

## DEVELOPING ASSESSMENTS ON RESEARCH-BASED PHYSICS LEARNING FOR STUDENTS OF SMAN 1 PADANG

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### **Abstract**

*The research-based learning in Secondary High School (SMAN) 1 Padang still limited to laboratory activity that is closed to theory verification only. The preliminary study shows that none of the physic teachers in SMAN1 Padang use research-based assessments. Moreover, many students do not satisfy the expected learning outcomes. Supporting facilities, such as physics laboratory and instruments, are available in that school. Yet, they are not used maximally. Research-based learning is one of the teaching methods to increase students learning outcomes. The selection of appropriate learning model based on students' character is crucial to support student' understanding of the subject matter. In order to investigate student's competency in physic learning, it is necessary to have assessments. The objective of this research is to developing an assessment research-based in physic, which is a valid and practical. This research uses four-D models. The instruments to collect data include validation sheet of assessment, observation and questionnaire of assessment practicality. Data were analyzed qualitatively and quantitatively. The result of the research shows that the developed assessment is valid, based on three experts judgment. The practical of assessment is categorized based on the result of the observation and the teacher's response.*

**Keywords:** assessment, physics learning, research.

### **INTRODUCTION**

Various attempts have been made to improve the quality of education. One of them is the establishment of eight national education standards by the National Education Standards Agency (BSNP). Three of the national education standards are content standards, competency standards, and standards is a benchmark in the implementation process of education. Content standards load competency standards and basic competencies that must be achieved by students after learning through the levels and time, in order to reach competency standards after students complete a certain mastery learning in the educational unit.

One of the demands of the curriculum 2013 is student-centered learning using a scientific approach. The teacher acts as a facilitator, motivator, and one alternate source of learning. Teachers design teaching materials in accordance with the demands of the curriculum to support students in mastering the competencies. The development of teaching materials should satisfy the demands of the curriculum. In the curriculum 2013 core and basic competences which have been set by the policy makers. However, the instructional strategies and teaching materials are left entirely to teachers to design it.

Initial surveys in SMAN 1 Padang showed that students' achievements in physics are still low. There are still many students who have not mastery in physics learning. The low of learning outcomes caused by several things, including learning physics not fun, not interesting, and not challenging for students, so students often found difficult to study physics. During the learning processes, students have not been actively involved in finding facts, building concepts and principles that can be applied to solve problems in everyday life. Some other causes of low the learning outcomes are: less variation in teaching methods, the dominance of the teacher, teaching material developed by the teacher is not in accordance with the characteristics of the students and content.

Instructional methods used by teachers should foster students to be involved actively in learning processes, so that the learning processes is not optimally. This instructional methods impact on student learning activities that are less creative and passive, so that students' difficulties in understanding the physics concepts. Teachers are less creative in developing teaching materials in accordance with the characteristics of the students. The teachers tend to use available teaching materials, regardless of the characteristics of the students.

Teachers need to keep abreast of the times in order to understand the world the students to face the challenges of the future. Teachers are required to be able to create active learning, creative, effective and fun, can innovate and use appropriate learning methods. In the era of information and communication technology (ICT) continues to grow, without being taught the students can follow the development of ICT well. On the other hand there is the tendency of weakening of motivation and lack of student interest in reading, so that result in low productivity innovative work. Reading has been replaced a variety of multimedia impressions through television and the internet. Many of the students that are resistant to linger in front of the television, but sleepy while reading a book.

Factors causing low quality of science education are the lack of development of thinking skills and science process skills in the classroom. Thinking skills is an important aspect in solving a problem. If the thinking skills are not trained constantly in learning activities can be ensured students' ability in solving various problems will be very minimum and less qualified. Science process skills to train students in the process of thinking and the human form who have a scientific attitude. In the study of physics required aspect of creativity. Creativity can be achieved among others through creative thinking skills. The development of creative thinking skills and science process skills in students who started early will form the habit of thinking of students is very beneficial for the students themselves at a later date.

Factor of students' learning difficulties, among others, the lack of motivation, fatigue, less passionate, and sleepy in class, one reason is the imbalance use of the right brain and the left brain. One way to enable the two halves of the brain by doing research based learning are very concerned about the process and the product (Wardoyo, 2013). Students are trained to be able to solve the problem by looking at the fact that research meets.

Research-based learning in addition to helping to solve problems based on real experience, nor does it always takes longer and is not to be performed by each subject separately. To maximize and streamline time, learning activities with research can be done with the collaboration of several teachers and conducted lessons outside study hours, so the problem can be resolved short of time. Research-based learning can motivate student learning, can bring positive character. It is time the teacher triggered a scientific character of students to carry out research based learning. Teachers must be able to identify the basic competencies that can be taught using a research-based learning model. In the research-based learning does not close the possibility of integration across subjects. In research based learning, teachers and students are expected to have the ability to construct knowledge through research.

Research-based learning model is one of the student-centered learning models that integrate research in the learning process. Based learning research conducted in a wide variety of learning methods. Research-based learning gives students the chance to search for information, draw up hypotheses, collect data, analyze data, and make conclusions (Wardoyo, 2013). All the learning outcomes that are owned by the student comes from a simple research they do, for example, through experiments and field studies. With the application of research-based learning students are expected to have the character of a scientist. The character is marked by a high curiosity, is able to solve problems, think systematically, objectively, and has a strong thought.

Teachers are expected to create a creative learning, interesting and innovative. In his role as a researcher, a teacher can be very critical of text books. Criticality of the text books that allowed the teacher to develop a wide range of alternative ideas to explain the substance of a science. Teachers can demonstrate analytical skills in front of their students. Such teachers are also most likely to inspire students to do simple research. Capable teachers as researchers are teachers who are able to teach the students researched. The challenges of the present and the future must be answered by science-based solutions to problems.

Research-based learning is based on the philosophy of constructivism which includes four aspects, namely; (1) learning that build understanding, (2) learning that develops the knowledge early, (3) learning is a process of social interaction, and (4) meaningful learning is achieved through real experience. Research is an important means to improve the quality of learning. Research component consists of; (1) the background of the problem, (2) formulation of the problem, (3) procedures for implementation, (4) research, (5) discussion, and (6) the publication of research results. It is believed to be able to improve the quality of learning. Research-based learning is a teaching strategy that uses authentic learning, problem solving, cooperative learning, contextual, and inquiry approach (Roach, 2000).

Good quality of learning should be followed by a good assessment anyway, because of the results of the assessment information useful for the improvement of the quality of

learning. Wolf (in Badmus, 2007) and Mardapi (2008) argued that the assessment of students is an important part of learning and good teaching can not succeed without a good assessment. The opinion indicated that every effort to improve the quality of learning should include efforts to enhance assessment system used. According to Popham (2005) reasons for doing assessments, are to: (1) diagnose the strengths and weaknesses of students, (2) monitor the progress of learning, (3) gives the attribute grading, and (4) determine the effectiveness of teaching. Stecher (1997) states that there are three purposes of assessment of learning that is (a) to develop learning, (b) certify the ability of individuals, and (c) evaluating the success of the program. From some of these opinions reflected the importance of assessment of learning both in school and outside school.

In research based learning models necessary assessment appropriate to the learning characteristics. With reference to the characteristics of learning in the lab where students face to face with real problems and learn the patterns of cooperation to resolve problems faced, the right type of assessment to be developed is authentic assessment. Inger (1995) suggested that the assessment of authentic produce more valid information about education programs results compared to information available with traditional testing procedures. Authentic assessment models to be used, because the valuation models can measure students' abilities and skills. Badmus (2007) suggested that to improve the quality of the assessment results and the quality of learning is to use authentic assessment. The reason is that the right to use the authentic assessment of learning using the reference benchmark assessment, which emphasizes the performance assessment.

From the results of the Review of literature, authentic assessment consists of several types, such as portfolios, performance assessment, peer assessment, self assessment, project appraisal, the journal. According Badmus (2007) among several existing methods of authentic assessment, performance assessment is an appropriate way to use the competency-based learning. Airasian (2001) defines performance assessment as an assessment of the acquisition process, the application of knowledge and skills, through a learning process that demonstrates the ability of the students in the process and the product. Assessment of the process and the work of the individual is a feature in the performance assessment, every individual can demonstrate the maximum performance capabilities through its involvement in the process or the product. Allen (Aiin & Turnock, 2007) states that the assessment of performance assessment is a very relevant and suitable to be applied to research based learning. This assessment requires the student to demonstrate competence and special skills they have mastered in the form of display or produce something.

Based on the above, then do research to develop research-based assessment models to assess the competence of high school students in learning physics research based, valid, practical, and effective. Problems in the study was formulated as follows: *How is assessment models to assess the competence of high school students in research-based physics learning?*

## **THEORETICAL FRAMEWORK**

Research is often described as a process of investigation carried out with the active, diligent, and systematic, which aims to discover and interpret facts. Research generates knowledge about events, behavior, theory, and law. Physics lab activities are aimed at learning process so that students have the opportunity to test or discover concepts, principles, and laws. Students observe phenomena that occur through data collection, data analysis, and make conclusions. Through practicum students doing research on the level of simple to complex levels in order to obtain the pattern of active thinking, creative, diligent, patient, thorough, and responsibility. Students are expected to work scientifically, to solve the problem, to be scientific, and scholarly communication.

Attitude obtained through the activity of receiving, running, respect, appreciate, and practice. Knowledge gained through the activity of remembering, understanding, applying, analyzing, evaluating, and creating. Skills gained through observing activity, ask, try, reasoning, presenting, and create. The syntax of research-based learning is: (1) Pre-research: (a) One day before the learning activities, the research group took the sweepstakes materials and guide the research, (b) Teachers motivate students to do research include; first learn the underlying concepts and research procedures properly; make a report in accordance with the format of the report. (c) The teacher sets learning objectives, prepare tools and test tools to be ready to use. (2) Implementation of research: (a) Students entering the laboratory, (b) the students carry out practical activities, assembling, observe, collect data, analyze the data, conclude, and make a report, (c) the teacher observing, assessing, and record events during student activities in the research group. (3) Follow-up research: Students create and consultation papers.

Assessment in the research-based learning using performance assessment. According Zainul (2001) performance assessment is an assessment that requires students demonstrate performance not answer or choose answers from alternative answers. Performance assessment is an assessment that asks students to demonstrate and apply knowledge in a variety of contexts in accordance with the desired criteria. Performance assessment linked to the quality of teachers in the learning (Gauglianone, 2009). In the assessment of performance used various forms of duty to obtain information about what and how far he has done in research activities. Monitoring is based on demonstrated performance in completing a given task or problem. The results are an outcome of the performance. There are three main components in the assessment of performance, namely task performance, performance rubrics, and scoring guide (Haryati, 2008). Performance task is a task that contains topics, standard tasks, job descriptions, and the condition of the completion of the task. Performance rubrics is a column that contains the ideal performance components and descriptors of each of these components. Performance evaluations, there are three: (1) a holistic scoring, the scoring is based on the general impression of the quality assessor performance. (2) Analytic scoring, the scoring of the aspects that contribute to performance, (3) primary traits scoring, the scoring is based on several dominant element of the performance

In the performance assessment of students are required to demonstrate the scientific inquiry, reasoning and skills in solving tasks in real life (NSTA, 2006). To obtain a valid evaluation, task performance must have the following criteria: (1) focus on the essential teaching elements, (2) in accordance with the referenced curriculum content, (3) integrating information, concepts, skills, and work habits, (4) involving students, (5) enable the willingness of students to work, (6) feasible and appropriate for all students, (7) there is a balance between group work and individual work (8) is well structured for ease of understanding, (9) has a process and the products are authentic, (10) to enter the self-assessment, (11) allows the feedback from others (Hibbard, 1995).

## **RESEARCH METHODS**

Design research using methods of research and development, which refers to the four-D models is applied in this study. According to Thiagarajan (in Trianto 2009) the four-D models stage is define, design, develop, and disseminate. Research conducted on the assessment of learning physics for high school students. The subjects of the study is the assessment of learning physics for high school students. Respondents were students and teachers of physics at SMAN 1 Padang. The instruments on data collection include validation sheet, observation sheet and questionnaire. Based on the type of data collected the data was analyzed qualitatively and quantitatively. Data validation of learning assessment models were analyzed with descriptive statistics and compared with the validity criteria. Questionnaire data were analyzed quantitatively to determine the practicality of learning assessment models. Learning assessment implementation data was analyzed qualitatively by revising procedures and learning assessment items. Revisions were made based on the records of researchers, the results of observations conducted by the observer on the implementation of the learning assessment, and by weighing the opinion from the experts and peers.

## **RESULTS AND DISCUSSION**

The implementation of research-based assessments is using various forms of assessment. One form of the assessments is the assessment of performance. The main characteristics of the assessment of the performance of not only measure student learning outcomes, but complete gives clearer information about the learning process. In other words, the performance assessment is a process that accompanies all activities of student learning. The implementation of performance assessment, 54% of teachers claimed to have carry and 46% of teachers have not applied it.

To maintain objectivity required performance assessment scoring rubric. Rubric prepared on purpose instrument, and use this column are communicated to students in order to know what criteria will be assessed so that they can maximize its capabilities. Use assessment rubric can help teachers assess student performance unruk more accurately and objectively.

Based on the results of the forum group discussions (FGD) were conducted, to aspects of the content of 83% of teachers expressed assessment models produced good 17% said

very good. From the aspect of construction 86% of teachers expressed very good and 14% said good. In terms of language 75% said good and 25% excellent. Wilde (in Padmono, 2006) declared the implementation of assessment requires the ability of teachers to modify the provision of information used to plan learning activities. Teachers should not rely on the assessment form that is commonly and frequently used, but teachers can make an assessment of innovation in order to improve the quality of student learning. Tends assessments undertaken in the assessment to measure the cognitive aspects while affective and psychomotor aspects have not received attention.

Suggestions obtained through FGD in accordance with the concept of assessment expressed by (Brown, 2004) that the test should be carried out as naturally as possible, topics meaningful use, relevant and interesting to students and tasks given the proximity to student life. Research-based assessment is an assessment process in which involves the performance that reflects how students achieve competence in learning. Wiggins (2012) gives students a set of tasks that reflect the priorities and challenges encountered in learning activities: conducting research, write, revise and discuss the article. Through research-based assessment of students more involved in the task and teachers can be more confident that the assessment that it provides meaningful and relevant.

**Results Assessment Model Validation**

Before conducting the field test, assessment models and instruments to advance conceptually validated by three experts on education, with a view to determine whether the draft assessment models and their supporting instruments qualify the validity. The validation results are summarized in Table 1.

**Table 1.** Results of Validation of the Research-based Assessment Model and Research Instruments

No	Validated Components	Validity	
		Index	Conclusion
1	Assessment models	3.82	very valid
2	Assessment rubrics	3.84	very valid
3	Questionnaire for teachers	3.65	very valid
4	Questionnaire for students	3.76	very valid

Based on the information presented in Table 1, note that the model of assessment and research instruments already qualified validity. The expert assessment is based on theoretical knowledge and their experience.

**Results of Field Test the Assessment Model**

Pilot activities in this study were conducted three times, which consists of individual testing, small group trial, and the trial was expanded. Test individuals and small groups are intended to identify problems that could hamper feasibility assessment model of learning, such as readability, use of language, and the time required by students and

teachers, so that it can be revised to obtain a model that meets the criteria of a practical assessment. Based on the results of these trials carried out revisions to the draft assessment models to obtain a better assessment models. Assessment of the results of the processing of the practicalities of assessment of learning by teachers obtained the teacher's response to the assessment of learning is the very good category with an average value of percentage is 82.38%. Thus, it can be concluded that the assessment model is practical category.

## CONCLUSION

Based on the development and testing that has been done, the conclusion as follows:

1. Assessment model to assess the physics competence of students in research-based learning using performance assessments in carrying out research in the laboratory.
2. Performance assessment is equipped with a rubric. Use rubric can help teachers assess student performance more accurately and objectively.
3. Assessment model of research based physics learning and rubrics have been valid, based on expert assessment.
4. Assessment model of research based physics learning and rubrics have been very practical categorized, based on the response of teachers.

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