Validity and practicality of worksheet assisted by PhET interactive simulations to improve students creative thinking skills in a research based learning model

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Abstract. Research has been carried out to determine the validity and practicality of the sheet using interactive simulations. This study aims to describe the validity and practicality of worksheets as a learning tool in research based learning model. The method used is descriptive analysis of quantitative data, the teachers response and the students responses to the questionnaire instrumen. The result showed that the validation of the students worksheet obtained an average score of 0.83 on the aspects of the feasibility of content, presentation, and language. The practical result obtained for the teachers response were 75% with the practical category and 81.70% for students responses with the very practical category. Based on the results of the developed phet assisted worksheets, it is stated that they are valid and practicality used in research based learning to improve the creative thinking skills of students at the high school.

1. Introduction

Education is a conscious, planned effort to create an atmosphere of learning and the learning process of active students can develop the potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, the people of the nation and the state . Quality education is expected to produce individuals who are skilled and capable in their respective fields.

Various government efforts to improve Indonesian education, one of which is by compiling the 2013 curriculum. The 2013 curriculum does not really adapts the 21st century competencies in it, but also regulates two competencies, namely authentic assessment and a scientific approach [1]. With the implementation of the 2013 curriculum, the government attempts to prioritize students in determining their own talents and interests [2]. In the curriculum there is an integration that makes learning material closer to real world situations [3].

In the 21st century, it is very necessary for the success of future education graduates. In the 21st century, four skills are needed, namely critical thinking skills, communication skills, collaboration skills, and creative thinking skills [4]. To achieve these competencies students are required to learn the learning process independently and actively. An important factor that must be considered in improving student learning outcomes is to use the right learning model and the ability to think creatively [5]. Students can remember lessons longer by using a research-based learning model. Research based learning model is a research-based learning model as a step in implementing the process. This means
that students are expected to play an active role during the learning process [6]. Research-based learning is introduced in the teaching of modern physics experiments. Because in teaching, the relationship between knowledge and ability development and student independence is emphasized [7].

However, in reality, the efforts made have not shown maximum results. It has been proven by the results of the class X physics teacher interview that the teacher only uses teaching materials that have not yet referred to the 2013 curriculum. Students are not actively involved in competency development activities that are in accordance with the 2013 curriculum. Students are only required to record and memorize subject matter, as well as being able to complete the given practice questions. This causes students to be less active and less interested in learning, so that students think that learning physics is difficult and boring learning. As a result, students experience learning difficulties and are thought to have an effect on learning outcomes.

In addition, creativity or operationally formulated as Creative Thinking Skills. Creative thinking skill is a thought process that is used by individuals to generate other people's ideas in solving a problem. By carrying out the analysis of students, it can be seen that the percentage of creative thinking skills in schools is still low.

From the data the questionnaire results, it can be stated that the value of each indicator of creative thinking skill varies from 54.4% to 65.5%. The lowest value is Originality at 57.5%, while the highest value is the elaboration component. The average value of these four Creative Thinking Skills indicators is 67.2%. This average value is still in the low category. Thus, students' creative thinking skills are still categorized as low.

But the learning process cannot run well without good teaching materials. Student Worksheet (LKPD) as teaching material is reading material by students during learning activities. In its preparation, there are several steps that must be taken including: (1) conducting curriculum analysis, (2) compiling a map of LKPD needs, (3) determining the title of LKPD, (4) writing LKPD which includes formulation of KD, determining assessment tools, preparing materials, and the structure of the LKPD [8].

Student worksheets were prepared using virtual media in the form of PhET. PhET is an intermediate simulation or a tool in the form of a virtual-based interactive simulation program that can be used to convey messages or information in learning physics. Election this solution is based on the characteristics of science learning such as physics. Experimental activities are important in physics to explain and describe a physical phenomenon and characteristics.

Based on the need for the importance of teaching materials that are oriented according to the demands of the 2013 National curriculum, research has been carried out to develop teaching materials in the form of lkpdpd and produce Student Worksheets (LKPD) based on Virtual PhET Experiments through a Research Based Learning Model that is valid and practically used in the physics learning process in SMA / MA in order to improve students' Creative Thinking Skills.

2. Research methods
This study seeks to present findings about the quality of the worksheets the teacher will use, namely validity and practicality.

This type of research is a descriptive analysis of quantitative data on the response of material expert validators, teacher response questionnaires and student response questionnaires to validation instruments and practicality. This study seeks to present findings about the quality of the worksheets that teachers will use, especially validity and practicality. To assess the validity of worksheets assisted by phet Interactive Simulations in the Research Based Learning model. The researcher used a validation sheet that was filled in by three experts who were experts in their fields. Measured validity aspects include aspects of the feasibility of content, presentation, and language.

The results of the validation of the worksheet assisted by phet Interactive Simulations in the Research Based Learning model are analyzed in the following steps:

1) Give a score for each validated item using the Likert’s scale as follows:
Table 1. Validation item scales

| Alternative Answer | Score |
|--------------------|-------|
| Strongly disagree  | 1     |
| Disagree           | 2     |
| Agree              | 3     |
| Strongly agree     | 4     |

2) Determine the average value of the validity of each item using the Cohen’s Kappa formula:

$$Kappa(k) = \frac{P - P_e}{1 - P_e}$$  

Where:
- $K$ = kappa which indicates the validity of the product
- $P$ = the realized proportion is calculated by dividing the number of values given by the validator by the maximum number of values
- $P_e$ = the unrealized proportion is calculated by means of the maximum value minus the total value given by the validator divided by the maximum value.

The validity assessment criteria are presented in the Table 2.

Table 2. Worksheet validity criteria

| Interval       | Criteria       |
|----------------|----------------|
| $\geq 0.61 - 1.00$ | Valid          |
| $< 0.61$       | Invalid (reorder) |

The validity value of the worksheet is considered sufficient to be continued at the next stage if it reaches a value greater than 60. Analysis of practical data was obtained from the questionnaire instrument responses of teachers and students to the developed student worksheets. Practicality analysis uses a Likert scale, with the following steps:

1) Give a score for each item with alternative answers: 4 = strongly agree (SS), 3 = agree (S), 2 = disagree (TS), 1 = strongly disagree (STS)

2) Providing practical value is done using the following formula:

$$P = \frac{Q}{R} \times 100\%$$  

Information:
- $P$ = practicality value
- $Q$ = score obtained
- $R$ = highest score

The practicality assessment criteria are presented in Table 3.

Table 3. Practicality assessment criteria

| Interval | Criteria            |
|----------|---------------------|
| 0-20     | Impractical         |
| 21-40    | Less Practical      |
| 41-60    | Quite Practical     |
| 61-80    | Practical           |
| 81-100   | Very Practical      |

3. Results and Discussion
The validation of worksheets assisted by phet Interactive Simulations in the Research Based Learning model is carried out by three validators who are two media experts and one linguist
Aspect assessment on the appropriateness of content, presentation, and language. In the feasibility aspect the content consists of 8 statement items which include an assessment of the relevance or suitability of the material, consistency or consistence of the material and education or the adequacy of the material. Whereas the presentation aspect consists of 12 statement items which include the presentation of learning steps using the Research Based Learning model. And finally the language aspect which contains 4 points of statement covering the suitability of the worksheets to be developed using good and correct Indonesian and the spelling used on the worksheets refers to EYD. The worksheet analysis is briefly shown in Table 4.

Table 4. Results of validation of the Phet interactive simulations worksheet in the Research Based Learning model

| No | Aspects that are validated | Kappa Value | Average |
|----|---------------------------|-------------|---------|
|    |                           | US     | RM     | HE     |         |
| 1  | Contents                  | 0.76   | 0.66   | 0.76   | 0.76    |
| 2  | Construction              | 0.92   | 0.79   | 0.85   | 0.85    |
| 3  | Language                  | 0.93   | 0.86   | 0.86   | 0.88    |
|    | Overall average           |         |         |         | 0.83    |

The results of the validity of the Phet Interactive Simulations worksheet in the Research Based Learning model in table 3 obtained a value of 0.83 with valid criteria. This means that worksheets assisted with Phet Interactive Simulations in the Research Based Learning model can be used in the learning process.

Practicality data obtained from practicality instruments. Practicality instruments consist of teacher response questionnaires and student response questionnaires during learning using LKPD through Research Based Learning model. The results obtained for the response of 81.70% students were in the 81-100% interval with the very practical category which indicated that LKPD through the Research Based Learning model could help and facilitate students in the learning process.

Whereas for the teacher response the results obtained were 75% in the 61-80% interval with the practical category. Thus, teachers assess that LKPD through the Research Based Learning model is practically used and makes it easier for teachers to convey material momentum and impulses.

Data analysis from the validity questionnaire of the worksheet assisted by Phet Interactive Simulations in the Research Based Learning model by lecturers and teachers is based on 3 components, namely content feasibility, presentation feasibility, and language. The result showed that pieces of work aided Phet Interactive Simulations on the model of Research Based Learning has an average value of the validity of 0.83 with a valid category.

Judging from the feasibility of the content, the worksheet is declared valid with a value of 0.76 which means that the worksheets that have been developed are in accordance with the 2013 curriculum. In terms of the presentation component, the worksheets are declared valid with a value of 0.85 which means that the worksheets have been presented systematically, contains detailed material and clear learning objectives, is able to support the learning process, contains motivation, stimulus and response of students. Meanwhile, in terms of language, the worksheet is declared valid with a value of 0.88. The linguistic component is pleased with the use of clear sentences and does not cause confusion for students.

Overall, the value of the validity test results of the worksheet assisted by Phet Interactive Simulations in the Research Based Learning model is 0.83. Therefore it can be said that the worksheets assisted by Phet Interactive Simulations in the Research Based Learning model developed are valid and can be used in physics learning.

Meanwhile, based on the discussion of practicality tests, teacher response questionnaires and student response questionnaires that have been analyzed show a positive response to the LKPD used. then LKPD through the developed Research Based Learning model has met the practical criteria.
4. Conclusion

The process of developing this LKPD is to use the Plomp development model. Consists of 3 phases used, namely (1) preliminary research, in this phase analysis of the problems needed to develop LKPD. The analysis is in the form of needs analysis, curriculum analysis, student analysis and material analysis. (2) prototype phase, in this phase the researcher designed the LKPD through the Research Based Learning model after the LKPD was made and then validated by the expert to find out whether the LKPD was feasible to be tested. And finally (3) the assessment phase, namely the test, evaluation, and revision phase, at this stage the LKPD that had been validated in the previous phase had met the validity criteria then the LKPD was ready to be tested to find out whether it met the practical and effective criteria.

Based on the analysis results of the validators, validation results were obtained on several validity instruments. Each of these validity instruments is in the valid category, thus the LKPD and its supporting instruments meet the validity criteria. Then the results of data analysis from the components of practicality, namely the teacher response questionnaire and the student response questionnaire were in the practical category with 75% and 81.70% presets, respectively.

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