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Electronic Validity Of Workshop Based On The Project-Based Learning Model Assisted With The Science Laboratory Kit To Improve Science Process Skills In Class X SMA

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Abstract – The purpose of this study was to determine the electronic validity of student worksheets based on a project-based learning model assisted by a science laboratory kit to improve the elucidation of the scientific process in class X SMA. The type of research to be used is research and development using the Plomp model, which consists of preliminary research, development or prototyping phase, and assessment phase. However, this research is limited to the development or prototyping phase. In the development stage or prototyping phase, the validation is carried out using instruments filled in by an expert lecturer (validator). The validation of this study was carried out by three lecturers at the State University of Padang. Based on the validation of three validators, the validity is 90.0% with the valid category. This means that electronic student worksheets based on a project-based learning model assisted by a science laboratory kit to improve the scope of the scientific process in class X SMA can be used in learning at school.

Keywords – Electronic Wozrksheet, Project-based learning, Science Laboratory Kit, Science Process Skills.

I. INTRODUCTION

Science is a collection of systematic theories, its application is generally limited to natural phenomena, born and develops through scientific methods such as observation and experimentation, and demands scientific attitudes such as curiosity, openness, honesty, and so on. Science deals with how to systematically find out about natural phenomena in life.

The importance of the role of science education, the government is trying to improve the quality of education by improving the curriculum, including the 2013 Curriculum which is an improvement of the Education Unit Level Curriculum (KTSP). Based on the 2013 Curriculum, the goal of learning is to provide a direct learning experience through the use and development of process skills and scientific attitudes. Science education enables students to explore their potential through learning experiences and to research and construct science optimally [1].

The success of students in the field of science is related to the ability of a teacher to design learning activities that will be carried out. Learning that involves students actively obtains better learning outcomes so that teachers must be able to design lesson plans, and determine the teaching materials used. Teaching materials can help teachers in classroom learning activities.

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Teaching materials are all materials (both information, tools, or text) that are arranged systematically, which contain competencies that will be mastered by students and used in the learning process with the aim of planning and reviewing the implementation of learning. For example, textbooks, modules, handouts, student worksheets, audio teaching materials, interactive teaching materials, and so on [2].

The availability of teaching materials is also expected to improve students' reasoning abilities in learning [3]. So far, the teaching materials developed are less attractive and not optimal. To be maximized, the teaching materials developed must be able to adapt to the times and habits of students. These activities by providing a set of tools and materials that must be assembled or worked on by students.

One of the factors that influence the success of laboratory activities is the availability of resources that include materials and equipment, space and furniture, laboratory staff, and technicians. However, the limited laboratory equipment in schools and learning time makes teachers tend to only teach the material in theory in class. Responding to these problems, researchers are interested in developing teaching materials in the form of electronic student worksheets (electronic worksheets) to facilitate students' learning.

To be maximized, the teaching materials developed must be able to adapt to the times and habits of students. These activities by providing a set of tools and materials that must be assembled or worked on by students. This set of tools and materials is commonly referred to as a laboratory kit.

A laboratory kit is a teaching aid consisting of a set of tools and materials that can be assembled into a tool for experiments. Usually, this lab kit is available in every school laboratory. However, due to various limitations, the kit cannot function properly. For this reason, teachers must be able to innovate in simple teaching aids or lab kits to help the learning process. There have been several applications such as a spring practicum kit [4].

To do practicum such as assembling the kit, of course, requires instructions. Then to implement it, a learning model is needed, one of which is Project Based Learning (PjBL). The Buck Institute for education states that the project-based learning model is a systematic learning method that involves students in learning knowledge and skills through a structured process, real experiences, and meticulously designed to produce products [5].

Physics learning is expected to be implemented by the demands of the 2013 Curriculum. However, the reality of learning Physics in the field has not been as expected. Based on this, the researcher conducted initial data collection using interview sheets, teacher questionnaire sheets, and student questionnaires. Initial data collection was carried out at SMAN 16 Padang. There are three components of analysis in interviews with teachers, namely: physics learning, use of teaching materials, and use of learning models.

The results of the second interview regarding the use of teaching materials. The teaching materials used are in the form of printed books and worksheets from the publisher. To improve science process skills, students must have practical/experimental, but there are some books and worksheets that do not have practical/experimental. Because not all KDs are made experimental procedures. During learning, some students forget to bring printed books and worksheets. The books and worksheets used by teachers and students still do not contain the use of information and communication technology.

The results of the third interview regarding the learning model. Teachers have used a learning model that is by the demands of the 2013 curriculum. Teachers still rarely use the Project-Based Learning model because it is adjusted to the material being taught. Application of the Project-Based Learning model by dividing students into several groups and thoroughly creating a project by KD. During the application process, there are several obstacles such as dense material, a small amount of time, less than optimal use of laboratories, and maximum use of teaching materials.

In addition to interviews, researchers also observed the physics learning process for teachers and students at SMAN 16 Padang through an observation questionnaire. The initial study conducted on students was an analysis of interest, learning motivation, learning styles, attitudes, knowledge, and skills. The results of the analysis are expressed in the form of an average percentage. The results of the analysis of students consisted of interest, learning motivation, learning styles, attitudes, knowledge, and skills, namely 51.5%, 52.9%, 65.5%, 91.5%, 49.3%, and 54.1 %

II. METHODS

The type of research that will be used is research and development (Research and Development). Research and Development is a research method used to produce certain products and test the effectiveness of these products [6]. Development research aims to produce certain products and test the effectiveness of the resulting products. Products developed in the form of electronic worksheets based on the Project-Based Learning (PjBL) model assisted by the Science Laboratory Kit are limited to science process skills, physics material for class X semester I.

The research model is a set of sequential procedures for carrying out the design and development of learning which is manifested in diagrammatic or narrative form. The electronic worksheet development model based on the Project-Based Learning (PjBL) model assisted by the Science Laboratory Kit uses the Plomp model. The Plomp model has three stages, namely: preliminary research, development or prototyping phase, and assessment phase [7]. However, in this study, researchers limited themselves to the development stage of making prototypes.

The researcher took the initial data using interview sheets, teacher questionnaire sheets, and student questionnaires. Initial data collection was carried out at SMAN 16 Padang. There are three components of analysis in interviews with teachers, namely: physics learning, use of teaching materials, and use of learning models. However, the reality of learning Physics in the field has not been as expected.

Electronic worksheets were first designed, then directly validated by researchers (self-assessment), and finally validated by experts. Self-assessment is carried out to review components that the researcher thinks are missing and need to be revised. After the self-assessment stage, it will be validated by an expert. The experts who were asked to evaluate were 3 expert lecturers from Padang State University. This aims to determine the level of validity of the electronic worksheets developed in terms of content aspects, construct aspects, graphic aspects, and language aspects.

This assessment is carried out by providing an assessment instrument to three expert lecturers (validators). After being given an assessment and input, then a revision is made, will be known the feasibility of the developed electronic worksheet. Inputs and suggestions given by expert lecturers (validators) are a reference for the improvement of the product being developed. To find out the validation of the product being developed, namely electronic worksheets based on a project-based learning model to improve science processing skills, the data will be processed using data analysis techniques.

The validity analysis used a Likert scale with the following steps; 1) Give a score for each item the answer is strongly agreed (4), agree (3), disagree (2), and strongly disagree (1). 2) Add up the total score of each validator for all indicators. 3) Giving the validity value by using the Aiken's V formula, namely:

$$V = \sum \frac{s}{[n\,(c-1)]}$$

Determining validity according to Azwar [8], the range of numbers "V" obtained will be obtained between 0 to 1.00 so that the range ≥ 0.6 can be interpreted as a fairly high coefficient so that it can be categorized that the validity is in the "valid" category. The following is Table 1 validity categories

Table 1. Validity Category

Achievement Level	Category
0,6 – 1,00	Valid
< 0,6	Invalid

III. RESULTS AND DISCUSSION

The electronic worksheet that has been designed is validated by three experts and two practitioners. Each validator is given an instrument to assess the electronic feasibility of the student worksheet based on a project-based learning model to improve science process skills, this assessment aims to determine the weaknesses and strengths of the electronic worksheets. The scores on the assessment on the electronic worksheets range from 1 to 4, with categories ranging from valid and invalid. The results of the validity of this expert lecturer are used as an improvement over the shortcomings of the developed electronic worksheets. The assessment instrument provided includes four aspects, namely content aspects, construct aspects, graphic aspects, and language aspects. The results of the electronic validity of the worksheet can be seen in Figure 1.

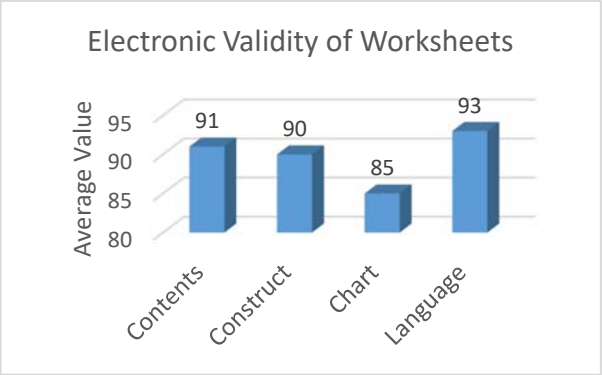

Figure 1. Electronic Validity of Worksheets

Based on Figure 1, it can be seen that the average value of the electronic validity of worksheets by experts and practitioners is 90.0% and is greater than 60.0% in the valid category. The values of content aspects, construct aspects, graphic aspects, and language aspects were 91.0%, 90.0%, 85.0%, and 93.0%. Thus the electronic validity of the Model-Based Project Based Learning worksheet to improve science process skills and can be used. The results of the electronic validity of the worksheet on the content aspect can be seen in Figure 2.

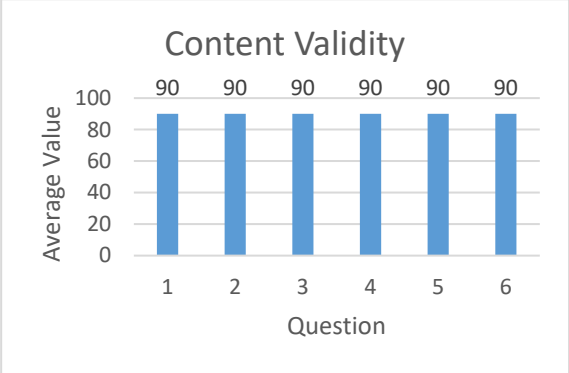

Figure 2. Electronic Validity Value of Construction Content Aspects of Worksheets

The content aspect consists of six questions, namely; 1) The material presented in the electronic worksheets based on the Project-Based Learning model is by the demands of KI, KD, and formulated indicators, 2) The facts in the presentation of the problems given are by the topic in the material, 3) The examples provided are up to date and relevant with the material, 4) Activities and observations associated with the real-life of students, 5) Activities in electronic worksheets based on the Project-Based Learning model encourage students to learn scientifically, and 6) Learning steps on electronic worksheets according to the Project-Based Learning model. Based on Figure 2, it can be seen that the average value of the electronic validity of worksheets on the content aspect by experts and practitioners is 89.0% and a large of 60.0% is in the valid category. The value of the six questions is the same, namely 90,0%. The results of the electronic validity of the worksheet on the construct aspects can be seen in Figure 3.

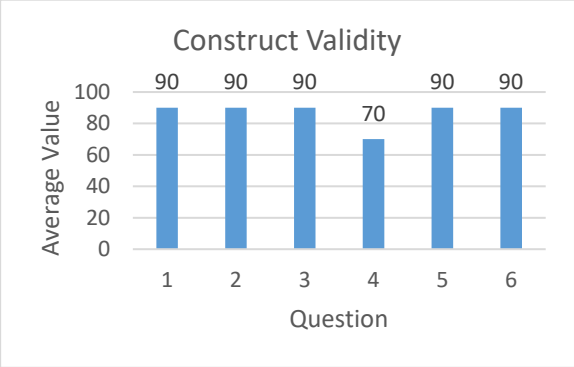

Figure 3. Electronic Validity Value of Construction Aspects of Worksheets

The content aspect consists of six questions, namely; 1) Presentation of electronic worksheets based on the Project-Based Learning model by a standard electronic worksheet sequence, 2) The electronic structure of worksheets based on the Project-Based Learning model has a relationship between one another, 3) The steps of the Project-Based Learning model are clearly illustrated in electronic worksheets, 4) questions in electronic worksheets based on project-based learning models in order from simple to complex, 5) consistency in using symbols and symbols, and 6) the planning stage of activities is easy to understand and implement. Based on Based on Figure 3, it can be seen that the average value of the electronic validity of worksheets on the aspects of construction by experts and practitioners is 85.0% and is greater than 60.0% in the valid category. The value of the six questions, namely; 90.0%, 90.0%, 90.0%, 70.0%, 90.0%, and 90.0%. The results of the electronic validity of the worksheet on the graphic aspect can be seen in Figure 4.

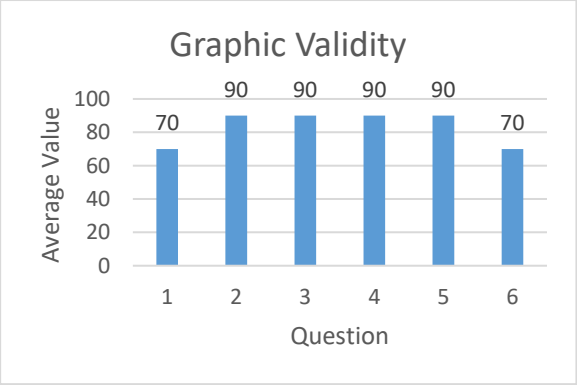

Figure 4. Electronic Validity Value of Graphic Aspects of Worksheets

The content aspect consists of six questions, namely; 1) electronic worksheets based on the Project-Based Learning model present attractive images, 2) electronic worksheets based on the Project-Based Learning model using attractive colors, 3) electronic worksheets based on the Project-Based model using clear and legible fonts, 4) electronic worksheets based on the Project model Based Learning has an orderly layout, 5) electronic worksheets based on the Project-Based Learning model have an orderly layout, and 6) electronic worksheets based on the Project-Based Learning model have an attractive appearance design. Based on Figure 4, it can be seen that the average value of the electronic validity of the student worksheet on the graphic aspect by experts and practitioners is 81.0% and is greater than 60.0% in the valid category. The value of the six questions, namely; 70.0%, 90.0%, 90.0%, 90.0%, 90.0%, and 70.0%. The results of the electronic validity of the The results of the electronic validity of the worksheet on the language aspect can be seen in Figure 5.

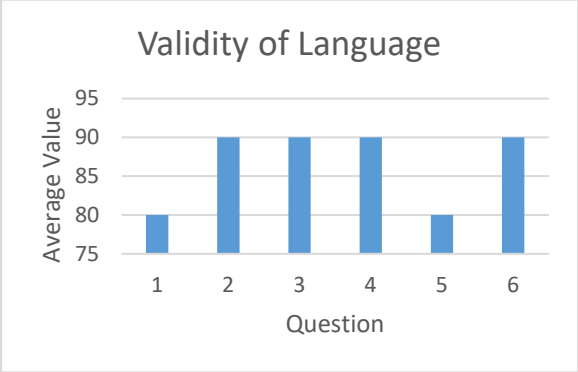

Figure 5. Electronic Validity Value of Language Aspects of Worksheets

The content aspect consists of six questions, namely; 1) The language used is good and correct according to the rules of Indonesian, 2) The language used is easy to understand and does not have multiple meanings, 3) The language used is communicative, 4) The information conveyed is clear, 5) The spelling used refers to EBI, and 6) Consistency in using terms that describe concepts. Based on Figure 5, it can be seen that the average value of the electronic validity of worksheets on the language aspect by experts and practitioners is 85.0% and is greater than 60.0% in the valid category. The value of the six questions, namely; 80.0%, 90.0%, 90.0%, 90.0%, 80.0%, and 90.0%.

Overall, from each foreign aspect of the validation results assessed by three expert lecturers (validators) who are experts in their fields, it can be seen in table 2.

Table 2. Value Electronic Validation Value of Worksheets

Instrument	**Validator**	
	Aiken's V Value	**Category**
Content Aspects	91,0%	Valid
Construct Aspects	90,0%	Valid
Graphic Aspects	85,0%	Valid
Language Aspects	93,0%	Valid
Average	**90,0%**	**Valid**

Based on table 2, the overall validity results obtained show that the aspects used in the electronic validity instrument of the worksheet based on the Project Based Learning (PjBL) model assisted by the Science Laboratory Kit consist of four aspects. each of these aspects is a content aspect, construct aspect, graphic aspect, and language aspect. In the content aspect, the validation value obtained is 91.0% in the valid category. Where the content aspect assesses the material, facts, examples, scientific activities and is in accordance with the syntax of the project based learning model.

In the constructed aspect, the validation value obtained is 90.0% which is in the valid category. Where the constructed aspect assesses the order, relationship, clear, statements from simple to complex, symbols, and easy to understand electronic worksheets. In the graphic aspect, the validation value obtained is 85.0% which is in the valid category. Where the graphic aspect assesses the image, color, font, layout, layout, and attractive appearance. In the language aspect, the validation value obtained is 93.0% which is in the valid category. Where the language aspect assesses the rules of language, does not mean double, communicative, clear, uses Indonesian spelling, and consistent.

During the research process, of course, it is not easy to find materiality. To get results that are close to perfect, of course, there are constraints and limitations in the process. First, the constraints in the material used in electronic worksheets based on the Project-Based Learning (PjBL) model assisted by the Science Laboratory Kit are limited to materials of straight motion, parabolic motion, and regular circular motion. for class X SMA semester 1. This is due to limited time in product development in several KDs. The solution to this problem is to make electronic worksheets for class X in both semester 1 and semester 2.

IV. CONCLUSION

Based on the results of the research conducted, it can be concluded that the electronic validity of worksheets based on the Project-Based Learning (PjBL) model assisted by the Science Laboratory Kit to improve science process skills developed in this study consists of four aspects, namely; 1) the isis aspect with a value of 91.0% with the valid category, 2) the constructed aspect with a value of 90.0% with the valid category, 3) the graphic aspect with a value of 85.0% with the valid category, and 4) the language aspect with a value of 93,0% with a valid category. Overall the final validation results with an average value of 90.0% with the valid category.

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