill, 2020).

In the study organized by the International Association for the Evaluation of Education Achievement (IEA), an international association for assessing achievement in education, centered at Lynch School of Education, Boston College, USA assessing grade IVelementary school students and class VIII middle school named Trends International Mathematics and Science Study (TIMSS), Indonesian students are still below the TIMSS average achievement score. TIMSS is an international study on the trend or development of mathematics and science, Indonesia is still in the low country-level in mathematics and science achievement in 2015, out of 47 countries Indonesia is in the 44th position in Science of Grade 4 with an average score of 397 while the countries that have high achievement has a value of 590 which is Singapore (Martin, Mullis, Foy, & Hooper, 2016). While for grade 8, in 2015 only 39 countries participated TIMSS excluding Indonesia based on official page of IEA TIMSS & PIRL International Study Center. The achievement of grade 8 students in Indonesia in 2011 mostly in low international benchmark with ranked 34 out of 35 countries taken the test. Low achievement on TIMSS score of students is caused by several factors, one of which is because students in Indonesia are less trained in solving contextual problems, demanding reasoning, argumentation, and creativity in solving the problems, where these questions are characteristic of TIMSS questions (Knight, 2020).

To answer that, the Ministry of Education and Culture of the Republic of Indonesia launched a *Kurikulum 2013* in which it states that students should be taught learning that focuses on problem-solving that can train students' critical thinking skills and problem-solving abilities so that students can compete with other countries (Pendidikan & Kebudayaan, 2014). Regardless of the important problem-solving abilities of students, a learning strategy or approach to improve students' problem-solving abilities is also important. Learning strategy must have (1) learning and innovation skills, such as critical thinking and problem-solving, communication and collaboration, creativity and

innovation; (2) information, media, and technology skills; and (3) life and career skills as the result (Anazifa & Djukri, 2017; Trilling & Fadel, 2009). To improve students' problem-solving abilities, the approach used in learning must be appropriate. To build problem-solving skills in students, design thinking is one approach that suitable to implement.

Design thinking is the hottest topic in innovation that helps to break the messiest problem with a systematic approach to uncovering creative insight and new solutions. To ensure that the correct issues are answered, design thinking seeks to transcend the immediate boundaries of the problem. The process envisages steps that allow participants, through drawing, prototyping, and storytelling, to examine, synthesize, diverge, and generate insights from different domains (Panke, 2020). The design thinking process allows students to offer solutions to a problem through the stages of empathy, define, idea, prototype, and test that can make students creative and innovative problem solvers (IDEO, 2014). Design thinking can be defined as a discipline that uses the sensibility and methods of the designer to meet the needs of people with what is technologically feasible and what can be transformed into consumer value and market potential by a viable business strategy (Matthews & Wrigley, 2017). Design thinking is both a process and mindset that involve scientific thinking to solve the 'wicked problems' (Luka, 2020).

Not only in business, design thinking very applicable in the field of education to improve student problem-solving skills, especially in science education to solve problems in everyday life. In the previous research by Munyai (2016); McCurdy, Nickels, & Bush (2020); and Lee, Jung, & Yoon (2019) reported that design thinking was used as a learning strategy in higher education, to improve student empathy in STEM, and fostering group creativity in the teaching-learning process and design thinking is successfully implied in the learning process. From that evidence, the researcher attempt to apply design thinking in science education to give the student understanding and mindset as a designer to be an innovative problem solver in learning environmental pollution. The novelty of this research is to involve students directly in observing and looking for problems (empathy stage in design thinking) and making students plan solutions based on the perspectives and needs of the surrounding society by integrating together the problem based learning process. so the problem would be come from society and the solution is for society but involve students in planning, so that students become more skilled in solving problems.

The topic of environmental pollution is a very suitable topic to be taught to students in increasing problem-solving skills of students through design thinking approach because the environmental pollution topic is related to their environment around them so they can see and tell what is happening to the surrounding environment and find the right solution to environmental problems around them and increase their concern for the environment. The topic of environmental pollution is also in line with the aims of the *Kurikulum 2013* that students must be able to compete and face future challenges to create a sense of responsibility towards the environment (Pendidikan & Kebudayaan, 2014). So the researcher believes that design thinking is a suitable approach to improve student problem-solving abilities to address environmental issues and can be applied in education especially in environmental pollution topics. Therefore researcher decides to conduct the research entitled **"Enhancing Students' Problem-Solving Skills through Design Thinking Approach in Learning Environmental Pollutions"**

1.2 Research Problem

Based on the background stated, the research problem is "How does the design thinking approach enhance problem-solving skills on the student in learning environmental pollutions topic"?

1.3 Research Question

Based on the research problem, the researcher attempt to elaborate on the research question as follows:

1) How is the implementation of design thinking enhance student Problem-Solving skills in learning environmental topics?

2) How is the enhancement of student problem-solving skills after using a design thinking approach in environmental pollutions topic?

3) How is the students' experience towards design thinking approach after learning environmental pollution topic?

1.4 Limitation of Research

Based on the background stated above, the limitation of this research as follows:

1) The problem-solving skill is described as the ability to formulate a fresh response to build solutions that are increasingly facing each other in their daily lives (Irwanto,

Saputro, Rohaeti, & Prodjosantoso, 2018). Problem-solving skill in this paper is limited which is stated by Polya which has 4 phases such as 1) understanding the problem, 2) planning for problem-solving, 3) implementing problem-solving, 4) reviewing the solution (Havill & Havill, 2020). The problem that will be solved by the student is limited by the problem is related to the environmental pollution problem.

2) The stages of design thinking that are implementing in this research based on guided of Stanford d-school of design thinking there are five stages of design thinking approaches as the stage of empathy or understanding, the stage of define, the stage of ideate, the stage of prototype and the last is a stage of the test.

3) The topic coverage in this research is limited to an environmental condition the specific topic was chosen is environmental pollution in grade 7. The topic is limited by core competence no. 3 and 4. Then, for basic competence limited for 3.8 and 4.8 that are attached in the 2013 National Curriculum of Indonesia for Junior High School.

1.5 Research Objective

Elaborating on the research question stated above, the objective of this research is specified as follows:

1) To investigate the implementation of a design thinking approach to enhancing Problem-Solving skills in learning environmental pollution.

2) To analyze the enhancement of problem-solving skills on students in learning environmental pollutions topics using a design thinking approach.

3) To investigate the students' experience towards design thinking after learning environmental pollution

1.6 Research Benefit

This research is expected to provide benefits for:

1) Students

Students can enhance their problem-solving skills through a design thinking approach so they can implement this to overcoming environmental problems that happen in their life and maintain the environment around them. The student also can implement this approach to solve another problem that happens in their life using design thinking.

2) Teacher

Teachers can implement and found an interesting and meaningful approach to educate the student about the environment. This design thinking can also become material for consideration in selecting and developing evaluation tools that can improve students' problem-solving abilities.

3) Another researcher

This paper can be used as a reference or example in the making of research about the problem-solving skill of the student. Design thinking can also be used to measure student empathy, creativity, and communication skill, and another skill related to 21st-century skills. It can be a reference for the researcher in the future.

1.7 Organization of the Research

1) Chapter I: Introduction

This chapter which is an introduction covers the background of the research, research problems, research questions, limitation of the research, research objectives, research benefits, and systematic structure of the research paper.

2) Chapter II: Literature Review

This chapter contains the relevant theories and research that underlie the discussion in detail containing the research variables in this research. The literature includes the fundamental explanation about problem-solving skills, design thinking approach, and environmental pollution topic.

3) Chapter III: Research Methodology

This chapter explains the detail of the research conducting in this research. The methodology consists of research methods, research design, research subject, operational definition, assumption, hypothesis, research instrument, data analysis, and research procedure.

4) Chapter IV: Result and Discussion

This chapter describes the discussion of the research finding. In this chapter, the stated research concerns are addressed through analysis using figures, tables, and references to earlier studies.

5) Chapter V Conclusions, Implications and Recommendations

This chapter contains the research conclusion, implications as well as recommendations for further research.