

# Development Of Student Worksheets (SW) Based On Project Based Learning Models Assisted By Tracker Applications With Scientific Approach On Simple Harmonic Motion

Yohandri, Lusiana, Fatkhur Rohman

**Abstract:** This research occurred by the demands of the 2013 curriculum which states that the 2013 curriculum was developed based on the challenges of advancing information technology, the rise of creative and cultural industries, and the development of education at the international level. Thus, an innovation is needed in the form of developing learning models, learning resources and learning media that are in line with the demands of the 2013 curriculum, including SW as a simple learning resource that is easily understood by students, project based learning learning model as one of the recommended learning models in Curriculum 2013 and can improve the competence and creativity of students, and tracker applications as IT-based learning media that can compete at the level of international education. The purpose of this study is to produce SW based on project based learning application assisted tracker with a scientific approach to the material Harmonic Motion with valid, practical and effective criteria. The results showed that the student worksheets based on the project based learning model were assisted by a tracker application with a scientific approach with valid categories obtained on average from experts (0.78). SW is very practical according to educators (87.08) and very practical according to students (92.21). The SW that was developed was effective in increasing the competency of students including knowledge competence (84.13), attitude competency (82.55), and skill competence (83.48). The results of the study can be concluded that the SW developed is valid, very practical and effective in improving the competence of students and can be applied to a broader scope.

**Index Terms:** Student Worksheet (SW), Project Based Learning, Tracker, Simple Harmonic Motion..

## 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 is to able the students to solve problems founded in life and have a broad view of Physics and must realize that Physics is close to their daily life. Teachers are expected to be 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 at SMA N 7 Padang through the distribution of questionnaires to Physics teachers and students of grade X. The initial analysis is done in the form of performance analysis, 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 preliminary analysis results for the performance analysis show that in the learning process teachers still have difficulty implementing a scientific approach with learning models that are in accordance with the 2013 Curriculum. In addition, teachers rarely carry out practicum and utilize technology as a learning medium so the students can not improve their skills. Then, the teacher still has difficulty combining the students'

worksheets created with one of the 2013 Curriculum learning models. In the analysis of learning difficulties students have the problem with associating the facts to learning material. Learning has not utilized technology and practiced. Lacking in learning resources. When students are interested to doing the practice, they found the difficulty because they do not understand how to use the practical instructions. To see the students' responses to Physics learning, an X class of science students at SMA N 7 Padang was also analyzed. The results of the students' analysis are as follows: First, lack of students' motivation towards learning Physics, the students feel bored in learning due to teaching materials used does not increase curiosity, so students have difficulty in solving problems in Physics learning. Second, rarely get a different way of learning such as using a laptop / computer. Third, students find it difficult to apply understanding to solve complex problems, such as combining principles and calculations because practice is rarely done. Fourth, students difficult to analysing the concept of motion and processing interpretation of data and graphics. Fifth, from the criticisms and suggestions in the questionnaire most students complained that learning had not provided direct experience.

Based on the problems raised earlier, there have been several solutions that have been made about the effect of digital student worksheets on student learning outcomes [1]. 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 student activities are presented only in terms of work steps and materials contained in digital student worksheets, but the work is still real and for the results of the presentation of data can not be saved automatically [1]. In addition, the

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development of learning tools assisted by tracker applications has also been carried out [2]. 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 carried out has limitations including, not all students can carry a laptop so that when understanding the material description students cannot

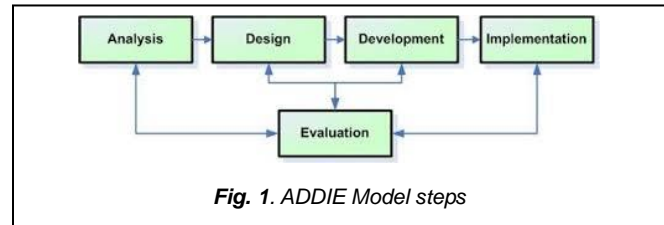
**TABLE 2**

No	Statement	Score
1	Easy understand	90
2	Interesting	81,25
3	Efficient	90
<b>Sum</b>		<b>261,25</b>
<b>Average</b>		<b>87,08</b>
<b>Category</b>		<b>Very Practice</b>

learn in their own style and must follow the way of a group of friends. In addition, time is quite limited to understand the concept because of the limitations of the laptop being used. [2] Based on several solutions that already exist and referring to the limitations of some previous researchers, the researcher wants to develop a teaching material in the form of Student Worksheets (SW). SW is one of the learning resources that can be developed by educators as facilitators in learning activities. In addition, SW 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. At this SW will be faced with a Project Based Learning model and the advantage of this model is that students can obtain a new set of learning knowledge and skills through a product produced by the students themselves. SW developed using a scientific approach, with a scientific approach to SW makes students better active in learning physics. SW uses a scientific approach that is SW 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, found law or principle. Then, the SW that was developed was also assisted through a video analysis application and tracker modeling tool. Through the tracker software, the teacher can facilitate students in recording motion videos and analyzing them. In simple terms students insert a video file into a program that is available on the computer and analyze the motion of the object. 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 advantages of tracker software include: providing a simple and easy way to understand the process of moving objects [3], providing a large representation of experimental data [4], being able to capture videos of a life event and analyze them easily [5], help understand the principle the principles and natural phenomena in more depth and make physics more interesting [6]. Physics teachers who have used this software certainly feel the ease and excellence of software to analyze object motion videos. Based on the description that has been explained, the researcher has developed a SW based on the Project Based Learning model assisted by the Tracker application with a scientific approach to the material of Harmonious Simple Motion that meets the validity, practicality and effectivity criteria.

## 2 METHODS

Research conducted is Research and Development / R&D. R&D is a research method used to produce certain products, and test the effectiveness of those products [7]. This development research uses the ADDIE development model. As the name implies, ADDIE stands for Analysis, Design, Development, Implementation and Evaluations [8]. The device development model with the ADDIE model can be seen in Fig. 1.

**Fig. 1. ADDIE Model steps**

## 3 RESULT AND DISCUSSION

### 3.1 Product Validation Result

**TABLE 5**

Indicator	1 <sup>st</sup> Meeting (%)	2 <sup>nd</sup> Meeting (%)	3 <sup>rd</sup> Meeting (%)	Average (%)
Curiosity	75,54	80,15	84,56	80,15
Thorough	80,88	83,83	87,5	84,07
Teamwork	78,67	80,88	84,56	81,37
Responsibility	75,73	84,56	85,29	81,86
Communicative	82,35	86,03	87,5	85,29
<b>Average (%)</b>	<b>78,63</b>	<b>83,09</b>	<b>85,88</b>	<b>82,55</b>
<b>Category</b>	<b>Good</b>	<b>Very Good</b>	<b>Very Good</b>	<b>Very Good</b>

Validation of experts used a validation sheet for SW which was developed in which the validation sheet was filled by three lecturers. Based on the validation instrument, the validity carried out there are four aspects: the aspect of content, aspects of the construct, linguistic aspects, and graphical aspects. The results of the overall product validity analysis can be seen in Table 1. Based on the results of the validation, it can be concluded that the project based learning SW based on tracker application with scientific approach is in the valid category. This is evidenced by the value of each aspect being at the value of  $\geq 0.6$ . So, this SW can be used in the learning process.

### 3.2 Product Practicality Result

**TABLE 1****PRODUCT VALIDITY ANALYSIS**

No	Validation Component	Validator Score			Score
		V 1	V 2	V 3	
1.	Aspect of content	37	35	37	0,76
2.	Aspect of construct	43	42	43	0,77
3.	Aspect of linguistic	30	29	30	0,77
4.	Aspect of graphic	20	20	23	0,83
<b>Average</b>					<b>0,78</b>

At this stage a practicality test is carried out on teachers and students. The aim is to see the level of practicality or ease of use of products developed in the learning process.

SW practicality test of teacher responses using teacher response questionnaires. The practicality test results for SW from each statement are presented in Table 2.

Based on Table 2, the practicality level of SW in the category is very practical with a value of 87.08%.

**TABLE 6**  
**THE EFFECTIVENESS RESULT OF SKILL COMPETENCIES**

No.	Aspect	1 <sup>st</sup> Meeting (%)	2 <sup>nd</sup> Meeting (%)	3 <sup>rd</sup> Meeting (%)	Average (%)
1	Observing	75,74	83,09	88,24	82,36
2	Questioning	77,21	84,56	87,5	83,09
3	Trying	79,41	81,62	86,03	82,35
4	Associating	80,15	84,56	88,24	84,32
5	Communicating	80,88	86,03	88,97	85,29
<b>Average (%)</b>		<b>78,68</b>	<b>83,97</b>	<b>87,80</b>	<b>83,48</b>
<b>Category</b>		<b>Good</b>	<b>Very Good</b>	<b>Very Good</b>	<b>Very Good</b>

The practicality test results for the Student Worksheet (SW) of each statement are presented in Table 3. Based on Table 3, the level of practicality of SW in the category is very practical with a value of 92.21%.

**3.3 Product Effectivity Result**

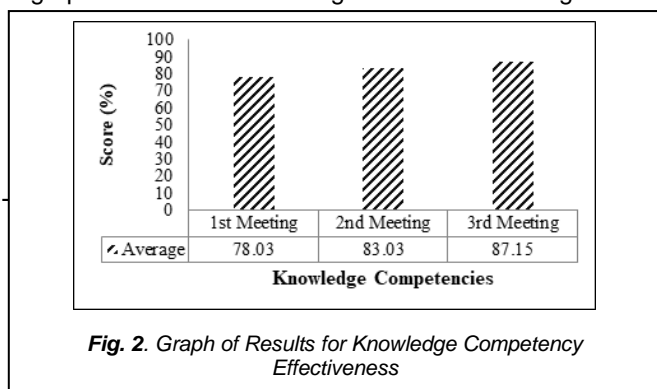
Effectiveness test is done by giving questions to students for each meeting after the teacher confirms. The effectiveness test is carried out on three competencies: knowledge, attitude

**TABLE 3**  
**STUDENTS RESPONSES TO STUDENT WORKSHEET**

No	Statement	Score
1	Easy understand	89,71
2	Interesting	97,61
3	Efficient	89,34
<b>Sum</b>		<b>261,25</b>
<b>Average</b>		<b>87,08</b>
<b>Category</b>		<b>Very Practice</b>

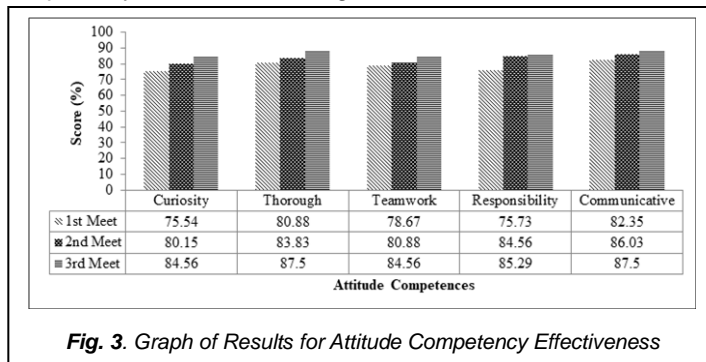
and skills. The effectiveness test of knowledge competency is measured using an objective test. The test developed aims to measure the learning objectives that have been set. The effectiveness of knowledge competencies is done after using SW. The results of the effectiveness of knowledge competencies can be seen in Table 4.

Based on Table 4, the effectiveness of students after using the SW at the first meeting obtained an average value of 78.03%, the second meeting 83.05% and the third meeting 87.15%. The graph of students' knowledge can be seen in Fig. 2.



**Fig. 2. Graph of Results for Knowledge Competency Effectiveness**

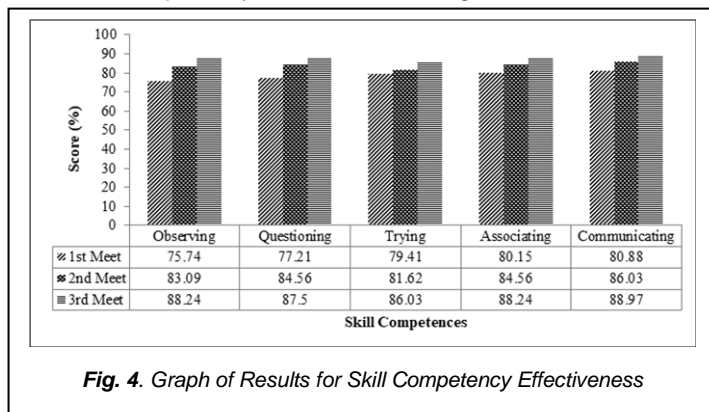
Based on Fig.2, there is an increase in the value of the knowledge competencies of students after using SW. Attitude assessment uses observation sheets. The results of the effectiveness of spiritual attitude competencies can be seen in Table 5. Based on Table 5, the attitudes measured by the observation sheet obtained an average of 82.55%. So, the SW that was developed was effective in developing students' attitudes. The graph of the effectiveness of students' attitudes competency can be seen in Fig. 3.



**Fig. 3. Graph of Results for Attitude Competency Effectiveness**

Based on Fig. 3 it appears that there is an increase in the attitude of students at each meeting. The measured aspects of skill competence are observing, asking, trying, associating, and communicating. An overview of the results of the effectiveness of skills competencies for each meeting can be seen in Table 6.

Based on Table 6, the average value of students' skills is above 83.48%. So, the SW that was developed was effective in developing students' skills. The graph of the effectiveness of students' competency skills is seen in Fig. 4.



**Fig. 4. Graph of Results for Skill Competency Effectiveness**

Based on Figure 4, there is an increase in students' skills at each meeting.

**4 CONCLUSION**

Project based learning SW based on tracker application with scientific approach is valid, practical and effective. Therefore, it is suggested to teachers to be able to make SW as a source of learning and for other researchers, in order to be able to add time sharing for each step of the learning model that will be needed in SW to make it more clear, shorten the time when using SW in the learning process.

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