

# CHAPTER I

## INTRODUCTION

### A. Background

Modern technology offers educators a variety of new tools that can be used in the classroom. Technology can help teachers track and assess their students' as well as their own performance in the classroom. The rapid advancement of Information and Communication Technologies (ICT) in teaching and learning has shifted the paradigm from paper-pencil-based to computer-based system of examinations. Early research on CBT almost exclusively focused on theoretical issues such as improving measurement efficiency by achieving adequate levels of test score reliability using as few items as possible (Aliyu, et al., 2015).

Various examination methods are used in higher education institutions to assess the academic progress, for example paper-pencil-based examinations, assignments, and presentations (Jamil, et al., 2012). Sim, Holifield, and Brown (2004) identified more than fifty varied techniques used within higher education for assessment purposes; the most commonly method used are examinations. The rapid advancement of Information and Communication Technologies (ICT) in teaching and learning has shifted the paradigm from paper-pencil-based to computer-based system of examinations which are usually termed as Computer Assisted Testing, Computerized Assessment, Computer Based Testing (CBT), Computer Aided Assessment (CAA), Computer Based Assessment (CBA), Online Assessment, E-Assessment and Web-Based assessment. This test uses computer based test method known as CBT (Aliyu et al., 2015).

Today, CBT is a broad-based industry that encompasses a large variety of assessment types, purposes, test delivery designs, and item types appropriated for educational accountability and achievement testing, college and graduate admission testing, professional certification and licensure testing, psychological testing, intelligence testing, language testing, employment testing, adult education, military use (Luecht and Sireci, 2012). In other hand, Friedrich (2008) noted that CBT enables educators and trainers to author, schedule, deliver and report on surveys, quizzes, tests and exams. Nowadays, computers are used to

conduct the examinations online, usually in the form of multiple choice questions, submit and get immediate results. Since 2015, the National Exam is not used as a determinant of graduation, as was the case in previous years. There are two methods used in the national exam this year, namely, computer-based test (CBT) and paper-based test (PBT). Computer and related technologies provide powerful tools to meet the new challenges of designing and implementing assessments methods that go beyond the conventional practices and facilitate to record a broader repertoire of cognitive skills and knowledge. According to Bodmann and Robinson (2004) computer-based tests offers several advantages over traditional paper-based tests. Technology based assessment provide opportunities to measure complex form of knowledge and reasoning that is not possible to engage and assess through traditional methods.

This research introduces a science virtual test to measure the critical thinking of the students. Critical thinking includes the component skills of analyzing arguments, making inferences using inductive or deductive reasoning, judging or evaluating, and making decisions or solving problems (Lai, 2011). Critical thinking is the most important skill for problem solving, inquiry and discovery. According to Zhang (2003), "The ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused on inquiry, and persistent in seeking results which are as precise as the subject and the circumstances the inquiry permit". Paul (1993) also believed that acquisition of critical thinking skills is considered vital for students to face a multitude of challenges of adult life and function effectively in today's increasingly complex world.

A graduate's ability to be a critical thinker is expected by many employers; therefore development of students' critical-thinking skills in higher education is important. There is also a perception that today's students are technologically "savvy", and appreciate the inclusion of a technological approach to learning. However, the complexity of the concept of critical thinking and the assumptions

about students' technological skills are debatable issues that require clarification and evidence-based research in terms of teaching and learning (Carmichael and Farrell, 2012). Bringing together critical thinking and digital technologies may be beneficial in that it provides an additional opportunity for interested students to achieve higher levels of knowing and/or to practise the seven processes of critical thinking (Charmichael et al., 1998).

Nowadays knowledge always develop, that's why the test should be developed because one of the test purpose is to develop students' achievement, ability and skill. This research focused on developing the science virtual test item to measure students' critical thinking. The item tests should be selected because it has the highest fidelity with the target domain of task representing an important ability, such as reading, writing, or mathematical problem solving and it should be developed in consistently with the most rigorous guidelines (Haladyna and Rodriguez, 2013). The quality of test questions or items can be measured with the help of "Item Analysis Process". The major concepts related to item analysis including validity, reliability, item difficulty, and item discrimination (McCowan, 1999). As item development is a major step in test development, validity can be greatly affected by a sound, comprehensive effort to develop and validate test items (Haladyna and Rodriguez, 2013). The test item should be fieldly tested, and test takers should be appropriately prepared, then they should know what is the expected of item. Item analysis uses statistics and expert judgment to evaluate tests based on the quality of individual items, item sets, and entire sets of items, as well as the relationship of each item to other items (McCowan, 1999). Therefore, the quality of test will be increased.

## **B. Research Problem**

The research problem is "How is the science virtual test to measure students' critical thinking on living things and environmental sustainability developed?"

## **C. Research Question**

The research attempts to explore the following question:

- a. How is the science virtual test to measure students' critical thinking on living things and environmental sustainability based on the characteristic of critical thinking constructed?
- b. How is the legibility of science virtual test to measure students' critical thinking on living things and environmental sustainability based on the characteristic of critical thinking?
- c. How is the validity and reliability of science virtual test to measure students' critical thinking on living things and environmental sustainability?

#### **D. Limitations of Problem**

To focus the research, these the limited problem as follow:

- a. Virtual test

Virtual test that used in this study is made from Adobe Flash Software. Virtual test is the test that used a computer based testing (CBT) concept. In this study there are some media such as video, picture, diagram, and science comic. According to Fagbola, Adigun, and Oke A, (2013) Computer Based Test (CBT) is an effective solution for mass education evaluation.

- b. Critical thinking

Critical thinking which used in this research is an according to Inch et al. (2006), contain eight elements of critical thinking which as a related function. The elements are: purpose, question at issue, assumptions, point of view, information, concepts, interpretation and inference, and implication and consequences.

- c. Living things and environmental sustainability

The topic that used in this study is living things and environmental sustainability in 8<sup>th</sup> grade that limited by Core Competency Number 3 and Basic Competence of 3.7, 3.11, 3.12, 3.14, and 3.15 that are attached in 2013 Curriculum. Sub topics are structure and function of plant, reproductive system, developing of citizen, sun radiation, and climate change.

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

This research has objectives as follow:

- a. To construct the science virtual test to measure students' critical thinking on living things and environmental sustainability based on the characteristic of critical thinking.
- b. To evaluate the legibility of science virtual test to measure students' critical thinking on living things and environmental sustainability based on the characteristic of critical thinking.
- c. To test the validity and reliability of science virtual test to measure students' critical thinking on living things and environmental sustainability.

#### **F. Research Benefit**

This research has a benefits for other, such as:

- a. For Teacher, especially for science teacher the critical thinking of student use as basic information to develop the quality of test, method or media which appropriate in teaching on living things and environmental sustainability. Teacher can reflect more about how to construct and develop an appropriate instrument or test item to measure students' critical thinking.
- b. For Students, as the motivation to develop more skill in the purpose to understand and to actively participate in teaching and learning activity. They have experience in solve a problem to measure a critical thinking. To make them train their critical thinking when doing the test.
- c. For another researcher, especially for educational and assessment researcher as basic research to do more development and go to the next step, which more focus on a way to increase the level of critical thinking of students, by doing various kind of method. They can continue the research to develop the virtual test for further. This research can be a reference for a relevant research.

#### **G. Definition of Terms**

- a. Science virtual test or computer based testing is an e-exam, computerized testing and computer-administered testing, it is a method of administering tests in which the responses are electronically recorded, assessed, or both (Kuzmina, 2010).

- b. Critical thinking is that mode of thinking about any subject, content, or problem in which the thinker improves the quality of his or her thinking by skillfully taking charge of the structures inherent in thinking and imposing intellectual standards upon them (Elder, 2007).
- c. Living things are organisms that display the key characteristics of life. These characteristics include the ability to grow, reproduce, take in and use energy, excrete waste, respond to the environment, and possess an organized structure more complex than that of non-living things (Skamp, 2004).
- d. Environmental sustainability is the rates of renewable resource harvest, pollution creation, and non-renewable resource depletion that can be continued indefinitely (Daly, 2005).
- e. Legibility is ease and accuracy of reading of written or printed material (Page and Thomas, 1979)

#### **H. Organization of Research Paper**

In making systematically of this research paper consist of five part, as follow:

- a. Chapter I Introduction. In this chapter contains background of the research, research problem, research question, limitation of problem, research benefit, definition of terms, and organization of the research.
- b. Chapter II Literature Review. In this chapter explained about a literature review about the concept of virtual test or computer based testing, students' critical thinking, living things and environmental sustainability. Then, the related research to support this research.
- c. Chapter III Research Methodology. In this chapter explained about the research method that was used in this research, population and sample, operational definition (science virtual test and critical thinking), research instrument, instrument analysis, research procedure, and research plot.
- d. Chapter IV Results and Discussion. This chapter described about the results of the research such as critical thinking test, legibility test of science virtual test, and test item analysis (validity, reliability, difficulty index, discriminating power, and quality of the distractor). Then, it is explained the discussion of result analysis of the research.

- e. Chapter V Conclusions and Recommendations. In this chapter explained about the conclusion of the research and recommendation for teacher and other researcher about this research.