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THE EFFECT OF LEARNING PHYSICS WITH *PROBLEM BASED INSTRUCTION* (PBI) MODELS IN PHYSICS AT THE CLASSROOM

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Abstract. *Physics learning at school aim to know difference about using PBI model on learning outcomes on dynamic electrical in SMA Istiqlal Delitua A.Y. 2009/2010. This research is a quasy experiment and sampling was done with simple random sampling. From the data analysis and hypothesis testing is concluded, learning outcomes with conventional model to dynamic electrical is 69.13(enough criteria). Learning outcomes with a PBI model to dynamic electrical is 80.65 (good criteria). It was based on calculation results by t test t_{count} = 6.82 and t_{tabel} = 1.99, with $t_{count} > t_{tabel}$ (6.82 > 1.99), then H_a accepted and H_0 rejected thus stated that there are significant differences using PBI models on result student learning on a dynamic electrical in grade 10th SMA Istiqlal Delitua A.Y. 2009/2010.*

Key words: *problem based instruction model, conventional model, learning outcomes*

Introduction

Education is a conscious and planned effort to create an atmosphere of learning and the learning process so that learners are actively developing their own potentials to have the spiritual power of religion, self control, personality, intelligence, noble character, and the skills needed themselves and society. Education includes teaching specific skills, and also something that can't be seen but the more profound the gift of knowledge, consideration and wisdom. One of the main basic education is to teach culture through the generations.

Based on the results of preliminary studies conducted by researcher at Istiqlal High School Delitua A.Y. 2008/2009 unknown for 80 samples of questionnaire respondents obtained approximately 75% of students who like physics. This is supported by passing the data shown by high school students Istiqlal Delitua which shows that the graduation rate for high school science Istiqlal very high. However, based on the results of interviews with physics teachers at Istiqlal stated value average of the physics class is still low around 6.8 for grade 10th, students and even less able to understand the concepts and the existing formulation.

There are so many causes of low student learning outcomes such as lack of student understanding, positive interaction among students, presenting a less suitable way, as well as the weaknesses of the students on such matters. Realizing that the researcher presents the learning model of information processing is to improve communication between students and enhance thinking power of students. One character of information processing model is a problem based instruction model.

According Kanreguru (2009), problem based instruction model is an effective approach to teaching high level thinking processes. This learning helps students to process information that has been so in his mind and devises their own knowledge about the social world and about. Lessons are suitable for developing basic

knowledge as well as complex. In the PBI model used as the focus of learning problems that can be solved through group work so students can give the experience a diverse learning experience in students such as, cooperation and interaction with in the group. Learning experience associated with solving such problems, make hypotheses, design and conduct experiments, collect data, present data, make conclusions, presenting, discussing, and creating reports.

According to Hakim (2008), learning has a principle that finds us with an effective learning method. These principles are; (a) Learning a clear goal oriented, (b) Learning occurs when a person is in the problematic situation, (c) Learning with understanding is more meaningful than the rote, (d) Learning is a continuous process, (e) Learning requires a strong will, (f) The success of learning is determined by many factors, (g) Learning as a whole more successful than in divided, (h) Requires an appropriate method, (i) Requires compatibility between teachers and students, and (j) Requires the ability to capture the essence of the lesson. A similar propsed by Dewey about study (Trianto, 2007) that study on the problem is the interaction between the stimulus with the response, which is a two ways relationship between learning and the environment. Environment advising the students in the form of assistance or problems, while the nervous system that help interpret the brain function effectively so that their problems can be investigated, evaluated, analyzed and sought the solution well.

According Djamarah and Zain (2002), assessment of the success that can be seen from the success rate of learning is done with the formative test, summative tests, and achievement test. This is regarded as an assessment of learning outcomes that can be used as reference matter and evaluation of the process of teaching and learning activities. With this background, educators need to be considered an effective instructional design so that objectives can be achieved.

According to Herbert Simon, instructional design is a process of problem solving in learning. The goal of instructional design is to achieve the best solutions to overcome problems in learning. Sambaugh describes the process of instructional design as a series of activities which are linear as Figure 1 below (Sanjaya, 2008).

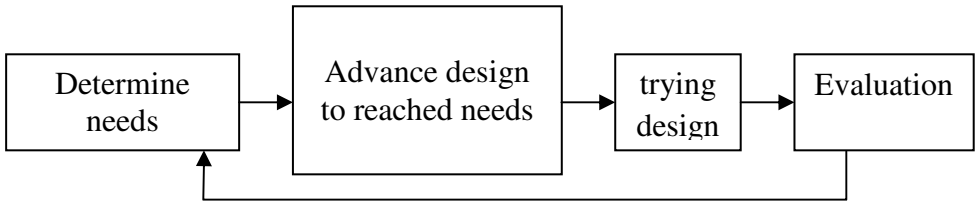

Figure 1. Design of learning as a series of linear activities
Source: Sanjaya (2008)

Gentry argues that instructional design with respect to the process of defining learning goals, strategies, and techniques for achieving objectives, and designing media that can be used to effev activities achievement of goals. So, it was concluded that the criteria for good instructional design must have criteria such as Oriented students, Based on a systems approach, and Tested empirically. (Zaifbio, 2009). Thus planning and the selection is done by considering all aspects so that objectives can be realized it is necessary to move the collection of information, as well as evaluating the pros and cons to consider the effect of which was decided in the selection of an instructional design.

This indicated that the PBI model provides a rich experience to the students so that they can improve their understanding of what is learned and can be applied in daily life

days. In addition, the advantages of PBI model that students involved in learning activities so that knowledge absorbed well, trained to work with other students, and can obtain information from various sources.

Developments in education have produced many types of learning model. According to Joyce and Weil, the general model is divided into four properties based learning activities, namely information processing model, a model of personal, social interaction models, and models behavioral. This classification is done based on the implementation of the learning model itself. Thus, an appropriate selection can improve learning outcomes and students' understanding of the matter, as well as learning goals can be achieved. (Zaifbio, 2009).

According to researchers who use PBI model, teaching is carried out to produce an increase in the value of result learning. According Indrayani (2009), teaching in SMK Negeri 2 Kebumen Semarang problems with the problem based instruction model has increased both in the cognitive, affective, and psychomotor aspects of student learning outcomes. Similarly, according to Sumarsono (2006) in SMA 1 Batang Semarang and Rusmiyati (2007) in SMA 3 Semarang. According to the Asy'ari (2008), in SMA 5 Klumpang districts Hamparan Perak learning with problem based instruction models gives results of higher learning than direct instruction. Similarly, according to Pakpahan (2009) in SMAN 1 Onanrunggu claimed Samosir model of problem based instruction provides fixes the value of learning outcomes for 48,20% (from 2,63 to 6,97).

PBI model has several advantages compared with other teaching models, including: (a) Encouraging cooperation in completing the task, (b) Encourage students to make observations and dialogue with others, (c) Involve students in investigating their own choices. So that students explain and develop his own understanding of the phenomenon, and (d) helping students become independent learners.

The purpose of PBI model are as follows, thinking skills and problem solving skills, cooperation by encouraging the emergence of various skills inquiry and dialogue, so that will develop social skills and thinking, and adult role model, help students perform in real life situations and learn about the importance of adult roles. Based on this background, the researchers intend to conduct quasy experimental study for show the effect of PBI model on learning outcomes in dynamic electrical matter in SMA Istiqlal Delitua A.Y. 2009/2010.

The aim of the research are to know how is learning outcomes with conventional model and how is learning outcomes with PBI model in dynamic electrical matter. Then, to know difference in learning outcomes with PBI model as significantly higher than conventional model.

The hypothesis used was there is a significant effect using PBI model on learning outcomes in a dynamic electrical matter in grade 10^{th} SMA Istiqlal Delitua A.Y. 2009/2010.

Methods

Based on the preliminary study conducted at Istiqlal Senior High School stating that the existing grade is homogeneous, then withdraw all of samples was determined using a *simple random sampling*. In the study used two types of research variables, namely the dependent variables and the control variable. The dependent variables are used *problem based instruction* model and independent variable is student learning outcomes of the dynamic electric matter. This study is a quasy experimental research that is intended to determine whether there is the influence of something imposed on students as research subjects, which can be seen from learning outcomes students.

This research design using a model of *two group pretest-posttest design* based on Table 1. This design is used to determine student learning outcomes by providing tests in both classes before and after a given treatment.

Table 1. Design of research

Class	Pre test	Treatment	Post test
Control	T_1	X_1	T_2
Experiment	T_1	X_2	T_2

Description: T_1 = Pretest; T_2 = Posttest; X_1 = Teaching with conventional model; X_2 = Teaching with the PBI model.

Instrument is used in the form of student learning achievement test which amounts to twenty five questions in the form of multiple choice with five options *(option)* and is given twice, during the pretest and posttest. In the assessment of the learning process are given worksheets and portfolio of student work.

In preparing this test used the validity of the content and validity of prophecy. To test the feasibility question then tested the validity, reliabelitas test, the level of difficulty, and the distinguishing test.

This test criterion is that if the $L_{count} < L_{table,}$ then the normal distribution. If the normality test data obtained in normal distribution, homogeneity test is then performed using the variance ratio test based on Eq. 1.

$$F = \frac{\text{var}\,ians\ of\ \max imum}{\text{var}\,ians\ of\ \min imum} \quad \text{(Sudjana, 1995)}$$

Then the value F_{count} compare with value F_{table} for α = 0,05 with $dk_{\ varians\ of\ maximum\ -\ 1}$ and $dk_{\ varians\ of\ minimum\ -\ 1}$. If the obtained value of F $_{\text{table}} \geq$ F $_{\text{count}}$, then the homogeneous data. For test the hypothesis whether the learning outcomes of students with *problem-based instruction* model is significantly higher compared with student learning outcomes with conventional models, so the truth can be accepted or rejected, the test statistic *t two tails* with a significant level α = 0,05.

In this case, the conclusion of the effect of problem based instruction model's on learning outcomes taken based on the value of *the t - test* on its right side, with the hypothesis. H_0 : There isn't a significant impact on learning outcomes by using the model of problem based instruction on the dynamic electrical matter in the second semester grade 10th SMA Istiqlal Delitua A.Y. 2009/2010. $H_0 : \mu_1 = \mu_2$. H_a : There is a significant impact on learning outcomes by using the model of problem based instruction on the dynamic electrical matter in the second semester grade 10th SMA Istiqlal Delitua A.Y. 2009/2010. $H_a : \mu_1 \neq \mu_2$.

With a value of μ average class population. Thus, *the t-test* and the standard deviation of the two parties combined mathematically expressed as follows:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \quad \text{(Sudjana, 1995)}$$

$$S^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2} \quad \text{(Sudjana, 1995)}$$

By: t : t from calculation; $\overline{X}_1$: Average experimental students' grade; $\overline{X}_2$: Average students' grade control; s : Standard deviation of the combined two class; S^2 : Variance of the combined two class; n_1 : Number of samples of an experimental class; n_2 : Number of samples of the control class

The test criteria, accept H_0 if: $-t_{1\ -\ 1/2\alpha} < t < t_{1\ -\ 1/2\alpha}$. Where $t_{1\ -\ 1/2\alpha}$ obtained from the t distribution list by $df = (n_1 + n_2 - 2)$ and opportunities $(1 - 1/2\alpha)$. For the price of other t, H_0 is rejected.

Analysis

To see if the same class then the other class using *t test*–two sample on values average pretest both classes. The test results obtained with α = 0,05, value t_{count} = 1,17 and t_{table} = 1,99. By comparing t_{count} and t_{table}, in order to obtain $t_{count} < t_{table}$, or 1,17 < 1,99, which means the two classes together as same. Hypothesis testing results can be seen in the following Table 2.

Table 2. Summary of Calculation of *t–Test*

No.	Data	Mean	t_{count}	t_{table}	Conclusion
1.	Pretest eskperimen class	47,46	1,17	1,99	*Both the same class*
2.	Pretest control class	45,00			

Source: Data analysed from result of research

The result of research to determine whether there is any difference in problem based instruction model's on learning outcomes in a dynamic electrical matter after the samples is given different treatment (given the experimental class treatment with PBI model and control class were treated using conventional model), based on posttest results obtained the following data shwon:

Table 3. Data Posttest In Both of Classes

Classroom Experiments				Control Class			
Value	Frequency	Value	Frequency	Value	Frequency	Value	Frequency
72	7	80,65	7,63	60	2	69,13	6,28
76	10			64	9		
80	9			68	11		
84	2			72	3		
88	2			76	4		
92	4			80	2		
96	3			88	1		
∑ = 37				∑ = 32			

Source: Data analysed from result of research

Before the first test of the hypothesis testing is a prerequisite normality test of data using the *Liliefors test.* Normality test results obtained can be seen in Table 4.

Table 4. Normality Test of Pretest Data In Both of Classes

Class	Pretest data		Conclusion
	L_{count}	L_{table}	
Experiment	0,127	0,146	Normality
Control	0,119	0,153	

Source: Data analysed from result of research

It shows that $L_{count} < L_{table}$, so that concluded that the data from both classes have normal distribution. Homogeneity test conducted to determine whether samples come from the class of a homogeneous population or not, meaning whether the samples used in this study may represent the entire population. Homogenety testing data conducted by *F test.* Results of homogeneity test data obtained $F_{count} < F_{table}$, which means that the sample used in this study revealed homogeneous or can represent the entire population of the existing. For test the hypothesis testing posttest values using *t-tests* that distinguish average grade posttest experimental and control groups with the purpose to determine whether there is any difference in problem based instruction model on learning outcomes. The results shows at α = 0,05 obtained by t_{count} = 6,82 and t_{table} = 1,99. By comparing t_{count} and t_{table}, so the obtained $t_{count} > t_{table}$ or 6,82 > 1,99 which means that H_a accepted and H_o rejected, so that there are significant differences using problem based instruction model on learning outcomes in a dynamic electrical matter in grade 10th SMA Istiqlal Delitua A.Y. 2009/2010. Hypothesis testing results can be seen in Table 6:

Table 6. Summary of Calculation *t – Test*

No.	Data	Mean	t_{count}	t_{table}	Conclusion
1.	Posttest eskperimen class	80,65	6,82	1,99	H_a accepted
2.	Posttest control class	69,13			H_o rejected

Source: Data analysed from result of research

Observations aimed to observe activity of the students with PBI model. From Table 7, can be seen that the development of socialization and cooperation of students in the group meetings was increased from I to III with attendance average value is shown.

Table 7. The Development of Group Learning Activities

Group	Meeting I	Meeting II	Meeting III
I	42,86	71,43	78,57
II	85,71	50,00	92,86
III	57,14	71,43	71,43
IV	42,86	71,43	85,71
V	50,00	57,14	71,43
VI	78,57	85,71	85,71
Mean	59,52	67,86	80,95
Average Overall		69,44	

Source: Data analysed from result of research

In Table 7, it can be seen that the development of student activities has increased during the period of the study by using a PBI model is improving student learning activities from the meeting I to III with attendance average values are all shown.

Table 8. The Development of Student Learning Activities

Meeting I			Meeting II			Meeting III		
% Thorough	Rating	∑	% Thorough	Rating	∑	% Thorough	Rating	∑
20%	very bad	3	30%	very bad	1	30%	very bad	0
30%	very bad	9	40%	bad	1	40%	bad	0
40%	bad	10	50%	bad	2	50%	bad	0
50%	bad	7	60%	poorly	16	60%	poorly	0
60%	poorly	3	70%	well	7	70%	well	6
70%	well	4	80%	well	3	80%	well	19
80%	well	1	90%	very good	7	90%	very good	12
Average success = 43,78%		37	Average success = 67,30%		37	Average success = 81,62%		37
Average = 4,38			Average = 6,73			Average = 8,16		
Average activity = 6,42 or 64,23%								

Source: Data analysed from result of research

This shows that the problem based instruction model not only improve learning outcomes, but also increase student activity, cooperation, and socialization among students. It can be seen from the increase in value of learning outcomes average posttest in the experimental class at 80,65. The results showed that there are significant differences using PBI model on learning outcomes in a dynamic

electrical matter in grade 10th SMA Istiqlal Delitua A.Y. 2009/2010.

Discussion

The results showed that there are significant differences using PBI model on learning outcomes in a dynamic electrical matter in grade 10th SMA Istiqlal Delitua A.Y. 2009/2010. This is strengthened by the acquisition value average pretest students in the experimental class was higher than control class.

Basically, the main objective of this research is to know the difference PBI model on learning outcomes. Sheet activities provided to each group require the listing of the activities of students during learning activities. Results of observations made by the observer indicated that the activity increased. In the development of socialization and cooperation of students in the group meetings was increased from meeting I to III with average value is wholly 69,44. For student activities meeting I average percent success of student activity at 43,78%. This happens because students are not familiar with the existing learning phase until the instruction and motivation given by researchers poorly understood by some students. Therefore, researchers continue to provide instruction and direction to students until the students are motivated to understand and implement, prepare, and work together in groups in this study. Meeting II obtained an increasing in value average of percent success activity 67,30%. This is because the students have started to understand and prepare their obligations and responsibilities in this learning; in this case, researchers continue to provide motivation and direction to students. Meeting III obtained an improvement of student activity with the value average percent success of the activity 81,62%. This is because the students have started to work together and understand their roles in this learning, so that was obtained average value of percent of the overall success of the learning activities of students is 64,23%. It turns out that student's activities in line with the increase in learning outcomes. In this case, the activity has a positive influence on learning outcomes.

When doing research, application of PBI model provides advantages such as giving equal opportunities to all students, they were randomized to be able to explain the matter from the conclusion of each group. This can be seen in the course of the presentation groups. PBI model teaches students to learn to be more responsible and work together in achieving the success of the group. This is seen when students learn in groups, students help each other and discuss the work and solve the existing problems on the worksheet and answer the questions posed by teachers.

Although problem based instruction model can improve result learning and student activities, but as long as there is still learning the constraints faced by the drawbacks, namely the group discussion there were some students who are quiet, less participation in completing the task groups, the unequal division of tasks, and indifferent attitude of the students. But the efforts are more concerned with and guiding students for work in groups with an active way to ask each student about what he has done in groups so students will be more motivated to be active in completing the task group to socialize. In addition, some students understand less and better understanding on the implementation of the instruction or problem based instruction model. Overcome this, the efforts made prior to start of learning first time described and given examples to students learning how the implementation and the results obtained so at the time of execution of students already understand what to do and not take more time for phases other learning.

Conclusion And Recomendation

Based on the research are found at first, learning outcomes with conventional model's of dynamic electrical matter is *enough*. This can be seen from the results of value average grade obtained during posttest of 69,13. Second, learning outcomes with PBI model on

the dynamic electrical matter is *good*. It can be seen from the results of value average grade obtained during posttest of 80,65. Third, there is significant higher using PBI model than conventional models. It is based on calculation results by *t test* t_{count} = 6,82 and t_{tabel} = 1,99, with $t_{count} > t_{tabel}$ (6,82 > 1,99), then H_a accepted and H_0 rejected thus stated that there are significant differences using PBI model on learning outcomes in a dynamic electrical matter in grade 10th SMA Istiqlal Delitua A.Y. 2009/2010. From these differences can be seen that the effect of significantly higher usage PBI model on learning outcomes in a dynamic electrical matter.

Based on the implementation, results and conclusions of research, researchers suggest for the next researcher who conducted the study with PBI model and recommended more attention to guiding students for work in groups with active way to ask each student about what he has done in groups so students will be more motivated to be active in groups to complete tasks with socializing. Beside it, before to start of learning first time described and given examples how the implementation and the results obtained so at the time of execution of students already understand what to do and not take more time for phases other learning.

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