

# CHAPTER I

## INTRODUCTION

### 1.1 Background

In the current era of globalization where information and news revolve rapidly, we must be able to sort out the information needed. Science and technology advancements are rapidly developing the transformation of data and news (Hafizan, Shahali, & Halim, 2010) and it is overwhelming for students to be able to understand everything at once.. The ability to sort out information and think critically in response to information received is urgently needed.

This condition also applies to school. Students should be able to follow the development of information while following the learning flow in school. The science process skills should be used by teachers in teaching to effectively teach the facts and truths of science. Understanding science is not only learning the knowledge but understanding the ways to comprehend the world systematically. Students need skills in science processes to discover more about the world of science and technology. Students can study science meaningfully by exploring the abilities of science processes centered on the constructivist strategy (Turiman, Omar, Daud, & Osman, 2012).

Thus, it is important for teachers to include how to obtain knowledge rather than teaching the knowledge directly through science process skills in the teaching process. In this regard, the use of science process skills as a means of acquiring knowledge has become a necessary goal in science education (Hafizan, Shahali, & Halim, 2010). Obtaining science process skills, at the same time, means preparing future scientists, having scientific literacy acquired, that is enabling students to use scientific information in daily life (personal, social and global).

The science process skills (SPS) are described as transferable skills that are applicable to many areas and reflect scientists ' habits. They are skills that encourage physical science teaching, ensure efficient participation of learners, allow learners to build a sense of responsibility in their own teaching, enhance lifelong learning, and also provide academic skills to learners (Ergul et al., 2011). Science process skills as unique competencies that optimize the learning of science, stimulate students, develop students' responsibility of their learning, improve the

stability of learning as well as introduce them the techniques of research methods (Carey, Evans, Honda, Jay, & Christopher Unger, 2007). Learning science process skill is an important method for this purpose.

The term of process skills has been used a lot in the educational discussion as the basis of critical skills needed by students in formulating and evaluating information. Such skills as observing phenomena, comparing information, classifying necessary data, inferring, predicting, and hypothesizing information or news are very much needed by students in learning science (Ozdemir, Dikici, & Relationships, 2017; Padilla, 1990). Being said, science process skills are the building blocks of critical thinking skills. Some skills of science process skills are proved to support 21st-century skills including critical thinking and science literacy. As the main focus of learning in 21st-century skills, critical thinking has proven that improving critical thinking will essentially improve the quality of education (UNESCO, 2000).

Other than teaching science process skills in school, Assessment of science process skills are also needed to improve the quality of education. More than dozen of science process skills test has been developed such as The Science Test Instrument (TSTI) by Walbesser, Biology Readiness Scale (BRS) by Lavinghousez, The Test of Science Inquiry Skills (TSIS) by Riley, The Science Process Test (TSPT) by Ludeman, and A Group Test of Four Processes by McLeod, Berkheimer, Fyffe, and Robison were developed on general topics and has similar characteristics as (a) the test mainly uses multiple-choice test items; (b) the tests cover only some of the process skills; (c) the tests covers only the general science topic in school. However, some researchers have highlighted the need to develop the tests in alternative formats to answer the new arrival of the times. The suggested alternative tests must include observation of students' laboratory work, computer simulation (Berger, 1982), technological applications, and open-ended questions test items (Temiz, Taşar, & Tan, 2006). Seeing the needs of developing a test with computer simulation in the application, the researcher has initiated to develop a virtual test to assess students' science process skills.

The international education quality is measured by PISA and TIMSS as they also release the list of education quality of the countries. The list shows

students' ability of science, math, and literacy of the countries. Countries which acquires low PISA and TIMSS ratings show that the science process skills of the students in the country are low, including Indonesia which placed in 62th in 2018 (Echazarra, Daniel, Mendez, Denis, & Rech, 2016). Indonesia ranks 64th out of 120 countries based on the evaluation of the Education Development Index (EDI). (UNESCO, 2012). Some research results have shown that the factors of high quality of education is teachers and technology meaning that improving the crucial factors would eventually lead to the advancement of quality of education in a country.

This 21<sup>st</sup> century era demands learners to acquire skills to face it and being technologically literate is the crucial one. Science and technology advancement has a important impact in education as in any other field. Science education as the significant sector has the latest goal of having science and technology literate people. However, teachers ' capacity to use technology has not met the requirements, the teaching method remains teacher-centric and tends to be tedious and less interactive and communicative in knowledge transfer (Kirkup, Schagen, Wheeler, Morrison & Whetton, 2007; Nentwig, Parchmann, Grasel, Ralle & Demuth, 2007). Therefore, technology-based assessment and testing took notice of many teachers and evaluators.

Computer based assessment (CBA) has been offering the need of technology-based assessment in the past year, especially in Indonesia. Since 2013 the national examination has used CBA in the form of computer based-test (CBT). However, in utilizing CBT as assessment tools, there are features in CBT that hasn't been utilized well (Retnawati et al., 2017). The CBA has had many advantages, such as decreasing paper use, minimizing cost costs for conducting experiments, providing additional opportunities for testing variants in one trial, and the appearance of audio, picture, and video in one test. The CBA has been sufficiently advantageous rather than paper based test(Joshua, Ikiroma, & Joshua, 2013; Yurdabakan & Uzunkavak, 2012). The national examination served only the print-out as a digital test. It is unfortunate that there are many features that can be applied in CBT that could improve the content and the test. (Sunyono, 2018).

Computer-based assessment is believed to be able to discover a new assessment of several process skills in science (Hafizan, Sahali & Halim, 2010In

this research, CBT is a virtual test that is being created as the new tool to teach science. It would be interesting and meaningful for learners to implement the science process skill test in the form of a visual test. It is anticipated that students will be able to use technology as their new method of teaching and broaden their understanding, as well as explore their skills in science processing with actual issues served with the exam in images, video and even audio.

In Indonesia junior high school, the topic of science and technology is designed to obtain basic skills in science and technology and to critically, creatively and independently cultivate scientific thinking (Rusyati & Firman, 2017). Through experiencing the test of science process skills in a virtual test form, would cover the goal of students to have basic skills in technology as well as have their science process skills assessed in a new way. Being said, this study aims to develop an assessment instrument in the form of virtual test to assess students' science process skills in the specific biology topic, which is levels of organization and cell transport topic.

Noticing that most of the test developed before only covers general science topics and only BRS by Lavinghusez that specifically covers biology in general, it is important to develop the virtual test in particular subject and topics region. The associated anticipation has embedded science process skills abilities in multiple particular materials within a topic matter instruction to promote the development of process skills that are relevant to a broad range of thinking functions within the topic in question and promote their application to other everyday issues (Dillashaw & Okey, 1980). Biology as one of the main life science courses mainly use these skills in the practice, especially in learning about cells and levels of organization. Students need to understand the origin of cells as it is the compulsory topic of biology. As cells are an abstract concept, students need help to virtually draw the image of cells to learn it deeply and meaningfully. Science virtual test would help students in visualizing the content if the topics thus no misunderstood of topics can occur.

## 1.2 Research Problem

The research problem of this study is “How is the development of science virtual test on levels of organizations topic to assess junior high school students’ science process skills?”.

## 1.3 Research Question

In attempt to elaborate the research problem, this research will explore these following questions:

- 1) How is the process to develop science virtual test on levels of organizations and cell transport topic to assess junior high school students’ science process skills?
- 2) How is the validation and reliability of science virtual test on levels of organizations and cell transport topic to assess junior high school students’ science process skills?
- 3) How is the profile of students’ science process skills during the application of science virtual test on levels of organizations and cell transport topic to assess junior high school’s students’ science process skills?

## 1.4 Limitation of Problem

To focus the research, research problem is limited as follows:

- 1) Science Virtual Test. The science virtual test was developed using Adobe Flash Professional CS 6. The test item within this science virtual test was multiple choices questions.
- 2) Science Process Skills. The skills of science process skills to be developed in this study covers the eight skills, which are; interpreting, classifying, communicating, applying concept, predicting, raising questions, hypothesizing, and planning an experiment/investigation (Rezba, Sprague, & Fiel, 2003; Rustaman, 2010).
- 3) Levels of organization and cell transport topic. The science topics that used in this study cover levels of organization and cell transport topic in 7<sup>th</sup> grade that limited by Core Competence number 3 and Basic Competence number 3.9 in Indonesia’s Curriculum of 2013 and two Subject Content of IGCSE Cambridge Syllabus which are Organization of Organisms and Movement in and out of Cells. Sub topics are levels of organization, cell organelles and function,

eukaryotic and prokaryotic cells, animal and plant cells, specialized cells, and cell transport.

### **1.5 Research Objective**

The objectives of this research are described as follows:

- 1) To develop science virtual test on levels of organizations topic to assess junior high school students' science process skills.
- 2) To analyze the validity and reliability of science virtual test on levels of organizations topic to assess junior high school students' science process skills.
- 3) To analyze junior high school students' science process skills on levels of organization and cell transport topic during the application of science virtual test.

### **1.6 Research Benefit**

The benefits of this research are described as follows:

- 1) For teachers, the virtual science test established in this research can be used as a tool for evaluating the scientific process abilities of learners. Teachers can also assess the instruments to enhance test quality, media and methods, particularly in levels of organization and cell transport topic as an improvement of assessment of science process skills in science.
- 2) For students, this virtual science test can be used as a instrument for measuring their science process skills with expectations that learners will be more encouraged to develop new skills in the science process and will participate actively in the science class after the exam.
- 3) For another researcher, especially science education and assessment researchers could be used as basic research regarding the use of science virtual test to assess science process skills.

### **1.7 Organizational Structure of Research Paper**

In arranging the research paper systematically, the structure is divided into five parts. Chapter I Introduction. This chapter contained background of the research, main research problem, research question, limitation of problem, research objective, research benefit and organizational structure of the research.

Chapter II Literature Review. This chapter explained in detail the variables involved in the research, in particular the concept of science virtual test or computer based test, students' science process skills, and levels of organization and cell transport topic. Other than that, the related research that support the research is also explained in this chapter.

Chapter III Research Methodology. This chapter covered the research method used in the research, research subject, operational definition of variables (science virtual test and science process skills), research instrument, instrument analysis, and research procedure.

Chapter IV Result and Discussion. This chapter presented the results of the research such as the process of science virtual test making, validity and reliability of the science virtual test, test item analysis (validity, reliability, difficulty index, discriminating power, quality of distractor), students' science process skills profile, and students' impression. The results then are described in the discussion of result analysis of the research.

Chapter V Conclusion and Recommendation. This chapter explained the conclusion and recommendation of the research for teachers and other researchers regarding this research.