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DEVELOPING MULTIMEDIA SUPPORTED CRITICAL THINKING TEST on HEAT TRANSFER CONCEPT

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Abstract
Critical thinking skill is one of the skills that should be possessed by the students to compete in the global area. There are many ways to practice and increase critical thinking skills of the students by using model and media learning. In order to measure critical thinking skills of the students appropriately, we need the precise test instrument. The purposes of this research are to develop and validate of Multimedia Supported Critical Thinking Test (MSCiT Test) instrument in heat transfer learning material for senior high school students. MSCiT Test is a test instrument that optimizes the function of computer by presenting media, simulation, video, and picture which describe the test that will be done by the students in an interactive dynamic content, a content that enables the students to feel as if they face the real phenomena in the test. MSCiT Test is adapted Halpern's critical thinking framework which was developed by Tiruneh, involving four different categories, reasoning, hypothesis testing, argument analysis and problem solving and decision making. The research method employed in this research was the research and developmental 4-D model method adapted from Thiagarajan, involving four main steps, define, design and develop. MSCiT Test has been tested in terms of its validity. The validity test consists of construct,the analysis of construct validity was conducted by using Content Validity Ratio (CVR). And the result of value of CVR all of item in instrument are valid with value of CVR 0.722.

Keywords*: MSCiT Test, critical thinking, heat transfer concept*

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I. INTRODUCTION (12pt)

To face the challenges of the 21st century, the students must possess qualified and resilient human resources, high-level thinking skills to solve problems encountered, international competitiveness in the development of various fields including the field of education and also are sensitive to the progress of the field Technology and communication. According Liliasari, there are four high-level thinking patterns, namely critical thinking, creative thinking, problem solving and decision making [1]. Among the four high-level thinkings, critical thinking underlies three other patterns of thinking. Critical thinking skills are deep and reflective in making decisions and solve the problems to analyze situations, evaluate arguments and conclude precisely [2]. And according to Halpern, critical thinking is using a thinking strategy that increases the probability of expected outcomes. With five critical thinking indicators namely reasoning, hypothesis testing, argument analysis, likelihood and uncertainty analysis and problem solving and decision making [3].

Critical thinking can be developed not only in learning but also must be supported by evaluations or tests that reflect critical thinking because evaluation or testing is an integral part

of classroom learning [4]. Therefore, appropriate test instruments are needed to evaluate the critical thinking skills of learners.

Permendikbud number 104 year 2014 stated that "assessment of learning outcomes by educators conducted on the mastery of the level of competence as a learning achievement and assessment of learning outcomes by educators implemented using assessment instruments." The statement shows that the competence of critical thinking skills as one of the goals of achievement in physics learning should be assessed during and after The learning process took place, then it takes an instrument that will be used to assess and obtain quality data or information right and correct about the picture of quality development and the achievement of students' critical thinking skills.

The use of appropriate instrument or critical thinking skills assessment with continuity training can sequence and develop students' critical thinking skills. The assessment is function as feedback for teachers so that it can improve their learning quality from time to time to achieve students' achievement. Additionally, feedback for students is for stimulate the quality of their critical thinking skills [5]. Based on the results of the literature review, the instrument that assesses the critical thinking skills of Halpern Critical Thinking Assessment (HCTA) students developed by Halpern (1998) is still general. Therefore, Tiruneh et al (2016) developed a test to measure students' critical thinking with the Halpern critical category 5 criterion framework developed into several specific domains adapted in physics. The test developed is physically charged to the material on magnetic material in the form of paper and pencil test.

The development of information and communication technology, computers become a primary need in education. The use of computerized technology in judgment became a demand on the assessment and teaching of the New World of Work in the 21st century [7]. Computerized optimization enables automated test, fast and objective reporting of results, so that computer functions can be maximized in education [8]. Therefore, to be effective in its implementation, teachers can use the Computer Supported Test as a tool in conducting the assessment. It also affects the National Examination in Indonesia, implementation of conventional test change (paper and pencil test) in 2015 to computer-based test (CBT) is still in the stage of moving the national exam exams in paper to computer.

Based on the above description, it can be taken by the essence that computer-based assessment has advantages in presenting information in the matter. The information presented in the computer-based problem is very varied. With these advantages, the packaging of critical thinking by using CST is a good choice. Therefore, the position of this research becomes important to be implemented in order to develop critical thinking test instruments supported by Multimedia (Multimedia Supported) that is with the context of dynamic content in the form of animation, the addition of images, graphics, video, audio and simulation. This article describe the results of development of MSCiT Test in heat temperature material, the results of expert judgement or review which was developed.

II. RESEARCH METHOD

This research used research and development (R&D) design. The research focused on the development of instrument test to measure critical thinking skills for physics lesson in high school. The development step is using 4D stage, including define, design, develop and disseminate, but the steps of the development in this research is from define until develop [9]. The product which was developed then tested its feasibility with the validity and tested of the product to know as far as the feasibility of the instrument. The subjects of this study were the students of senior high school grade X who have obtained heat and temperature lesson. Data processing techniques MSCiT Test was also tested the validity. Validity test consisted of collisions and media, to test the validity of constructs analysed using Content Validity Ratio

(CVR) based on assessment result by validator (expert of physics) to obtain the content and construct validity items, use the formula:

$$CVR = \frac{n_e - \frac{N}{2}}{\frac{N}{2}}$$

n_e is number of validator agreeing on item test, N is total number of validator. The category of CVR according to [10] in Table 1

Table 1. Index of CVR

Index CVR	Criteria
0,00 – 0,33	Not suitable
0,34 – 0,67	Suitable
0,68 – 1,00	Very suitable

Furthermore, MSCiT Test is tested media Validity by expert of multimedia, it is aimed to enhance the appearance, clarity and readability of writing, video clarity, images, simulation and graphic images and ease of use of the application MSCiT Test.

III. RESULTS AND DISCUSSION

MSCiT Test was developed based on the basic competencies of physics of the 2013 curriculum by Halpern critical thinking framework. The following table is the categories and domain specific critical thinking which adapted by Tiruneh who developed Halpern critical thinking framework were presented by Table 2.

Table 2. Elaboration of the domain specific critical thinking targeted in CSCiT Test

Critical Thinking category	Domain specific critical thinking outcomes
Reasoning	Evaluate the validity of data
Hypothesis testing	Draw valid interferences from a given tabular or graphical information
Argument analysis	Criticize the validity of generalizations in an experiment
Problem solving and decision making	Identify the best among a number of alternatives in solving problems

MSCiT Test have 12 items and two tiers test. Tier I and tier II are closed ended. Following table is explained codification of rubric in two tiers test

Table 2. Codification of rubric for MSCiT Test scoring guide

Tier I	Tier II	Code	Description of code	Score
True	True	Excellent	High critical	4
True	False	Very good	Medium critical	3
False	True	Good	Low critical	2
False	False	Poor	Poor critical	1

1.1 Result of Content validity

There were nine expert physics to review 12 items. The content experts were requested to review each item in MSCiT Test based on criteria (a) appropriateness of the items to the purpose of the test and the population of test takers, (b) accuracy of the information presented in the items, and (c) clarity of the words/ phrases/diagrams of each item. And the result of content and construct validity was used by CVR two-tailed test $\alpha = 0.01$ [10], it is show in Table 3.

Tabel 3. Result of validity use CVR

Critical Thinking Category	Items	$CVR\ Value$	$p\ Value, (N = 8, \alpha = 0.01)$
Reasoning	1	1.000	0.548
	5	0.778	
	9	0.778	
Hyphothesis testing	2	0.556	
	6	0.778	
	10	0.556	
Argument analysis	3	0.778	
	7	0.778	
	11	0.556	
Problem solving and decision making	4	0.778	
	8	0.778	
	12	0.778	
Value of CVR		0.722	

On table 1 shows result of validity use CVR, if value of CVR is higher than the p, so the instrument is valid. And the value of CVR is lower than value p, it means that the instrument is not valid. Based on Table 1, value of CVR all of item in instrument are valid with value of CVR 0.722. The reviewers reported that most of the CSCiT Test items were appropriate and relevant to measure the targeted critical thinking skills in heat and temperature. They had also given useful feedback on a few of the items that they thought required revision. In line with the comments, all the necessary revisions were made

IV. CONCLUSION

The main purpose of this study was to develop MSCiT Test in heat and temperature. Results showed that MSCiT Test is valid in content and media. MSCiT Test can be used to measure students' critical thinking on senior high school level. Because this research is still on the validity of the content test and validates the media, it has not reached the limit of the test stage and wide test. So this article needs to be refined with test implementation to be tested on high school students

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