Validity of student worksheet based on project based learning models assisted by tracker application for simple harmonic motion experiment

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Abstract. This research was backgrounded by curriculum 2013’s demand which stated that this curriculum was developed the advanced of technology and information, as well as the internationally educational development. Therefore, an innovation was needed; that was the development of learning model, its source, and its media which were relevant with the demand of curriculum 2013. The innovation was the development of students’ worksheet (LKPD) as one of learning sources which was easily understood by students, the project based learning as one of models recommended by 2013 which could improve students’ competence and creativity, as well as tracker application as a learning media which was IT based that could be internationally competitive. The aim of this research was to produce LKPD based on project based learning equipped tracker application for simple harmonic motion experiment, with a valid, practical and effective criteria. The result of the analysis stage from the beginning to end a chance using tracker application. The result of students’ analysis needed LKPD as a learning source and a project based learning as a model. The result of material analysis which was predominated by the principal and conceptual material. The result of the development stage was gained from LKPD referring to the analysis result. The result of the development stage was produced by a valid LKPD with a criteria (≥0,6) and used in the implementation stage.

1. Introduction

Physics is a branch of science that plays an important role in the development of science and technology. The purpose of learning Physics, namely students are able to solve problems found in life and are expected to have a broad view of Physics and must realize that Physics is close to their daily environment. Teachers are expected able to create a learning process that can develop thinking processes for students in addition to having the ability to make learning fun, centered on students and learning activities that are associated with daily life. This allows students to be more active in the learning process so that students feel the learning is meaningful. However, conditions in the field show that physics learning is not as expected. This was obtained based on the results of observations and interviews that have been carried out in SMA 7 Padang through the distribution of questionnaires to Physics teachers and students of class X Science. The initial analysis is in the form of performance analysis of graduate competency standards, analysis of learning objectives and analysis of learning difficulties which have several obstacles that are often faced by teachers.
The results of the initial preliminary analysis for performance analysis show that in the learning process of students are still less active in learning, practice is rarely done resulting in students not being able to improve their skills. Then the standard aspects of graduate competency analysis, students are still lacking in understanding the concepts of physics correctly resulting in students being less creative in analyzing the problems raised in the learning process. Next to the analysis of learning difficulties, students find it difficult to understand physics learning so it is not motivated in learning and results in bored learners in the learning process.

To see the students’ responses to learning physics, an analysis of the students of class X IPA SMA N 7 Padang was also carried out. Based on the analysis of students shows there are some obstacles faced by students. First, the motivation of students towards learning physics is still lacking. Learners feel bored in learning because the teaching materials used have not increased curiosity which results in students difficulty in solving problems in Physics learning. Secondly, it is difficult for students to apply understanding to solve complex problems, namely the problem of combining principles and calculations because practice is rarely done. Third, students still find it difficult to analyze in the concept of motion and also difficult in processing interpretation of data and graphics. Fourth, from the criticism and suggestions from the questionnaire that was distributed, most students complained that learning had not provided direct experience.

Based on the problems mentioned earlier, there are several solutions that have been done on the effect of digital student worksheet to the learning outcomes of students (Dyah Sukowati, 2017). The result is the influence of digital student worksheets on student learning outcomes with increasing student learning outcomes. However, in the research conducted there are some limitations, namely, technically students are not easy to improve data before the teacher takes the value. This is because digital student worksheets are presented in offline form, so they cannot save automatically. In addition, not all of the students’ activities are presented only in the steps of work and materials contained in the digital student worksheets, but the process is still real and for the results of the presentation of their data, they cannot be saved automatically. [1]

In addition, the development of learning tools assisted by the tracker application has also been carried out (Fitri, 2017). The results show that the module developed is valid, very practical to use according to the teacher, students and is effective in increasing the competency of students. The development that is carried out has limitations including, not all students can carry a laptop so that when understanding the material description of students can’t learn in their own style and must follow the way a group of friends, in addition, time is quite limited to understand the concept because of the limitations of the laptop used. [2]

Based on some existing solutions and refers to the limitations of some previous research, the researchers wanted to develop a teaching material in the form of LKPD. LKPD is one of the learning resources that can be developed by educators as facilitators in learning activities. In addition, LKPD can also help educators to activate and provoke students’ knowledge in the learning process, so that the learning that takes place is oriented towards students. In this LKPD will be faced with a model of Project Based Learning and excess model of Project Based Learning this is that students can acquire the knowledge and skill set of the new learning through a product produced by the learners themselves. LKPD that was developed using a scientific approach. The scientific approach to LKPD makes students better active in learning physics. LKPD uses a scientific approach that is LKPD that is designed so that students actively construct concepts, laws or principles through stages of observing, formulating problems, proposing or formulating hypotheses, collecting data with various techniques, analyzing data, drawing conclusions and communicating concepts, law or principle found.

Then, LKPD that developed also assisted through video application analysis and tool modeling tracker. Through the tracker software, the teacher can facilitate students in recording motion videos and analyzing them. Students to enter a video file into the program that has been available on the computer and analyze from objects such.
Tracker software has several advantages because it explains the pattern of relationships between Physics quantities and determines the value of Physics quantities. In general, the strengths of a tracker software include: providing a simple and easy way to understand the process of moving a body [3], providing a large representation of experimental data[ 4], being able to capture videos from a life and life and analyze them with easy [5], helps to understand the principles and natural phenomena in greater depth and makes physics more interesting [6]. Physics teachers who have used this software certainly feel the ease and excellence of software to analyze object motion videos.

Description of what has been presented so researchers have developed a LKPD-based model of Project Based Learning aided applications Tracker on the material Motion Harmonic Simple class X SMA who meet eligibility with the title "Development LKPD Based Model Project Based Learning aided applications Tracker Approach Scientific in Simple Harmonious Motion Material Class X High School ".

2. Method
Research carried out is a type of research and development, or known as Research and Development (R & D). The R & D method in this study aims to produce products and test the feasibility of these products. R & D aims to produce a new product through the design process. This study uses research methods to develop procedural models to produce specific products that are used in research that are needs analysis and to test the effectiveness of these products so that they can function in the wider community, research is needed to test the effectiveness of these products. [7]

The product that will be designed to build in this study is a tool and a regular linear material Simple Harmonic Motion utilizing tracker software. The media development model is using the ADDIE development model. As the name implies, ADDIE stands for Analysis, Design, Development, Implementation and Evaluations (Benny, 2010). This model consists of five main phases or stages as the name implies, namely analyzing, designing, developing, implementing and evaluating.

These five phases need to be done systematically. The ADDIE model emerged in the 1990s which was introduced by Reiser and Mollenda, then developed by Dick and Carrey in 1996. This model can be used for various forms of product development such as models, learning strategies, learning methods, media and tools or teaching materials. The device development model with the ADDIE model can be seen in the Figure 1. [8]

![ADDIE Model Step](image)

**Figure 1. ADDIE Model Step**

Furthermore, all the tools and materials used in this study are assembled and the tools are ready for use. Data collection techniques conducted in this study were interviews (questionnaires), questionnaires (questionnaires), observations (observations) and a combination of the three. While the scale used is the Likert scale. Scale of assessment criteria questionnaire items as in the following Table 1.

| Answer                                      | Value |
|---------------------------------------------|-------|
| If in one indicator meets 3 references      | 4     |
| If in one indicator meets 2 references      | 3     |
| If in one indicator meets 1 references      | 2     |
| If there is no reference in one indicator   | 1     |

Table 1. Criteria for Assessment Questionnaire
While the stages of data collection in this study, in detail are shown in the following table.

| Activity                              | Data collection technique                                                                 | Respondents                  |
|---------------------------------------|------------------------------------------------------------------------------------------|------------------------------|
| Preliminary Research (Needs Analysis) | The selection of the type of teaching material is the Student Worksheet                  | Research team                |
| Expert validation                     | Angket media feasibility (To find out the feasibility of the product according to media experts and material experts) | Media experts and material experts |
| Limited Trial                         | User response questionnaire (To find out the initial response of the student's assessment of the product) | Teacher, Student             |

3. Results and Discussion

LKPD validity test is done after the validity instrument validation test. The instrument evaluation uses a validation sheet which includes the following indicators: clarity of instructions for filling out the validation sheet, statements made in accordance with the indicators, goals to be achieved, do not contain multiple meanings, use a simple and easy to understand assessment form, and the language used in accordance with EBI rules is good and right. The results show the validity of the instrument validation LKPD each aspect assessed $\geq 0.6$ which are the selected valid.

Based on validation instruments that have been validated, validity tests can be carried out, where validity is carried out with four aspects, namely aspects of content, construct aspects, linguistic aspects, and graphic aspects. Data obtained as follows:

3.1. Content aspect

LKPD validation on the aspect of content consists of 11 statements which include 1) The material presented in the LKPD is in accordance with indicators formulated, 2) Facts in the presentation of the problem presented in accordance with the topic in the material, 3) Examples given are up to date and contextual, 4) Examples of questions given are relevant to the material, 5) Practice questions help students achieve learning goals, 6) LKPD presented in accordance with the truth of science, 7) LKPD presented in accordance with the depth of the material, 8) LKPD has a knowledge of knowledge to the reader, 9) LKPD is presented following technological developments, 10) LKPD is presented containing the Project Based Learning model, and 11) LKPD presented contains instructions on how to use the tracker. Validation results as pack contents are in a valid category with a value $\geq 0.6$ on each aspect assessed.

3.2. Construction aspects

LKPD validation consists of 13 statements which include 1) LKPD in accordance with the standard LKPD sequence, 2) LKPD structure has a relationship with one another, 3) The steps of the Project Based Learning model are clearly illustrated in LKPD, 4) The stage of identifying problems is easy to understand and can improve students' thinking ability, 5) There is a column for writing problem solving strategies and determining the topic of activities in LKPD based on Project Based Learning, 6) Stage of planning activities that are easy to understand and carry out, 7) Questions at the investigation and presentation stage in accordance with the activities that have been carried out, 8) Format of writing the results of the project or work at the finishing stage in accordance with the format of writing the report, 9) Questions of evaluation in accordance with the objectives of learning, 10) Steps the steps on how to use the tracker in accordance with the actual steps, 11) The instructions on how to use the tracker in LKPD are easy to understand, 12) KPD in accordance with a scientific approach, and 13) Be consistent in using symbols and symbols. The results of construct aspect validation are in the valid category with values $\geq 0.6$ for each aspect assessed.
3.3. Linguistic Aspects
LKPD validation on linguistic aspects consists of 9 statements which include 1) Using language according to the level of maturity of students, 2) Using clear sentence structure, 3) Avoiding questions that are too open, 4) Using simple and short sentences, 5) Having a sort order lessons according to students' level of ability, 6) Providing sufficient space in LKPD so students can write or draw something in LKPD, 7) Using more illustrations than words, 8) Having clear and useful learning objectives, 9) Having an identity to facilitate administration.

3.4. Graphic aspect
LKPD Validation consists of 6 statements which include 1) Fonts that are used clearly and legibly, 2) Proportional layout and layout of LKPD, 3) Illustration of LKPD pictures and photos appropriately in accordance with the material, 4) Design of LKPD display interesting readers, 5) The color combination in LKPD is interesting, and 6) LKPD provides interaction to readers in the form of stimulus.

The summary of the validation values of all validators for each component of validation concluded that LKPD based on project based learning assisted tracker application with the scientific approach is presented in Table 3.

| Aspect                | Presentation | Category |
|-----------------------|--------------|----------|
| Content Aspects       | 0.76         | Valid    |
| Construction Aspects  | 0.77         | Valid    |
| Language Aspects      | 0.77         | Valid    |
| Graphic Aspects       | 0.83         | Valid    |

Based on the results of the validation that has been done, it can be concluded that LKPD based on project based learning assisted tracker application with the scientific approach is in the valid category. This is evidenced by the value of each aspect at a value ≥ 0.6.

4. Conclusion
Based on the results of research and development carried out starting from the analysis phase, design stage, development stage, implementation stage, and evaluation stage obtained student's worksheets based on project based learning equine tracker application for simple harmonic motion experiment with valid criteria.

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