CHAPTER I

INTRODUCTION

1.1 Background

Indonesia is one of the countries that has participated in the Program for International Student Assessment (PISA) test since 2000 (Tohir, 2019). In 2015, Indonesia was only able to achieve score 397 on reading, score 386 on mathematics, and 403 on science. Compared with Singapore, it successfully achieves a score of 535 on reading, 564 on mathematics, and 556 on science (Argina et al., 2017). In terms of ranking, Indonesia's position at 70th ranks out of 78 countries. Based on rank proves that Indonesia's PISA score is still meagre and needs to be improved (OECD, 2019).

Based on the PISA score, factors that cause score is still low because students have difficulty in understanding the learning methods used in class (Tohir, 2019). The use of classical learning books used in schools also affects the outcome score of the test (Pratiwi, 2019). The other factor is the inability of students to answer about analysis question type. Based on the problem causes, the score of PISA students still does not change (Rizal, 2018). The PISA test includes communication, representation, reasoning and argument, devising strategies for solving problems, using symbolic, formal, and technical language (Tohir, 2019).

Solutions that have been implemented in Indonesia to improve PISA score is applying critical thinking skills in national exam questions since 2015, which tested questions in the form of Higher Order Thinking Skills (HOTS). In recent years, questions that measure critical thinking skills have been tested on the National Examination (NE). The question's composition refers to a cognitive level with a range of 10-15% for reasoning, 50-60% for applications, and 25-30% for knowledge and understanding (Argina et al., 2017). The result shows that the average value of science UN for junior high schools in Indonesia is still in the low category. The average score for Junior High School is only 48.79, with a minimum passing

score of 55.5. The result shows from 2015 to 2019, average achievement of Junior High school score is decreasing, from 62.18 (2015), 58.56 (2016), 54.54 (2017), 51.84 (2018), and 52.82 (2019) (Schleicher, 2019)

One of the curriculum components tested on PISA is categorized into three types, namely, the ability to re-reveal information, develop interpretations, and reflect and evaluate texts (Gresse & Antonio, 2005). From these components, there are similarities to the principles of critical thinking expressed by Facione, which include interpretation, analysis, evaluation, self-regulation, and inference. This strengthens the evidence that students' critical thinking skills must be trained (Facione, 2011). The ability to think critically can change students from passive become active (Mahanal et al., 2016). Students can do activities such as reading, analysis, and writing to improving critical thinking (Thyer, 2013).

Biology is the subject chosen in this research because in biology topic is mostly still based on textbooks, so there are still many students who are passive in learning this material (Prasetyo et al., 2019). Respiratory system topic was chosen because students still have difficulty seeing the respiratory organ directly, which causing boredom in students learning. After all, what they are learning is abstract (Putra et al., 2018). Then, students also have difficulty studying biology topics because biology is categorized as one of the subject topics in school (Çimer, 2012). Therefore, tools are needed to overcome these problems, one of that is the usage of technology as tools to support the teaching-learning process (Putra et al., 2018).

In this 21st century, technology is very rapidly developing and has a relationship with education, including emphasizing creativity and effectiveness in the field of learning, increasing innovation and also content to improve the quality of learning (Henriksen et al., 2016). Collaboration between technology and learning makes it easier for students and teachers to imitate learning and improve the quality of learning in the global era (Shelia, 2014). Technology emphasizes teachers to be collaborative and expand learning outside the classroom, incorporating activities outside of the classroom and in the classroom (Milrad, 1998). With technology, it makes easy access for teachers to access material, instruction, and assess the quality of technology (Bourdeaux, 1981).

The ability to use technology in learning has become an essential skill in arithmetic, reading, and writing (Eggen & Kauchak, 2017). The 21st century requires students to have breakthrough thinking skills so that students have essential skills in creative, collaborative, communicative, and critical thinking (Joynes et al., 2019). To practice critical thinking, it takes a means to support critical thinking skills. One of them is through the media games (Changwong et al., 2018) Game-based learning acts as a medium for utilizing games and involves specific goals, such as involving knowledge and training skills, one of which is critical thinking (Boyle, 1997). Afterward, game-based learning in education is to re-create themselves in a new world and achieve deep learning goals (Gee, 2003). Game-based learning is also intense instructional learning (Von Wangenheim & Shull, 2009). Educational games can make a learning process more attractive and effective Game-based learning has four principles, namely, explicit, interactive, challenging, interactive games that have an impact on mastering new vocabulary (Hui Chan, Chen, & Taheri, 2014).

Research on ERIC (an educational literature database), stated that the number of peers reviewed concerned game-based learning was approximately five times greater in 2012 than in 2002 (Fujimoto, 2017). History about game-based learning started at the beginning of 1990, started with gaming and simulation, entertainment education, edutainment, serious games, and gamification. In Japan, developed a multiplayer card for education, which utilized causal relations to problem-solving, and measure its effects. Another research is “Connect the World II,” which allows students to experience social dilemmas and encourages cooperative behaviour. It was shown game roles, likely to trust in social dilemmas situations where players cooperate to achieve a common goal, compared to games that pursue only individual goals

There are several ways to improve students' critical thinking skills through games, with this game-based learning. Game-based learning will consider either environment that is motivating but combined with the learner (cognitive perspective) or conversely, approaches that provide the rich contextual information and interactions needed for learning in the 21st century (De Freitas et al., 2012). Game-based learning also mostly emphasizes that it is a type of gameplay with

defined learning outcomes (Shaffer et al., 2005). Game is a system in which players engage in artificial conflict, defined by rules; that results in a quantifiable outcome (Sallen & Zimmerman, 2004). Learning games involves cover the subject matter with the desire to prioritize. (Plass & Nordlinger, 2010). Game-based learning will resolve the lower score of students when they learned biology topics.

Game-based learning useful for the learning era, students will learn and apply information to reinforce correct answers by the provisions of points and verbal praise, and they can learn by using games (Cutri et al., 2016). In learning biology, students not only get material about the respiratory system but also students will get better score because they repeated the game many times, get new challenges, achieving better scores, trying out different roles, being able to express what they feel and reflect certain information (Cicchino, 2015). Benefit game-based learning for teachers is to reach the new generation of learners with the medium they are used to interact with childhood (Cicchino, 2015). Game-based learning will establish dialogue break and social, cultural boundaries. Game-based learning is used for personal development and to improve the self-esteem of players (Pivec, Dziabenko & Kearney, 2005). Digital games can offer an opportunity to experience the world and game designed to learn or adjust their environment (Kearney, 2005). Based on the score from PISA, there is a relationship between critical thinking and game-based learning. From the previous explanation, concluded that media needed to support learning on respiratory system material, it is necessary to develop media to improve students' respiratory system learning through games, therefore "Captain Lungs 3D" was created to improve critical thinking on the topic of biology on respiratory system material with game-based learning method that will give students new experience and inimitable material for students.

1.2 Research Problem

Based on the background stated, the research problem for this research is, “how is the development of “Captain Lungs 3D” in respiratory system topic to enhance students' critical thinking skills?”

1.3 Research Question

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

1) How is the design and development of "Captain Lungs 3D" as a learning media in respiratory system topics to enhance students' critical thinking skills?
2) How does the response of experts on content, language, and media of development of "Captain Lungs 3D" as a learning media in respiratory system topics to enhance students' critical thinking skills?
3) What is the stage of implementing the development of "Captain Lungs 3D" as a learning media in the respiratory system topics to enhance students' critical thinking skills?
4) How do students respond to the development of "Captain Lungs 3D" as a learning media in respiratory system topics to enhance students' critical thinking skills?

1.4 Limitation of Research

The research also has a limitation, to make research more detailed, the limitation of the research is:

1) Game-Based Learning

   Storyboard and games created using Unity 2019. Then, after the game project is finished, the project is exported to the android platform so that it can run the apk file in a smartphone. The rubric assessed by the expert, including mechanical, information structure, documentation, and alignment, the survey taken from the students in the screen, language, and navigation
2) Student's Critical Thinking

   Critical thinking skills adapted from Facione (2015), based on six indicators, namely interpretation, analysis, inference, evaluation, explanation, and self-regulation. In the implementation of critical thinking skills, students will answer questions in a pre-test, post-test, and question that inserted into games.
3) Respiratory system topic-subtopic

   The topic in this research is the respiratory system topic limited by core competence 3 and 4 and basic competence 3.9 and 4.9 that are attached in the

2013 national curriculum of Indonesia in Junior High School.

1.5 Research Objective

Based on the research question that has been made, the research objectives are specified as follow:

1) To design and develop "Captain Lungs 3D" as a learning media in respiratory system topics to enhance students critical thinking skills
2) To analyze the respond of experts on content, media of "Captain Lungs 3D" as a learning media in respiratory system topics to enhance students critical thinking skills
3) To implement critical thinking skills of students after learning the respiratory system using "Captain Lungs 3D."
4) To analyze students respond to game-based learning by using "Captain Lungs 3D" on respiratory system topic to enhance students critical thinking skills

1.6 Research Benefit

The result of this study is expected to provide the following benefits below:

1) For students, this research can give a new experience of learning and can enhance students critical thinking through 3D games
2) For a teacher, this research about the development of "Captain Lungs 3D" as a learning media in respiratory system topic to enhance students critical thinking skills can be used as a media of teaching in the learning process
3) Another researcher, this research can be used as a reference and can be used as one alternative in developing research. Deficiency and excess in this study can be evaluated