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APPLICATION OF PROBLEM BASED LEARNING MODEL ON STUDENT LEARNING OUTCOMES ON MOMENTUM AND IMPULSE MATERIALS

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Abstract

This reasearch aims to establish the effect of Problem Based Learning (PBL) on Student Learning Outcomes in Momentum and Impulse Material in Medan 14 SMA A.Y.2018/ 2019. This study used the quasi-experimental method with the research design of two design pretest-posttest groups. The population of this research was all students of class X. The sampling technique used cluster random sampling consisting of two classes with a total sample of 66 students. The instruments used were essay tests totaling 9 validated items and observation sheets for student learning activities. Analysis can be done by testing normality, homogeneity and t. The results of the study showed that there were differences in student learning outcomes taught by using PBL models with a posttest average value of 76.79 compared to students who were taught with conventional learning with a posttest average value of 67.73. From these results, it can be concluded that the PBL model is better used in improving student learning outcomes.

Keywords: Learning Activities, Learning Outcomes, Problem Based Learning

Education is one form of embodiment of a dynamic and growing human culture. Changes or developments in education are things that do occur in cultural change. Education that is able to support future development is education that is able to develop students, thereby supporting the difficulties that occur in life (Trianto, 2011). The Education System in Indonesia currently uses the revised 2013 Curriculum which aims to make students have higher-order thinking skills at Higher Order Thinking Skills (HOTS). HOTS is a process of thinking that not only memorizes and conveys information that is already known, but the skill to connect turns existing knowledge and experience into creative thinking in making decisions and solving problems in new situations. Students who have high-level thinking skills in learning will cause them to be accustomed to analyzing, creative thinking in solving problems found in daily life (Simanjuntak, 2018).

One of the objectives of Physics in High School is that students have the ability to develop the ability to reason in thinking inductive and deductive analysis by using concepts and principles of physics to explain various natural events and solve problems, both qualitatively and quantitatively. Thus, it is hoped that through physics learning students can develop themselves in thinking. Students are required not only to have the ability to think at a lower level, but to the ability to think at a higher level.

In fact, the implementation of learning activities in schools is not in accordance with the above expectations. The problem faced is the weak learning process. This is because the teacher is still not optimal in preparation. Children are less encouraged to use thinking skills. The learning process in the classroom is directed at the child's ability to memorize information; the child's brain is forced to remember and hoard a variety of information without being required to understand the information it remembers to connect it in daily life (Ngalimun, 2014)

The results of preliminary observations conducted at SMAN 14 Medan by using a questionnaire showed 53.1% of students said they did not like physics, with the reason that physics was very difficult to understand because it focused on remembering so many formulas. 70.4% of students said that teacher learning rarely connects Physics material with everyday life. 71.8% of students said the teacher's teaching method only recorded material, ignited the formula, and worked on the questions. This statement was reinforced based on interviews with the Physics Teacher Mr. Drs. Hotman Arnol, M.Si. He stated that some students did not give good responses and were less active when learning physics. Students are more enthusiastic if the material being taught is related to daily life. He also said students were still unable to apply physical concepts in the real world and if they gave questions that were slightly different from the examples given, only a few students were able to solve them, students were not yet able to fully have the skills to solve these problems, especially authentic problems. The learning strategy commonly used by teachers is conventional learning that is teacher-centered by teaching concepts or material and using formulas in a balanced manner.

Difficulties in understanding the concepts of physics are still abstract and complicated, so the learning process is not optimal. This problem can be seen from their low skill in solving problems which is one of HOTS components. The low level of problem-solving skills of students was also seen when the researchers tested the HOTS problem in students in class XI IPA 3, where 63.3% of students were still incomplete with Minimum Completion Criteria (KKM). One of the reasons for the low physics problem solving skills of students is that there are still many teachers in the learning process. In addition, the average cognitive ability of students is also still at the level of remembering, understanding and applying based on the questions given. Students' thinking ability is still classified as low-level thinking ability.

In solving problems there are still many students who are not in accordance with what is desired, there are still many students who do not understand what the purpose of the problem is, what is sought in the problem, what is known in the problem, so that in the problem-solving stage

there are still many students who do not know the symbols of physical formulas, and do not write what is known and asked in the question.

A common problem faced by physics teachers in schools is the lack of ability to develop learning models or methods that can improve students 'thinking processes to achieve problem solving abilities and the lack of teacher's desire to bring students to the actual environmental conditions, so it is fewer provoking students' thinking processes to can solve a problem that is around it or achieve an understanding of the concept of learning.

Responding to the problems above, it is necessary to have models that orient learning to real problems that create student involvement in teaching and learning to foster students' problem-solving skills. Familiarizing scientific work is expected to foster habits of thought and action that reflect the mastery of scientific knowledge, abilities and attitudes possessed by students, so that the learning model itself will result in increased knowledge, abilities and scientific attitudes of students as a result of learning (Abubakar, 2018).

According to Arends (2018) Problem Based Learning Model is a learning model that organizes learning around questions and problems through the submission of authentic and meaningful real-life situations, which encourages the process of inquiry and inquiry, by avoiding simple answers, and allowing for various kinds of solutions from the situation. Learning based on student activeness problems is preferred because activities in PBL include analysis of problems, formulating hypotheses, planning research as implementation.

The Problem Based Learning Model emphasizes the problem-solving process. Through problem solving in the PBL Model students are directed to build new knowledge, solve problems in various contexts (Simamora, 2017). The use of the PBL Model was chosen because there are several studies that have good results. PBL Model is able to improve students' thinking ability in finding and finding their own solutions to problems (Zabit, 2010).

METHOD

The research was conducted at SMA Negeri 14 Medan, Medan Denai, Medan City, North Sumatra. When the research was conducted on March 10 to May 25 in class X Even Semester A.Y. 2018/2019. The population in this study were all students of class X which consists of 7 parallel classes. The sample in this study consisted of two classes namely class X IPA 2 as the experimental class, and class X IPA 4 as the control class, each of which amounted to 33 people. The experimental class and the control class were taken by cluster random sampling technique.

This research involved two classes, the experimental and the control class which were taught with different models. The PBL model is the experimental class, whereas the control class uses conventional learning. The pretest-posttest control group research design can be seen in Table 1.

Table 1. Two Group Pretest- Posttest Design

Class	Pretest	Treatment	Posttest
Experiment	X_1	Y_1	X_2
Control	X_1	Y_2	X_2

Information :

X_1 = Pretest
X_2 = Posttest
Y_1 = treatment in the experimental class that is the application of inquiry training models with multi-representation
Y_2 = treatment in the control class that is the application of conventional learning models

Researchers provide pretest in the experimental class and the control class. The instrument used in this study consisted of 9 essay questions. The learning outcomes test is standardized using the content validity test by two lecturers and one teacher according to the expert experts. After the pretest data is obtained, data analysis is done with the normality test, namely the Lilliefors test, the homogeneity test and the variance similarity test. After that the two parties 't-test hypothesis is tested to determine the students' initial ability in the two sample groups, in this case the initial abilities of the two samples must be the same. Furthermore, researchers teach subject matter by using PBL models in the experimental class and conventional learning in the control class. Posttest data is conducted prerequisite test with normality test and homogeneity test, then t test is done to find out whether there is an influence of PBL model on student learning outcomes compared to conventional learning on the subject matter Momentum and Impulse.

RESULT AND DISCUSSION

Result Research

The data described in this study include data on student learning outcomes on material momentum and impulses, which are given different treatments, namely 1) problem based learning model, 2) conventional learning. The results of the pretest data of the experimental class and the control class can be shown in Table 2 below

Table 2. Data Value Pretest Experiment Class and Control Class

No.	Experiment				Control			
	Score	F	Average	SD	Score	f	Average	SD
1	6-10	8			6-10	9		
2	11-15	7			11-15	6		
3	15-20	11	15.42	6.63	15-20	7	16.39	7.81
4	21-25	4			21-25	6		
5	26-30	4			26-30	5		
	n= 33				n=33			

Table 2 shows that the pretest value in the experimental class and the control class has a low value but the value of the experimental class and the control class is not much different, the average comparison of the values is 15.42 and 16.39.

The frequency distribution of posttest data of the experimental and control class students can be visualized in Table 23

Table 3. Data on The Post-Test of The Experimental Class and The Control Class

No.	Experiment				Control			
	Score	F	Average	SD	Score	F	Average	SD
1	56-60	0			56-60	2		
2	61-65	2			61-65	7		
3	66-70	21			66-70	17		
4	71-75	6	76.73	5.69	71-75	5	67.73	4.78
5	76-80	18			76-80	2		
6	81-85	3			81-85	0		
7	86-90	2			86-90	0		
	n= 33				n=33			

Table 3 shows that the posttest value of the experimental class is higher than the posttest value of the control class, the average comparison value is 76.73 and 67.73. There is an increase in student learning outcomes obtained in both classes, but the experimental class is better than the control class.

Discussion of Research Results

Based on the results of the hypothesis conducted by researchers using the t test, the results obtained t_{count} = -5.46 and t_{table} = 1.67 because the value of t_{count} is greater than the value of t_{table} (-5.46> 1.67). This shows that there are significant differences due to the influence of the implementation of PBL models on material Momentum and Impulses in class X of semester II at 14 Medan Senior High School A.Y. 2018/2019. From the results of the normality test in Table 4.6 in the hypothesis test, $L_{count} < L_{table}$ (0.1309 <0.1544) means that the sample is normally distributed. The

homogeneity test results in Table 4.7 also show that $F_{count} < F_{table}$ (1.420 <1.830) means that the sample used in the study represents the entire population (homogeneous). This is in accordance with the results of previous studies by Boangmanalu (2018) that based on the results of the t test showed $t_{count} > t_{table}$ (0.42 <1,998) means that there is a significant effect on student learning outcomes by using PBL models with pre- test and post-test in the experimental class were 39.40 and 76.17 while the control class taught with conventional learning with an average value of pre-test and post-test were 38.08 and 61.69.

This proves the learning outcomes of students who use PBL models better than conventional learning. These results are obtained because the PBL is a model that is based on the many problems that require authentic inquiry, namely investigations that require real solutions. PBL is innovation in learning because in PBL students' thinking skills are really optimized through a systematic process of group work or teams, so that they can empower, sharpen, test, and develop their thinking skills on an ongoing basis (Rusman, 2012).

The advantages of applying the PBL model are first, students become accustomed to solving problems given by the teacher, thus making students more independent. The research results obtained are in line with research conducted by Abanikanda (2016). Second, the application of the PBL model makes students think critically, in line with research conducted by Tarigan (2017). Third, the application of the PBL model has been proven to increase student learning activities in line with research by Nurliana and Juliani (2015).

Weaknesses in the application of PBL models in research are in the first phase, which is to provide orientation to the problem to students, some students, are less able to connect problems in daily life, so they lack confidence in solving problems, in the third phase which is to assist investigations independent and group, there are still many students who are confused in carrying out the practicum because they are not accustomed to using the tools and practicum materials and do not understand the work procedures that they will do, causing the class to be less conducive and controlled and in the fifth phase which is to present and evaluate the process of solving problems, researchers lack time so that each group presents the results of the discussion in front of the class because it takes a lot of time in the third phase, namely in the process of investigating the problem.

CONCLUSIONS

Based on the results of research obtained from the results of data analysis and hypothesis testing it can be concluded as follows: The results of learning physics students are taught by using

the PBL model (Problem Based Learning) in the material momentum and impulse in class X Semester II in 14 Medan High School A.Y. 2018/2019 experienced an increase with an average pretest score of 15.43 after being given treatment the average student learning outcomes experienced an increase of 76.79. Learning outcomes are learned by using conventional learning on the material momentum and impulses in class X Semester II in SMA Negeri 14 Medan A.Y. 2018/2019 has increased with an average score of 16.39 pretest and posttest average value 67.73 and Effect of PBL model based on the results of t-test calculations that are differences due to the influence of the use of PBL models on student learning outcomes in material momentum and impulses in class X Semester II in SMA 14 Medan A.Y. 2018/2019.

Based on the results and conclusions in this study, the researcher has some suggestions in applying PBL models, namely in the first phase, researchers should be more motivating students to be involved in problems related to daily life, in the third phase, the time for practicum implementation in This research is less conducive and controlled because it is not accustomed to using practicum tools and materials and does not understand the work procedures that they will do, so for further research the researchers suggest to further optimize the class, supervise PBL models and provide rules that must be obeyed by students during practicum activities take place

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REFERENCES

Abanikanda, (2016). Influence of Problems Based Learning in Chemistry on Academic Achievement of High School Students in Osun State Nigeria. Journal of Education 4(3):55-36.

Abubakar & Panjaitan, M. E., (2018). Pengaruh Model Problem Based Learning Terhadap Kemampuan Pemecahan Masalah Pada Materi Suhu dan Kalor di Kelas X Semester II SMA Negeri 5 MedanA.Y.2017/2018. Jurnal Inpafi 6(4):1-8.

Arends, Richard. I.(2018). Belajar Untuk Mengajar. Jakarta: Salemba Humanika.

Boangmanalu, S., dan Manurung, S.R., (2018). Pengaruh Model Pembelajaran Berbasis Masalah Terhadap Hasil Belajar Pada Materi Suhu dan Kalor di Kelas X Semester II SMA Swasta Nusantara Lupuk Pakam A.Y. 2016/2017. Jurnal Inovasi Pembelajaran Fisika. 6(4).70-76.

Nurliana dan Juliani, R.,(2015). Pengaruh Model Pembelajaran Berbasis Masalah Terhadap Hasil Belajar Siswa Pada Materi Pokok Gerak Lurus Kelas X Semester I SMA Negeri 11 Medan T.A. 2014/2015. Journal Inpafi.3(1):139-146.

Rusman, (2011). Model-model Pembeljaran. Jakarta: Raja Grafindo Persada

Simamora, R. E., Sidabutar, D. R., danSurya, E. (2017). Improving Learning Activity and Students' Problem Solving Skill through Problem Based Learning (PBL) in Junior High School.International Journal of Sciences. 33(2):321–331.

Simanjuntak, M.P., dan Ramadhani, D. (2018). Pengaruh Problem Based Learning Berbantuan Simulasi Komputer dalam Meningkatkan Keterampilan Berfikir Kreatif Siswa. Jurnal Inpafi:1-8.

Tarigan, R., (2017). The effect of Problem Based Learning Model for Student Learning Outcomes on Materials Temperature of Heat and Heat Transfer in Class X Semester II SMAN 16. Journal of Research and Method in Education. 7(5):32-37.

Trianto.(2011). Mendesain Model Pembelajaran Inovatif –Progresif Konsep, Landasan, dan Implementasinya Pada Kurikulum Satuan Pendidikan. Jakarta: Kencana.

Zabit, M. N. M. (2010). Problem based Learning On Students Critical Thinking. A Literature Review. American Journal of Business Education (AJBE), 3(6), 19–32