The development of work sheet tracker-based students using project-based learning models on straight movement learning materials in Class X Senior High School

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Abstract. The student worksheets are one of the learning resources that can help students in the learning process and improve their competencies. The purpose of this study was to determine the needs of students needed in the use of Tracker-Based Student Worksheets by using the Project Based Learning model on Regular Straight Motion (GLB) material. This research is a qualitative research method which is included in descriptive research. Respondents selected in this study were Class X High School. The instrument used is an observation sheet in the form of a questionnaire whose data is processed using a Likert scale. In the field obtained, teachers tend to only use whiteboards and books as learning media which results in students feeling bored and bored so that they have a low impact on student learning outcomes. This is because the models and assessments used in schools are not in accordance with the 2013 recommended curriculum. For attitudes, good category is 79.4%, while for knowledge competencies 64.7% and skills competencies are 67.9% in good categories. Learners during the learning process are lacking. The conclusion is the need to use Tracker-based Student Worksheets by using the Project Based Learning model in the Regular Straight Motion (GLB) material.

1. Introduction
The curriculum currently applied by education in Indonesia is the 2013 curriculum. The 2013 curriculum emphasizes independent, active, and creative learning activities for students. The component of the 2013 curriculum method at the SMA / SMK level is that a teacher must be able to develop various learning strategies, using strategies that enable students to apply their learning processes independently, actively, creatively and fun, with high effectiveness.

The curriculum 2013 can be applied to the study of physics. Physics is one of the branches of science that plays an important role in creating new technologies so as not to be underdeveloped in Science and Technology (Science and Technology). In fact, it can be said that physics is the backbone of science and technology. The concept of physics is expected to be able to increase the knowledge
and admiration of students towards God Almighty. In order for the learning process to get good results, the teacher needs to make changes to the learning process and make appropriate assessments based on the demands of the 2013 curriculum. conducting seminars, technical guidance and training [1].

Subjects of learning media that are inadequate to support the learning process in the 2013 curriculum, especially the physics learning media at the high school level, teachers tend to only use whiteboards and books as learning media which results in students feeling bored and bored with student learning outcomes. On the other hand, we see rapid technological development if we take advantage of the development of this technology to develop interactive learning media, where learning media can be used by high school students anywhere and anytime [2].

One alternative to overcome this problem is to improve the Physics learning system through learning media, one of the learning media in the form of Tracker-based Student Worksheets. Learning media aims to visualize physical material so that students can fully understand it and create fun and weighty learning conditions.

Currently there is Tracker software that allows students to conduct research in terms of kinematics comprehensively. This software is through video analysis methods of natural events, especially those relating to speed, speed, acceleration, force, gravitational field, conversion and energy conservation. Through this software students are expected to activate the process skills possessed, through observations made, measurements produced and calibrated into software, the process of designing experiments in video analysis, interpretation of data generated in the form of graphs and data tables to draw conclusions based on data statistics generated by the tracking process carried out by students with Tracker software. So that the achievement or success of learning is not only seen from the aspect of learning outcomes but also the process to get these results.

Learning media in the form of Tracker is a free video analysis software that has many tools suitable for video and image analysis. Therefore, teachers need to establish appropriate classroom strategies for video use, so they can be used as demonstrations, exploration or problem solving, or more [3].

Teachers can record videos or take certain experimental photos, which they distribute to students, or the teacher can ask students to make their own video recordings, to engage students in an interactive learning environment and to expand the teaching process outside the classroom.

To increase student activity in solving problems by applying the skills of researching, analyzing, making, and presenting learning based on real experience. Students develop their own investigations with group colleagues or individually, so students will automatically develop their research abilities so as to attain competencies in attitudes, knowledge and skills. Therefore, it makes LKPD teaching materials by using a project-based learning model to encourage students to be more active and creative in learning.

Based on the description above developed in the form of Tracker-based Student Worksheet which aims to help students in learning. Therefore, this study aims to produce Tracker-based Student Worksheets by using the Project Based Learning model on regular X grade motion material that meets the high school feasibility.

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 [4].

The product that will be designed to build in this study is a tool and a regular linear motion material physics practicum module (GLB) 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 [5]. 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 / teaching materials. The device development model with the ADDIE model can be seen in the figure 1 [5].

![Figure 1. ADDIE Model Step](image1)

Furthermore, all the tools and materials used in this study are assembled and the tools are ready for use. The circuit of tool and material can be seen in figure 2.

![Figure 2. A series of tools](image2)

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 table 1.
Table 1. Criteria for Assessment Questionnaire

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

While the stages of data collection in this study, in detail are shown in the table 2.

Table 2. Stages of data collection

| Activity                        | Data collection technique                                                                 | Respondents                  |
|---------------------------------|------------------------------------------------------------------------------------------|------------------------------|
| Preliminary Research (Needs     | The selection of the type of teaching material is the Student Worksheet                    | Research team               |
| Analysis)                       |                                                                                           |                              |
| Expert validation               | media questionnaire 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) | Student                      |

3. Results and Discussion

Product Validation Results Data by Media Experts Data from the results of product validation calculations by media experts on aspects assessed, can be seen in table 3.

Table 3. Data from validation by media experts

| Aspect                        | Average Score | Category | Presentation |
|-------------------------------|---------------|----------|--------------|
| Physical Form of Props        | 3.33          | Worthy   | 83 %         |
| Use of Props in Practicum     | 3.00          | Worthy   | 75 %         |
| Average total score           | 3.17          | Worthy   | 79 %         |

The table 3 shows that, from the assessment of these two aspects carried out by media experts, the average total score of media expert validation results was 3.17. Then the score obtained is included in the "Decent" category based on a four-scale score grouping.

3.1 Product Validation Results Data by Material Experts

Data from product validation calculation results by material experts on the assessed aspects can be found in Table 4.

Table 4. Results of validation by material experts

| No   | Aspect               | Average Score | Category      | Presentation |
|------|----------------------|---------------|---------------|--------------|
| 1.   | Feasibility of content | 3.33          | Worthy        | 83 %         |
| 2.   | Linguistic           | 3.75          | Very decent   | 94 %         |
| 3.   | Presentation         | 3.00          | Worthy        | 75 %         |
| 4.   | Integrate            | 3.69          | Very decent   | 98 %         |
| 5.   | Product Utilization  | 3.68          | Very decent   | 95 %         |
| 6.   | Practical Practices  | 3.65          | Very decent   | 96 %         |
|      | Average total score  | 3.65          | Very decent   | 91 %         |
The table above shows that, from the assessment of the six aspects carried out by two material experts, the average total score of the material expert validation was 3.65. Then the score obtained is included in the "Very Eligible" category based on a four-scale score grouping.

3.2 User Trial Response Results Data

The results of student response data on the trial of the practicum tool users on the assessed aspects, can be seen in table 5.

Table 5. Data from trial response users of practicum tools

| Aspect                  | Average Score | Category    | Presentation |
|-------------------------|---------------|-------------|--------------|
| Physical Form of Props  | 3.68          | Very decent | 92 %         |
| Use of Props in Practicum | 3.73        | Very decent | 93 %         |
| Average total score     | 3.71          | Very decent | 93 %         |

Table 5 shows that, from the assessment of these two aspects carried out by students as users of the practicum tool, the average total score obtained from the students' assessment responses in the user trial was 3.71. Then the score obtained is included in the "Very Eligible" category based on a four-scale score grouping.

While the results of the student assessment data on the trial user practicum module on the aspect assessed, can be seen in table 6.

Table 6. Data from trial response users of practicum module users

| No | Aspect                  | Average Score | Category    | Presentation |
|----|-------------------------|---------------|-------------|--------------|
| 1. | Feasibility of content  | 3.67          | Very decent | 92 %         |
| 2. | Linguistic              | 3.63          | Very decent | 88 %         |
| 3. | Presentation            | 3.68          | Very decent | 92 %         |
| 4. | Integrate               | 3.56          | Very decent | 89 %         |
| 5. | Product Utilization     | 3.68          | Very decent | 92 %         |
| 6. | Practical Practices     | 3.73          | Very decent | 93 %         |
|    | Average total score     | 3.64          | Very decent | 91 %         |

Table 7 shows that, from the assessment of the six aspects carried out by students as users of the Student Worksheet, the average response of students in the user trial was 3.64. Then the score obtained is included in the "Very Eligible" category based on a four-scale score grouping.

Based on data analysis was carried out to analyze the data of product validation by experts and user response. Analysis of validation data by experts aims to determine the feasibility level of the Tracker-Based Student Worksheet on the Regular Straight Motion (GLB) subject according to media experts and material experts. While the analysis of user response data aims to find out the user's response to the Tracker-Based Student Tools and Worksheets on the Regular Straight Motion (GLB) subject that has been designed to wake up. Based on the above, the frequency distribution of the total score of students in the trial user manual can be presented in the form of Figure 3.
In accordance with the diagram picture can be seen that, 77% of students in the trial user manual practicum stated that the practicum tool in the Regular Straight Motion (GLB) material was in the "very feasible" category as a learning medium. Whereas 23% of other students stated in the "decent" category. The practicum tool is said to be very feasible and feasible to use because every aspect of the assessment indicator is in accordance with what students need as a product user or learning media, so that with this tool it is expected to improve the quality of learning. While the frequency distribution of the total score of students in the pilot module user trial can be presented in the form of figure 3.

Based on the results of the feasibility test by the experts and user response, it can be stated that the Student Worksheet on Regular Straight Motion (GLB) material can be applied in the learning process at school.

4. Conclusion
Tracker software is able to present physical symptoms in real terms and their representations in the form of both quantitative data and graphics and make it easier to carry out physics experiments (data retrieval and analysis).
Based on the data obtained from the results of research and discussion that has been done, it can be concluded that the use of tracker in designing Tracker-based Student Worksheet can be useful in learning activities. Tracker-based Student Worksheet is used as a guide for the use of practicum tools that have been designed to build according to needs for teaching materials. Learning activities will become more interesting and students will get more opportunities to learn independently with educators. The things that need to be suggested by researchers regarding the use of tracker software design tools and Student Worksheet based on Tracker on Regular Straight Motion (GLB) material in learning include: 1). the tools that have been made and researched are still very simple, so there is a need for further development and research on these tools, especially in terms of designing of these tools to be maximized. 2). Tools that have been designed to build researchers using a calibration length of 50 cm and a mass of 100 g objects, it is expected that further research can vary the length of the calibration and mass of objects. 3). This Tracker-based Student Worksheet is effective for learning. Therefore, educators can develop in other materials and can be developed in learning activities.

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