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THE DEVELOPMENT OF PROBLEM-BASED STUDENT WORKSHEETS TO IMPROVE LEARNING OUTCOMES OF NATURE SCIENCE LESSON WITH REFERENCE TO POWER AND SIMPLE AIRCRAFT ON CLASS V STUDENTS SDN 091571 BAH JAMBI

Eko Lesmono[1]*, Mara Bangun Harahap[2], Ajat Sudrajat [3]
[1]Postgraduate Student, State University of Medan, UNIMED. Jln. Willem Iskandar Psr V Medan Estate, 20221, Indonesia
[2]Department of Physics, Faculty of Mathematics and Natural Sciences, State University of Medan, UNIMED. Jln. Willem Iskandar Psr V Medan Estate, 20221, Indonesia
[3]Department of Chemistry, Faculty of Mathematics and Natural Sciences, State University of Medan, UNIMED. Jln. Willem Iskandar Psr V Medan Estate, 20221, Indonesia
**email : echo.lesmono@gmail.com*

Abstract
The objective of this research is to develop appropriate, valid and effective problem-based Student Sheet. This research is development research with model of Dick and Carey. The subjects in this study are students of fifth grade at SDN 091571 Bah Jambi . The object in this study is the Student Worksheet based on the problem. The instruments used are consisted of validation sheets, test result, learning result test, student response questionnaire and teacher response questionnaire. Data analysis is descriptive analysis. The results of the study indicate that: (1) validation of material experts, linguists, and presentation experts state that the developed student worksheet is suitable for use in the field without revision and it is very valid; and (2) based on field trials, student worksheet can be declared effective. It is based on: (i) the percentage of classical completeness increases by 86.67%, of the 30 students who take the test; (ii) the achievement of learning objectives is achieved; (iii) positive student response; and (iv) the percentage of effective learning time. The level of effectiveness of problem-based student worksheet in improving student learning outcomes based on gain score is moderate.

Key words: student work sheet, project, learning outcome, power and simple aircraft

I. Introduction

The development of the era demands an effort to improve the quality of education. Education is an important aspect in life because education is a medium to create quality human resources. To improve the quality of national education, the government makes various improvements in the field of education, one of which is by improving the curriculum. This is in line with the continuous development of education curriculum in Indonesia. According to Rusman (2008: 471), the curriculum is a set of plans and regulations on objectives, content, and lesson materials and ways used as guidelines for the implementation of learning activities to achieve certain educational goals. Based on the guidelines of the implementation of learning activities, students do learning activities that encourage development and growth in accordance with established educational goals.

The quality of science education in Indonesia in international is still far behind compared with other countries. It can be proven based on the results of the PISA (Program for International Student Assessment) survey in 2015, the science score of Indonesian students ranked seventh from below (position 69) with the total number of study participants as many as 76 countries following PISA. And also based on the results of TIMSS (Trends in International Mathematics and Science Study) survey in 2015, Indonesia was ranked thirteen from bottom (position 36) with the total number of study participants of 49 countries following TIMSS. It can also be reinforced from data obtained from Minister of education, as it can be seen on tables 1.1 and 1.2 below:

Table 1.1 Indonesia Rating by PISA

Year Study	Lesson	Score Average		The Rank of Indonesia	The number of participants
		Indonesia	International		
2012	science	382	501	64	65
2015	Science	403	501	69	76

Source: http://litbang.kemendikbud.go.id/index.php/survei-international-pisa

Tabel 1.2 Indonesia Ratting by TIMSS

Tahun Studi	Mata Pelajaran	Skor Rata-Rata		Peringkat Indonesia	Jumlah Negara Peserta Studi
		Indonesia	Internasional		
2011	Sains	406	500	40	42
2015	Sains	409	500	36	49

Source: http://litbang.kemendikbud.go.id/-international-timss

Based on the results of the survey, it shows that Indonesia must find solutions of various problems in human resource development, especially in the field of education.

The learning process will be successful if there are changes in students, as well as involving changes in knowledge, attitudes, and skills. The learning process involves the interaction between students and teachers, and students with a student. But in reality, in the field of learning conducted in schools is still teacher-centered without involving the active role of students so that the lesson learned tends to be boring. It directly results in low student learning outcomes.

Based on the results of preliminary observations made by the researchers in class V SDN 091571 Bah Jambi, indicating that the results of student learning on science subjects is still low. It is derived from the average data midterm I and II, as well as the average value of final term I and II as shown in the table 1.3.

Table 1.3. Average Value of midterm and final term I and II Academic Year 2015/2016

Number	Class	The number of Student	The average of midterm Semester I	The average of Final Term Semester I	The Average of Midterm Semester II	The average of Final Term Semester II
1	V	28	59,05	61,88	60,11	60,50

(***the source of data : SDN 091571 Bah Jambi***)

The data shows that the problem is quite serious that students' learning outcomes are still low and not completed according to Minimum Criteria Mastery, that is 67. It can be seen from the midterm and final term semesters I

and II of the academic year 2015/2016. The results obtained based on the value of midterm semester I obtained an average of 59.05 and the results of final term, semester I obtained an average of 61.88, as well as the results of midterm semester II average 60.11 and final term semester II average 60.50 with Minimum Criteria Mastery 67, from 31 students. This shows there is still the difficulty of students to improve the learning result as a whole.

Based on the results of the preliminary data conducted by the researchers, the general problems experienced by students at the time of learning are: 1) teacher center learning, 2) the students still learn individually, 3) the low activity of students to learn, and 4) the learning model is still conventional. The problems that arise are in the cognitive and psychomotor aspects. they are still lacking or the students are still many who have not been completed, for affective aspects already in the category quite well.

The problem with cognitive aspects is the lack of students' understanding of material, "power and Simple Aircrafts". This is caused by the material given by the teacher is still abstract, thus making the students difficult to understand the theory given by the teacher. In addition, there are several factors seen by the researcher as one of the causes of the low learning outcomes obtained by students in science subjects, namely in terms of KBM, students dominant listening and recording, not actively involve students in the process of teaching and learning activities. Teachers are more likely to use conventional approaches in the form of lectures and individual assignments, students are taught with abstract thinking styles by making teachers a primary source of learning. Students have not been accustomed to solve the problem of Science lesson which sometimes related to daily life.

Teaching and learning process is essentially communication process between teachers and learners. However, the process does not always work properly when the communication process is in a hurdle. This is where the media plays an important role as a tool to help the communication process so that it can run well so that no mistakes are made (Wina Sanjaya, 2008: 206). Interesting learning is a dream for every teacher and student. One of the things that need to be prepared for learning to be interesting and fun is the activity in the classroom equipped with adequate teaching and learning facilities. Student learning facilities must be prepared one of them is the Student Worksheet.

Sanjaya (2014: 68) states in the learning process, there are other tool besides lesson book which have an important role in determining the success of learning. One of the supporting teaching materials is student worksheet. It is one of the most important learning tools, as a means of achieving basic competence and competency standards. Student work Sheet is one of the tools of learning tools that support the implementation of learning in order to ease the understanding of the learning material. It can make students more active in finding concepts, developing concepts, training students in developing process skills, and developing students' critical thinking skills. Student Worksheet contains the tasks that should be done by students (MoNE, 2004). In the student worksheet, learners will get materials, summaries and tasks related to the material. In addition, learners can also find a structured direction to understand the material provided (Prastowo, 2011). Daryanto (2013: 98) states that one of the innovations needed to create student worksheet is learning which provides students with opportunities to build knowledge through experience, social interaction, and the real world.

However, based on observations made by the authors at SDN 091571 Bah Jambi and some surrounding schools, the student work sheet currently are distributed by private publishers. It contains only the materials, duty sheets and exercise questions in the form of a stuffing test, multiple choice and essay only. It is used by teachers to provide additional training to students. It starts directly with the concept of science exercise questions. Based on the observation on the sample of student work sheet, there are deficiencies in the student work sheet. They are student worksheet which is printed on average with blurred paper, the print is colorless and looks boring because the form is less interesting and there is no student work sheet that guides the students to find the concept of learning through problem solving in daily life.

As a matter of fact, many teachers who have not used varying teaching material in learning. Based on interviews with one of the teachers at SDN 091571 Bah Jambi, teachers have not been able to design their own student work sheet because time is not possible. This shows that the ability and skills of teachers in developing student work sheet and teaching materials are considered still lacking and still need to be improved, so that they can be responsible as a good teacher. To realize the useful learning needs to be developed problem-based student work sheet. Daily problems with science, involves students actively and not feel bored in the learning process which will also affect student learning outcomes due to a deeper understanding of knowledge of the material.

According to Arends (2008: 101) learning with Problem Based Learning provides an opportunity for students to learn academic materials and problem-solving skills by engaging in various real-life situations. This implies that most concepts or generalizations can be introduced effectively through problem-solving (Suprihatiningrum, 2013: 216). This is because in Problem Based Learning, students are given various problems in everyday life especially those related to the material, *power and simple aircraft*. It is selected as materials for developing student work sheet because they are closely related in everyday life. After learning the material, students are required to be able to solve the problem in the way they have learned.

Student work sheet developed by educators can be tailored to the characteristics of students. In addition to the development of the problem-based student worksheet is expected, so that students are accustomed to solving the socio-cultural environment, the characteristics of students also includes the stages of student development, the ability of the beginning has been mastered, interests and others. The development of student work sheet is expected to change the learning condition from the teacher center model to the student centered and become more interesting. Because the developed student work sheet provides an attractive appearance, color, the presentation of the material, language that adapted to the child's age.

II. Research Methodology

This study is research development. Research Development is a research method used to develop a particular product, and test the effectiveness of the product (Sugiyono, 2015: 407). The product that will be developed in this development research is the fifth Class of Problem-based science Student Worksheet.

This research wis conducted at SDN 091571 Bah Jambi, Java Maraja Bah Jambi, the fifth class , semester II, academic year 2016/2017 on science subjects. Researchers have their own reasons why SDN 091571 Bah Jambi is a place of research. This is because similar research has never been implemented in the school. Furthermore, in SDN 091571 Bah Jambi, there has been no development of problem-based student worksheet applied by teachers especially science subject at class five, lesson material power and simple aircraft. It is planned to be implemented for 3 months. The subject in this development research is the students of grade V SDN 091571 Bah Jambi who amounted to 30 students, and the object of this study is student worksheet based science subjects, power and simple aircraft. The systematic stages of the study and procedure steps of student worksheet based on problem based learning that will be done based on modification of Borg & Gall and Dick & Carey model can be seen in Figure 3.1 below.

III. Result and Discussion

3.1. Discussion of Research Results

Based on the results of the research that has been proposed, it shows that there is an improvement in the management of teacher learning taught by using problem-based student worksheet developed on the material power and simple aircraft. In the pretest obtained an average value of 59.62 or, while the posttest obtained an average value of 75.49. In terms of students' learning completeness on pretest, the total number of students who complete the study as many as 14 students (46.67%) while the number of students who achieve mastery learning on posttest of 26 students (86.67%). And in terms of achievement of specific learning goals, students are able to complete in each indicator where percentage of specific learning goal completeness attainment of 75.36%. This proves that the use of project-based student worksheet developed in science can be applied to improve student learning outcomes. In the student response is also positive and very good because more than 86.75% of students are interested to follow teaching and learning activities with the developed problem-based student worksheet.

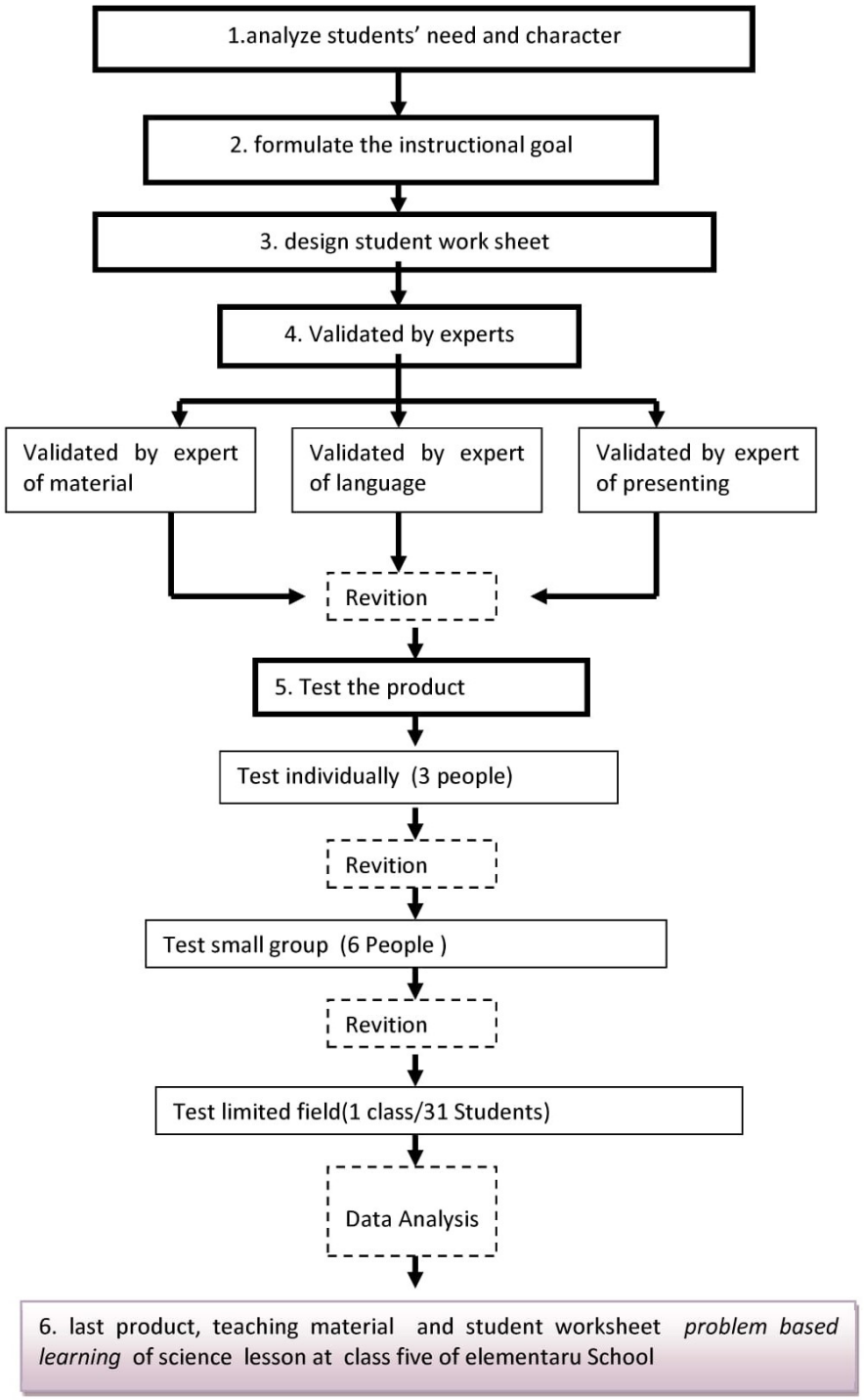

Figure3.1. the procedure of the devolpment of *Problem Based student worksheet* dadopted by Model Borg & Gall (1983)

From the results of the above research, justify and strengthen the theory of problem-based learning which is based on the theory of cognitive psychology, namely Piaget and Vigotsky (constructivism) theory. According to constructivism theory, students learn to construct their knowledge through interaction with their environment. Learning with the problem-based model can enable students to learn through real-world problem-solving in a structured way to construct student knowledge. This learning requires students to actively conduct investigations

in solving the problems and the teacher acts as a facilitator or mentor. Learning will be able to form higher order thinking and improve students' ability to think critically. (Sani, 2014: 127).

Problem Based Learning is a centralized learning through the relevant problems because it contains scenarios, team units that put back the desired subjects. The objectives in this learning process is the ability of students in solving problems, describing the problems and revise them. When making presentations, it will add information according to competence. One of the most widely adopted methods to address the Student Centered learning approach and which can empower students is problem based learning (Wanhar, 2015: 28).

Problem Based Learning is as one of the designed learning models so that learners get important knowledge, which make them proficient in solving problems, and have their own learning model and have the ability to participate in the team. The learning process uses a systematic approach to problem solving or facing challenges that will be required in daily life (Setiawan, 2013: 266-267).

Student worksheet has many benefits in learning activities, teachers get the opportunity to lure students to actively engage with the material discussed. The benefits of using it for learning activities according to Pastowo (2011: 278) are: a) enable students in the learning process. b) assist students in developing concepts. c) train students in finding and developing process skills. d) train students to solve problems and think critically. e) as teacher and student guidance in implementing the learning process. f) help students get a record of the material learned through learning activities. g) helps students add information about concepts learned through systematic learning activities.

In addition, students can also build knowledge with the creation of experience in their activities solving any problems in the student work sheet. Learning objectives will be achieved by providing meaningful experiences to students. If the students' experience makes sense, it will encourage students to deepen their understanding of the experience. Experience is provided through the division of tasks in the group or student worksheet, and the demonstration of skills / presentation in learning. Based on the results of the research analysis and the above theoretical studies, it is proven true that the developed problem-based student worksheet can be used to improve student learning outcomes.

3.2. Research Findings

Based on the results of research discussion, this study finds things as follows:

1. Based on individual trials and small groups, it is known that students are more enthusiastic about learning to use the developed problem-based student worksheet on materials, power and simple aircraft.

2. In the pretest, there are 14 students who reach the completeness of study with an average score of 59.61. While the posttest increases to 26 students who achieve mastery learning with the average student 75.49%.

3. On the achievement of specific learning objectives in learning on pretest the student reaches 58.40% of TPK completeness, whereas in posttest the student reaches specific learning objective's mastery that is equal to 75,36%.

4. From the questionnaire of the students 'responses in the field trials, it is found that the students' responses were very good and positive in the developed problem-based student work sheet in the science lesson because more than 86.75% of the students are interested in teaching and learning activities using based problem.

5. The percentage of learning time needed in learning by using problem-based student work sheet is also smaller than that of learning without using it. The learning time required in field trials with problem-based student work sheet 14 meetings, while learning without student work sheet 20 meetings.

3.3. Limitations of Research

In the development of problem-based student worksheet on material about power and simple aircraft with this effectiveness test, researchers find some limitations such as:

1. The developed student worksheet has not been fully able to accommodate the students' wishes in material about power and simple aircraft, since it still can be developed more interesting. Therefore, the student worksheet based on this problem still needs to be developed again by doing further research.

2. Testing of this product is only done on 30 students of grade five at SDN 091571 Bah Jambi. Broad testing cannot be done because of limited time, energy, and cost researchers. Thus, there may still be a bias factor affecting the research results. Therefore, the sample research should be more representative for the results of research can be more leverage.

3. Limitations of facilities, infrastructure, and ability of researchers in making students worksheet and the ability of teachers during the trial will certainly greatly affect the results of product development and student learning outcomes.

4. Limitations of student worksheet implementation time so it still cannot be tested as a whole in the classroom learning will greatly affect the results of product development and student learning outcomes.

5. The effectiveness test of student worksheet shall be conducted without a comparison class. In order to get a complete picture of the effectiveness of student worksheet, further quasi experimental research is required for the entire content of the product by using a comparison class.

6. The test result after being validated by the material experts covers C1, C2, C3, and C4 so it cannot meet the six cognitive domains, then the more varied questions needed up to level C6.

IV. Conclusions and recommendations

4.1. Conclusion

The conclusions of the validation of material, language, and presentation after going through the second stages of validation as a whole can be stated that the problem-based student worksheet are feasible to use in the field without revision and are very valid.

The effectiveness of the developed problem-based student worksheet is obtained through one experiment. In the field trial, the result shows that the percentage of classical completeness increases. The achievement of learning objectives is achieved, the students' response is very good and positive, and the percentage of learning time is effective. Based on the score, the effectiveness of problem-based students' worksheet in improving students' learning outcomes is moderate. In field trials the terms of effectiveness are met, it can be concluded that the problem-based student worksheet that has been developed is effectively used.

From the results of the validating stage and field trials that apply problem-based learning models, it is concluded that the developed problem-based student worksheet can improve learning outcomes.

4.2. Suggestion

Based on the results of this study, it can be put forward some suggestions as follows:

1. Problem based student worksheet that have been developed can be used as an alternative teaching materials in improving student learning outcomes on material about power and student work sheet so that can be used as input for schools to be used in learning. In addition, this problem-based student worksheet is interesting, in line with student characteristics and enthusiastic and creative students.

2. The result of student worksheet has not been widely implemented in other schools, its dissemination is a limited spread that is only on the subject in the research school. To determine the effectiveness of problem-based student work sheet on various topics of science lessons and other appropriate subjects, it is recommended that teachers and researchers implement it on this issue on a wider scope in schools.

3. Positive student response is to learning by applying problem-based student work sheet. Therefore, it is expected for science teachers to create an atmosphere of learning that provides a positive response and fun for students. Thus, students will not assume that science is a record-only and boring lesson.

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