

# CHAPTER I

## INTRODUCTION

### A. Background

Nowadays, educational world has been trying to emphasize on digital multimedia known as Technology-based assessment (TBA). Within the last few years, these innovations have fundamentally changed the way people live, learn and communicate. Soon TBA will replace paper-based testing, extend business and substance of assessment in education (Bennett, 2002). Parallel to these tendencies, paper-based assessment reached its limits (Scheuermann and Björnsson, 2009). Paper-based test as the conventional test which common to be implemented in the educational field now facing several weaknesses compare to paper-based test, such as it needs longer time to calculate students' score, it required higher cost to provide the printed questions, and several other more. Further development such as reduction of costs, logistic and feedback time is unexecutable with paper-based test tools (Molnar, 2010). There is no longer doubt that multimedia application design offers new insights into the learning process, gives possibilities to represent information and knowledge in a new innovative way which have the potential to transform education (Molnar, 2011).

The following condition related to science virtual and paper-based test was becoming a problem since paper based test was not enough to be implemented in educational field. Roseleen and Eric (2015) in their research about the controversial video to investigate critical thinking of secondary student was showed that the information provided in form of audio narrative video impact on the students critical thinking which is significantly higher compare to long text information. From that relevant research, it can be inferred that paper-based test has weakness in measuring students' critical thinking. Being motivated by the fact shown on the result, it was necessary to compare science virtual test and paper-based test in order to find out which test which necessary to be implemented to measure students' critical thinking.

Refers to the development of technology-based innovation for education, Indonesia has also implement the use of computer in order to held national examination called as *Ujian Nasional Berbasis Komputer (UNBK)*. UNBK was first implemented limited at *SMP Indonesia Singapore* and *Sekolah Indonesia Kuala Lumpur* in 2014. The result showed that both schools were encouraging and further pushing to improve students' literacy to Information and Communication Technology. Furthermore gradually in 2015, UNBK was implemented in Indonesia by involving as many as 556 schools consisting of 42 SMP / MTs , 135 SMA / MA and 379 vocational schools in 29 provinces and Foreign Affairs as it is mentioned in *Kemendikbud.go.id*.

The development of testing technology seems offer many advantages in manything that mostly can overcome what has becoming problems of paper and pencil test. Computer based test where it is empasizing on technology drives people's way of thinking to take the simple and costless way rather than keep using conventional or traditional way as it has been offer by paper and pencil test. Hence, there are still several advantages ofered in traditional testing. For instance, testing that still require the students to solve certain mathematical calculation will still expect student to do manual calculation in order to keep stimulate students to strengthen their skill in calculation and mathematical logics. Ruling out the things offered by both of the test in couple of point of view, it was driven this research to be conducted in order to figure out the comparation between computer- based test and paper- based test.

Supporting the information about computer based test, the creation of a technology-enriched classroom appears to have a positive effect on student acquisition of higher-order thinking skills (Hopson, Simms, and Knezek, 2004). Critical thinking as one of higher order thinking skill can be simply put in contrast to illogical or irrational ways of thinking (Facione, 2011). However, it cannot be equated with argumentative types of thinking or making criticisms (Lau, 2009). Critical thinking further involves reflective types of thinking, that is thinking about activities (Dantas and Whitney, 2002). Refers to that, critical

thinking was necessary to be brought as a skill that possible to be measured in implementation of computer based test.

Critical thinking includes both cognitive competencies and personal competencies which interact each other. Each of these competencies involves different components all of which are in constant interaction with one another. Cognitive competencies include having the ability to dissect, modify, analyze, interpret, examine, correlate, synthesize, summarize, understand, and make inferences and generalizations. Personal competencies, on the other hand, include being tolerant of ambiguity, thinking independently, having perseverance, self-confident, inquisitive, motivated, reflective, creative, and curious (Nugent and Vitale, 2008). Research has provided some insights into factors that may enhance students' abilities to think critically. Clearly, more years of education are associated with higher scores on tests for critical thinking, but performance in general is poor and many students graduate from college lacking proficiency as critical thinkers (Nugent and Vitale, 2008). That statement indicate that critical thinking should be innovate to drive student to think more critically on certain problem, no exception on science problem.

One of science topic which can be taken in order to measure students' critical thinking is living thing and environmental sustainability. Environmental sustainability is correctly defined by focusing on its biogeophysical aspects. It means maintaining or improving the integrity of the earth's life supporting systems (Moldan, Janouskova, and Hak, 2012). Currently, with the major growth and ambitions of technology production, criticism in various countries has become more widespread, and pointed toward environmental sustainability. Other than that, environmental sustainability is also defined as the ability to maintain the qualities that are valued in the physical environmental. Sustainability issues arise wherever there is a risk of difficult or irreversible loss of the things or qualities of the environmental (Sutton, 2004). The importance of environmental sustainability maintenance, the issues regarding environmental sustainability, and the criticisms toward it had driven the research to be conducted.

Other thing which also interesting to discuss is a finding which stated that male and female students have significantly different learning styles. It was the responsibility of the instructor to address the diversity of learning styles and develop appropriate learning approaches (Wehrwein, Lujan, and DiCarlo, 2007). Male and female has several differences in term of thinking. Male tends to think as a leader while female tends to think like a manager (Bleidorn et al., 2015). Refers to that, it was necessary to elaborate whether science virtual test is available for any gender or it was beneficial for certain gender only. In addition, it was also necessary to elaborate students' learning style as it was mentioned on the research done by Wehrwein, Lujan, and DiCarlo (2007) that learning style also being influenced by gender where female tends to visual, while male tends to audio and kinesthetics. It drives the author to find out whether science virtual test that provides the information in various type such as video, audio narrative, picture, and text will be available for anykind of learning style or it was beneficial only for one type of learning style. Besides, students' experience is also influence the implementation of education. A study done by Dewey (2013) defined education as reconstruction and reorganization of experience which adds to the meaning of experience which increases ability to direct the course of subsequences experience.

Science virtual test as one of computer based test which provide information in various type was appropriate to be used in measuring students' critical thinking. Concoidering such kind of imformations above, the author would like to conduct a research entitled "Comparing Science virtual Test and Paper-Based Test to Measure Students' Critical Thinking on Living Thing and Environmental Sustainability".

## **B. Research Problem**

The research problem of this study is constructed and formulated as "How is the Comparison between Science Virtual and Paper-based Test to Measure Students' Critical Thinking on Living Thing and Environmental Sustainability?"

### **C. Research Question**

Elaborating the research problem, the research attempts to explore these following questions :

- (1) How is the comparison between science virtual and paper-based test to measure students' critical thinking?
- (2) How is the comparison between science virtual and paper-based test to measure students' critical thinking based on gender?
- (3) How is the comparison between science virtual and paper-based test to measure students' critical thinking based on Visual-Auditory-Kinesthetic (VAK) learning style?
- (4) How is the comparison between science virtual and paper-based test to measure students' critical thinking students' experience?
- (5) How is the comparison between science virtual and paper-based test to measure students' critical thinking based on science content?

### **D. Limitation of Problem**

In order to make the research becomes more specific and focuses, the problem is limited as follows:

- (1) Science virtual test used in this research means a set of multiple choice test item where include several supported informations in form of video, picture, chart, audio-narrative, and graph provided virtually and constructed by using Adobe flash player 9 software. The implementation of science virtual test in this research is by showing the problem in LCD projector for the whole class considering the existance of supported technology in most of Indonesian public school which still lack of computer and earphone.
- (2) Paper-based test which is used in this research is set of multiple choice test item provided in black and white printed version. The test item were constructed by converting validated science virtual test item into paper-based test. Those was the way that is conducted in order to set the equality within those two tests.

- (3) Critical thinking that is used in this research is an ability to criticize certain problem elaborated on eight elements of critical thinking, which are purpose, question at issue, assumption, point of view, information, concepts, interpretation and inference, and implication and consequences (Inch, 2006). Those elements then implemented in test item construction.
- (4) In this research, Science content was taken and limited by Core Competence no. 3 and Basic Competences No. 3.7, 3.11, 3.12, 3.14, 3.15 which are attached in *Kurikulum 2013* document. The topics which are elaborated in this research are plant structure and tissue, reproduction system, society development and its effect, sun radiation, and climate change. Those topics then simplify in certain theme which is “Living Thing and Environmental Sustainability”.
- (5) Gender difference which is used in this research is students’ gender classified into two groups which are male group and female group. Each group were given the same treatment and experience in both science virtual test and paper based test.
- (6) Learning style which is used in this research is VAK (Visual- Auditory- Kinesthetic) model. The data of students’ learning style is obtained through VAK Learning Style Inventory by Victoria Chislett. The questionnaire consists of 30 multiple choice questions with three options which indicates visual, auditory, and kinesthetic.
- (7) Student experience which is used in this research is specified and limited into students’ previous experience on conducting a test virtually (computer-based test). The students’ are classified into experienced and inexperienced group were given the same treatment and experience in both science virtual test and paper based test.

#### **E. Research Objective**

In line with what has been stated on research question, this research is conducted by mean:

- (1) To analyze the general comparison between science virtual and paper-based test to measure students' critical thinking.
- (2) To analyze the comparison between science virtual and paper-based test to measure students' critical thinking based on gender.
- (3) To analyze the comparison between science virtual and paper-based test to measure students' critical thinking based on VAK (Visual-Auditory-Kinesthetic) learning style.
- (4) To analyze the comparison between science virtual and paper-based test to measure students' critical thinking based on students' experience.
- (5) To analyze the comparison between science virtual and paper-based test to measure students' critical thinking based on science content.

#### **F. Research Significant**

The results of this study are expected to provide benefits to anybody including teacher as the one who directly implement the test item to the student, school system, and other researcher. The benefits were not only during the implementation of science virtual test and paper-based test but also in term of development of the result in this research.

In implementing science virtual test, it might be beneficial for teachers because it drives teachers to emphasize on digital media in order to assess the students's score in any given variable and give the student kind of test item which is more real and contextual to a certain problem. Besides, science virtual test is paperless so it might decrease the school cost which has to be spend for paper-and pencil test in printed version. Other than that, the implementation of science virtual test is also beneficial for the school to enhance school integrity because of the implementation of technology-based assessment. The teacher might also be able to analyze the contextual comparison between science virtual and paper-based test.

Hence, it might also developed by mean to be beneficial as the model of test item development which is available to measure high order thinking. The development could be implemented by conducting following research, involving

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science topic which mostly contained nowadays issue, find out ways to strengthen the significant comparison between science virtual and paper-based test, and explore more about science virtual test potential in term of fulfilling 21st century educational demand.

### **G. Organization Structure of Research Paper**

In order to simplify the discussion and drafting research reports, following the author plans to make the organizational framework of the research described by systematic writing as follows:

Chapter I Introduction, including background, research problem, research question, problem limitation, research objective, research benefit, and organization structure of research paper

Chapter II Literature Review, including description of basic theory of the research which are about science virtual test, paper-based test, students critical thinking, gender differences, Visual-Auditory-Kinesthetic (VAK) model, student experience on science virtual test, and the content which is living thing and environmental sustainability.

Chapter III Research Methodology, which is about research method and research design, sample and population, operational definition, assumption, hypothesis, research instrument, data analysis technique, research procedure, and research flowchart.

Chapter IV Result and Discussion, contains data which is obtained and its interpretation, discussion about the data, and analysis of the research.

Chapter V Conclusion and Recommendation, contains the conclusion of the research and some recommendations regarding the research.