SE – 06

Developing an Authentic Assessment Science Process Skills, Critical Thinking Skills and ProblemSolving 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 thequantitative 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 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 Frijtersat. 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,writingof 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:

$$V=\frac{\Sigma s}{n(c-1)}$$

Description:
s = 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 ofscience 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 Muhamadiyah 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.

TABLE 1. CORE COMPETENCIES AND BASIC COMPETENCIES

Types of Skills	Core Competencies	Basic Competencies
Science Process Skills	3. Understanding of knowledge (factual, conceptual and procedural) by curiosity about science, technology, art, cultural phenomena and events related to the visible.	3.9. Explaining the structure and function of the human excretory system and its application in maintaining personal health.
Critical Thinking Skills	3. Understanding of knowledge (factual, conceptual and procedural) by curiosity about science, technology, art, cultural phenomena and events related to the visible. 4. Rework, manage, and reasoning in the realm of the concrete (using, parse, compose, modify, and make) and the realm of the abstract (writing, reading, counting, drawing, and writing) in accordance with the learned in school and other sources in the same viewpoints / theories.	3.8. Understanding the pressure of liquids and their application in everyday life to explain the blood pressure, respiration diffusion at the event, and the osmotic pressure. 4.8 Conducting an experiment to investigate the fluid pressure at a certain depth, the buoyant force, capillarity (fluid transport in the stem of the plant), and the fluid pressure in the enclosed space.
Problem Solving Skills	3. Understanding of knowledge (factual, conceptual and procedural) by curiosity about science, technology, art, cultural phenomena and events related to the visible. 4. Rework, manage, and reasoning in the realm of the concrete (using, parse, compose, modify, and make) and the realm of the abstract (writing, reading, counting, drawing, and writing) in accordance with the learned in school and other sources in the same viewpoints / theories.	3.11. Describe the properties of light, shadow formation, as well as its application to explain human vision, and working principles optic equipments 4.11. Report the results of the investigation of the formation of a shadow on mirrors, lenses and optical instruments

2. *Determinethe Instrument's Specifications*

Science process skills indicators used in the assessment instrument are the prediction, measurement, experimentation, observation, communication, and inference. Indicators of critical thinking skills used in the instrument are a skill gives a simple explanation, generalize, infer, gave further explanations, and perform strategic steps. Indicators of problem-solving skills used in the instrument are to understand and define the problem, formulate alternative solutions, planning/define and implement a strategy, and evaluating.Indicators of each skill presented in Table 2.

TABLE 2. INDICATORS OF SCIENCE PROCESS SKILLS, CRITICAL THINKING SKILLS, AND PROBLEM SOLVING SKILLS

Types of Skills	Indicators
Science process skills	prediction, measurement, experimentation, observation, communication, and inference
Critical thinking skills	gives a simple explanation, generalize, infer, gave further explanations, and perform strategic steps
Problem-solving skills	to understand and define the problem, formulate alternative solutions, planning/define and implement a strategy, and evaluating

3. *WritingInstruments*

Writing instruments are carried out taking into account the aspect of material, construction, and language. The assessment instruments developed contain: title, usage instructions, scoring guidelines, e.g. scoring, and the observation sheet.

4. *Determinethe Scale of the Instrument and Scoring System*

The instrument was developed using a scale of 1-4. Scoring is determined in accordance with the scale used. The highest score of each indicator is 4 and the lowest is 1.

5. *ReviewingInstruments*

Authentic assessment instruments developed were investigated by seven rater.Two ratersare a matter experts and expert lecturers and five-rater else are a science teacher.

B. Results of Authentic Assessment Validation

Validation of product based on the assessment of the substance, construction, and language. Subsequent validation results are analyzed with the Aiken's V approach that aims to quantify the magnitude of the content validity coefficient (V). The magnitude of the numbers V obtained confirmed with numbers based on table Aiken's V. The minimum figure should be reached based on table V Aiken (1985:134) category 4 range and number of panel 7 are 0.86. The magnitude of V is obtained on the validation of the performance assessment sheet to measure process skills in science is about 0.86-1. The magnitude of V is obtained on the portfolio assessment sheet validation to measure critical thinking skills are of 0.98. The magnitude of V is obtained in the project assessment sheet to measure problem solving skills is of 0.86-1.

Based on the results of the analysis of the magnitude of the content validity of the assessment instrument's third showed that magnitude V instruments already exceed the minimum coefficient of Aiken's V. Thus, the assessment instruments developed meets the validity of the content. In addition to knowing the validity of the instrument developed, validation is aiming to obtain advice which can be used as material for the repair of the instrument before conducted trials at the school.

C. Revision of The Product

Assessmentinstruments are revised based on some suggestions by experts and practitioners. During limited trials and operational field test or measurement is in not discovering things that demanded he do revision, so that the revision could be made only when the process of examination of the instrument. In more detail, some revisions to the product can be outlined as follows.

1. Revisions to the usage instructions of the instrument so that more communicative and clear.
2. Revision of the observation sheet so that each observation sheets are given examples of scoring.
3. Revision of the rubrics so that homogeneous and focus on the systematic sequence.
4. Details of revision of the statement so that the statements communicated and homogeneous with other grains in one indicator.
5. Details of revision of the statement on the indicators devised the hypothesis so that made that clear parameters for measuring the skills of learners and presented grain statement about the interconnectedness between variables.
6. The revised grain statement on indicators composing the purpose of probation order made clear parameters for measuring the skills of learners and presented a statement stating the presence of grains of the verb.
7. Revision details of a statement on the observation sheet so that the language clarified.
8. Revised assertions so that the grain grain statement made clear parameters for measuring the skills of learners.
9. Revised assertions so that the grain grain statement clarified.
10. Revision of the format of the observation sheet so that there are six columns on a sheet for granting score the learners are assessed.
11. Clarify how to use observational science process skills sheet that is by adding the phrase "**give a sign check (√) in the number of students in student performance met observation of grain**" on a scoring rubric.

IV. CONCLUSION

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 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.

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