Development of physics student’s worksheet based on inquiry training model to improve students creative thinking ability

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Abstract. The purpose of this research was to develop a worksheet based on inquiry training physics students to improve the creative thinking ability of students in high school that is valid. This research method used research and development. The evaluation of the validity of LKPD is important to determine whether a LKPD has a proper quality. This study sought to evaluate the validity of the LKPD on the aspects of content, Construct, language and Graphical using a valid questionnaire which was developed based on Likert scale. The validity of the LKPD was assessed by three educational experts and practitioners. The data was later analyzed to determine the value of V of Aiken. The V of Aiken value of experts and practitioners on the aspect of content is 0,92, on the aspect of LKPD presentation style is 0,91, on the aspect of language is 0,94, on the aspect of face is 0,96. The value of V showed that the content, presentation style, language and face of the LKPD is categorized as valid. This means the LKPD has satisfied most of its standard quality criteria.

1. Introduction

In the world of education, various educational and educational facilities are being developed to help solve the problem of education or learning. Physics learning requires deep understanding of concepts for students so that they can be applied and useful in everyday life. However, in reality, the quality of education in Indonesia is still relatively low, especially in the field of physics. Physics is a difficult subject to learn, where physics includes theory, law, formulas / equations mathematically and must have deeper analytical skills. Understanding concepts is closely related to thinking skills. One form of thinking skills in the learning process is high-level thinking skills. Thinking activities involving cognitive levels have an important role for the success of learning, because some activities in learning are always related to the problem of thinking [1]. Even though it is very important, but rarely involved in physics learning in class [2].

Creative thinking is an original cognitive ability and a problem-solving process that allows individuals to use their intelligence in a unique way and directed towards a result [3]. Divergent thinking is the root in finding many possible answers to certain problems or open tasks [4]. Divergent thinking is seen as a mental operation that demands the use of creative thinking skills, including fluency, flexibility, originality and elaboration [5]. Creative thinking is the original cognitive ability and problem solving process. Students are involved all their thinking skills to find a way to the solution to a problem.
at hand. Although sometimes too many ways will make it difficult to the final results, but with the many choices will allow students to reach the goal compared to students who really have no way to get to the solution to the problem. Therefore creative thinking is very important in a student.

Learning is said to be effective if the relationship between students and the classroom environment is suitable [6]. Physics learning has several abstract concepts so students have difficulty in understanding a material being taught. The abstract concept of physics makes students less active in communicating in class so that students' creativity in physics is low. The importance of someone mastering a concept is that students are able to communicate, classify ideas, ideas or events that they experience in everyday life [7]. Each student has different thoughts in solving problems.

To overcome the problems in this learning, several researchers developed several ways, including applying student discussion, learning to characterize the scientific explanations obtained by students [8] developing learning models [9] and developing scientific explanation assessment tools [10]. Where learning material that can be developed by educators in accordance with the character of physics in school subjects is in the form of LKPD.

Student Worksheet (LKPD) is a guide used by students in investigating or solving problems of activities to develop all aspects of learning in accordance with indicators of achievement of learning outcomes that must be taken [11]. LKPD has the following functions: 1) as a guide for students in conducting learning activities, such as conducting experiments 2) as an observation sheet, where the student worksheets provide and guide students to write the observations, 3) as a discussion sheet, where LKPD contains a number of questions that lead students to discuss in the context of conceptualization, 4) as a discovery sheet, where students express their findings in the form of new things that he has never known before, 5) as a vehicle to train students to think critically in learning activities, and 6) increasing student interest in the learning process [12]. LKPD can be combined with learning models. learning models used include the latest innovations [13] selected based on the 2013 curriculum. In addition, the selection of learning models is also based on the results of the analysis of the material and the characteristics of students. The use of learning models that can train independent students is an inquiry training model.

The LKPD structure includes the LKPD number which is intended to make it easier for the teacher to recognize and use it, the title of the activity which contains the topic of the activity in accordance with the KD, there are objectives which are learning objectives in accordance with the KD. If in the learning activities there are experiments to be conducted, then in the LKPD there must be tools and materials, work procedures and tables for writing the results of the experiment. For activities that do not require data, then the data table can be replaced by an empty box where students can write, draw, or count. The LKPD component also includes questions that can lead students to develop concepts. These questions are the subject of discussion when working on LKPD [12].

The development of LKPD needs validation. Validation is defined as accuracy, truth, validity and validity which in this study will be carried out by experts to get the level of validity from LKPD that has been developed [14]. The validity test of LKPD assesses the aspects of constructworthiness, component content, grammar, and graphics [15]. A valid device contains compatibility between each component [16]. In the aspect of LKPD content, it is seen that the substance of the material is in accordance with the competencies to be achieved, needs, truth, depth, and the present. In the graphic aspect seen from the use of fonts, types and sizes, layout, illustration of images and photos, as well as the appearance of the design [17]. In the linguistic aspect seen from the readability, clarity of information, conformity with the rules of Indonesian language that is good and right, the use of language effectively and efficiently [11]. The purpose of this study was to determine the validity of the development of LKPD based on the inquiry training model to increase the ability to think creatively.

2. Method
This study aimed to look at the feasibility of a product that is used. Validation is performed on the stages of development in the development model ADDIE which ADDIE development phase, namely Analysis, Design, Develop, Implementation and Evaluation. The purpose of the validation by the validators is to
assess and see the truth or validity of the student’s worksheet as a good learning resources used by student’s.

This research method uses descriptive statistics. Descriptive research is not to test certain hypotheses [18]. Where, descriptive research aims to describe, interpret and explain or explain what it is about a variable or state [19]. This study explains the results of the validation stage on the development of student worksheets based on inquiry training. The data collection instrument used a validation sheet that was filled in by three expert validators for validating student worksheets. The validation sheet used has been validated beforehand by an expert validator. Validation sheets can assess four components: content validation, construct validation, language validation, and graphical validation. The total score of each validator for all indicators is summarized and the validity value is given using the Aiken V. formula

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

Where \( s = r - l_o \), \( l_o \) is the lowest validity assessment figures (in hail this = 1), \( c \) is the validity of the assessment to the highest number (in this case = 4) and \( r \) is the number given by the validator. The validity category [20] is based on the final value obtained can be seen in Table 1.

| Value | Criteria |
|-------|----------|
| \( \geq 0.6 \) | Valid |
| < 0.6 | Invalid |

3. Results and Discussion

3.1 Results of LKPD Validation

Validity test of student worksheets is done after the instrument validity is declared valid. Instrument assessment uses a validation sheet that includes the following indicators: Instrument validation is able to measure the level of validity of LKPD, Instruments have clear usage instructions, Instruments are easy to use in the assessment process, Instruments are able to measure eligibility, Instruments can measure the feasibility of presenting LKPD, Instruments can measure language feasibility used, the instrument can measure the quality of graphics, the instrument can measure aspects of the ability to think creatively, the instrument can measure the steps of the inquiry training model, the instrument has feedback on the results of the assessment, the size and type of writing instruments can be read clearly, display of structured instruments systematically, and the display of how to write instruments is consistent. The results of the average evaluation instrument validation carried out by three experts is equal to 0.96 declared valid. Furthermore, product validation was carried out. The LKPD validation was conducted by 4 validators, namely 3 experts and 1 practitioner. Inquiry training LKPD validation to improve students' creative thinking skills consists of four aspects: content aspects, construction aspects, language aspects and graphic aspects. The results of the LKPD validation analysis can be seen in Table 2.
Table 2. Results of LKPD Validation Analysis

| Validation  | Expert | Practitioner | Average V | Category |
|-------------|--------|--------------|-----------|----------|
| A           |        |              |           |          |
| B           |        |              |           |          |
| C           |        |              |           |          |

Based on the results of the analysis in Table 2 it can be stated that the average validation component results from the validator's contents are 0.92 in the valid category. Then the average result of the validation component of the validator's construction is 0.91 in the valid category. Furthermore, the average result of the validation of language components from the validator is 0.94 in the valid category, and the average results of the graphical component validation from the validator are 0.96 in the valid category. Overall the results of the analysis from the validator were 0.93. These components are said to be valid because on the Likert scale a large value of 0.6 is obtained. Thus this LKPD can be used in the learning process.

3.2 Validation Results of Students' Creative Thinking Abilities

Validation of aspects of creative thinking ability was carried out by 4 validators, namely 3 experts and 1 practitioners. The results of the validation are summarized in Table 3.

Table 3. Results of Analysis of Aspects of Students' Creative Thinking Abilities

| Component                            | Value V | Category |
|--------------------------------------|---------|----------|
| The aspect of Thinking Fluency       | 0.92    | Valid    |
| The aspect of Flexible Thinking      | 0.92    | Valid    |
| The aspect of Original Thinking      | 0.92    | Valid    |
| The aspect of Elaborative Thinking  | 0.92    | Valid    |
| The aspect of Evaluative Thinking   | 0.83    | Valid    |

Average Value 0.90 Valid

Based on the results of the analysis in Table 3, it can be explained that the average aspects of creative thinking ability are in the valid category with an average of 0.90, said to be valid because on the Likert scale the results obtained are larger than 0.6 where the values are categorized as valid.

3.3 Results of Validation of Learning Model Components inquiry training

Validation of the inquiry training Learning Model component was carried out by 4 validators, namely 3 experts and 1 practitioners. The results of the validation are summarized in Table 4.

Table 4. Results Of Validation of Learning Model Components Inquiry Training

| Component                  | Value V | Category |
|----------------------------|---------|----------|
| Presentation of the Problem| 0.92    | Valid    |
| Verification Data Collection| 0.92    | Valid    |
| Experimentation Data Collection| 1.00    | Valid    |
| Organization of Data and Formulations Conclusions| 0.88    | Valid    |
| Analysis of Inquiry Processes| 1.00    | Valid    |

Average Value 0.93 Valid

Based on the results of the analysis in the Table, it can be explained that the validation of the components of the training inquiry learning model with an average of 0.93 valid categories is said to be
valid because on the Likert scale the results obtained are large than 0.6 where the value is categorized as valid.

Based on the validation analysis it can be stated that the LKPD is inquiry training based to improve the students' creative thinking skills in a valid category because the V values of all aspects are above 0.6. The results of the validator's assessment indicate that the LKPD has fulfilled the requirements in terms of the feasibility of content, construction, language and graphics. Thus the LKPD developed can be used in learning at school. After the LKPD validation phase is completed, it will continue with the next phase of the Implementation phase, in this phase the effectiveness of the LKPD is tested so that the LKPD will be produced effectively used in learning.

4. Conclusion
The results of the student worksheet validation on the feasibility aspect of the content are in the valid category with an average of 0.92, the construct aspects are in the valid category with an average of 0.91, the aspects of the language in the valid category with an average of 0.96. The product is said to be valid if each indicator is ≥ 0.6 and invalid <0.6. Overall LKPD based on inquiry training is valid which can be implemented in the learning process.

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