

CHAPTER I INTRODUCTION

1.1 Background

The term of 21st century skills emerges because technology, knowledge, information are growing rapidly to be more digital. The consequences are changes the demands on how people work and life. The change gives an effect to educational world to develop new ways of thinking and learning. To answer the challenge in 21st century, the framework of K-12 Next Generation Science Standard was design to provide students with creativity, critical thinking, communication, and collaboration (Griffin, 2012). The K-12 is a term in educational as school grades from kindergarten until grade before college, this term commonly used in United States of America and Canada. The K12 provide students with knowledge, crosscut concept, core ideas of science and engineering. This encourage students to be able to engage public discussion on science related issue, to be critical consumers of scientific information of their lives, and continue learning about science through their lives (National Research Council, 2012).

The national scope, the science education in Indonesia also has suitable assertion with National Generation Science Standard, it stated in Indonesia curriculum and the Indonesia government regulations no 17 the educational management and administration the objectives is the young generation expected to be critical, creative, independent, and innovative. Meanwhile it is also stated on Indonesia curriculum the science education have to be provided with critical thinking and problem solving skills (Kementrian Pendidikan dan Kebudayaan, 2017). However Indonesia students critical thinking have been reported to be poor (Ilyas, 2015), that statement is also supported by data from PISA (Program for International Students Assessment the Performance) on 2015 that the performance Indonesia students in science still below the average.

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According to Jude, N. (2016) students at the level A can consistently identify, explain, and apply scientific knowledge. They can demonstrate advance thinking and reasoning in science by using evidence from the process of relating different information and explanation. They can use the evidence to construct argument for giving recommendation and decision justification related to scientific issue. However most of Indonesia students proficiency level on environmental science is still below the average, 75% Indonesia students still in D and below D level and only 3% students that in A level (OECD,2012).

The learning process that integrates science, technology, engineering, and mathematics (STEM) to improve students' critical thinking is important. Marginson, Tytler, Freeman, & Roberts (2013) stated that STEM disciplines makes learning more engaging and practical. Thus encourage students to do higher order thinking including the ability to do complex problem solving, judgment, critical thinking and decision making. Critical thinking skills also used to develop students argumentations skills (Inch, E, Warnick, B, Endres, 2006).the argumentations process need ability to think critically, to make argumentation there some factor that influence each other it is justify beliefs, attitudes and value. The argumentations as a part of critical thinking is important and to develop it is require time and disciplines, one of the way to train the critical thinking is reading. Relate to the educational world, book that students used for reading is also important.

The learning instruction that influences the critical thinking, there is another factor that can be influenced one of them is learning material such as a textbook. In Indonesia education system BSE textbook or electronic school textbook provided by the government to support the learning but the book has not been developed the critical thinking and it also does not cover the STEM component completely. One of the example BSE science book by (Zubaidah, 2017), the practical still cookbook, it is not fully encourage students to think critical, and analytical.

The research of (Rochintaniawati, Agustin, & Rusyati, 2017) in STEM-based e-module is one example that can be used to train students' thinking skills to encourage students to solve real world problem. From those

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explanations, the purpose of this research is to investigate the profile of students' critical thinking skills in STEM based learning by using e-module. Profiling the critical thinking in this research is to makes sure the conditions and define the data to give similar research useful insight of students critical thinking skills in STEM based learning by using e-module. The STEM based e-module has been develop by (Rochintaniawati, Agustin, & Rusyati, 2017). Relate to the topic, students need environment that provide clean water and proper sanitation for living, and every human action give an impact to the environment, not only sanitation problems, there is also complex environmental issue such as plastic pollutions that can cause the interrelated problem such as air pollution, water pollution and soil pollutions.

The environmental topic also include in sustainable development goals set by the United Nations development program to achieve better and sustainable future for all. The environmental topic also give students relevant insight about our environmental conditions or issue that can encourage students to think critical and creative to solve the problem. The environmental topic in education also support STEM learning, meet the 21st century need, contributing to sustainability, support the decision making skills, and create enthusiastic students. That is why this study chose environmental topic to investigate critical thinking skills.

1.2 Research Problem

The research problem of this study is “How is the profile of students' critical thinking skills in STEM-based learning by using e-module in environmental pollution topic?”

1.3 Research Questions

Based on the research problem above, the research attempts to explore the research question and there are:

- 1) How is the students' critical thinking skills by using STEM e-module in environmental pollution topic?
- 2) How are students' impressions by using STEM e-module in environmental pollution topic?
- 3) How are teachers impressions by using STEM e-module in environmental pollution topic?

Tias Subiasti, 2018

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1.4 Limitation of Research

The research also has limitation to make research more focus, and the limitation of the research is:

- 1) The STEM-based e-module is developed by using Macromedia flash professional. The STEM education cover the processes of critical thinking, and analysis in which students integrate the processes and concepts in real-world contexts of science, technology, engineering, and mathematics. In every chapter of e-module, it is provided with one or two STEM project activity.
- 2) The critical thinking use in this e-module development is according to (Inch, E, Warnick, B, Endres, 2006) that contain eight elements of critical thinking, the elements are questions at issue, purpose, information, concept, assumptions, a point of view, interpretation and inference, implication and consequences.
- 3) The topic in this research is environmental pollution topic that limited by core competence number 3 knowledge and 4 skills that are attached in 2013 national curriculum of Indonesia in Junior High School.
- 4) The subject familiar using a computer.

1.5 Research Objective

Based on the background, and the research problem that already explains the objective of this research is:

- 1) To analyze the profile of students' critical thinking in STEM-based learning by using e-module.
- 2) To analyze the students' impressions about STEM-based e-module on environmental pollution topic.
- 3) To analyze teacher impression about STEM-based e-module on environmental pollution topic.

1.6 Research Benefit

The researcher expects that result of the interactive STEM-based e-module able to conquer these following benefit aspects:

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- 1) For science teacher, this research about the profile of students' critical thinking skills in STEM-based learning by using e-module. Get the overview about the conditions of students' critical thinking skills, knowing how is the implementation of STEM-based e-module in the learning process.
- 2) For students, with the existence of this research, they can feel the new experience in the learning process using e-module, especially involved in STEM project activity.
- 3) For other researchers, this study may enrich the similar research and can use as a reference of critical thinking skills profile on environmental pollution topic.

1.7 Organizational Structure of Research Paper

Overall, this research paper consists of 5 chapters and several appendices and each chapter consist of sub-chapters. The systematics of this research paper is as follows:

- 1) Chapter I: Introduction
This chapter consists of background, research problem, research questions, research objectives, limitation of the problem, benefits of the study, and organization of research paper.
- 2) Chapter II: Literature Review
This chapter describes the definition of STEM-based e-module, inch's critical thinking, the topic of environmental pollution and also describes the related research.
- 3) Chapter III: Research Methodology
- 4) This chapter explains the methodology that conducts during this research. In this chapter consist of research method, research design, population and samples, operational definition, research instrument, instrument analysis result, data processing technique and research procedure.
- 5) Chapter IV: Result and Discussion
- 6) This chapter concern with data that has been gathered, present research finding based on result and data analysis to answer the research questions that have been stated in the first chapters.
- 7) Chapter V: Conclusion and Recommendation

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- 8) This chapter describes the conclusion and recommendation of the resear

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