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## Developing an Authentic Assessment Science Process Skills, Critical Thinking Skills and Problem Solving Skills

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**Abstract**—This research is aimed to know the procedure of instrument development of authentic assessment and to know the worthiness of authentic assessment instrument of development result is seen from the content validity by the validator. This research is development research by model of non-test instrument. Development model of non-test instrument used has steps as follows: (1) determining of the instrument specification, (2) writing the instrument, (3) determining the instrument scale, (4) determining the scoring system, and (5) beating out the instrument. The writer used quantitative and qualitative technique to analyze the data obtained. The qualitative approach was used to analyze the input from experts and teachers, and the quantitative approach was used to analyze the results of experts' validation using Aiken's validity. Conclusion of this study are as follows: (1) The procedure of the authentic assessment development follows the stages of research and development. The stages include pre-survey research, problem analysis, analysis of curriculum, research studies, experts consultation, and drafting an instrument. The stages of development include experts' validation. (2) The quality of the developed products of the developed authentic assessment has a valid criterion as an instrument, in terms of aspects of the construct, substance, and language. All these aspects meet a very good criterion and can be used with revisions.

**Keywords:** *authentic assessment, science process skills, critical thinking skills, problem solving skills*

### I. INTRODUCTION

Natural Sciences is the mastery of facts, concepts, principles, and a process of discovery. The process of discovery in learning the natural sciences in accordance with the Nature of Science (NOS) means that science is a way of knowing. Lederman, et al. (2002:231), stating that "that science is a way of knowing and there are values and beliefs inherent to the development of scientific knowledge". Based on these statements, NOS is defined as the concept of complex natural sciences involves philosophy, sociology, and historical knowledge.

Natural Sciences is the mastery of facts, concepts, principles, and a process of discovery. Learning the natural sciences is based on the contents of the standard form students who have a body of knowledge; standard process will shape the students with scientific skills, thinking skills and strategy of thinking; the standard scientific inquiry will form students capable of critical and creative thinking; as well as a standard assessment evaluates students humanely.

Sheeba (2013: 109) defines the science process skills as a device suitable skills in the disciplines and reflect behavioral scientists. Abungu, Okere, & Wachanga (2014: 359) states that the science process skills is an activity the students to conduct scientific investigations to develop scientific knowledge and skills. Science process skills include some skills in the students' activities. Types of science process skills according to Martin (2006: 68) include: a) basic science process skills including observation, classification, communication, measurement, inference and prediction; b) integrated science process skills include identifying and controlling variables, formulate and test hypotheses, interpret data, define operational, conducting experiments and building models.

Critical thinking is defined as the activity of the mental discipline to think reflectively and reasonable to evaluate arguments or propositions to decide what to believe or do (Huitt, Ennis in Çimer, 2013). Critical thinking is also a cognitive abilities and strategies that increase the likelihood of the expected results, thinking that aim, reasoned, and goal-oriented. This thought includes solving problems, formulating conclusions, calculated the odds and make a decision (Halpern in Frijters et al., 2008). Problem solving skills are an action to resolve the problem or process that uses the power and benefits of mathematics in solving the problem, which is also a method of discovery solutions through the stages of problem solving. According Arends (2008: 45)

problem based learning is an approach to learning in which students work on authentic problems with a view to construct their own knowledge.

The learning process is directed at the development of the third realm of knowledge, attitudes, and skills should be implemented as a whole or holistically, meaning the development of one domain cannot be separated from other domains. The question that still occurs in the process of learning one's current assessment of the natural sciences still dominated the test form, which can only measure the realm of knowledge. The fact that learning the natural sciences is not always judged by using an assessment form test to measure student learning objectives. Assessment can be done by collecting information about students to give more accurate information about the skills and attitudes of students. The assessment directive can also be done to measure the learning process of students (Phopam 2008:6). That kind of assessment called the authentic assessment.

Mueller (2006: 1) said authentic assessment is an assessment of immediate or direct size so that the assessment will be more obvious when votes directly to do with the granting of a task or project. Callison (1998: 1) provide broader understanding of the authentic assessment, namely:

*Authentic assessment is an evaluation process that involves multiple forms of performance measurement reflecting the student's learning, achievement, motivation, and attitudes on instructionally-relevant activities. Examples of authentic assessment techniques include performance assessment, portfolios, and self-assessment.*

O'Malley and Pierce also categorize common types of authentic assessment that must be observed and documented as follows: (a) Project / Exhibition: Students work with other students as a team to create a project that often involves the production of multimedia, oral and written presentations, and displays. (b) Experiment / Demonstration: Students documenting a series of experiments, describing the procedure, perform the steps required to complete the task, and document the results of the action. (c) Portfolio: A collection of work focused students to demonstrate progress over time. (Callinson, 1998: 2-3)

Authentic assessment can be used to measure performance, achievement, motivation, and attitude of students in relevant activities in learning. The results of the study are eligible to be used as a basis in determining the kind of authentic assessment is (Stiggins, 1994:67): students' ability against (1) the substance of knowledge; (2) knowledge in doing the reasoning and solving problems; (3) skills in the mastery of knowledge; (4) the making of a product; and (5) achievement attitude in applying knowledge. The basic types of assessment methods offered by Stiggins (1994:83) include: (a) selected response assessment; (b) assessment essay; (c) performance assessment; and (d) personal communication assessment.

The material has different characteristics of natural sciences so not all matter natural sciences can be taught with the same method. Thus, the assessment instrument used of course will also be different, because if the instruments used are the same for all natural sciences material then there will be some aspects which cannot be measured. The selection of basic competence (KD) should be conducted to determine the appropriate type of assessment. In the development of this research material class VIII natural sciences which KD 2.4 can be used kind of an assessment portfolio. The assessment of the project can be used on a KD 3.11. with learning that directs students to solve problems by doing project work to resolve the issue. In addition, KD 3.9. can be used to measure the performance assessment science process skills students in doing the experiment.

Referring to the problems outlined, then researchers trying to develop authentic assessment instrument can measure a few skills students i.e. science process skills, critical thinking skills and problem solving skills on some of the KD in the natural sciences learning in junior high school.

## II. METHODOLOGY

### A. Type of Research

This research included in the classification of research development. The products developed in this research in the form of instrument performance assessment, portfolio and project. Research development uses a five-step development instrument non test.

### B. Research Time

Development of instrument in authentic assessment was conducted in October 2015 until January 2016.

### C. Development Procedure

Procedure of development following the stages of the development of non-test instrument. Stages of the development of authentic assessments include (1) determining of the instrument specification, conduct an analysis of the specification of the instrument being developed include the analysis of students, needs analysis, analysis of curriculum, selecting the shape and format of the instrument, determine the indicators, making the latticework of instruments; (2) writing the instrument, writing of authentic assessment was

developed based on the lattice that have been created and then draw up the details of the statement; (3) determining the instrument scale, the scale of the instrument that was used in the development of this authentic assessment instrument in the form of scales with a scale of 1 to 4; (4) determining the scoring system, a system of scoring in this authentic assessment instrument refers to the scale of use that is the scale of 1 to 4 to the emergence of student activities provided by the observer; and (5) beating out the instrument, perform the validation material, expert assessment and teacher.

#### D. Data Analysis Techniques

Analysis of the validation of the content of the descriptive and quantitative basis. Quantitative analysis using Aiken's V analysis (Azwar, 2014:113) by the following formula:

$$V = \frac{Es}{n \cdot c - 1}$$

Description:

- s =  $\sum r - lo$
- n = number of panels of assessors
- lo = lowest validity assessment
- c = highest validity assessment
- r = the numbers given by an assessor

### III. RESULTSS AND DISCUSSION

#### A. Procedure the development of Authentic Assessments

The products developed are authentic assessment instrument which covers the instrument performance, portfolio, and projects. The instrument used to measure the performance of science process skills learners in the material system for excretion. The portfolio of instruments used to measure critical thinking skills learners on the material pressure of the liquid. Project assessment instrument used to measure problem solving skills learners on optical materials on the human eye. The assessment instruments developed is in the form of sheets of observations accompanied by grating and rubric assessments. Authentic assessment instruments development procedure is as follows.

##### 1. Preliminary Studies

Some of the things done on the preliminary study include: analysis of the problem, an analysis of the curriculum, and the analysis of the learners. Problem analysis was done based on interviews with a number of teachers of science in SMP N 15 Yogyakarta, SMP N 1 Piyungan, and SMP Muhammadiyah 3 Depok. The issues that emerged from the interviews that is not yet the availability of valid assessment instruments to measure skills learners, so it is important to develop these instruments. Curriculum analysis conducted to determine the competence of the basic curriculum of 2013 which corresponds to the selected material. Learner analysis aims to find out the characteristics of the students i.e. students of class VIII junior high school. Core competencies and Basic Competencies that are used in the development of authentic assessment instruments are presented in Table 1.