Proceeding: The First International Seminar on Trends in Science and Science Education 2014 – ISBN 978-602-9115-37-6

SE-004

THE EFFECT OF PROBLEM BASED LEARNING MODEL TOWARD STUDENTS' SCIENCE PROCESS SKILLS IN SENIOR HIGH SCHOOL

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ABSTRACT

This study aims to determine the effect of problem based learning model toward students' science process skills on the material of Waves and Sound. This research is a quasi experiment with the entire population of high school students of class XII SMA HKBP Sidorame Medan academic year 2014/2015. The instrument used in this study is science process skills test in the form of description. The observation of science process skills made during the process of learning and science process skills test conducted after the application of learning models. The data of science process skills test were analyzed by statistical test with hypothesis testing by using t-test. The increase of science process skills were analyzed with the normalized gain value, N-gain. The results showed that the model of problem-based learning (PBL) effect on students' science process skills on the material of Waves and Sound. The application of PBL models can improve students' science process skills better than conventional models and are included in the medium category.

Keywords: *Model of problem-based learning, science process skills*

INTRODUCTION

Science is the study of natural phenomena. Physics as one element in science has a very important role in the strategic and future technology development. Therefore, in promoting science and technology, physics learning process should receive more attention from elementary to university level. Physics as a branch of science is formed and evolved through a scientific process, which also must be developed on the learner as a meaningful experience that can be used as a provision for further self-development. Learning physics is essentially a product, process and scientific attitude. The nature of physics as product includes facts, concepts, principles, theories and laws. In terms of process, physicists determine the variables studied, with observing, questioning, hypothesizing, predicting, find patterns and relationships, communicate, design and create, plan and conduct investigations as well as measuring and counting. Such activities are part of the science process skills (SPS) (Harlen & Elstgeest, 1992). SPS emphasis on skill formation acquire and communicate knowledge acquisition. Skills means the ability to use the mind, reason and act efficiently and effectively to achieve a particular outcome, including creativity.

Based on the above, it can be stated that students need to be equipped science process skills. In fact, in the process of teaching and learning in school, physics teachers were more stressed as the physical delivery of the product and the students try to memorize it. Teachers tend to emphasize the mathematical equations in solving physics problems not train students in a science process skills.

One model that involves students' active learning to increase the skills of its scientific process is the model of problem-based learning (PBL). PBL is a learning approach that uses learning problems as a starting point and to be able to solve that problem learners require new knowledge. In solving the problem, PBL prefer the activity of students for activity in PBL include observation of the problem, formulating the hypothesis, planning up to the implementation of the research, until obtain a conclusion of the answer to the given problems. Then the model PBL is very suitable when used in science process skills for activity in PBL can provide experience investigating the use of problem-solving activities through investigation as contained in the science process skills.

The implementation of PBL models will help students learn about the content and skills to solve problems involving learners in situations related problems of their real life. In the PBL students are faced with the problem of authentic (real) so hopefully they can construct their own knowledge, develop the skills of the process, make student independence and boost their confidence. The benefits of using the model PBL is to train students to improve the skills, creative, problem-solving skills to new situations and circumstances in the future, working together in groups and capable of presenting and communicating effectively, both orally and in writing.

Observing the importance of the application of PBL models, this research aimed at applying the PBL models to determine the effect of problem based learning models of the science process skills of students on the material of Waves and Sound

METHODOLOGY

This research was conducted at the SMA HKBP Sidorame Medan. The population of this study were all students of class XII in SMS Sw. HKBP Sidorame, Medan academic year 2014/2015 consisting of two classes with 50 students. The sample of this research consisted of two classes, totaling 26 students for experiment class and 24 students for control class. The experimental group was given a model of problem-based learning (PBL) while the control class using conventional teaching to the science process skills of students on the Waves and Sound material.

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Type of research is quasi experimental with two group pretest posttest design. The instrument used in this study are: observation and science process skills test in the form of description. Indicators of science process skills include observing, formulating hypotheses, predicting, find patterns of relationships, communicating, mastering tools / materials investigation and measure / calculate (Harlen & Elstgeest, 1992). Science process skills test conducted after the application of learning models. Science process skills test data were analyzed with statistical test of hypothesis testing using t-test. Improved science process skills is determined by the average scores of normalized gain, N-gain. The level of N-gain can be classified as follows: (1) if N-gain> 70%, then the N-gain generated in the high category; (2) if 30% ≤ N ≤ 70% gain, then the N-gain generated in the medium category; and (3) if N-gain <30%, then the N-gain resulting in a lower category (Hake & Richard, 2002).

Syntax PBL models used in this study are: the orientation of students to an authentic problems, organize students in learning, helping students individually or in groups to conduct research, develop and present the results of the work and the analysis and evaluation of problem-solving process (Arends, 2008).

RESULTS AND DISCUSSION

Results. The study begins by providing a pretest to determine the initial capability in terms of students' science process skills (SPS). The results of the experiment class pretest obtain an average value of 33.56 and a control class scored an average of 34.79. Based on the results of tests of normality and homogeneity, data showed normal and homogeneous. Based on the hypothesis test using a different test (t-test) showed that the experimental classes and control classes have the same initial ability in other words that the two classes are not significantly different. Since both classes have the same ability in terms of science process skills, than both of the classes sample given a different treatment, the experimental class was given treatment by applying the model of PBL while the control class is given the treatment by applying conventional learning. After being given a different treatment, both classes are given post-test to see any difference due to the application of different learning models. The average value of posttest in experimental was 64.90 while the average value posttest in control class was 60.83. Based on t-test showed that there was an effect of the application of PBL model of science process skills of students. In other words, PBL models increases students' process skills better then conventional models. Pretest and posttest results both classes is shown in Figure 1.

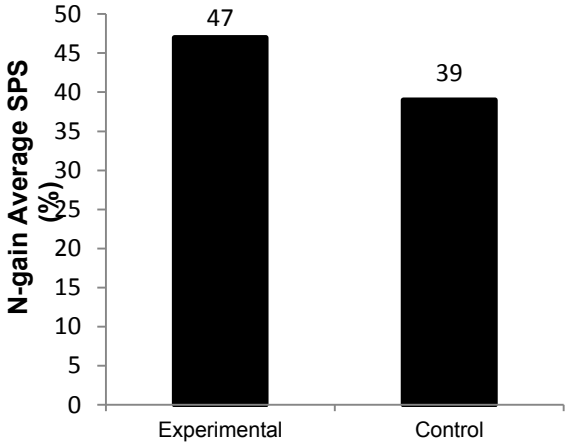

Figure 1. The Average Comparison of Science Process Skills Among Experiment Group and Control Group

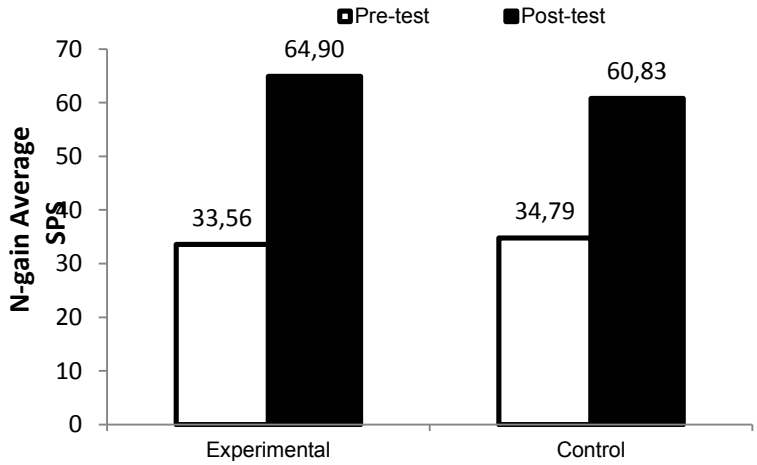

Figure 2. Comparison of the N-gain SPS between Experimental Group and Control Group

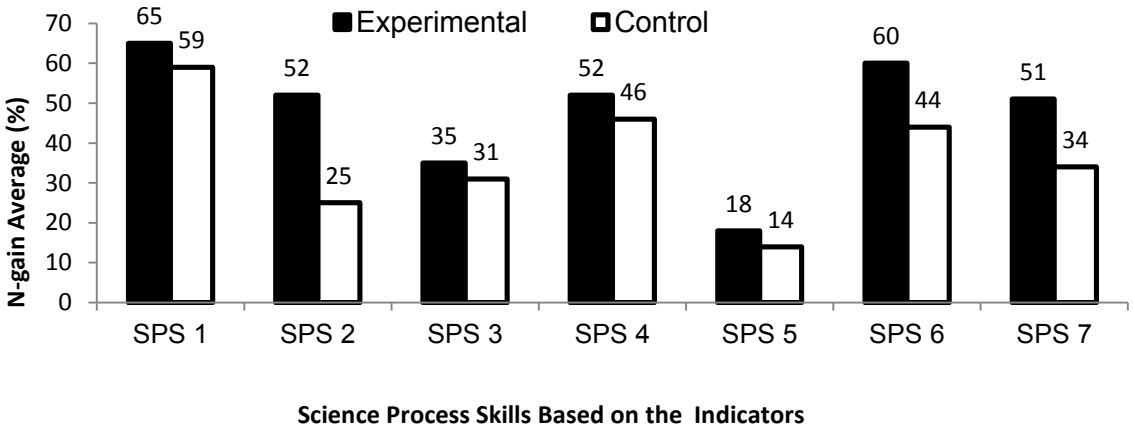

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Figure 3. Comparison of the N-gain each indicator SPS both in Experimental Group and Control Group

Improved science process skills is determined by the average scores of normalized gain, N-gain. Percentage of increase in N-gain SPS for the experimental class was 47%, it is including in the medium category and percentage of increase in N-gain for the control class was 39%, and it is including in the medium category. Percentage of increase in N-gain SPS for both experimental and control classes are shown in Figure 2. Based on Figure 2 it can be seen that the increase in N-gain

SPS can be described by its indicator, that is observed (SPS 1), make a hypothesis (SPS 2), predicted (SPS 3), finding patterns (SPS 4), communicating (SPS 5), master the tools / materials investigations (SPS 6) and measure and calculate (SPS 7) as shown in Figure 3. The amount of percentage of N-1 gain SPS, SPS 2, 3 SPS, SPS 4, 5 SPS, SPS 6 and SPS 7 respectively in a row is 65% ; 52%; 35%; 52%; 18%; 60%; and 51% and 59% for the control group; 25%; 31% 46%; 14%; 44%; and 34%. The highest increase percentage of N-gain SPS for the experimental group occurred in observing indicators and master the tools and materials investigations while the lowest in terms of communicating. The results showed that the students' science process skills due to the influence of PBL models better than conventional learning in the Waves and Sound material. This is indicated by the difference between the science process skills upgrading experimental class with the control class.

Discussion. Upgrading the skills process in experimental class has a higher value and significantly different compared with the control class with 47% and 39% for each % N-gain. Increased N-gain the science process skills vary for each indicator, but overall, including the medium category, for both experimental and control group classes. Based on the different test, both groups showed differences in science process skills significantly.

The results of the above studies indicate that the problem-based learning physics effectively improve students' science process skills in the material Waves and Sound. When examined further by Figure 3, it appears that the% N-gain science process skills of students in the experimental class, for each indicator science process skills are always higher than the control class.

Based on Figure 3, it can be seen that the increase in % N-gain science process skills were highest for the experimental group occurred in observing indicators and master the tools and materials investigation. The highest increase in science process skills in observing indicators, it is possible because through problem-based learning, students are not only required for the orderly follow steps in the available guidance, but students are required to be able to use the senses to gather information, capable identify the differences between the same object or event, able to identify similarities between different objects or events, able to notice details that

are relevant to the investigation, being able to recognize when the execution order of the learning takes place, able to distinguish the observations of any problems that exist.

After observing, the highest increase in the science process skills is mastering indicator investigation tools and materials, it is possible because through problem-based learning, while an investigation through experiment, students are required to be able to use the tools and materials as well, able to maintain and care for tools and materials, being able to assemble / modify the tools and materials and are able to do a good job with good precision.

The implementation of problem-based learning can enhance science process skills, in accordance with the terms in Gbolagade (2009) and Adedigba (2002) which states that in the problem-based learning, students' participations are more active to solve the problem. This is supported by Ukohn (2008) and Miller (2004) which was separately stated that problem-based learning facilitates the students to be able to increase their scientific process skills. This is possible because the students were allowed to take over their learning, find the solution of the problem so that their skills are trained. This is supported also by Kinshuk (2003) who reported that by applying problem-based learning, students can learn and construct a better knowledge and actively participate striving to solve encountered problems. In problem-based learning, students work in groups to solve one or more complex problems and interesting and related to daily life. Students are developing their skills in collecting, evaluating and synthesizing resources and then propose a solution. Students are required to make conclusions and present their solutions. Teachers only facilitate the learning process by monitoring the progress of learners and help students make inferences, the teacher is not the only resource to provide material or information, but rather to guide students as they seek out the appropriate resources (Major and Palmer, 2001 and Ukoh 2009).

Furthermore Major and Palmer (2001) stated that the problem-based learning gives students the opportunity to gain knowledge and skills, helping students develop higher cognitive abilities such as critical thinking, problem solving and communication skills as well as improving students' attitudes toward learning.

CONCLUSION

The results showed that the model of problem-based learning (PBL) effect on science process skills of students on the material Waves and Sound. The application of PBL models can improve students' science process skills better than conventional models and are included in the medium category.

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