CHAPTER 1

INTRODUCTION

1.1 Background

The curriculum in Indonesia is developed perpetually. The latest curriculum, which is curriculum 2013, is expected to improve the quality of education in Indonesia. Curriculum 2013 is arranged and developed by seeing the needs and the potential of the students. Curriculum 2013 offers some models of teaching. Three models are suggested by the curriculum 2013 which is Discovery Learning, Problem Based Learning (PBL) and Project Based Learning (PjBL). The government also gives special approach that is called Scientific Approach that expected to improve students' science literacy (Kemendikbud, 2016). The way to assess students' scientific literacy in Indonesia is by participating in PISA (Program for Student Assessment) and TIMSS (Trends in International Mathematics and Science Study).

The result of PISA 2015 showed that Indonesia has low achievement compared to other 69 countries. Indonesia ranked 62 out of 70 countries based on the performance of science, reading, and mathematics (OECD, 2016). Many researchers in Indonesia have observed and conducted research to improve students' science concept and literacy so Indonesia can improve in PISA score. PISA stated that science can be improved by do the extracurricular activities that help students to raise their interest in science. Moreover, the use of technology will help explain the concept through a fun learning, such as the use of applications as a learning media. Ganasen, Shamuganathan, & Matriculation (2017) support this statement by stating that the integration of technology in education is very important because it helps students to be more creative and more engaged in the lessons. The implementation of learning media (technology) found to reduce students' misconception about science concept that is difficult and abstract (Panis, 2017). States of Matter is one of concept that still found to be misunderstanding by the students.

1

The topic of States of Matter found to be a misunderstanding by most of the students. Findings consistently reported that students have great difficulty in explaining the changes of substances, basic properties of invisible molecules and explaining the changes of state in matter. Study of students' understanding in matter topic showed a specific misconception (Griffiths & Preston, 1992). Research has found that the elementary student experience a very common misconception in particles expanding on heating (Özmen & Calik, 2010). The using of teaching media or technology is one of way to reduce students' misconception.

Instead of improving students' understanding, the more important thing is to engage students' interest. Student that has high interest will be tending to comprehend the concept. Student that has high interest in a subject will have more positive outcome than those with lack of interest (Swarat, 2012). The previous researcher found that interest is in line with the students' understanding score or achievement. Based on the result of PISA 2015, students in Indonesia have a high index of interest in learning science. This result can conclude that Indonesia should have a high achievement in science learning. Instead of that, this result turns out to be in line with (Aikenhead, 2006) that found most of students were not interested in science concept. Thus, the students' interest will be more studied in this research.

Lots of teaching media have implemented to discover the misconception of States of Matter concept. One of the media that is used is PhET mobile application. PhET (Physic Education Technology) is an interactive simulation in a form of mobile application used for teaching and learning science concept in which students learn the concept through exploration. This application creates an animated for abstract fact or invisible phenomena to be modeled, such as electrons, magnetic field, electricity, element. The previous works have implemented PhET as learning media for helping students to study about Gas Behavior concept. The result stated that students who participated in this study found a great improvement in their score and recommend PhET simulation to

their peer (Correia, 2018). The study of Electromagnetism concepts have positively impacted the performance of learners (Kotoka & Kriek, 2014). PhET simulations also found to improve students' interest. Students who have been exposed to PhET interactive simulations achieved higher interest in a science subject. Panis (2017) stated that college students are increasingly interested and easy to learn physic using PhET because it provides simple and interactive physic problem simulation and present abstract concept become concrete, give passion and motivation to students. Thus, this work will investigate the use of PhET mobile application in learning the States of Matter.

This study is to investigate the implementation of PhET mobile application in learning physic subject especially States of Matter topic. States of matter is the concept that explains the characteristics and shape of particle and matter in the universe. This is one of the basic physic concepts that teach in 7th-grade students. The using of PhET simulation expected to helps reduce the misconception of the students. In this research, students' understanding and interest will be further investigated.

1.2 Research Problem

The research problem of this study is "How does Learning States of Matter using PhET Mobile Application Improve Students' Understanding and Interest?"

1.3 Research Question

Elaborating on the research problem, the research attempts to explore the following question:

1) How to Implement the Learning States of Matter using PhET mobile application?
2) How does Learning States of Matter using PhET mobile application improving students' understanding?
3) How does Learning States of Matter using PhET mobile application improving students' interest?

4) Is there a correlation between students' understanding and motivation in learning States of Matter topic using PhET simulation?

1.4 Limitation of Problem

Limitations of the research are examined in order to define the research. This research will be defined based on the following limitation:

1) PhET is an interactive simulation in a form of mobile application used in this study for teaching and learning physic concept that is States of Matter topic. The title of PhET simulation used in this research is States of Matter simulation and Density simulations.

2) Students' interest in this research is students having an effective reaction to and focused attention for particular content to re-engage particular classes of objects, events, or ideas. Situational interest describes those interests that are triggered at the moment, such as by a sudden sound, the opportunity to work with friends on a project, a cartoon illustrating a text. Individual interest develops slowly over time and tends to be long-lasting. It is often accompanied by positive affect and persistence and tends to lead to increased knowledge.

3) Students' understanding is the ability of students to understand the topic states of matter based on core competence and basic competences in national curriculum 2013. This understanding will be asses by using Taxonomy Bloom which is remembering (C1), understanding (C2), and applying (C3) (Anderson, 2001).

4) In this study, the topic States of Matter is limited by core competency number 3 and 4 and basic competence number 3.3 and 3.4 that are attached in curriculum 2013. The limitation of the topic in this study focused on particles movement in solid, liquid, gas, phase changes and density.

1.5 Research Objectives

Objectives to be achieved in this research are:

1) To investigate the implementation of the Learning States of Matter using PhET mobile application.

2) To improve students' understanding in using PhET mobile application on states of matter topic.

3) To improve students' interest in using PhET mobile application on states of matter topic.

4) To investigate the correlation between students' understanding and interest in learning the States of Matter topic uses PhET simulation?

1.6 Research Benefits

1) Benefits for teachers

Nowadays, the educational system prepared students with the 21st-century skill. To achieve this skill, the educational system needs an educator that also masters the technology and 21st-century skill. In this research, the teacher can use interactive learning media PhET to achieve these needs. The teacher can prepare and conduct interactive teaching-learning in the topic States of Matter to be more creative and trigger students' interest.

2) Benefits for student

PhET simulations can give a new experience to students to use a mobile phone in the learning process. Hopefully, the use of PhET interactive simulation can improve students' understanding and interest in the physic concept. This teaching media also can fulfill the needs of 21st-century skill that is technology literacy.

3) Benefit for researcher

This research can assist and developed the study about another mobile learning in teaching in the future especially in science education.

1.7 Organizational Structure of Research Paper

The research paper consists of five chapters which include the following.

1) Chapter I: Introduction

   This chapter contains basic information about the research. This chapter includes background, research problem, research question, research objectives, limitation of problems, research benefit, and research paper structures. The research problem and question will be further explained in the discussion.

2) Chapter II: Literature Review

   This chapter includes the explanation of Physic Education Technology (PhET), students' understanding based on Taxonomy Bloom, students' interest and States of Matter topic. This chapter explains the theory which was applied in this research.

3) Chapter III: Research Methodology

   This chapter focused on the methods which were used in this research. It consists of the research method and design, population and sample, assumption, hypothesis, operational definition, research instrument, instrument analysis result, data processing technique and research procedures.

4) Chapter IV: Result and Discussion

   This chapter focused on the result of the objective test, questionnaire, and interview of research, the analyzing of data during the research. Detailed information of the data processing will be described in order to answer the proposed research question.

5) Chapter V: Conclusion and Recommendation

   This chapter includes the conclusion of the research. The conclusion is made from the result in the previous chapter. This chapter also includes the recommendation from the author to the reader which could be other research, student, or teacher.