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Development of Student Worksheets (LKPD) to Measure Student Creativity

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Abstract: This research is a development research which aims to develop valid project based learning worksheets, practical project based learning worksheets, effective project based learning worksheets for measuring creativity. The subjects of this research trial were 32 students of class XI MIPA 2 SMAN 3 Polewali. This study uses the development of a 4-D model. The instruments used in this study were LKPD validation sheets, practitioner response questionnaires (educators/teachers), creativity test instruments and non-creativity test instruments (cognitive dimension creativity assessment sheets, affective dimension creativity questionnaires, psychomotor dimension creativity assessment sheets). LKPD eligibility criteria seen from the aspect of validity. The practicality criteria are seen from practitioners' assessment of LKPD, and the effectiveness criteria are seen from the level of creativity of students after being given project-based learning LKPD. Based on the results of the analysis, it was concluded that the developed project based learning LKPD, based on expert judgment using Aiken V index analysis, obtained a V value of 0.77 meaning that the LKPD was declared valid and feasible to use with minor revisions, then the project based learning based LKPD in terms of response physics teacher practitioners obtained an average score of 3.5 meaning that the LKPD is in the very good category and the effectiveness of project based learning LKPD is seen from the results of the analysis of student creativity, after being analyzed it is found that the average percentage of students' creativity scores on the cognitive dimension is 78.22%, the average percentage of creativity in the affective dimension is 79.25%, and the average percentage of creativity in the psychomotor dimension is 77.50% so that it can be said that the project based learning worksheets developed are effective for measuring student creativity because they have the average creativity score is above 75%.

Keywords: Creativity; Model 4-D; Project based learning; Student worksheets

Introduction

Implementation of the 2013 curriculum which is based on character and competence, plays the role of educators as forming the character and competence of students. There are several important points in the 2013 curriculum, one of which is integrating literacy including 21st century skills or what is termed 6C (Creative, Critical Thinking, Communicative, Collaborative, Computational Thinking, and Compassion).

Creativity is an important aspect of learning and teaching. This ability can be interpreted as the ability to respond and provide a way out of all existing solutions, is involved in the discovery process for problems and the ability to produce or create something new (Dong et al., 2022; Morney, 2022; Sunarto, 2018). In everyday life, people with high creativity will also be able to solve problems better (Sambada, 2012).

Creativity is one of the internal factors of student learning success. It is very important for an educator to develop student creativity because in everyday life, people with high creativity will also be able to solve problems better (Syefrinando et al., 2022). According to Christensen (2011) the gene factor only plays a role of 20-40% in a person's creativity, while 2/3 of a person's creativity can be obtained from the learning process.

To ensure that students are involved, diverse, and creative in each learning session, educators must be able

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to choose and implement learning models or methods that encourage creative student decision making (Wahyuni, 2013) especially in learning physics. One learning model that has great potential to provide a more interesting and meaningful learning experience for students is the Project Based Learning (PjBL) model (Trianto, 2018).

PjBL is a learning model that is able to teach students about the process of solving various problems. PjBL is able to guide students in doing group assignments so that they can gain new insights and solve problems with their knowledge (Bell, 2010). PjBL can increase motivation, student abilities and learning achievement by using problems related to certain subjects in the real world (Trianto, 2014).

PjBL is student-centered learning, so this learning model provides a meaningful learning experience. Learning experiences or students' concepts are built based on the final product produced in learning (Afriana et al., 2016). PjBL gives freedom to students to plan learning activities, thereby providing opportunities for students to develop their creativity through project activities (Widiarini et al., 2021). In line with that, with qualitative and quantitative data, Song (2018) emphasized that PjBL can help students solve problems collaboratively.

PjBL is more appropriate in interdisciplinary learning because it naturally involves many different skills, such as reading, writing, and helps construct conceptual knowledge (Capraro et al., 2013). Various types of student skills can be enhanced through a project-based learning environment (Wurdinger et al., 2015). PjBL has great potential to create interesting and meaningful learning experiences for students (Gunawan et al., 2017).

The steps of the project-based learning model are able to provide opportunities for students to explore creative thinking skills that give birth to student creativity. Four aspects of creativity, namely fluency, flexibility, originality, and elaboration can be developed through project-based learning. The first stage is determining fundamental questions that can develop aspects of the fluency and flexibility of students' thinking. In the second stage, students are asked to design a project related to the problems that have been given so that they can develop original aspects. The third stage of preparing the schedule and report on the results of the project can develop the elaboration aspect. Each stage of the project-based learning process will be able to significantly increase the creativity of students (Widiarini et al., 2021).

The Project Based Learning model is a learning model that uses projects, meaning activities carried out and completed within a certain period of time. So that the implementation is carried out through several stages. One of the suitable learning tools used to accommodate the steps of the Project Based Learning model is Student Worksheets (LKPD). LKPD can be an alternative learning tool that can be used to describe the steps for implementing the project-based learning model. LKPD serves as a guide for students in learning. This is in line with Anjarwati et al. (2018) that said the use of LKPD can make students' learning activities more focused.

The results of interviews conducted by researchers with physics educators for class XI Mathematics and Natural Sciences (MIPA) at Senior High School (SMAN) 3 Polewali found that the project-based learning model had not been applied to the learning process. This is because educators experience several obstacles, one of which is not having project-based learning worksheets. The unavailability of project based learning worksheets has an impact on the process, namely: 1) the project based learning model is not implemented in the learning process, 2) physics material with Basic Competency (KD) which is required to be taught with project based learning models tends to be taught using discovery learning models or problem-based learning where this model is less effective for completing KD in class XI whose KD characteristics require students to make a work/project, 3) the lack of optimal development of students' creativity aspects in the learning process can be seen from the results of the analysis of students' creativity before given LKPD based on project based learning, it was obtained that the average creativity of students in class XI MIPA 2 SMAN 3 Polewali was 8.13, if it was percentage, a value of 50.78% was obtained. This is because students are not trained to complete tasks that require creativity in solving problems, so that creativity in making projects is low.

Based on the problems that occur in the physics learning process for class XI MIPA SMAN 3 Polewali, it is necessary to develop worksheets that are packaged with a project based learning model so that they can help students develop creativity through project activities (Amalia et al., 2017). The development of project-based learning worksheets is a learning innovation that is expected to develop students' ability to think creatively and innovatively, and foster students' productive creativity (Abidin, 2014). Project-based learning worksheets provide opportunities for students to carry out project activities freely and collaborate with students according to topics and create final products that can train students to develop their creativity (Santyasa et al., 2020). Project-based learning can increase student creativity. Project-based learning also trains students in designing projects to make products (Nugraheni, 2018).

Based on this description, the researcher conducted a study entitled "Development of Student Worksheets (LKPD) Based on Project Based Learning to Measure the Creativity of Students of SMAN 3 Polewali with the formulation of the problem, namely how is the validity of experts on the development of Project Based

Learning-based LKPD to measure the creativity of students in SMAN 3 Polewali, then what is the practitioner's response to the development of Project Based Learning-based LKPD to measure the creativity of students at SMAN 3 Polewali, and how is the effectiveness of Project Based Learning-based LKPD to measure student creativity at SMAN 3 Polewali.

Method

This type of research is research development or Research and Development (R & D). This research was conducted to produce a project-based learning worksheet to measure student creativity. The research procedure adapted from the steps of the 4-D development model which includes 4 (four) stages, namely the define stage, the design stage, the development stage, the disseminate stage. The flow can be seen as in Figure 1.

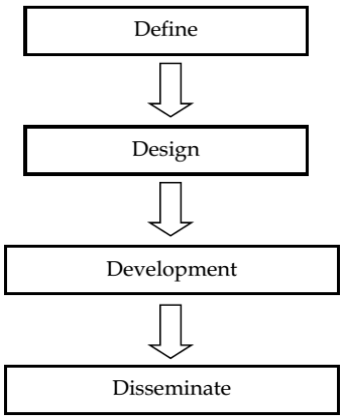

Figure 1. Interactive physics e-module development chart modified from ADDIE model

The activities carried out at each stage of project-based learning LKPD development can be explained as follows.

Define

The definition stage is carried out to determine the right problems and solutions as well as determine the competence of students which is the basis for the development of project-based learning worksheets. At this stage a preliminary study was carried out, namely an initial interview with the teacher of this introductory subject beginning with analyzing the problems or needs of students and schools in improving physics learning. This definition stage includes:

Preliminary final analysis

The researcher examines the basic problems that exist in the physics learning process at SMAN 3 Polewali. Based on the results of a study of the implementation of physics learning at SMAN 3 Polewali Mandar it was found that educators had not applied one of the learning models set out in the 2013 curriculum, namely the project-based learning model in the learning process. This is because educators experience several obstacles, one of which is not having worksheets that can accommodate the steps of the project-based learning model. Student worksheets owned by educators are not prepared based on the steps of the project-based learning model so they cannot be used to carry out learning activities using the project-based learning model. No. The unavailability of project-based learning worksheets has an impact on the process, namely: 1) The project-based learning model is not implemented in the learning process. 2) Physics materials with KD which are required to be taught using project-based learning models tend to be taught using discovery learning or problem-based learning models where this model is less effective for completing KD in class XI whose KD characteristics require students to make a works/project. 3) The lack of optimal development of the creative aspects of students in the learning process can be seen from the results of the analysis of students' creativity before being taught using project-based learning worksheets.

Analysis of students

Student analysis was carried out to determine the creativity of students before being given project-based learning worksheets in the learning process. The creativity of students is assessed based on the achievement of each indicator of creativity which consists of four indicators.

Concept analysis

Concept analysis is used to identify the concepts that will be taught in the learning process. Based on the 2013 curriculum for class XI MIPA even semester, the material for light waves (reflection and refraction of light) is obtained.

Task analysis

Task analysis is used to analyze tasks based on competencies that will be developed in the learning process. This activity is intended to identify the skills possessed by students which will be developed in learning.

Conclusion of preliminary final analysis

The conclusion of the preliminary final analysis obtained information in the initial analysis related to the problems experienced by educators and students at SMAN 3 Polewali, the researcher chose an alternative problem solving, namely by developing student worksheets (LKPD) based on projects. LKPD is prepared based on the concept of light wave material to be achieved in accordance with the concept map listed in the concept analysis.

Design

The design stage is the planning stage of the project-based learning worksheet framework that will be developed. At this stage, several preparations were made before developing a project-based learning-based e-LKPD. The purpose of the project-based learning worksheets is to close the gap in the performance of the physics learning process in class XI SMAN 3 Polewali. The purpose of this development is to measure the creativity of students. Activities at this stage include selecting the Project Based Learning-based LKPD format and designing Project Based Learning-based LKPD. The LKPD design stage uses supporting applications such as Microsoft Word 2019.

At the design stage, the development process is carried out after the supervisor and teacher agree on the design made to close the gaps in learning physics. After the evaluation is carried out, the results of the evaluation in the form of suggestions will be used as revision material before the development stage is carried out.

Development

The development stage aims to produce revised LKPD based on expert input, as well as data obtained from the trial results. The activities obtained at this stage are expert validation and LKPD trials. The results of expert validation are one of the main criteria for determining whether the developed LKPD can be used or not. The first design or prototype I was validated by 3 experts to determine the validity level of the LKPD. Validity was carried out using Aiken V analysis. The results of the expert assessment were used to measure the feasibility of the teaching materials, while corrections and suggestions from experts were used to revise project-based learning prototype II LKPD. The revised LKPD becomes the final product which is used in the trial and disseminate stages.

The trial design used was a pre-experimental design in the form of a One-Shot Case Study. According to Sugiyono (2019) the trial design is described as shown in Figure 2.

Figure 2. Research trial design

At this stage the researcher carried out the learning process by applying project-based learning worksheets accompanied by a physics teacher using a project-based learning model. The project-based learning model that is used to apply project-based learning worksheets can help and facilitate students in obtaining information and make students more active in knowing the material being taught. After implementing the project-based learning worksheet in accordance with the trial design used, the researcher gave a creativity test. The purpose of the test is to find out whether project based learning worksheets can measure student creativity.

After the project based learning LKPD is implemented in physics learning, then the teacher will then provide an assessment of the project based learning LKPD which was developed based on the statements in the practitioner's assessment questionnaire sheet. The results of the assessment in the form of suggestions for project-based learning-based e-LKPD are used as the next project-based learning-based LKPD, namely prototype III. The evaluation results are then analyzed through data analysis to determine the success of the development of teaching materials.

Disseminate

This dissemination stage was carried out by distributing project-based learning worksheets in every senior high school throughout Polewali Mandar.

Result and Discussion

The Results of the Development of Project Based Learning Student Worksheets

The project-based learning worksheets used are arranged based on the project-based learning model syntax. The physics material developed in LKPD is material that has characteristics that can be taught using a project-based learning model, namely light waves (reflection and refraction) for class XI in Senior High School in odd semesters. LKPD based on project-based learning is divided into three parts, namely introduction, content and closing.

Introduction

In the introduction there is a cover, preface, table of contents, core competencies (KI), basic competencies (KD), indicators, instructions for using LKPD and material concept maps.

Content

In the contents section there are columns for filling in student identity, goals, basic theory, problems, problem formulation, project design to be made, tools and materials needed to make the project, table for filling in the project implementation schedule, table for filling in monitoring project progress, discussion and conclusions.

Closing

In this section students are directed to write conclusions from the results of the projects they have implemented. Conclusions written by students are expected to be able to answer the formulation of the problems they have formulated in the content section.

The LKPD is validated by the Expert with the aim of knowing the content validation of the product resulting from the development of project-based

learning LKPD that has been made. The results of the content validity test were analyzed using the Aiken's V index. The results of the analysis of the coefficient content validity analysis of the expert agreement index for each component of content feasibility, presentation, language, and graphics are tabulated in Table 1.

Table 1. Results of Expert Assessment of Project Based Learning Student Worksheets

Eligibility Aspect	Percentage Score (%)	Validation Index	Information
Contents	80	0.73	Valid
Presentation	85	0.80	Valid
Language	82	0.76	Valid
Graphics	83	0.78	Valid

Table 1 shows that the validation results provided by the validator team have strong consistent responses. Thus, the project-based learning-based LKPD that has been developed is declared to meet the eligibility criteria (valid) so that it can be used. Referring to the results of the discussion by following the suggestions and instructions from the validator in revising, researchers, so that the project-based learning-based LKPD is valid and feasible for testing. LKPD based on project-based learning which is declared valid means that LKPD as a whole the content or material and components of LKPD are related consistently to one another.

LKPD based on project-based learning which is declared valid means that LKPD based on project-based learning as a whole the content or material and components of the LKPD are related consistently to one another. The component in question is the suitability of the content presented with the basic competencies and the applicable curriculum, linking the material to problems that are often encountered in everyday life, using language that is easy to understand. As stated by Rochmad (2012) that a development result (product) is said to be valid if the product is based on adequate theory and all components of learning products relate to each other consistently.

The results of the analysis of the validity of the LKPD based on the project based learning that has been developed show that the LKPD is feasible or valid. In line with the research that has been carried out by Sulaiman (2017) by developing project-based learning worksheets on harmonic motion material that has been developed is in the category of valid and feasible to try out. The same thing was done by Wahyudi (2016) who developed project-based learning worksheets on the material on operating the Proteus software with the results of expert or expert assessments being in the valid or feasible category to use.

Practitioner's Assessment Results of the Project Based Learning Student Worksheets

Practitioners' assessment of project-based learning e-LKPD aims to find out the response of practitioners who are members of the Physics Subject Teacher Consultation (MGMP) Community of Polewali Mandar Regency to the project-based learning-based LKPD that has been developed. Project-based learning worksheet assessment includes aspects of content feasibility, presentation feasibility, language feasibility and graphic feasibility. The results of the analysis of the assessment of the teacher's response to the project-based learning worksheets that have been developed can be seen in Table 2.

Table 2. Percentage of Practitioners' Assessment of the Project Based Learning Student Worksheet

Aspect	Percentage (%)	Category
Content Eligibility	88	Very good
Serving Eligibility	86	Very good
Language Eligibility	85	Very good
Graphic Eligibility	89	Very good
Software eligibility	86.7	Very good

Based on Table 2, all aspects of the project-based learning LKPD assessment component assessed by practitioners obtain a percentage above 80%. In general, the practitioner's score on project-based learning worksheet implementation is in the very good category. This means that the developed project-based learning worksheets are easy to use in the learning process.

In the developed project-based learning worksheets, instructions for using each activity are presented to facilitate the teaching and learning process. In addition, several pictures are presented in accordance with the question learning material and use language that is easy to understand so that it makes it easier for students to understand the material presented. In accordance with the opinion of Astuti et al. (2016) states that the practicality of the product is when the product is easy to use. Practical is the level of use and implementation of teaching materials by students and teachers, namely carrying out learning using teaching materials that have been revised based on the validator's assessment.

Results Analysis of Student Creativity

The results of students' creativity after using project based learning worksheets, then a percentage analysis is carried out to see creativity after being given project based learning worksheets. After being given a project-based learning worksheet, students are tested with tests (essay questions) related to the project material they have studied to measure the cognitive dimension of creativity. Furthermore, measuring the creativity of the affective dimension by giving questionnaires to students with the aim of measuring any creative attitudes that

arise after students learn with project based learning worksheets. Then to measure creativity on the psychomotor dimension is done by using a psychomotor dimension creativity assessment sheet to assess the creativity of students in making a creative product. The results of the analysis showed that the percentage of students' creativity in the cognitive dimension was 78.22%, the affective dimension was 79.25%, and the psychomotor dimension was 77.50%. Based on the results of student creativity data analysis, it can be seen that project-based learning worksheets are effectively used to measure student creativity because the percentage of creativity for each dimension has an achievement greater than 75%.

The results of the analysis of creativity for each dimension obtained an achievement above 75%, so it can be said that project-based learning worksheets are effective for use in the learning process to measure student creativity. Effective means that there is effect, influence, consequence or can bring results. LKPD has many roles as a learning resource. LKPD is one of the independent learning tools chosen because LKPD can be used by students independently. The LKPD component is designed interactively so that it can support interaction and communication between teachers and students. The material and problems presented are related to everyday life.

Presented basic questions that can develop students' creativity in solving a problem, students are active in the learning process, so that students' interest and motivation in learning can increase. With this LKPD, the learning process should run more effectively and efficiently and support interaction between teachers and students so that students can understand the concept of lessons and develop students' creativity.

The most important aspect of effectiveness is knowing the level or degree of product application (Rochmad, 2012). In line with research conducted by Wahyudi (2016) obtained research results that the use of project-based learning worksheets can see the level of creativity of students. In addition, also based on the results of research conducted by Yulianti (2014) with the results of research that the use of project-based learning worksheets can increase student creativity.

Based on several research references that are relevant to this research, it can be concluded that project-based learning worksheets have a positive impact on physics learning in class XI MIPA 2 SMAN 3 Polewali. LKPD based on project based learning can be used to measure the creativity of students. This is shown by the results of the analysis of creativity obtained that students after being given project-based learning worksheets in the learning process.

Conclusion

Based on the results of the research and discussion that has been carried out, it can be concluded as follows: The results of the content validity coefficient test, the project-based learning-based LKPD developed have met the valid category, Practitioners' assessment of the project-based learning-based LKPD that was developed gave a positive response with a very good category, and student creativity develops after being measured using project-based learning-based LKPD which is analyzed with a percentage above 75%, this means that project-based learning-based LKPD can be used to measure students of SMAN 3 Polewali.

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