

CHAPTER I

INTRODUCTION

A. Background

In the 21st century, there have been shifts in the way we live as well as in how we get and evaluate information. These shifts mean we need to look critically at critical thinking itself and determine what approaches are most effective to meet the challenges and opportunities (Anne & Kreitzberg, 2010). Critical thinking is the skill to prevent people from making bad decisions and helps to solve the problems (Inch, Warnick & Endres, 2006).

Critical thinking makes us think not just about the world around us but also about the thought process itself (Harpen, 2003). Consequently, teaching critical thinking skills is important for students, as they need to adjust to such change by actively and skillfully conceptualizing, applying, analyzing, synthesizing, evaluating the information gathered from, or generated by, observation, experience, reflection, reasoning, or communication (Paul & Elder, 2004).

Teaching critical thinking at schools is the main topic in the discussion regarding 21st Century skills (Greenhill, 2009). Students can be taught to critically examine different viewpoints on issues concerning the impact of science and technology on everyday life and evaluate these issues through critical thinking (Mapeala & Siew, 2015). Teaching critical thinking in science and technology also help to develop students' analytical skills, as well as their ability to make informed choices in their everyday lives (Mapeala & Siew, 2015).

According to (UNESCO, 2000) measuring the improvements of critical thinking skills will essentially improve the education quality. If tests are understood to shape both the curriculum and teaching, an efficient way to improve the quality of education in critical thinking is developing the better tests (Yeh, 2001). Tiruneh et al. (2016) stated that critical thinking tests which have been developed such as the Cornell Critical Thinking Test–Level Z (CCTT), the California Critical Thinking Skills Test (CCTST), the Ennis-Weir Critical

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Thinking Essay test, the Watson-Glaser Critical Thinking Appraisal, and the Halpern Critical Thinking Assessment (HCTA) were mostly general content-based and reviewed based on the following criteria: (a) is the test based on a clear definition/conception of critical thinking, (b) are the targeted critical thinking skills common across tests, and (c) do the test items appear to sufficiently measure the critical thinking skills targeted on a test. All the general content of critical thinking tests are diverse in terms of their formats, scope, and psychometric characteristics.

Recognizing the lack of specific content of critical thinking tests, it is required to develop critical thinking test in specific subject area. The accompanying expectation has been embedding critical thinking skills within a subject matter instruction in various specific content will facilitate the acquisition of critical thinking skills that are applicable to a wide variety of thinking tasks within the content in question and that it will facilitate their transfer to other problems in everyday life (Lawson, 2004). The present study addressed this concern by developing and validating a critical thinking test based on Inch Critical Thinking in science content for junior high school student.

The higher order thinking and complex information in the critical thinking test can be supported by the advanced technology in its development. The assessment also has been shifted towards the use of computer-based procedures (Jurecka 2008). Computer based-test enable teachers and researchers to collect different types of data. Hence, researchers have the possibility to design meaningful and motivating real-life scenarios, where students can solve complex and interactive problems (Greiff et al. 2013). The information in the computer based-test can be presented not only using a picture, the item which is presented also can use the interactive video.

Even in the field of science education, there are different approaches to use computers in order to facilitate the work on complex problems (Jonassen 2004). Computer based test is effective solution for education evaluation (Flagbola, Adigun & Oke, 2013). In addition, to traditional scores on multiple-choice or

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constructed-response items, data on the time needed to perform a number of interactions and the sequence of operations are accessible (Wirth 2008). The major advantage of computer-based tests is in the assessment of new content areas and constructs (Scherer, Koppelt & Tiemann, 2014). The use of computer based assessment is advantageous due to test economics, improvements in objectivity, and test reliability (Scherer, Koppelt & Tiemann, 2014).

The ministry of Education and Culture of Indonesia also has launched the National Examination based on computer in 2014 in SMP Indonesia Singapura dan SMP Indonesia Kuala Lumpur (SIKL). *Ujian Nasional Berbasis Komputer* (UNBK) also called Computer Based Test (CBT) is a national examination using the computer as a media. In the implementation, UNBK is different with paper national examination or Paper Based Test (PBT) which has been running out (Kemendikbud, 2016). It means, developing a test should follow the current technology in order to have the better benefits.

According to Agah, Ogbeche & Okorie (2016), there was a positive and direct relationship between computer anxiety, operation skills, attitude and students' preparedness for computer-based assessment. By using this developed test, students can practice before they conduct the national examination to prevent the influences of their computer anxiety, operation skills and attitude in using computer.

The author intended to develop and validate the instrument in the topic of matter and heat because in 2013 curriculum, this topic integrates each other which is connected from basic competence 3.3 and 3.4. Based on Rahayu & Kita (2009) students have great difficulties with and hold some alternative conceptions of the concepts of matter (homogeneous mixtures, phase changes from solid to liquid, and phase changes from solid to gas). So, matter and heat topic is important to be presented virtually because the content which is abstract for students is easier to be presented in the form of animation or interactive video.

Thus the present study, first, proposes to develop and validate test to assess 7th grade students' critical thinking based on Inch critical thinking on the topic of

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matter and heat. Author defines critical proficiency as the ability to reasonably respond to critical thinking tasks that do not necessarily require specific content knowledge, but rather application of content knowledge of everyday life. The topic which is included is based on the basic competence of 2013 curriculum, matter and heat topic that consists of mixture, element, compound, physical and chemical properties, physical and chemical change, state of matter and its change, temperature, expansion, heat and heat transfer sub-topic. Second, the design and characteristics of the assessment tool which use the computer based test are described. The design of critical thinking test using the computer based-test will be in the form of “Science Virtual Test” which not only can assess students’ critical thinking but also can used as preparation for students’ before conducting another computer based examination.

B. Research Problem

The research problem of this study is “How is development and validation of science virtual test to assess 7th grade students’ critical thinking on matter and heat topic?”

C. Research Question

Elaborating the research problem, the research attempts to explore the following questions.

1. How is the development of science virtual test to assess 7th grade students’ critical thinking on matter and heat topic?
2. How is the validity of science virtual test to assess 7th grade students’ critical thinking on matter and heat topic?
3. How is the reliability of science virtual test to assess 7th grade students’ critical thinking on matter and heat topic?
4. How are the characteristics of the items of science virtual test to assess 7th grade students’ critical thinking on matter and heat topic?

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5. How is 7th grade students' critical thinking on matter and heat topic and students' impression after using science virtual test?

D. Limitation of Research

In order to make the research become more focused, the problem is limited as follow.

1. The assessment is multiple choice items are quick and easy to score by hand or electronically, wide range of higher-order thinking skills, can cover lots of content areas on a single exam.
2. The items are presented in native's language to ensure that the respondent understood each item before responding.
3. The elements of critical thinking to be developed into assessment which are question at issue, purpose, information, concepts, assumptions, point of view, interpretation and inference, implication and consequences.
4. The science virtual test is developed by using Macromedia Flash Professional 8.0.
5. In this research, the topic is heat and matter that limited by core competence no. 3 and basic competence no. 3.3, 3.4 that are attached in 2013 National Curriculum of Indonesia.
6. The development of science virtual test is content analyzing until the limited tryout, while the validation is conducting the larger application of science virtual test.
7. The participants are 7th grade Junior High School students which have learnt about matter and heat.

E. Research Objective

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This research objective is specified as follow.

1. To develop the science virtual test to assess 7th grade students' critical thinking on matter and heat topic.
2. To analyze the validity of science virtual test to assess 7th grade students' critical thinking on matter and heat topic.
3. To analyze the reliability of science virtual test to assess 7th grade students' critical thinking on matter and heat topic.
4. To analyze the characteristic of the items of science virtual test to assess 7th grade students' critical thinking on matter and heat topic.
5. To investigate 7th grade students' critical thinking on heat and matter topic and students' impression after using science virtual test.

F. Research Benefit

The result of this study is expected to provide the following benefits.

1. Teacher

The teacher can use the science virtual test to assess critical thinking of the student specifically 7th grade. Teacher also can evaluate the instrument to improve quality of test, teaching media or method for the improvement in teaching instruction in the classroom, especially in the topic of matter and heat.

2. Student

Students are able to use the science virtual test to measure their critical thinking skill and measure their preparedness (anxiety, operating skill, and attitude) before conducting other computer based assessment.

3. Another Researcher

As the references in developing other kind of computer based assessment or critical thinking research, as basic for future empirical research that focuses on the test that integrates critical thinking skill within subject matter.

G. Organization of Research Paper

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In order to make the research paper systematically arranged, this paper is divided into five part as follow.

1. Chapter I Introduction. Generally, this chapter explains why we conduct the research. It consists of background, research problem, research question, limitation of problem, research objective, research benefit, and organization of the research.
2. Chapter II Literature Review. This chapter explains the literature review that support the research. It consists of the concept of critical thinking, science virtual test (computer based-test), matter and heat topic and related research.
3. Chapter III Research Methodology. This chapter explains the way we conduct the research. It consists of research method, research subject, operational definition of critical thinking and science virtual test, research instrument, data analysis, and research procedure.
4. Chapter IV Result and Discussion. This chapter explains our research's result. It consists of the production of science virtual test (preliminary and final design) and the instrument analyses (validity, readability, reliability, discriminating power, difficulty level, and distractor). The comparison with other research also discussed in this chapter.
5. Chapter V Conclusion and Recommendation. The chapter that explain the conclusion and its recommendation for the teacher and other researcher.