Development of Thinking Skill Test for Senior High School Students

Widha Sunarno[1], Nonoh Siti Aminah[2], Delisma Wisnu Adi[3], Bertha Wikara[4]

[1]Departement of Physics, Faculty of Teacher Training and Education, Sebelas Maret University, Indonesia,
[2]Departement of Physics, Faculty of Teacher Training and Education, Sebelas Maret University, Indonesia,
[3]Departement of Physics, Faculty of Teacher Training and Education, Sebelas Maret University, Indonesia,
[4]Natural Science Education Study Program, Sebelas Maret University, Indonesia

Corresponding email: widhasunarno@gmail.com

ABSTRACT

Thinking skills can be divided into critical thinking and creative thinking. Critical thinking is an ability to solve the problem, examine hypothesis, and reach conclusion by the scientific way. Creative thinking can be defined as the mental activity to increase purity or sensitivity to develop something. Students need to be trained to develop the two abilities because both abilities grow through the process, not instantly. This is the same as development of cognitive, affective, and psychomotor skills. There are many learning models can be used to explore the two abilities. On this research, we used Contextual Teaching and Learning which has known as learning method usually used in thinking skill explorations. The development of thinking skill test through several steps, those were getting the information, working with the information, judging the quality of information, using the information for a purpose, and using information to craft a product/presentation. Critical thinking and creative thinking abilities are considered as indicators of performance assessment (showed by determination values (R^2) of both R^2 creative = 0,1936 and R^2 critical = 0,0361). Senior high school students' phases of critical thinking consist of understanding a definition, identification, understanding a comprehension and understanding a correlation. This was proven by critical thinking indicator values (A_n), those were A_1 (to understand working definition according to physics) = 0,26, A_3 (to identify some activities in daily life that included as working or not working according to physics) = 0,26, A_4 (to understand comprehension of energy) = 0,22, A_7 (to analyse correlation among working, kinetic energy, and gravitational potential energy) = 0,20. Senior high school students' thinking ability phase only achieved expertise in cause and effect finding and this showed by indicator value of creative thinking, B_1 (to find conditions that cause working) = 0,37.

Keywords: Thinking skills, contextual teaching and learning, critical thinking, creative thinking

1 INTRODUCTION

Thinking skills are showing us action as a result of performance assessment. The product is an activity which related to understanding and design to complete some purposes. Working habits like perseverance, responsibility, punctuality, work quality, teamwork, safety prioritization, task organize skills, and neatness can be transferred into observation sheet. Performance assessment brings students into larger problems just like they can meet in real world. Some models can be developed from thinking skills, those are critical thinking and creative thinking. Critical thinking is an ability of thinking in a logic way that regular and systematic in order to solve the problem, examine hypothesis, and reach conclusion through the scientific way. Creative thinking is a mental activity to increase purity or sensitivity to develop something. Students need to be trained the two abilities because both abilities grow

through the process, not instantly. This is the same as development of cognitive, affective, and psychomotor skills.

2 THEORETICAL REVIEW AND METHODOLOGY

2.1 Theoretical Review

a. Phases of Thinking Skills

Michael Hibbard, r. K. (1985: 15) stated that thinking skills covered some phases, those were getting information, working with the information, judging the quality of information, using the information for a purpose, and using information to craft a product/presentation. Details of them are showed in Table 1.

Table 1 Steps of Thinking Skills

Steps in Process	Thinking Skills Used
Getting the information	Find, complete, count, collect, read, listen, define, describe, identify, list, match, name, observe (using all the senses), record, recite, select, scan
Working with the information	Compare, contrast, classify, sort, distinguish, generalize, evaluate, make analogy, make models, and/ or reason
Judging the quality of information	Evaluate whether information source is likely to be biased or objective, evaluate whether the information itself is accurate and complete
Using the information for a purpose	Inform, persuade, motivate, entertain
Using information to craft a product/ presentation	Speaking, debating, singing, writing, surveying, designing, drawing, computing, constructing, demonstrating, acting-out

Performance assessment brings students into real context so that it makes learning process becomes more simple for authentic purposes. Performance behavior shows working habits like perseverance, punctuality, working result quality, responsibility, teamwork ability, systematic task management, and working safety concern. All of them can be assessed by using observation format.

b. Measurement Theories

On education field, measurement consists of testing ability measurement and measuring instrument characteristic measurement. The measuring instrument characteristic showed by the result of measurement score analysis. There are two measurement theories that still in development by now, they are Classical Test Theory (CTT) and the modern one which called Item Response Theory (IRT). A good test must complete two conditions, those are validity and reliability. Validity shows us how far the test score is able to measure construct we defined, while reliability shows how little measurement's error. Reliability coefficient symbolized by ρ_{xx} and validity coefficient symbolized by ρ_{xy}. There are two types of test, those are an

objective test and subjective test. An objective test is still used by now and generally used in the formative and summative test. An objective test is a good solution when the test contains many questions and large subject. By using objective test, objectivity principle can be fulfilled.

2.2 Research Methodology

There were nine steps that should be completed in the making of a test. (Djemari Mardapi, 2008: 88), those were : (a) arrange the test specification, (b) write the questions of the test, (c) investigate or doing qualitative analyse of questions of the test, (d) examine the test, (e) analyse every question's item or doing quantitative analysis, (f) repair the test, (g) assemble the test, (h) practice the test, and (i) interpret the test's result. These steps are showed in Figure 1.

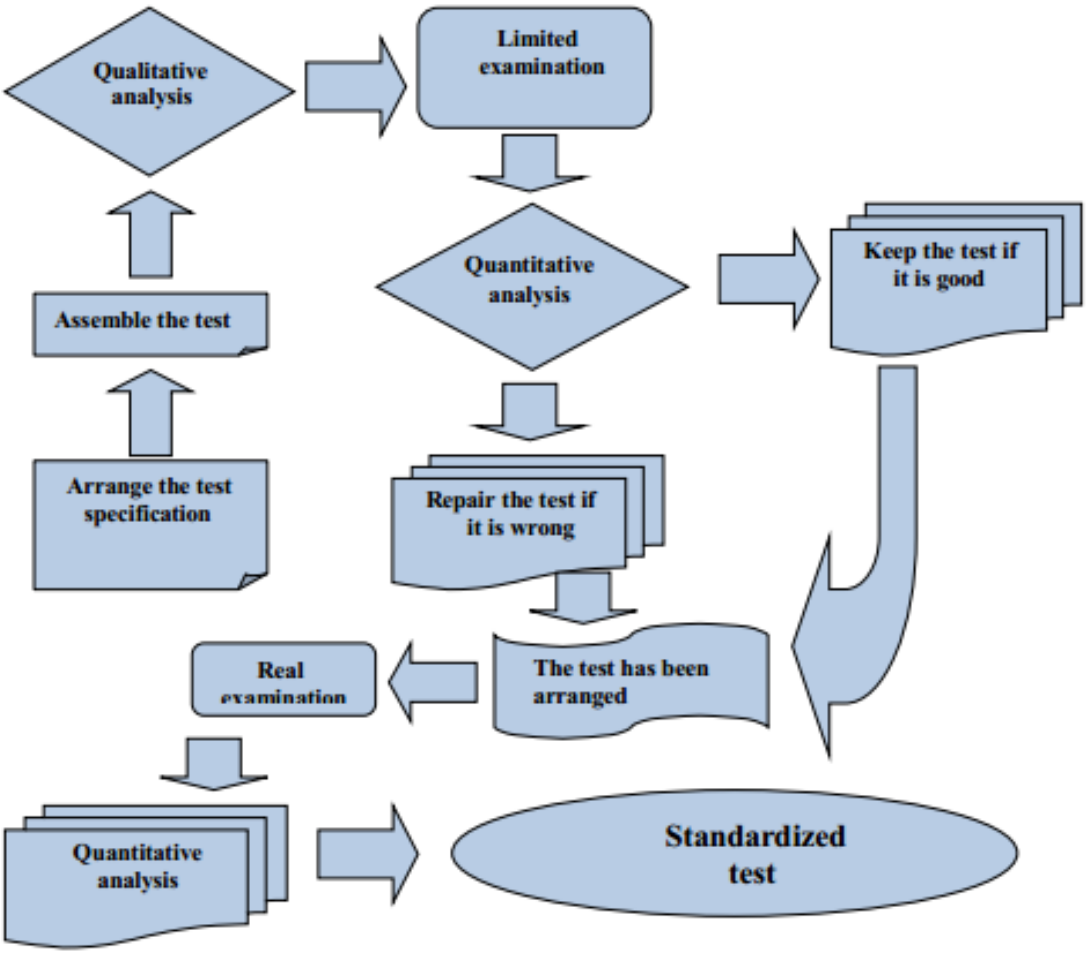

Figure 1: Pathway of thinking skill test arranging

If the pathway above has been completed successfully, characteristic of the test will be emerged. Nevertheless, test arranging usually takes a lot of cost and time so that something like test arranging pathway generally is only practiced on research or big scale test arranging which has been programmed. This is a bad news because if we are always hampered by problems like cost or time, no standardized

test will be successfully made. But the dilemma has been solved now by the development of thinking skill test. The development is useful to help researchers who want to make a good test without so much time or money requirement.

3 RESULT AND DISCUSSION

3.1 Result of the Research

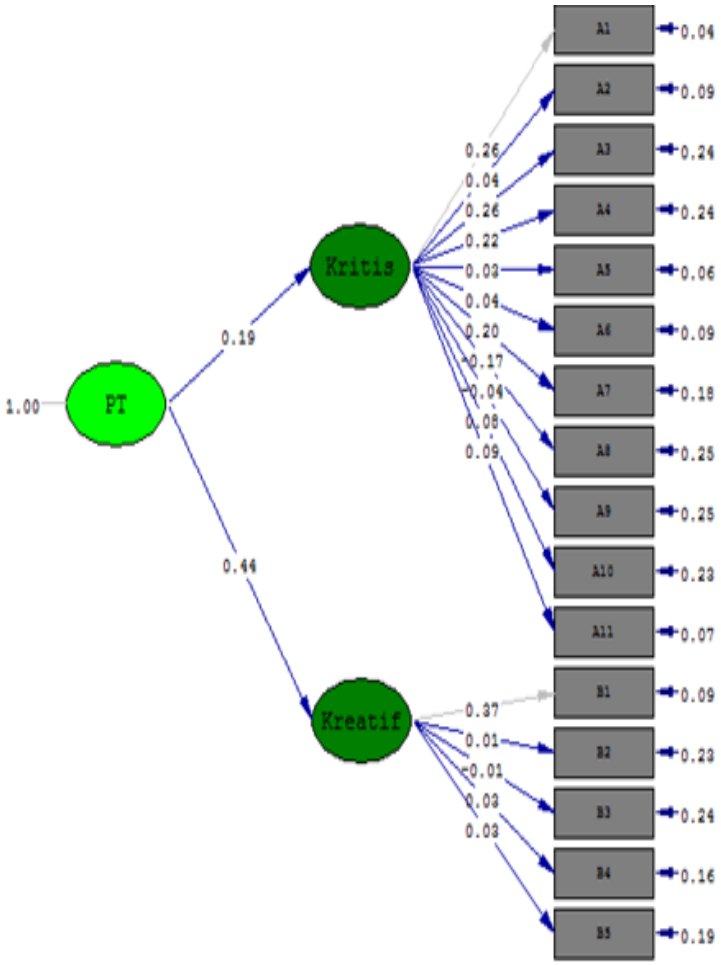

Figure 2 : Path diagram of critical and creative thinking skill

3.2 Discussion

Structural Equation Modelling (SEM) had been used in data analyzing and the result has shown in figure 2. The result of the research showed that both of critical and creative thinking skills were some indicators of performance assessment (this fact was proven on determination values of both, those were R2 creative = 0,1936 and R2 critical = 0,0361). Índicators of critical thinking skills include : A1 (to understand working definition according to physics) = 0,26, A2 (to identify correlation among force, distance, and working) = 0,04, A3 (to identify activities in daily life that included as working or not according to physics) = 0,26, A4 (to understand comprehension of energy) = 0,22, A5 (to understand concept of kinetic energy) = 0,09, A6 (to understand concept of potential energy) = 0,04, A7 (to analyze

correlation among working, kinetic energy, and gravitational potential energy) = 0,20, A8 (to represent correlation between working and energy by logical reasoning in order to movement dynamics problem solving) = - 0,17, A9 (to identify perpetuity of mechanical energy law practice in daily life) = - 0,04, A10 (to present perpetuity of mechanical energy law practice in daily life by using logical reasoning) = 0,08, A11 (to analyze correlation between power and working according to physics) = 0,09. Whereas indicators of creative thinking skills include : B1 (to find conditions that cause working) = 0,37, B2 (to predict values of working caused by some force values) = 0,01, B3 (to predict correlation between working and kinetic energy changing) = - 0,01, B4 (to predict correlation between working and potential energy changing) = 0,03, B5 (to ask about perpetuity of mechanical energy law) = 0,003.

4 CONCLUSION

Critical and creative thinking skills are indicators of performance assessment (showed by both determination values, those were R^2 creative = 0,1936 and R^2 critical = 0,0361). Phases of critical thinking skills of senior high school students consist of understanding a definition, identify, understanding a comprehension, and analyze correlation among subjects. These were showed by indicator value of critical thinking skills, those were A_1 (to understand working definition according to physics) = 0,26, A_3 (to identify activities in daily life that included as working or not according to physics) = 0,26, A_4 (to understand comprehension of energy) = 0,22, A_7 (to analyze correlation among working, kinetic energy, and gravitational potential energy) = 0,20. Phases of creative thinking skills of senior high school students were still limited on cause and effect finding. It was showed by indicator value of creative thinking skill B_1 (to find conditions that cause working) = 0,37.

5 SUGGESTION

Critical and creative thinking skills of senior high school students that still on low level need some better learning and assessment models. Interactive learning and assessment model that proper with applied learning model surely will help to increase students' critical and creative thinking skills.

6 ACKNOWLEDGEMENT

This research was supported by a postgraduate grant of Sebelas Maret University 2016. We thank our colleagues from Departement of Physics, Faculty of Teacher Training and Education, Sebelas Maret University who provided insight and expertise that greatly assisted the research.

REFERENCES

Allen, M.J. & Yen,W.M. (1979). Introduction to measurement theory. Monterey, CA: Brooks/ Cole Publishing Company.

Brennan, R.L. (2006). Educational measurement. Iowa City: United State of America: American Council on Education and Praeger Publisher.

Crocker & Algina. (1986), Introduction to classical and modern test theory. New York: United State of America: CBS College Publishing.

Djemari Mardapi. (2004). Penyusunan tes hasil belajar. Yogyakarta: Yogyakarta State University Graduate Program.

Djemari Mardapi. (2008). Teknik penyusunan instrumen tes dan non tes. Yogyakarta: Mitra Cendikia Press.

Dikdasmen Dikbud (1999). Pengelolaan pengujian bagi guru mata pelajaran. Jakarta: Department of Education and Culture.

Kolen, M.J. (2004). Linking assessment : concept and history. Applied Psychological Measurement , Vol. 28, No 4, pp . 219 – 226.

Lord, F.M.(1980). Application of item response theory to practical testing problems. Hillsdale, NJ: Lawrence Erlbaum .

Michael Hibbard, r.K. (1986: 15). Performance Assessment in The Science Classroom. New York: McGraw-Hill.