

CHAPTER I

INTRODUCTION

1.1 Background

PISA or Program for International Students Assessment held every three years since 2000. Indonesia is one of many countries that has been participated in taking the PISA test. However, from 2000 until 2018, the average value of the PISA test obtained by Indonesian students never reached the average number. In 2018, the average score for the science category was 296, while the average score for science was 489. This low score puts Indonesia in 70th place out of 78 participating countries in the science category (OECD, 2019).

The score of PISA test indicates that the science learning outcomes in Indonesia are still relatively low. Besides, Indonesia's low ranking indirectly indicates that Indonesian students' critical thinking skills are still low. According to Nugraha et al. (2017), the ability to solve the problem is one aspect that is measured on the PISA test. This skill is closely related to critical thinking skills. Referring to (OECD, 2019), one of the aims of the PISA test is to facilitate students to compete in this 21st Century era, one way to help them develop their abilities is to think critically.

According to *Peraturan Menteri Pendidikan dan Kebudayaan RI Nomor 20 Tahun 2016*, Creativity, productivity, critical, independent, collaborative, and communicative skills must be possessed by students (KEMENDIKBUD RI, 2016). Referring to Permendikbud (2016), in recent years, the questions measuring critical thinking skills have been included in the National Examination (UN). Nevertheless, the average score of the National Examination of Junior High School in science subject is still relatively low. The average science score is 49.79, which is below the minimum passing score of 5.5. This score of the National Examination implies that students' critical thinking skills in Indonesia are still low.

The students should be taught how to think critically because this skill is one of the most important education goals and an inseparable part of education at every level (Utami et al., 2017). It is also endorsed by Kusumoto (2018) who stated that improving critical thinking skills is one of the key pillars of educational reform. According to Lee et al. (2016), critical thinking is one of the skills that students

must be possessed in 21st Century learning, where 21st Century skills consist of creative, communicative, collaborative, and critical thinking. Facione (2015) stated that critical thinking is a way of thinking that aims to prove a point, interpret something, or solve a problem. There are six necessary critical thinking skills that accordance with Facione (2015), which are interpretation, analysis, inference, evaluation, explanation, and self-regulation.

As stated before about the low score of PISA test, one of the factors for the low score of PISA test is probably due to the learning process that does not meet the criteria for taking the PISA test. Exercising critical thinking skills in the learning process can help students improve their thinking skills (Rusmansyah et al., 2020). To develop 21st Century skills such as critical thinking skills, the teaching and learning process must follow the 21st-century learning characteristics, such as student-centered or active learning, integrating with technologies, and asking questions with HOTS level (Sumardi et al., 2020). Furthermore, Siregar et al. (2017) revealed that critical thinking is one part of higher thinking skills or called Higher-Order Thinking Skills (HOTS). Utami et al. (2017) revealed that to practice critical thinking skills must be with questions with HOTS.

However, Sumardi et al. (2020) found that most of the learning processes used teacher-centered learning, did not use technologies, using traditional approaches, and student's higher-order thinking skills are less developed. Furthermore, Utami et al. (2017) stated that most teachers still ask questions at cognitive level significantly lower than the higher-level questions. Sookoo-Singh & Boisselle (2018) revealed that the teacher-centered model leaves no opportunity for students to participate in active scientific activities. Because of that, students lack the opportunity to use and develop their thinking ability.

Kusumoto (2018) proposed that student-centered teaching could aid in the development of student's critical thinking skills. He also discovered that student-centered learning affects the improvement of student's critical thinking skills. Therefore, the teacher must be able to provide supportive learning environments. Consequently, we have to find an alternative way to overcome this obstacle to improve learning activities, supporting the student to use and develop their thinking ability.

As we know that the 21st century is globalization era. Science, technology, and information are rapidly developed. The technology can be used as an alternative media to support the learning process (Nyoman, 2018). Ahmar and Rahman (2017) revealed that according to the UNESCO web site, it stated that the ICT would lead to freedom of access to education, equality in education, and the implementation of high-quality learning and teaching. Furthermore, Sumardi et al. (2020) stated that digital media can be used. The digitalization of the teaching and learning process, and student-centered learning, are two main aspects of 21st Century learning. As a result, ICT shifts the teaching and learning activities from teacher-centered to student-centered.

One of digital media which can be used is interactive multimedia. Furthermore, Saputri and Indriayu (2018), interactive multimedia integrates several media: audio, graphic, text, animation, video, and game. It provides the students to communicate interactively with the device. Multimedia is effective to use in pedagogy. Furthermore, Yustiqvar et al., (2019) found that the use of interactive multimedia in learning has proven to improve learning outcomes, motivation, critical thinking skills, and understanding concepts.

One of the interactive multimedia which can be developed for education is the mobile application. Widodo et al. (2020) stated that gen-Z students tend to not be separated from their gadgets. An amount of 17.17 million active users utilize gadgets for apps, games, and other digital content. Moreover, almost every student from elementary to senior high school has their smartphone. Senay and Huseyin (2017) stated that mobile learning is appropriate for education since the device becomes more widespread and becomes part of everyday social and academic life. It can support learning outside the classroom and make it more efficient. Bidin and Abu (2013) found that mobile learning allows student-centered learning and participate actively in the learning process. Because according to

Walker (2011) stated that there are many higher-powered mobile devices platforms, one of which is Android. Android is an open-source platform. Furthermore, the process for developing applications in the Android platform is more user-friendly than the other platforms. Moreover, since the Android platform is open source, the developers can easily create Android applications. Ma, Gu and

Wang et al. (2014) also stated that some of the development tools are free because the Android system is open source. Furthermore, Fajar et al. (2021) stated that 75% of smartphone users in Indonesia use the Android platform. This data shows that the Android user is higher than the other platform user.

Chemistry subject was chosen in this study and the topic was chosen is matter. According to Yustiqvar et al. (2019), critical thinking skills are closely related to chemistry because chemistry consists of macroscopic and microscopic aspects that require critical thinking skills to connect those aspects. However, most students still struggle to grasp abstract concepts in chemistry because microscopic particles are invisible to the naked eye. Sya'Bandari et al. (2018) said that students have difficulties in matter concepts because they still could not connect abstract and concrete aspects. Furthermore, According to Yuniarti et al. (2017), interactive multimedia can visualize abstract concepts easier. Kotevski and Tasevska (2017) also stated that it can improve students' cognitive skills in learning and encourage student comprehension of abstract concepts.

Some previous research has been developed on interactive multimedia and media regarding the Android-based platform. Djamas, Tinedi, and Yohandri (2018) analyzed the effectiveness of interactive multimedia towards critical thinking skills. It found that interactive multimedia with equipped games is effective for improving students' critical thinking skills. However, the study only focuses on Newton's Law topic while this research focuses on the matter topic. Another research was conducted by Widodo et al. (2020). He developed gadget-based interactive multimedia. From the research, they found that the media can improve scientific literacy with medium improvement. The study's differences with this research are the study only focuses on pressure topics and improving scientific literacy. However, this research focuses on matter topics and to improve critical thinking skills. Hamimi and Sari (2020) also conducted a study to develop Android-based interactive multimedia. The media was developed to learn buffer solution topics. This study only analyzed the quality of media experts assessed, and the effectiveness of media toward learning outcomes.

The background above showed that interactive multimedia can improve learning achievement, motivation, and critical thinking skills. But there was still a

lack of digital science learning media that could train students' critical thinking skills. Consequently, the digital media which can be used to train critical thinking skills in learning science must be developed. Therefore, this research aims to develop Android-based interactive multimedia to enhance critical thinking skills in learning matter.

1.2 Research Problem

Based on the background, the research problem for this study is “How is the development of Android-Based Interactive Multimedia to Enhance Critical Thinking Skills in Learning Matter?”

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 development of Android-Based Interactive Multimedia to Enhance Critical Thinking Skills in Learning Matter?
- 2) How does the response of experts and teachers towards the Android-based interactive multimedia to enhance critical thinking skills in learning matter?
- 3) How is the improvement of students' critical thinking skills in learning matter after learning through Android-based interactive multimedia?
- 4) How do students respond towards the Android-based interactive multimedia to enhance critical thinking skills in learning matter?

1.4 Limitation of Problem

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

1) Interactive Multimedia

The interactive multimedia consists of text, image, video, animation, quiz, and game. Interactive multimedia was developed using Articulate Storyline 3 and the output is HTML 5. Then, the HTML file was converted into an Android application using website 2 Apk Builder Pro 4.0.

2) Student's Critical thinking

In this research, the critical thinking aspects used are based on (Facione, 2015) which consists of interpretation, analysis, explanation, evaluation, and inferring. The Critical thinking aspects will be included in the interactive

multimedia and in the questions that students should answer in pre-test and post-test.

3) Matter Topic

In this research, the matter content that will be included is limited by core competence 3 and 4 and basic competence 3.3 and 4.3 in curriculum 2013. The topic is also limited by the Syllabus of Curriculum 2013 which consists of the characteristics of matter, the state of matter, the properties of matter, the physical and chemical change, a single substance, mixture, and the separation of the mixture (Curriculum 2013).

1.5 Research Objective

The objectives of this research are elaborated below:

- 1) To design and develop android-based interactive multimedia to enhance critical thinking skills in learning
- 2) To analyze respond of experts and teachers towards the Android-based interactive multimedia to enhance critical thinking skills in learning matter
- 3) To analyze student' respond towards the Android-based interactive multimedia to enhance critical thinking skills in learning matter
- 4) To analyze the improvement of students' critical thinking skills after learning matter topic through Android-based interactive multimedia

1.6 Research Benefit

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

- 1) For the students, the results of this study are expected to help the students to upgrade their knowledge toward the matter topic, help them to connect macroscopic and microscopic aspects in matter topic, help the students to enhance their critical thinking skills, allows students to learn independently, and enhance students' motivation in learning matter.
- 2) For the teachers, the results of this study are expected for the teacher to use this interactive multimedia as a learning media in matter topic, as learning support to enhance students critical thinking skills on matter topic, and help the teacher to use the time allocation more effective because students can learn again the content outside the class.

- 3) For another researcher, the other researcher can use this research as a reference for those who has the relevant focus study.

1.7 The Organization of Research Paper

This section explains the structure of this research for each chapter. This research paper consists of five chapters. The description of chapter contents elaborated below:

- 1) The first chapter is the introduction which consists of background, research problem, research question, limitation of problem, research objective, research benefit, and the structure of this research paper. This chapter is the basis chapter because the work of this research is based on the research problem dan question.
- 2) The second chapter is a literature review which consists of literature theory, and information on research variables. The explanation of the literature of this research is based on books and journals. This chapter explains the literature about interactive multimedia, critical thinking skills, articulate storyline 3, analysis of core competence and basic competence, and matter topic.
- 3) Then the third chapter contains research methodology. This chapter explains the methodology used in this research. It consists of the research method, research design, research subject, operational definition, assumption, hypothesis, research instrument, instrument analysis, the technique to analyze the data, and research procedure.
- 4) The fourth chapter consists of the result and discussion regarding the research finding. It contains the analysis stage, design stage, development stage, evaluation stage, implementation stage, and the effectiveness of android-based interactivity towards critical thinking skills.
- 5) The last chapter consists of conclusion and recommendation. Conclusion explains the summarize of the research finding. In this chapter, the recommendation is for another researcher and teachers based on research findings.