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Implementation of Physics Learning Material Based on the 4E Learning Cycle Method for Student SMP Negeri in Left Behind Area (Case Study in District Parigi Moutong)

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Abstract: ***This study is the implementation of physics learning material based on learning cycle model that was developed in District Parigi Moutong. This implementation was done in three junior high schools (SMP) SATAP Negeri Parigi Moutong. The development of these learning material in an effort to improve the quality of learning physics and to develop students problem-solving skills. The results of the implementation show that enhance understanding of concepts and problem-solving skills. Use of the learning material is also effective in improving students' understanding of the concept mastery learning. Students commonly used memory based approach to solving problems. Positive feedback from teachers and students towards learning material products is evident from the results obtained student learning and enthusiasm of students and teachers in the learning process.***

Keyword: Learning material, learning cycle, and problem solving skill

1. Introduction

National Exam (UN) is an Indonesian government way to standardize each graduate education unit. School diffrent from advanced or disadvantaged areas was igrnored. So it is necessary to attempt to reduce the gap between the learning process of schools with advanced and disadvantaged areas. Parigi Moutong is one of a list of 199 disadvantaged districts in Indonesia, which also needs to be done in education reform.

In the context of educational reform, there are three main issues that need to be highlighted, namely: curriculum renewal, improving the quality of learning, and effectiveness of teaching methods (Khaeruddin, 2005). Operational curriculum developed by and implemented in each educational unit consists of unit-level educational goals of education, curriculum structure and unit levels of education, school calendars, and syllabus (BSNP, 2006). While the renewal of learning physics should have four main elements as the nature of science, namely: attitudes, processes, products and applications. The fourth element is an integral part. Knowledge is not a set of facts, concepts, or rules that are ready to be picked up and remembered. Humans must construct knowledge and give meaning through real experience. Students need to be taught to solve problems, find something useful for him, and wrestle with ideas (MONE, 2002). But in reality, especially in the less developed regions, there are many teachers of physics are still fixated on the old ways of learning in which the teacher as the sole source of learning (teacher center), do not attention the characteristics of their students. Students were not introduced to the nature of the physical sciences as a whole. So that students are only able to memorize concepts without being able to develop the ability to solve problems encountered in everyday life. Therefore should be a learning development to introduce students to the four main elements of the nature of physics. One method of appropriate learning and can improve student learning success is the 4E learning cycle method (Yilmaz and Huyugüzel Cavas, 2006). Moreover, learning can not be separated from the physics laboratory activities, learning cycle model is usefulness to increasing student activity in the laboratory (Stewart and Stavrianeas, 2008). Through the phases of the learning cycle, students learn directly exposed to the nature of physics, curiosity about objects, natural phenomena, how the scientists in the process of acquiring knowledge of the laws, principles and theories, and apply them to other problems in daily life. The 4E learning cycle method will assist teachers in teaching and learning practices (Marshall, Horton, and Smart, 2008).

According to Lawson (1989) in Bybee (1996), the science learning cycle is a way of thinking and acting that is suitable for student learning. The use of the learning cycle provides an opportunity for students to express prior knowledge and the opportunity to refute, debate their ideas, this process resulted in the cognitive imbalance, so as to develop a higher level of thinking, and is a good approach to learning science. Renner and Marek in Martin (1994), the research they did conclude that the learning cycle model is a way to help children apply mathematic, social science skills, interpreting graphs, tables, and posters as well as to solve the problem of data assimilation , and determine the intent or meaning of a sentence.

Phases of the science learning cycle consists of: Exploration (investigation), Explanation (Introduction), Expansion, and Evaluation. These phases according to Carin and Martin, pedagogic purpose is the same. The 4E learning cycle

method is very helpful teachers in meaningful learning practice (Marshall, Horton, and Smart, 2008), assist teachers in lab-based learning (Stewart and Stavrianeas, 2008) and also improve learning outcomes (Yilmaz, and Huyugüzel Cavas, 2006). Indication of the learning process that the ability to use information and skills to solve problems (Nur, 2000), is not enough just to remember and understand the findings of scientists (Karhami, 1998). Problem solving is a skill that can be taught and learned. Learning physics as a branch of science must lose what scientists did in the study of nature. So the ability to solve problems is the ultimate goal of learning physics (Korsunsky, 2004).

2. Methods

The research method used is the method of research and development (Research and Development / R & D) of Sugiyono (2006), the design of this study followed the steps as shown in Figure 1. Implementation of this research was conducted in three districts as the State eliminates Parigi Moutong randomly selected to find:

1) The effect of application physics learning material to increased mastery of physics concepts and problem-solving skills tests.
2) The strengths and weaknesses of physics learning material with learning outcomes, the views of teachers, and students.
3) the effectiveness of implementation product, the physics learning material.
4) the supporting and obstacles factors in implementation of product (the physics learning material).

3. Results and Discussion

3.1 Improved Understanding of Concepts and Problem Solving Ability

Instrument of the achievement test used is a multiple-choice test to measure students 'level of understanding of concepts and analytical test to measure students' ability to solve problems. These instruments tend to have validated and tested experts. Analysis of N-gain method used by Meltzer (2002):

$$N-gain(\%)=(\frac{Skor_{postes}-Skor_{pretes}}{Skor_{maks}-Skor_{pretes}})x100$$

Criteria: Height: N-gain> 70; Medium: 30 ≤ N ≤ 70-gain and low: N-gain <30.

3.1.1 Level of Understanding Concepts

In preliminary tests, where students have not been treated using the results of the development of students' level of understanding of the concept is very low. Only 11 students that scored above 60. The main cause is probably because they do not get tested material so it does not have a stock concept enough and answer only with everyday experience and maybe even just by mere intuitive.

At the end of the test the student's knowledge turns out to increase with the increase of each school is different. In SMP Negeri 1 Parigi West SATAP an average increase of 54.9%, SMP Negeri 2 SATAP Middle Parigi an average increase of 67.7%, and in SMP Negeri 3 SATAP South Parigi an average increase of 42.4%. The average value of the final test in SMP Negeri 1 Parigi SATAP West at 71.5, SMP Negeri 2 SATAP Middle Parigi was 82.8, and in SMP Negeri 3 Parigi SATAP South at 74.2. Figure 2 shows comparison of an improved understanding of the concept for each school.

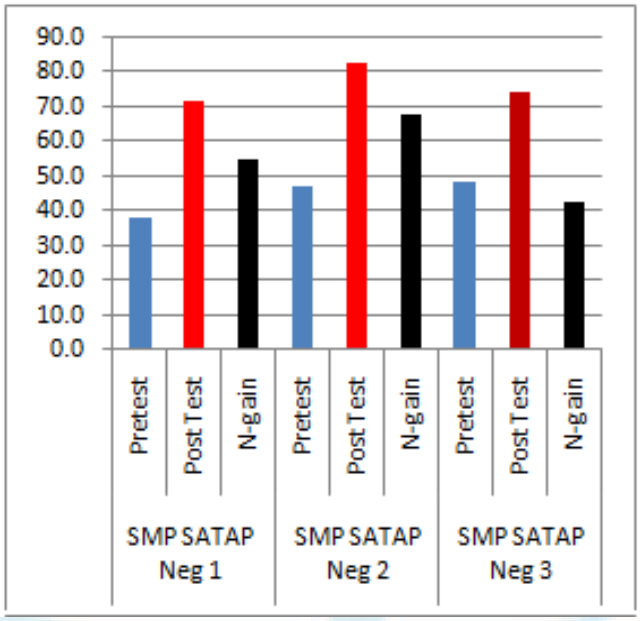

Figure 2: Comparison of the results of the test scores on the conceptual understanding of each school

Improved understanding of the students' concept is an indicator that the process of learning that teachers and students are going well in order to obtain maximum results. The learning process is certainly not out of the learning device used products ranging from the syllabus, lesson plans, and guide students, as well as the selection method used. The interesting thing about the effect of the application of physics-based learning learning cycle model to an improved understanding of physics concepts, especially the concept of electricity is the number of students does not affect the magnitude of the increase (N-gain) students' understanding of concepts.

3.1.2 Level of Problem Solving Ability

The test results of test problem-solving skills of students in each school were shown in Table 5.2 above shows that the developed learning tools and the selection method of the learning cycle, both teachers and students are very supportive of learning processes. So the problem solving abilities of students greatly increased with an average increase of over 65%. Figure 3 shows a comparison of the increase in the ability to solve problems for each school.

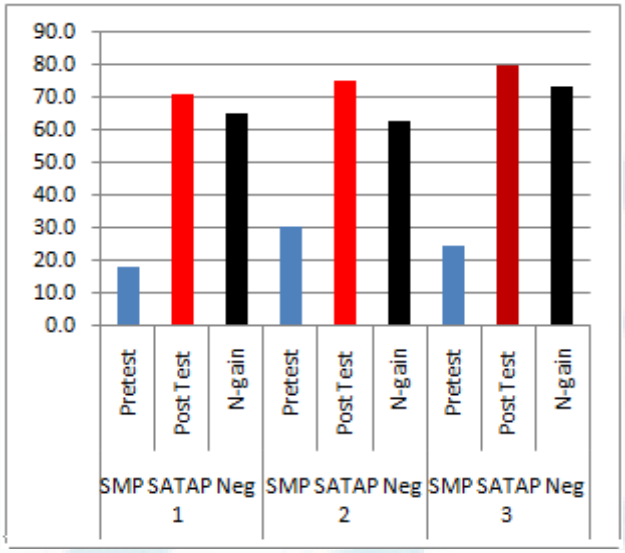

Figure 3: Comparison of the level of problem-solving skills of students in each school

Analysis of the students' work in problem solving approach generally uses memory (memory-based approach). Namely (Walsh, Howard, and Bowe, 2007):

1) The situation analysis based on previous examples
2) Process by trying to "match" the existing variable to the instance.
3) Referring concept is based on the variables
4) The results are not evaluated

3.2 Product Implementation Effectiveness

The effectiveness of the use of devices based learning learning cycle described by mastery learning students in terms of understanding concepts and problem-solving skills. Indicators of individual mastery learning is students who pass the study reached 70% and above (≥ 70%) and classical if 80% of students in the class completed individually.

Mastery learning in terms of students' understanding of concepts in each school are:

a) SMP Negeri 1 Parigi West SATAP many as 20 students who completed the individual (≥ 70) of the 25 students with classical completeness 80%.
b) eliminates Middle School 2 Parigi as 6 students who complete individuals (≥ 70) of 6 students with classical completeness of 100%.
c) SMP Negeri 3 SATAP South Parigi by 9 students who completed the individual (≥ 70) of 9 students with classical completeness of 100%.

While mastery learning students in terms of ability to solve problems in their respective schools are:

a) SMP Negeri 1 Parigi SATAP Western students who completed a total of 18 individuals (≥ 70) of the 25 students with classical completeness 72%.
b) eliminates Middle School 2 Parigi as much as 3 students who completed the individual (≥ 70) of 6 students with classical completeness 50%.
c) SMP Negeri 3 SATAP South Parigi as many as 8 students who completed the individual (≥ 70) of 9 students with classical completeness 89%.

Improved results of this study can not be separated from the PBM using learning tools that have been prepared carefully. These results also confirm previous research that is at the stage of trial. In general, also in line with previous studies that learning to use the learning cycle model (learning cycle) can improve the performance of learning objectives (Zainuddin, 2002), mastery learning (Widodo, S., 1999) and also the ability of the process to think (Chemistry and Piloting Team UM Faculty IMSTEP LC JICA, 2003) so that students are able to solve the problem even though the data shows there are two schools that do not achieve mastery in the classical style. However, overall the students have increased ability to solve problems.

3.3 Excellence and Weakness of Product

The results of the questionnaire on the implementation phase of software development syllabus, lesson plans and student guide are shown in Table 1.

Table 1: The percentage in each category of teacher's response to the products of learning.

Aspect	*Category*				
	1 (%)	(2 (%)	3 (%)	4(%)	5(%)
Syllabus	0,0	0,0	9,1	39,4	51,5
Lesson plan	0	0	8,3	50,0	41,7
Student book	0	0	8,8	47,4	43,9
Mean	0	0	8,7	45,6	45,7

Explain:
(1) Very Low
(2) Low
(3) Enough
(4) Good
(5) Excellent

The above table shows that the average teacher response to the three devices are 8.7% quite, 45.6% good and 45.7% excellent. This means that the learning device fit for use. As for the Students Book, in addition to the response from teachers was also a response from the students. Results from student responses as shown in Table 5.4, 54.8% is very good.

a. Syllabus
Teacher's response to the syllabus of products includes physical appearance, language, competencies, indicators, learning objectives, description of materials, learning activities, assessment, time allocation and contribution in the implementation of the learning process. Components of physical appearance and competence categorized excellent (score of 5). This is because the syllabus printed in color, and the suitability of both competency standards of competence and basic competences in accordance with the

applicable curriculum in schools is the curriculum in 2006 (SBC).

Language components, indicators, learning objectives, description of materials, activities, and contributing to the PBM (learning process) either category (4). Although there are still some errors in typing, but it does not diminish the meaning or interpretation errors for teachers as users syllabus. While the component indicators, learning objectives, material descriptions, and PBM activities, teachers choose either category because of doubts in completing all of the indicators according to the time available. But the teacher believes all these components contribute in achieving both the expected competence curriculum. Components of the assessment and allocation of time is sufficient component category (3). Conformity assessment is carried out with existing indicators measure cognitive enough that teachers expect. She also argues that the planned allocation of sufficient time in accordance with the number of planned learning activities.

b. Learning action plan (RPP)

Teacher's response to RPP products include physical appearance; language use; component of the RPP; conformity with indicators of competence, learning objectives, description of materials, methods / strategies used, learning and assessment activities; allocation of time and contribution models in the implementation of the learning process. Components of physical appearance and completeness RPP excellent (score of 5). This is because the syllabus is printed in color are interesting, and completeness of the components of lesson plans in accordance with the applicable instructions in schools. Although the feasibility of each component category RPP enough (3) given the weakness of teachers in managing the time available does not allow to implement all components of lesson plans come to fruition.

Components of language, the use of methods / strategies and activities categorized pretty good cover (3). But kesesuai indicators, learning objectives, particularly keoperasionalan indicators and learning objectives, description of materials, both preliminary activities and core activities, and contribute to the smooth running of the PBM model of either category (4). This shows that in general RPP well categorized and fit for use.

c. Student Book

In general, the responses of teachers to guide students categorized as either product (4) which is equal to 47.4%, 43.9% very good category and 8.8% enough categories (Table 1). Data captured from the component questions questionnaire covering physical appearance, language, competencies, indicators, learning objectives, material description, summary, example problems, exercises, answer keys, illustrations / pictures, and contribution to the learning process. Meanwhile, of the 40 students in general (54.8%) responded very well (5). Table 2 shows the percentage distribution of student responses to the Student Book product.

Table 2: Percentage of Students responses to the product category learning device

Aspect	*Category*				
	(1)	(2)	(3)	(4)	(5)
Student books	0,7	4,0	9,9	32,1	54,8

Table 2 Explains:
(1) Very Low
(2) Low
(3) Enough
(4) Good
(5) Excellent

Lack of books in junior high school student penggangan SATAP State where implementation activities became one of the reasons for students like Student Book used. So far, teachers use textbooks purchased on its own initiative. While most students do not have the handbook and just rely on the record when the PBM. Economic factors and areas away from the city center is one of the causes.

3.4 Supporting Factors and Obstacles in Implementing Product

The main supporting factor of the application of this product is the teacher in the learning experience. However, the presence of a miss match in the assignment of teachers will constrain the application of this product. In addition, support for science lab practicum Physics as a very important tool in supporting learning materials that require some lab activities. Where students can observe directly the electrical phenomenon that has been described in the Student Book.

4. Conclusion

1. The enthusiasm of teachers and students in the learning process using device-based learning cycle showed a positive response on improving student learning outcomes.
2. The use of product-based learning tools learning cycle is very effective in improving student learning outcomes, both conceptual understanding and problem-solving skills.
3. The use of this device is very helpful teachers in implementing the learning process because in the lesson plan and syllabus as described teachers handle every steps of the learning process and the targets to be achieved. Likewise, students are helped in meeting the needs of the student book as a learning material.
4. There is still a miss match of teachers and low teacher's ability to use the lab an obstacle in the application of this product.

5. Recommendations

The results demonstrated excellence in the implementation of the application of the learning cycle based learning. Some suggestions or recommendation related to the development of this product are:

1. For schools / teachers who will implement this product should be better prepared in their physical abilities and

mastery of concepts pembelajarn strategy especially in lab activities.

2. For researchers, need to be reviewed the effectiveness of the application of this product by comparing it with approaches, methods, or other models.

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