CHAPTER I
INTRODUCTION

1.1 Background

Teaching strategies are often used to deliver matters in curriculum objectives, in order to enhance student performance in learning process. Curriculum is the systemized and guided learning experiences and intended learning objectives in order to ensure the learner's incessant and willful growth (Mulenga, 2018). However, the school, teacher and the students have to collaborate to produce the best outcomes, especially for the student personal-social skills.

There are several outcomes from a learning process. The knowledge achieved from learning is called concept mastery, which means the students have to master the core of certain subjects to prove a positive result of a learning process (Rustaman, 2019). On the other hand, they had to have their curiosity drawn into mastering the concept. Yunanto (2013) stated that children are actually always curious and explore their surroundings, but the situation is almost totally different in the term of learning process. This could be a way to consider an ideal learning method implementation in a learning process.

Deciding the proper learning method or approach could be affecting the outcomes of the learning process. Not only that, but a correct learning approach also helps achieve the objectives from a curriculum smoother. Learning approaches had been introduced in many ways. It is mentioned by *Kementerian Pendidikan dan Kebudayaan Indonesia* [Indonesian Ministry of Education and Culture] (2014) that the original steps of learning approaches in Curriculum 2013 which currently used in Indonesia, are (1) Observing, (2) Questioning, (3) Associating, (4) Experimenting and last (5) Creating.

The established learning approaches before includes mastery concept through continuous action-reflection between teacher and students. However, additional learning approaches is needed to assure the relevance between contextual theme and the concept which the teacher wants to explain, whether using basic lecturing media or even the most recent technology development to enhance students'

1

understanding.

On the other hand, according to the Program for International Student Assessment PISA results (2018), several critical issues for Indonesia's educational system whereas inadequacy of evaluation system, the authority of education implementation for a region that faces divergence, the low teachers' ability and competency in acquiring learning material, the degradation of education orientation in which change the focus only on knowledge transfer without considering moral and behavioral aspects.

Adding to that, Indonesia came out with a very low rank in the OECD scores at reading, mathematics, and science(OECD, 2018). Only 40% of students in Indonesia can recognize the correct explanation for familiar scientific phenomena or can use such knowledge to identify, in simple cases, whether a conclusion is valid based on the data provided.

Quoted from Feriyanti (2018), one of the reasons could be that trend of implementing the curriculum is not carefully examined by many education practitioners, which leads to not achieving the learning purposes and objectives. The teacher should make appropriate approaches and use relevant media for the materials with the help of today's technology. This research will focus on a specific teaching method assisted by a media to address this issue.

One of the most-used teaching methods is Discovery Learning. According to Lee & Anderson (2013), discovery-based approaches have been widely accepted as major teaching methods by teachers and educators with constructivist views of learning. Discovery learning encompasses an instructional model that focus on active, hands-on learning opportunities for students. Castronova, (2002) proposed several ways for categorizing discovery learning, which are 1) case-based learning, 2) incidental learning, 3) learning by exploring, 4) learning by reflection, and 5) simulation-based learning. There are teachers who implement discovery learning by direct assistance from the teacher or completely let the students to explore without direct instructions.

Previous research states that when children were given indirect instruction,

they tended to focus on only the target function of a toy. In contrast, when the pedagogical demonstration was experimentally interrupted, or to be said, the teacher give direct instruction, children explored the function more broad and widely to discover information (Bonawitz 2012). Nevertheless, the findings in research from Alfieri (2011) an unassisted discovery does not benefit learners, instead, feedback and elicited explanations help a lot.

Adding to that, the research also mentioned that the optimal approaches should include at least one of the following requirement so that the result would be improved. They concluded that opportunities for constructive learning, like discovery learning implementation might not present themselves if the learners are left unassisted. Therefore, this research was conducted using guided discovery learning since it is also stated in Lee & Anderson's research (2013) that several empirical studies suggest the positive effects of providing direct instruction in assisting a teaching method.

To make the learning process worth the result, teaching methods are often balanced with the use of teaching media to help better understanding. One study shows that providing access to domain information seems effective, as long as the information is presented concurrently with the simulation so that the information is available at the appropriate moment. They also stated that providing learners with assignments, questions or games seems to have a clear effect on the learning outcome (Joolingen, 1998).

Teachers, on the other hand, claimed that guided exploration learning becomes something that is not interesting for students (Setyaningrum, 2018). Nevertheless, if the game contains clear instructions and appropriate stimulus, game activities are interesting for students. Teachers can easily monitor learning activities, thanks to technological sophistication, and web-educational games can help and facilitate the discovery learning process. Those reasons above assure the researcher to use web-educational game to assist discovery learning implementation.

The web-educational game that will be used is called Legends of Learning (LoL) which offers more than 2000 fun science and math classroom games that

align with the standard curriculum for elementary and middle school. The teachers use the platform to supplement their existing material like traditional textbooks and lectures that often failed to attract students' attention and curiosity to understand more about a topic. The founder, Vadim Polikov claim that their game collections will increase their engagement, lesson comprehension and test performance.

Regarding to the previous data about Indonesia's PISA result in math and science, the combination of discovery learning assisted with LoL's educational games could be an answer to Indonesia's low rank. Previous research by Liu (2013), stated that the effect of game-based learning improved students' scientific knowledge and performances. Therefore, this research used LoL's web-educational game as learning media, in discovery learning to develop children's curiosity and also enhance their concept mastery. Also, the game idea triggered the students to be challenged to master the concept in order to finish the games, therefore, it's a win-win situation for the teacher and student.

To simplify the current research project, the research chose a certain topic within a science curriculum. The chosen topic was Light topic from 8th grade level physics from junior high school. The material were all taken from International General Certificate of Secondary Education (IGCSE) Cambridge Physic book. The researcher applied the treatment onto the middle of selected Light physics learning process to see the enhancement of students' concept mastery and curiosity level. The aim was to be able to enhance concept mastery and curiosity by engaging the students in discovery learning collaborate with LoL.

There are several studies that analyzing about this issue such as Mukherjee's research (2015) that analyzed about the effective use of discovery learning to students' understanding. A research from Kennedy (2014) even combine a computer-based simulation with discovery learning as an active exploration process and more effective than passive observation. Zirawaga (2017), conducted a study about the use of gaming in education which resulted a benefit conclusion toward student excitement to process the material.

There is one similar study that also combine discovery learning with a specific

educational mobile application to enhance students' concept mastery and curiosity level in one of a physics topic (Zahara et al., 2020). However, the innovation from previous researches is the use of LoL as a web-educational game which provides games with standard curriculum qualities. As the new way for students to explore every possible topic with excitement that every game could create, in order to resulting a new solution to solve the Indonesia's PISA result in students' math and science performance in physics of light topic.

1.2 Research Question

The problem of this research is stated in this question is "How does discovery learning assisted by LoL web-educational games improve student concept mastery and curiosity level in learning about the physics of light?"

This Research will be more focused on these three questions:

a. How does the implementation of discovery learning assisted by LoL web-educational games in learning about the physics of light?

b. How does discovery learning assisted by LoL web-educational games improve student concept mastery in learning about the physics of light?

c. How does discovery learning assisted by LoL web-educational games affected student curiosity in learning about the physics of light?

1.3 Research Objective

The main purpose of this research is to determine how students' concept mastery and curiosity can be improved using the discovery learning method, assisted by the Legends of Learning (LoL) application as web-educational game in light topic from Cambridge curriculum.

1.4 Research Benefit

This research is beneficial in terms of knowing the efficiency of using discovery learning assisted by LoL to improve students' concept mastery and curiosity.

Here are the benefits for each party:

a. Teachers

If the research came up with a positive result, the treatment and the combination of discovery learning and LOL could inspire the teachers to make learning more interesting yet easier to understand.

b. Students

Physics is one of the complicated material of science in general. If this research shows that students master the concept easier, then it would be an ideal solution to overcome the difficulties students often face when they learning science, precisely phycics.

c. Another Researcher

Hopefully the research could be used as new reference for further research, or inspire other researchers to combine an instructional learning approach with other web-educational games.

1.5 The Organization of Research Paper

a. Chapter I: Introduction

An introduction is needed in every research to include fundamental reasons and begin with everything in detail. This chapter starts with the background of the research, along with the research questions. To limit the discussion, this chapter also includes limitations of the problem. The objective and benefits are also stated here.

b. Chapter II : Literature review

The second chapter is consisted of a whole literature review about the theories of scientific research relating to discovery learning, the LoL web-educational games, students' concept mastery, and students' curiosity.

c. Chapter III: Research Methodology

This chapter explains and describes the methods, which will be used in this research. Including about the research methods, research design, population, sample, hypothesis, assumption, and data analysis.

d. Chapter IV: Result and Discussion

In Chapter IV, the data which has been gathered, will be discussed here as a result for this research. The findings will be analyzed carefully in detail here.

e.   Chapter V: Conclusion, Implications and Recommendations

This chapter states the conclusion after the data was gathered, processed, and analyzed. It also states the recommendations or suggestions to other researcher, teacher and student.

1.6 Limitation of Problem

In order to make this research more focused, the problem is limited as follow:

a.   Discovery Learning

This research is used the "Incidental" and 'Exploring' architecture of discovery learning based on two variables, which are concept mastery and curiosity.

(1) Incidental Learning

Incidental learning is one of the kind of discovery learning, this activities work well with topics with rote memorization because they provide motivation to learn topics or skills that are typically perceived by students as not very interesting but somehow has to be mastered by the students. In an educational game, it can be motivational to students to learn, because they need to master the concept in order to finish the game (Castronova, 2002).

(2) Exploring Learning

Students are given a mystery to solve and they can only solve it by asking questions. In this architecture, curiosity is intended to serve as a dramatic motivational tool (Castronova, 2002).

Discovery learning in this research method used the syntax below:

(1) Stimulation

(2) Problem Statement

(3) Data Collection

(4) Data Processing

(5) Verification

(6) Generalization

The syntax or steps above taken from official book of *Model – Model Pembelajaran IPA dan Implementasinya* [Science Learning Models and the Implementations] *by Pusat Pengembangan dan Pemberdayaan Pendidik dan Tenaga Kependidikan Ilmu Pengetahuan Alam (PPPPTK IPA)* [Quality Improvement for Teacher and Educational Personel (QITEP) in Science] (Syarif, 2017).

b. Students' Concept Mastery

Students' concept mastery is measured from students' achievement on their cognitive level process dimension (Anderson et al., 2001). The total of cognitive process dimension is six, there are C1 until C6 (Remember, Understand, Apply, Analyze, Evaluate and Create). This research will be focused on C1 until C4 only as shown below;

(1) C1 Remembering; retrieve relevant knowledge from long-term memory

(2) C2 Understanding; construct meaning from instructional messages, including oral, written, and graphic communication

(3) C3 Applying; carry out or use a procedure in a certain situation

(4) C4 Analyzing; break material into its constituent parts and determine how the parts relate to one another and to an overall structure or purpose

The improvement of students' concept mastery will be measured with n-gain value enhancement based on Hake's rule (Hake, 1998).

c. Students' Curiosity

Researchers have debated how to define, measure, and support curiosity development in individuals. To address the need to measure students' curiosity, this research used a valid instrument from Science Curiosity in Learning Environments (SCILE). It consists of 12-item scale in a three factor model; 1) Stretch, 2) Embrace, and 3) Science (Zimmerman, 2016).

d. The Physics of Light Topic

According to the International General Certificate of Secondary Education (IGCSE) physics 3rd edition, Light topic is included in section 3, Properties of

Waves. The physics of light has several subtopics, but this research will only be focused on light waves, properties of light, electromagnetic spectrum, and the speed of light (Duncan, 2014).