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Organized by

**Faculty of Mathematics and Science
State University of Padang
Padang, Indonesia**

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DEVELOPMENT OF AUTHENTIC ASSESSMENT FOR SUPPORTING THE INQUIRY LEARNING MODEL IN BASIC ELECTRONICS 1 COURSE

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ABSTRACT

Implementation of authentic assessment gives potency and benefit in learning process. This assessment type is conducted comprehensively both process and outcome. For this reason, the integration authentic assessment is important in a learning model. The objective of this research is to develop authentic assessment that suitable with inquiry learning model and determine its validity, practicality, and effectiveness. This research uses research and development (R&D). R&D is a research method which is used to produce certain product and to test effectiveness of that product. Stages of development model consist of primarily study, development model, and model testing. There are four products in this research, those are: writing assessment of initial task, performance assessment, scientific attitude assessment, and written report assessment. Quality criteria of authentic assessment including validity, practicality, and effectiveness. The instrument which is used to measure quality criteria consist of validation sheet experts, practicality sheet by lecturers and assistants, and achievement test sheet. As the result of this research shows that: 1). the validity of authentic assessment for supporting inquiry learning model is high with average value of validity is 81.42 and 2). the use of authentic assessment is practice and effective in inquiry learning model.

Index Terms : Authentic assessment, Inquiry learning model, Quality criteria, Basic Electronics

1. INTRODUCTION

Education plays an important role in improving the quality of human resources. In every learner is stored some various of potency such as intellectual, spiritual, emotional, social, and so on. Education gives some opportunities to develop various of learner potency become competency is use in their lives. High competence is required by learner in solving various problems of life.

Graduates of an education should have a good competence. In general there are three competency standards, those are: knowledge, attitudes, and skills. Knowledge relates to facts, concepts, laws, models, and theories. The attitude consist of behavioral attitudes, values, and norms. On the other hand, the skills is associated with the performance of graduates. Education should be able to develop all three of these competences in a balanced manner.

Learning is an effort to develop the some potencies of students. In the learning process of students must be involved actively. They are involved actively in reading, finding information, writing, investigating, solving problems, and so on. Learning like this is known as a student-centered learning. The role of teacher in learning is as a motivator, facilitator, mentor, and assessor.

In the learning process, teachers can activate students through authentic tasks. Authentic tasks consist of student-centered activities that focus on content and real-world skills. Authentic tasks often involve the acquisition of knowledge and skills, their main focus is related to practical application of this

knowledge and skills. Authentic tasks require students to demonstrate a process or procedure of a product, these tasks serve simultaneously both learning and assessment. Therefore, authentic tasks provide a direct connection between learning and assessment.

Authentic assessment is a comprehensive assessment conducted to assess input, process and output of learning. This assessment consist of attitudes, knowledge, and skills. Authentic assessment requires that efficiency, reliability, and comparability of measures be carefully planned and delivered (Cy L, 2009). The orientation of authentic assessment includes the learning process and the learning outcomes. Competences of students which is assessed consists of knowledge, attitudes, and skills. Measurement of learning aspect includes process, performance, and product. On the other hand, the characteristics of authentic assessment are integrated in learning, related to the real world, have several methods, and conducted comprehensively.

Implementation of authentic assessment of learning can be done through authentic tasks. Authentic task consist of student-centered activities that focus on real-world and skills (Mark B, 1995). Authentic tasks encourage students to demonstrate a process or procedure of a product. This task serves simultaneously learning and assessment. For this reason, authentic tasks provide a direct connection between learning and assessment.

Making a rubric in authentic assessment is very important. A Rubric is an established set of criteria used for evaluating or rating student products and performances (Diane R, 2009). Authentic assessments

use rubrics to provide clear scoring criteria to learners enabling them to conduct self assessment or peer-assessment before submitting. The effectiveness of a rubric is dependent on its validity and reliability (Paul M, 2012). Several benefits of using scoring rubrics in performance assessments have been proposed, such as increased consistency of scoring, the possibility to facilitate valid judgment of complex competencies, and promotion of learning (Anders J, 2007).

The use of authentic assessment in learning provide some benefit to the students. First, the students are able to understand the learning material comprehensively. Second, students have some capabilities such as collecting information, using sources of information, mastering the technology, applying a systematic thinking, and so on. Third, students are able to connect the lessons with their experience, real world, and life in society. Fourth, authentic assessment can improve high-level thinking skills such as analyzing, synthesizing, identifying the problems, solving the problems, and following the cause and effect relationship. Fifth, students receive response and develop some alternatives. Finally, students are able to connect the lesson with other subjects and collaborate activities with those tasks.

Teachers should apply the authentic assessment in the learning process. The fact shows that here are some problems in implementing the authentic assessment. First, the teacher states that authentic assessment is difficult to be applied in learning process. Second, the teacher states that authentic assessment is complex because it includes many assessments which conducted during the learning process. Third, authentic assessment cause teacher is tired in performing their duties. Another problem is the authentic assessment incompatible with learning model which is implemented.

One solution to solve this problem is to develop authentic assessment on the context and the suitable learning situation. In other words, authentic assessment must be suitable with learning model which is selected. Authentic assessment has strong relevance to the scientific approach in learning. An alternative suitable learning with the scientific approach in science process is inquiry learning.

Inquiry is the process of defining and investigating problems, formulating hypotheses, designing experiments, gathering data, and drawing conclusion about problem (Trowbridge in Atilla C, 2007). A potential result in inquiry-based teaching enables students to gain insights into the nature of scientific inquiry. Inquiry activities provide a valuable context for learners to acquire, clarify, and apply an understanding of science concepts (Josef T, 2012).

Inquiry learning model is a model of learning which practice students to learn to find the problem, to collect, to organize, and to solve the problems (DD Kristianingsih, 2010). The general aim of inquiry is to help students develop the skills necessary to raise the

question that arises from their curiosity and effort to find the its answer. Inquiry learning encourages and facilitates students in asking questions, trying to collect the data and process them, and finding the answers of these questions.

In general, Inquiry learning model has six stages. The first stage is the orientation, teacher make condition so that students are ready to follow the learning process with stimulating and encouraging students to think and to solve the problem. The second stage is to formulate the problem, the teacher directs and guides the students to formulate the problem. The third stage is to formulate the hypothesis, teacher guides students to formulate the hypothesis of the problem. The fourth stage is to collect the data, teacher directs and guides the students to collect data based on problem. The fifth stage is to test the hypothesis that is a process to determine the tentative answer which appropriate with data or information obtained. The last stage is to formulate the conclusion that is a process describes the findings obtained based on the results of hypothesis testing (Widhar D, 2013).

Authentic tasks are used in inquiry learning model to activate students in learning process. These task will connect directly between the learning model and assessment. Assessment which is produced by authentic tasks are authentic assessment.

The use rubric on authentic assessment gives effect on learning outcomes. There are several research results that show the effect of the use of authentic assessment and rubric in learning. First, the use of rubric for assessment was found to be very effective in determining a pathway for both the teachers and the students to look for and get to the desirable results (Sher Azim, 2012). Second, authentic learning environment that engage students in real-world inquiry problems involving higher order thinking skills with an authentic audience beyond the classroom (Audrey C R, 2006). Third, authentic assessment is inseparable from and integrated to instructional activity, and contributes to students' achievement. Authentic assessment improves thinking skill because its principles develop meta-cognitive awareness (Yuni P, 2013).

Quality criteria of development result of authentic assessment and its rubric need to be determined. There are three quality criteria used. The first criteria is validity of initial product based on rational thinking of experts. The second criteria is practicality that is easiness and implementation of authentic assessment in learning. The third criterion is effectiveness of application the product in learning (Tjeerd P, 2013).

Based on the background of the problem can be formulated problem in this study. As the formulation of the research problem, namely: 1). What is the validity of authentic assessment instrument and its rubric ?, 2). What is the practicality of authentic assessment instrument and its rubric in inquiry

learning model ?, and 3). What is the effectiveness of authentic assessment instrument in inquiry learning model ?.

Based on this reason, the researcher is interested to develop authentic assessment to support the inquiry learning model. The general objective of this research is to develop authentic assessment which connected to inquiry learning model and to test its effectiveness. The specific objective of the research is : 1). to determine the validity of authentic assessment instrument and its rubric, 2). determine the practicality of authentic assessment instrument and its rubric in inquiry learning model, and 3). determine the effectiveness of authentic assessment instrument in inquiry learning model.

2. RESEARCH METHOD

Type of this research is research and development (R & D). R & D is a method of research to develop a specific product and to test the effectiveness of that product. As a product of this research is an authentic assessment which is adapted by inquiry learning model. Authentic assessment in this research consist of two parts, those are authentic instrument and its rubric.

To develop and to test the effectiveness of a product is used a particular development model. The stages of Borg and Gall development model is modified by Sukmadinata and colleagues. In general, stages of research and development which is developed by Sukmadinata and his colleagues consists of three stages, those are preliminary study, development model, and model testing (Nana S 2006).

First stage is preliminary study. This stage is conducted to investigate the needs of students and lecturers. There are three activities in this study, those are to do the literature study, to conduct the survey field, and to make the initial product draft. Observation result on electronics experiment activities showed that: 1). lecturers only use experiment method in electronics laboratory, 2). authentic task doesn't used yet in learning, 3). assessment is not connected to learning model, and 4). authentic assessment instruments and their rubric don't applied yet in experiment activities. Based on result analysis of students questionnaire can be stated that: 1). I can't make the problem formulation is 67.44, 2). I can't make the formulation of hypotheses in experimental activity is 72.09%, 3). I can't test the hypothesis is 48.84, and 4). I can't make finding summary on the results of hypothesis testing is 27.91%.

The second stage is development model. Authentic assessment is developed based on inquiry learning model. In this case, authentic tasks are used to connect between learning model and assessment. Development stage includes developing products, testing validity, and revising the product. Product development produces writing assessment instrument

and its rubric, performance assessment instrument and its rubric, scientific attitude assessment instrument and its rubric, and written report instrument of experiment activities. Validation of product development is conducted by six experts. Weaknesses and mistakes of product are revised based on suggestion from experts.

The third phase is model testing. In this research, limited try-out is applied to test inquiry learning model by integrating authentic assessment. The purpose of testing is to determine the practicality and the effectiveness of authentic assessment in inquiry learning model. Testing uses before and after experimental method design. Effectiveness of the authentic assessment is determined based on posttest and pretest. This testing is conducted for three meetings.

In try-out activities, inquiry learning model by integrating authentic assessment is implemented. In this case, tray-out is conducted to determined practicality and effectiveness of authentic assessment. Generally, the learning process can be divided into three part, those are introduction activities, body activities, and conclusion activities.

Introduction activity is activity to prepare students to follow the learning process. This activity is conducted based on the preliminary task. The lecturer asks students to review the last lesson, to explain the next learning material, to explain the purpose of learning, to explain the benefit of studying the learning material, and to explain the scope of learning material.

Body activity is main process of learning to achieve competence. In this activity is used experimental task to activate students in learning process. Lecturer directs and guides students to conduct experiments based on task experiment. In learning process, students formulate the problem, formulate the hypotheses, and collect the data. Performance and scientific attitude of students in experimental activities are assessed by assistants.

Conclusion activity is activity of lecturer to close the learning process. The lecturer asks the students to conclude the lesson, to check student understanding, to direct the task report, and to inform the learning material for next meeting.

Authentic tasks consist of preliminary task, experimental task, and report task. Preliminary task is used to encourage students to review the last lesson and to learn the learning material now. Experimental task is used to guide and to direct students to conduct experiment activity in laboratory. Meanwhile, report task is used to direct students to make a written report of experiment activity.

Authentic instrument is conducted based on authentic tasks. Writing assessment instrument is used to assess the preliminary task. Performance assessment instrument and scientific attitude assessment instrument are used to assess the experimental task. On the other hand, written report

instrument is used to assess the written report of experiment activity.

Validity sheet of experts is used to assess the validity of four types of products. Practicality sheet of lecturers and assistants are used to determine the practicality of use of the product in inquiry learning model. On the other hand, pretest and posttest sheet are used to determine the effectiveness of the use of product in inquiry learning model on RLC circuit, characteristics of diode, and wave rectifier circuit of learning material.

Writing skills assessment instrument on initial task consists of six indicators, namely writing word or letter, sentence structure, use of punctuation, paragraph structure, writing tidiness and writing consistency. Every indicator can be assessed based on certain level on its rubric. Various level and its value of rubric is advanced = 4, proficient = 3, basic = 2, and novice = 1.

Performance assessment of students conducted in experimental activities. Instrument performance assessment includes six indicators, namely: making the electronic circuit, arranging the equipment, connecting the circuit with equipment, using the electronics instrument, varying the independent variables, and getting the measurement data.

Scientific attitudes of students are observed when experiment activity in laboratory. Indicators of scientific attitude consist of curious, honest, strong, objective, discipline, and responsibility. The assessment criteria to include scientific attitude is very good, good, fair, and less.

Written report is made by the students based on the results of experiments to follow the stages of inquiry learning model. Indicator assessment of written report consist of formulation of problem, formulation of hypotheses, working procedures, truth of measurement data, testing hypotheses, and drawing conclusions. The sixth indicator is assessed using assessment sheet of written report.

Data from the validity result of expert and assessment the practicality of use the product of lecturers and assistants are analyzed by using graph method. Effectiveness data of the use of product in inquiry learning model is analyzed by using comparative mean test. A product is said to be effective is if there is a significant difference between student learning outcomes after and before intervention.

3. RESULT AND DISCUSSION

Results of this research consists of three parts. The first result is validity value of authentic instrument and its rubric scoring of experts. The second result is practicality value of application of authentic assessment instruments and their rubric scoring of lecturers and assistants. The third result is effectiveness value of application of authentic assessment instruments in inquiry learning model.

3.1. Validity of Authentic Assessment

Validation is assessment of a product design by experts based on rational thinking. There are four products authentic assessment and their rubric which is assessed by experts. First, writing skills assessment instruments and its rubric. Second, performance assessment instrument and its rubric. Third, scientific attitude assessment instrument and its rubric. Finally, assessment instrument of written report of experiment activities and its rubric.

Writing assessment indicators of initial task includes writing words or letters, sentence structure, use of punctuation, paragraph structure, writing tidiness, and writing consistency. The average value of writing assessment instrument and its scoring rubric of experts varies from 76.7 to 83.3 with an average value of 79.4. The average value of validity is categorized into good category.

The average value of writing skills assessment, performance assessment, scientific attitude assessment, and written report assessment can be seen in Figure 1

Fig 1. Validity Value of Authentic Assessment

Number 1 in Figure 1 is assessment instrument of writing skills. The average value of writing assessment instrument and its rubric is 79.4. Number 2 is instrument of performance assessment and its rubric. The average value of performance assessment instrument and its rubric is 81.7. Number 3 is scientific attitude assessment instrument and its rubric with average value is 83.8. Meanwhile, number 4 is assessment instrument of written report of experiment activities with experiment with average value is 80.8. The minimum value, maximum value and average value of authentic assessment respectively 79.4, 83.8, and 81.4. The average value of authentic assessment is included in very good category.

3.2. Practicality of Authentic Assessment

Practicality relates to the ease of application of a product in learning. Authentic assessment instruments and their rubrics are used in inquiry learning model. These instruments and their rubric used by two lecturer and five assistants to assess the writing skills of initial task, the performance of students, the

scientific attitude of students, and written report of experiment activities.

The first practicality testing is the use of writing skills assessment instrument and its rubric. Indicator practicality testing of use writing assessment instrument and its rubric consists of: 1). Indicator on writing skills is easy to use, 2). The language which is used in writing skills instrument is easy to understand, 3). Writing skills Instrument is easy to apply, 4). The criteria in rubric of writing skills instrument is easy to understand, 5). Language on rubric of writing instrument is easy to understand, and 6). The assessment criteria on rubric of writing skills is easy to implement. Practicality value of writing skills indicator varies from 75.0 to 92.5. The average value of writing skills instrument is 87.1.

The second practicality testing is the use of performance assessment and its rubric. Practicality testing indicators of the performance assessment instrument and its rubric include: 1). Indicator on performance assessment instrument of experiment is easy to understand, 2). Language in the performance assessment instrument is easy to understand, 3). Performance assessment instrument of experiment is easy to implement, 4). Criteria in rubric of performance assessment of experiment is easy to understand, 5). Language which is used in rubric of performance assessment of experiment is easy to understand, and 6). Criteria in the rubric of performance assessment of experiment is easy to apply. Practicality value of performance assessment instrument varies 77.5 to 92.5. The practicality average value of the use of performance assessment instrument and its rubric is 86.3.

The third practicality testing is the use of scientific attitude assessment instrument and its rubric. Indicator of practicality testing consists of: 1). Indicator on scientific attitude assessment instruments in the science process is easy to understand, 2). Language in scientific attitude assessment instrument is easy to understand, 3). Scientific attitude assessment instrument in the science process is easy to apply, 4). Criteria in rubric of scientific attitude assessment in science is easy to understand, 5). Language which is used in rubric of scientific attitude assessment in the science process is easy to understand, and 6). Criteria in rubric of scientific attitude assessment in the science process is easy to apply. Practicality value of the use of scientific attitude assessment varies from 80.0 to 92.5. The practicality average value of the use of scientific attitude assessment instrument in the science process is 87.1.

The fourth practicality testing is the use of written report assessment instrument and its rubric. As practicality indicator of the use of written report assessment consists of 1). Language in written report assessment instrument of experimental activities based on inquiry is easy to understand, 2). Instrument of

written report assessment of experiment activities based on inquiry is easy to implement, 3). Instrument of written report of experiment activities based on inquiry is easy to apply, 4). Criteria in rubric of written report assessment of experiment activities based on inquiry is easy to understand, 5). The language used experimental activities assessment rubric based on inquiry reports easy to understand, 6). Criteria in rubric of written report assessment of experiment activities based on inquiry is easy to implement, 7). Inquiry process which is conducted can be understood easily through the report, and 8). Inquiry process which is conducted can be assessed easily through the report. Practicality value of the use of written report assessment instrument of experiment activities varies from 85.0 to 95.0. The practicality average value of the use of written report assessment instrument is 90.3.

Value of practicality of authentic assessment of lecturer and assistant were shown in Figure 2

Fig 2. Practicality of Authentic Assessment

Figure 2 respectively practicality of writing skills assessment, performance assessment, scientific attitude assessment, and assessment of written report. The practicality average value of writing assessment instrument application and its rubric is 87.4. The practicality average value of performance assessment instrument application and its rubric is 86.3. The practicality average value of scientific attitude assessment instrument application and its rubric is 87.1. On the other hand, the practicality average value of written report assessment instrument and its rubric is 90.3. The practicality maximum value, minimum value, and average value of authentic assessment instrument application and its rubric respectively 86.3, 90.3, and 87.7. The average value of test results practicality of authentic assessment instrument application and its rubric included in excellent category.

3.3. Effectiveness of Authentic Assessment

The effectiveness of the use of authentic assessment in inquiry learning model is determined by comparing learning outcomes of students between after and before intervention. Descriptive statistical parameters both pretest and posttest are determined.

The parameter The average value standard deviation, and variance of pretest of 43 students respectively 31.16, 9.56, and 91.47. On the other hand, the average value, standard deviation and variance of posttest respectively 66.16, 10.46, and 109.33.

Difference of students learning outcomes between after and before intervention can be determined of compare mean test. T value is obtained from the calculation is 14.42. On the other hand, the t value which obtained from a table for 43 students and 90 % confidence level is 1. 69. From the comparison of two values of t can be stated that the null hypothesis is rejected. This means that learning outcomes of students after the use of authentic assessment in inquiry learning model is significant difference from the learning outcomes of students before the use of authentic assessment. Therefore, the use of authentic assessment is effective in inquiry learning model.

4. CONCLUSION

Based on the objectives of research and discussion of research results can be stated three conclusions from this research. First, validity value of writing assessment, performance assessment, scientific attitude assessment, and written report respectively 79.4; 81.7; 83.8; and 80.8. These values can be categorized into high level. Average value of authentic assessment validity is 81.4. This value is very high. Second, the use authentic assessment is practice in inquiry learning model. Practicality value of writing skill assessment, performance assessment, scientific attitude assessment, and written report respectively 87.1; 86.3; 87.1; and 80.8. The average value of practicality is 87.3. Finally, Integration the authentic assessment including writing skill, performance, scientific attitude, and written report instrument is effective in inquiry learning model.

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