The development of physics student worksheet based on project-based learning with Sketch Up assistance

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Abstract. The purpose of this research was to develop student worksheet based on Project Based Learning assisted Google Sketch Up on Newton's law subject. This type of research is Research and Development (R & D) according to Sugiyono. The data analysis technique used student worksheet feasibility test through validation of three experts and student worksheet legibility test on 33 respondents. The result of this research showed that student worksheet has been produced based on Project Based Learning assisted Google Sketch Up. The student worksheet feasibility test obtained score average 96.50% and test legibility 81.75%.

1. Introduction

The ability of Indonesian students based on the data of the International Student Assessment Program (PISA) is still relatively low. The PISA results in 2012 put Indonesia in the 64th position of 65 countries tested. Indonesia is only able to be in the order of the 62 of 72 countries that participated in the test [1]. The ability of science learners in Indonesia only reached 3rd level, while other countries such as Singapore, Japan, China and Thailand to 4th, 5th even 6th level in 2015 [2].

One of the factors causing the low ability of science learners is less match between the teaching materials with learning models used by teachers in learning [2]. The observation showed that the LKPD as one of the teaching materials is still not much in accordance with the objectives of LKPD itself. The existing of LKPD generally contained only a collection of exercise questions [2]. The student worksheet is a guide for the students in conducting an inquiry that contains not only questions, tasks or labs but also contains a flow of conceptual understanding that guides the students in summing up the material learned in their entirety [3].

Physics as one of science learning is included in this issue. Therefore an effort is needed to overcome this problem through the development of student worksheets that can improve the students' science skills with the selection of learning models that produce the project. One of the learning models that produce the work is Project Based Learning (PjBL). PjBL is a student-centered learning model that provides opportunities for learners to be active in the learning process, provides responsibility for self-study, develops the potential of learners, the ability to compile and understand the information received and develop and construct his own knowledge [4]. There are six steps of PjBL learning: (1) start with the essential question, (2) design a plan for the project, (3) create a schedule, (4) monitor the students and the progress of the project, (5) asses the outcome, (6) evaluate

the experiences [5]. PjBL is highly recommended for its implementation in the 2013 curriculum. This is intended to strengthen the scientific approach and produce contextual work [6].

Lack of multimedia utilization and the absence of student involvement in the direct observation process in learning is also one of the factors causing the understanding of the physics concept of low students [7]. Media has an important role in communication activities. Media into a means used to distribute messages from the sender of the message (communicator) to the recipient of the message (communicant) [8]. The use of learning media with technology-based gives a very positive impact on the ability and willingness of the students to follow the learning process [7]. One of the technology-based media is Google Sketch Up used to design an object into 3D, so that the learners not only imagine but also see directly the concept described by teacher [7]. The addition of technology in PjBL can improve motivation, problem-solving skills, and also can improve the achievement of learning objectives effectively [9].

2. Method

This type of research is Research & Development (R&D) according to Sugiyono [10].

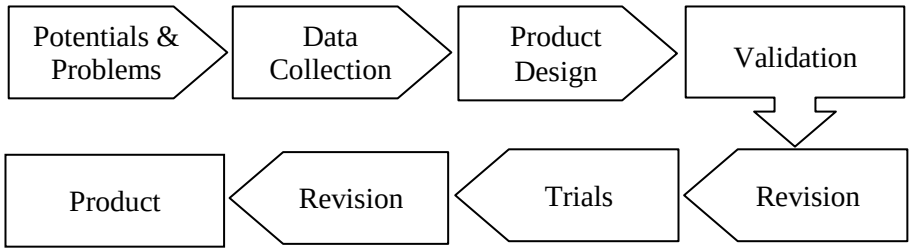

Figure 1. R&D steps according to Sugiyono.

Data analysis techniques in this study were observation, interview, and questionnaire. The observations were conducted at SMAN 1 Piyungan Bantul. Make observations related to learning and teaching materials used in schools. The interview was conducted with one of the physics teachers at SMAN 1 Piyungan. The results of interviews with the resource persons are contained in table 1. The questionnaire of the student worksheet legibility on 33 respondents was at SMAN 1 Piyungan Bantul. The student worksheet validation is done by 3 experts consisting of two lecturers and one high school teacher.

Table 1. Interview result

No	The Questions	The Answers
1.	Is the time of physics learning in the classroom using a particular learning model?	Teaching according to the learning plan used a cooperative learning model
2.	What types of teaching materials are used in physics learning in the classroom?	Some physics book
3.	Is there a student worksheet based on a particular learning model used?	Not yet
4.	Are the teaching materials used in accordance with the model or learning method used in the learning?	Still unsuitable
5.	Are the teaching materials used to suit the needs of learners? Such as in accordance with the 2013 curriculum?	The teaching materials used are still less appropriate.
6.	How do you comment if researchers want to develop one of the teaching materials, namely student worksheet based PjBL?	Yes, please.

3. Result and Discussions

Validation of student worksheet based Project-Based Learning on Newton's law of motion subject at SMAN 1 Piyungan was conducted by three validators consisting of two lecturers and a physics teacher. The validity instrument used to test the feasibility of student worksheet was adapted from the instrument of BSNP 2012 validity on minimum standards of teaching materials. There were 3 components of student worksheet feasibility assessment that was the content feasibility component, linguistic and presentation.

After validation by the three validators, the validation results were obtained as shown in table 2.

Table 2. The expert judgment result.

No.	Components	Aspects	Expert's Score			Mean	Category
			I	II	III		
1	Feasibility of Content	Material Coverage	4	4	4	4	E
		Material Accuracy	3,8	4	3,5	3,75	E
		Contextuality	4	4	4	4	E
		Stimulate Curiosity	4	4	3,7	3,89	E
2	Language	Communicative	4	3	3,6	3,53	E
		Sentence Clarity	4	4	4	4	E
		Aspects of Language	4	4	3	3,67	E
3	Presentation	Learning Presentation	4	4	4	4	E
		Presentation Supporters	4	4	3,7	3,89	E
∑ Mean			3,97	3,89	3,71	3,86	E

Based on table 2 above, the average score of the student worksheet assessment component is 3.86 which is categorized as excellent. Thus student worksheet based on Project Based Learning on Newton's law of motion was feasible to be tested on the learners. After the student worksheet was validated and declared feasible, then the next step was to test the legibility of student worksheet or in other words, measured the response of learners to the student worksheet developed by spreading the questionnaire of the learners' response.

Based on table 3, it can be seen that the lowest average score is the linguistic component while the highest average score is on the serving component. The components of the content and language feasibility scores average of 3.25 and 3.14 respectively are included in the Good (G) category while the presentation component earns an average score of 3.43 which is categorized as Excellent (E)

Table 3. The legibility test result.

No	Components	Indicators	Mean	Component Mean	Category
1.	Feasibility of Content	a. Material relevance	3.23	3,25	G
		b. PjBL	3.28		
		c. Satisfaction	3.23		
2.	Language	a. Language Usage	3.24	3,14	G
		b. Sentence clarity	3.03		
3.	Presentation	a. Figure	3.27	3,43	E
		b. Design	3.58		
Mean				3.27	E

From the validation results by the validator and student worksheet readability test by the respondent, the LKPD based on Project Based Learning on Newton's legal subjects deserved to be used as one of the teaching materials in the school.

4. Conclusions

The student worksheet based Project Based Learning physics on the subject of Newton's law of motion has been successfully developed according to the needs analysis of learners with an average score of validation and legibility test are 3.86 (excellent) 3.27 (excellent).

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