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Research Article

Development of Student Worksheet Helped PhET Simulation on The Study of Physics

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Abstract.
Related this teaching material in the form of LKPD, students are expected to be able to find physics concepts properly and correctly. This type of research is developmental research that using the 4-D model which consists of the stages of defining, design, development and disseminate Data collection is a tool in the form of a statement questionnaire. Based on the test result data from the student response questionnaire, the percentage was 88%. Thus it can be concluded that there are differences in student learning outcomes using Phet Simulation learning media that can be applied to physics lessons.Based on the validation analysis of teaching materials, it is found that the teaching materials that have been developed are in the very valid category. The results of the LKPD validation obtained 86% in the very valid category. The teacher's response questionnaire to the practicality of LKPD was obtained 9 0% with the very practical category and the effectiveness of LKPD was at 88.75% with the very effective category. Thus, this research produces high school physics teaching materials in the form of LKPD assisted by PhET simulation which is very valid, very practical and very effective

Keywords: PhET simulation; student worksheet; physics

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1. Introduction

One of the most important elements in education in a quality learning process that is carried out in an interactive, inspirational, fun way, challenges students to actively participate, so that it will help students to explore more of the information they have. Physics learning is learning that emphasizes physics as a product, as a process and as an attitude. Therefore, students need to be helped to develop a number of process skills so that they are able to understand and understand science for the purpose of problem solving and the development of science and technology. It related to how to find out about nature systematically, so that physics is not just a collection of knowledge in the form of facts, concepts or principles but a process of discovery.

Student worksheets (LKPD) are a means to assist and facilitate teaching and learning activities so that effective interactions will be formed between students and educators, so as to increase student activity in increasing learning achievement. PhET (Physics Education Technology) Simulation is a site that provides physics learning simulations for classroom teaching or can be used for individual learning purposes. PhET is learning software from the University of Colorado, a very interactive PhET Simulation that invites students to learn by way of direct explorationStudent worksheets (LKPD) assisted by phet simulation are a product that is developed from an existing product into a better product, where this LKPD is made and adjusted to the steps of the Phet simulation learning media on focus material and a display will be designed. From the contents of the LKPD in such a way and in the last step of the phet simulation media, questions will be made which will be the student's response to the media, as well as the use of students' creativity in describing ideas to convey what they see from the media that has been displayed using the PhET Simulation learning media.

2. Methods

The research conducted is research and development, which produces products. The model used in this development is the 4-D Model (Four D Model), which consists of four stages, namely: define, design, develop and disseminate (Thiangrajan and Semmel, 1974).

The subjects were teaching materials in the form of LKPD (sheet Working Students) aided application PhET Simulation. This research was conducted at MAN 2 Padang Lawas class X I MIA 2 in the 2020/2021 school year. Development research is used to make an existing product into a better product in learning, namely developing worksheets for physics students with emphasis material assisted by PhET Simulation learning media. The steps for the design of the LKPD development above can be detailed as follows:

2.1. The definition phase (define)

The first stage in the research is started with stage define. At the define stage, the learning requirements are determined by analyzing the competency standards and the limitations of the subject matter to be taught by the teacher based on the 2013 curriculum content standards . This stage consists of 3 activity steps, namely curriculum analysis, concept analysis, and student analysis. Curriculum analysis is carried out to

monitor the level of achievement of educational goals in accordance with national standards. Material analysis aims to identify, detail and arrange them systematically on the focus material. Material analysis also provides an overview of suitable methods and approaches to be used to study focus material. This analysis is intended to identify, detail, and systematically arrange the main concepts of the focus material needed to compile each page of the learning tool.

2.2. Design Stage (design)

At this stage, the design of learning tools, in the form of lesson plans, and LKPD assisted by PhET Simulation is carried out. At the design stage, two stages were carried out, namely: the preparation of the instruments needed in this study and the design of the RPP and LKPD prototypes. The learning design guide refers to the 2013 Curriculum. Before the LKPD is developed, it must be determined the learning design stages first.

2.3. Development Stage (develop)

The development stage is the stage to produce a development product which is carried out in two steps, namely: 1) expert appraisal followed by revisions, and 2) limited development trials for students (developmental testing). This development stage resulted in the final form of LKPD assisted by PhET Simulation on the focus material after going through revisions based on input from experts / practitioners and data from trial results. The purpose of this stage is to produce a valid, practical, and effective LKPD.

2.4. Deployment Stage

This stage is the stage of using tools that have been developed on a limited scale, for example in other classes by other teachers. The tools that are distributed are LKPD that are valid, practical and effective in the trial class. Due to limited time, energy and costs, LKPD is only distributed in class XI-2 MAN 2 Padang Lawas. The dissemination stage ((disseminate) is carried out in different classes in order to obtain the effectiveness of learning tools which include cognitive, affective and psychomotor assessments.

3. Results and Discussion

3.1. Results Define stage

At this stage three aspects have been analyzed, namely curriculum analysis, student analysis and material analysis. The following will discuss each of these aspects. Analysis at the curriculum stage, the results were obtained from four components, namely components of objectives, content, methods and evaluation. Based on the curriculum analysis, the results are shown:

1. Destination. By physics learning, it is hoped that high school graduates will have behaviors that reflect the character of scientific and creative education by forming independent, creative, believing and fearful students of Allah SWT in the form of honesty, responsibility, independence, collaboration and concrete thinking and mastering the stages in the learning process. Physics, so that the cognitive, affective and psychomotor domains are reflected in students.

2. Content Components. Competency Standards (SK) are a domain in the aspects of knowledge, attitudes and skills, which students must learn. In the realm of knowledge students are expected to ”know what”, and in the realm of attitudes students are expected to ”know why”, and in the realm of skills students are expected to ”know how”. Basic Competencies (KD) are competencies that students learn for subjects. From the existing KD, a teacher can make a lesson plan. The RPP for the focus material consists of the RPP for 3 X meetings, namely the 1st meeting for the material of the line eye and the 2nd meeting’s flat shape for the material of three-dimensional constructs and the 3rd meeting for the masses. The prerequisite for gravity is Newton’s Laws.

3. Approach component. The appropriate learning model for educators to do in delivering the focused material is inquiry-based learning model using LKPD assisted by the PhET Simulation application.

4. Evaluation Component. a) Assessment of the domain of knowledge through written test instruments is. The instruments in the LKPD are equipped with scoring guidelines. b) Attitude domain assessment is carried out through observation sheets. c) Assessment of the realm of skills through observation sheets.

For this student analysis, the authors work closely with the physics teacher and homeroom teacher. In the process of learning activities, the interaction between teachers and students is not optimal. Air is based on the analysis then LKPD aided product development PhET simulation application is in accordance with the conditions of learners and

stages of development. This LKPD is expected to improve students' cognitive, affective and psychomotor abilities.

The first step in analyzing learning materials is the identification of competency standards and basic competencies. The Competency Standards (SK) in this study are to understand the concept and application of emphasis in everyday physics technology products, while KD is describing the emphasis and its application in everyday life. Material analysis also provides an overview of the effective approaches used in achieving the expected goals. Material analysis is the identification of the main materials to be taught and arranges them systematically as well as looking for the relevance of the concepts studied with reality in everyday life, aimed at identifying, detailing, and systematically arranging the main principles of the weight point material.

3.2. Results of the Design Stage (design)

The design stage is an advanced stage after the define stage. The approach chosen in this study is an inquiry-based learning model in the form of LKPD assisted by the PheT animation application. . These observations come from experiences in everyday life and then relate them to physical concepts learned in school through an experiment that is guided in an application-assisted LKPD . The teaching material is in the form of LKPD (Student Worksheet) which aims to enable students to study independently without or with teacher guidance. LKPD is prepared in accordance with Competency Standards and Basic Competencies set by the curriculum and developed according to the indicators and learning objectives to be achieved so that high school students can understand facts, concepts and principles of science and physics independently.

3.3. Results Development Phase (develop)

This stage aims to produce student worksheet with focus material in inquiry-based learning models assisted by a valid, practical and effective PhET simulation application so that it is suitable for use in the SMA class XI MIA physics learning process. The results of the valuator's assessment of the validation sheet, which consisted of 5 validates consisting of 2 physics lecturers, one Indonesian language lecturer, one computer lecturer and one practitioner from MAN 2 Padang Lawas. After the student worksheet is valid and practical, we will see the effectiveness of the teaching materials. Data effectiveness of teaching materials obtained on the basis of student learning which includes cognitive, psychomotor and affective. In the cognitive ability, the classical

completeness percentage was 80.44% and the students' affective ability had an average of 80.4 0% with very good criteria. For psychomotor ability with classical completeness is 82, 06% it is very effective. Based on the description above, it can be concluded that the physics LKPD assisted by PhET animation on heavy attention material can improve student learning outcomes for cognitive, affective and psychomotor domains.

3.4. Discussion

3.4.1. LKPD validation

The validated LKPD is given back to the valuator. Validation is said to be complete when the valuator has stated that the LKPD that has been developed is valid and ready to be tested. The results of the LKPD validation can be shows that the LKPD that has been developed is in the very valid category. The validation value of each is including:

1. Material expert validation. The validation was carried out by Mrs. Mardiahayati, S.Pd with a total score of 36 and a percentage of 90% with a very valid category.
2. Media expert validation. The validation was carried out by Ms. Hotnida Sari Daulay, S.Pd with a total score of 18 and a percentage of 90% with a very valid category.
3. Expert linguist validation. The validation was carried out by Nurlaili Harahap, S.Pd with a total score of 24 and a percentage of 86% with a very valid category.

3.4.2. Test Results

Test phase includes testing the practicalities and effectiveness of learning physics LKPD aided Phet Simulation on material developed gravity. The trial was carried out in MAN 2 Padang Lawas class XI at three meetings. Here are the test results LKPD Physics aided P het Simulation on material developed gravity.

3.4.3. Practical LKPD

Practicality data is taken from the results of observations on the implementation of lesson plans and student and teacher response questionnaires.

1. The results of the analysis of the implementation of the RPP. Based on the observation it is stated that the implementation of the lesson plan is in the practical category because the contents of the lesson plan both from meetings I, II, and III

starting from initial activities, core activities and final activities have been carried out.

2. Teacher response questionnaire. The teacher response questionnaire was given to find out the teacher's response to the practicality of the LKPD that had been developed.

TABLE 1: Questionnaire Results of teacher responses to practicality of LKPD.

Amount Score	Average	Gratuity	Category
36	3,6	90%	Very practical

Table 4.5 shows that the assessment of the practicalities of LKPD physics teacher aided P het Simulation on material weight is categorized as very practical point with a percentage of 90%.

3.4.4. Student response questionnaire

1. Questionnaire student responses to practicality and effectiveness of LKPD. Student response questionnaires were given to students to determine the level of practicality of the LKPD and the effectiveness of the LKPD. Student response questionnaires were filled in by students. Based on the student response questionnaire table, the results of student responses to the practicality of LKPD were obtained with an average number of 37.4 and a percentage of 93.5% with a very practical category. While the student questionnaire responses to the practicalities of LKPD result by the number in 1136 and average of 35, 5 to 10 indicators of 32 students with a percentage 88.75%. The effectiveness of LKPD is categorized as Very effective.

2. The results of the knowledge competency assessment. The knowledge result data is used to obtain an assessment of the knowledge, attitudes and skills of students' observation about the discussion.Based on the observation, it was obtained the results of the assessment of knowledge, attitudes, and observation skills of students in response to student discussions with an average of 450 of 14.1 out of 32 students with a percentage of 35%.

3. Product skills assessment results. Based on the observation, an assessment of product skills is obtained with the aspects being assessed according to the type of product being made. Total score 11, average 3.6 and percentage 90%.

4. Student motivation questionnaire. Student motivation questionnaires were given to all students of the research class concerned to determine the level of student motivation after using the developed module. Based on the results of the student motivation questionnaire, it was obtained a score of 1128 from 10 indicators and 32 students with an average result of 35.3 and a percentage of 88 %. Student motivation is categorized into ”Very active”. Students’ motivation after using the LKPD increased and was very good for learning physics.

5. Deployment Stage. This stage is the stage of using LKPD which has been developed on a limited scale, namely increasing the number of LKPD in the library. The LKPD that is distributed is the LKPD that is already valid, practical and effective in the trial class.

4. Conclusions

This research and development resulted in a product in the form of student worksheets (LKPD) assisted by Phet Simulation with emphasis on learning in class XI MA N 2 Padang Lawas. The steps taken to produce LKPD assisted by Phet Simulation are as follows: a) information gathering stage b) planning stage c) development stage and d) validation and testing phase. in each material, students will be asked to be active in learning. The learning media developed is also equipped with steps in the use of Phet Simulation. Based on the validation of material experts and media experts, it can be seen that the results of the validation of material experts are 3.61 or good and the validation of media experts is 3.7 or good. The results of interviews with teachers and students overall showed good responses to the use of LKPD assisted by Phet Simulation in the physics learning process.

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