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The Implementation of Problem Based Learning Toward Critical Thinking Skills of Student on General Physics I

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ABSTRACT

This research aims to apply the model of Problem Based Learning (PBL) to improve students' science process skill in material Temperature and Heat. Population in this research is all students who contracted course of General Physics I Academic Year 2014/2015 FMIPA in one of the colleges in Medan. Sample of research is selected by cluster random sampling which consisted of one class with amount 26 students. The method used in this research is pre-experimental with one group pre-test post-test design. The research instrument used is the science process skill test amounted to 40 items formed like multiple choice in material Temperature and Heat. Based on the result of data analysis test showed that by applying model of Problem Based Learning can enhance science process skill of students. Percentage of students' critical thinking skill N-gain increasing is 44% in medium category.

Keywords: problem based learning, critical thinking, temperature and heat

INTRODUCTION

Thinking as a mental ability that can be divided into several types, including logical thinking, analytical, systematic, and critical. Logical thinking is a thinking skill to draw legitimate conclusions according to the rules of logic and can prove that the conclusions are true according to previously known knowledge. Analytical thinking is the thinking skill to describe, detail and analyze the information used to understand a knowledge by using logical reasoning, not just by feeling or guess. Systematic thinking is the thinking skill to do or accomplish a task in the proper order, step, or plan, effective and efficient. Logical, analytical, and systematic thinking are interrelated. Someone is said to think systematically if he thinks analytically and understands the information used. To think analytically need logical thinking skills in taking conclusions on the situation.

Critical thinking is a set of cognitive skills and intellectual dispositions necessary for basic clarification, basic support, inference, advanced clarification, and strategy and tactics (Ennis 1996, 1987). Critical thinking can be viewed as a thinking skill to compare two or more information and can conclude it with consideration, clarity and can evaluate from what has been obtained from that thought. Critical thinking according to Costa (1985) is part of the embodiment of higher order thinking skills (HOTS).

In recent years, critical thinking has become a very popular term in the world of education from basic education to higher education because critical thinking allows students to discover the truth among the events and information faced every day. Critical thinking also helps students to survive in today's development.

Based on the description above , critical thinking skills are important to be trained to students, especially in physics learning. For students, critical thinking skills are needed primarily to understand the concepts in the course being studied. Students with good critical thinking skills can analyze problems, identify related concepts, consider the credibility of relevant sources of information, analyze arguments, critique opinions and evaluate possible solutions so as to produce the best possible solutions.

One of the learning models that can train students' critical thinking skills is the problem based learning (PBL) model. PBL is a learning model that uses real-world problems as a context for students to train their skills to acquire essential knowledge and concepts. The PBL model uses contextual problems to stimulate students to generate curiosity, so it is more motivated to seek information as a solution to the problem (Arends, 2012). Problem based learning is designed on the basis of real life issues that are ill-structured, open, and ambiguous (Forgaty, 1997). Information seeking process in order to solve this problem will help students in constructing their knowledge, creative, and also able to develop their critical thinking skill.

Based on the description above, the purpose of this study is to determine the improvement of students' critical skills with the application of PBL model.

RESEARCH METHODS

The population in this study is all FMIPA students in one of the universities in Medan who contracted General Physics I in First Semester. The sample of this study consists of two groups, namely the experimental group applying the PBL model and the control group with conventional learning. Each group has 42 people. The method used in quasi experimental research with randomized control group pretest-posttest design. Both groups were given preliminary and final tests and only experimental groups were treated. The research design used is shown in Table 1.

Table 1. *Pretest-Posttest ControlGroupDesign*

Group	Pretest	Treatment	Posttest
Experiment	O_1	X_1	O_2
Control	O_1	X_2	O_2

Ket:

O_1 = Pretest of critical thinking skills

X_1 = General physics based learning problems

X_2 = General Physics Learning conventionally

O_2 = Posttest of critical thinking skills

The data collection instrument is a description test of 16 questions that has been validated based on indicators (McLean, 2005). The percentage increase in science process skills is sought by using N-gain with the equation:

$$\text{N-}gain = \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}} \text{ x } 100\%$$

Where: N-*gain* = Normalized N-gain

S_{post} = posttest score,

S_{pre} = pretest score

S_{max} = ideal maximum score

With categories: high: N-*gain*>70; medium 30 ≤ N-*gain* ≤70; and low: N-*gain*< 30 (Meltzer, 2002).

RESULTS AND DISCUSSION

Indicators of critical thinking skills used in this study include: clarifying problems, concluding and interpreting, supporting conclusions and interpretations, and evaluating (McLean, 2005). The effectiveness of problem-based learning model test in improving critical thinking skills is expressed by% N-gain. Test results Based on Table 1shows that the N-gain of students' critical thinking skills, in the experimental group and the control group is normally distributed and the variance is homogeneous. Significance of difference % N-gain critical thinking skills between the two groups using different test (t-test). Different test results show that the application of problem based learning model is significantly more effective in improving students' critical thinking skills on the topic of Temperature and Heat.

The average of pretest and postes of critical thinking skills in the experimental classes were 26.38 and 66.15. The mean values of pretest and postes in the control classes are 27.82 and 58.18. The value of pretest and postes of critical thinking skills in each class is shown in Figure 1.

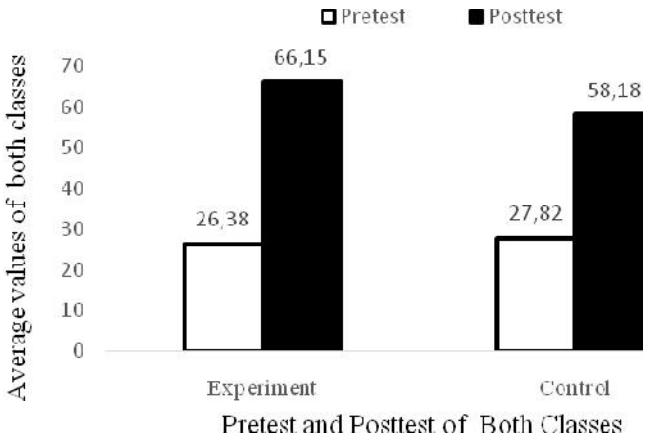

Figure 1. Average Values of Pretes and Postes of Critical Thinking Skills of both classes

Based on Figure 1, it can be seen that the improvement of critical thinking skills achieved by the experimental group is higher than the control group. Based on the% N-gain of critical thinking skills achieved by the experimental group and the control group it can be concluded that the application of problem based learning model can more effectively improve students' critical thinking skills compared with the use of conventional learning model.

Table 2. Pretest, Postes and N-gain Improvement Critical Thinking Skills

Experiment Group					Control Group					Varians % N-$gain_{Eks}$with % N-$gain_{Kont}$	*p*
Ave. of pretest	Ave. of postest	N-*gain* (%)	Cate-gory	Distri-bution of % N-*gain*	Ave. of pretest	Ave. of postest	N-*gain* (%)	Cate-gory	Distri-bution of % N-*gain*		
26,38	66,15	59	medium	normal	27,82	58,18	49	medium	normal	homogeneous	0,000 (significant)

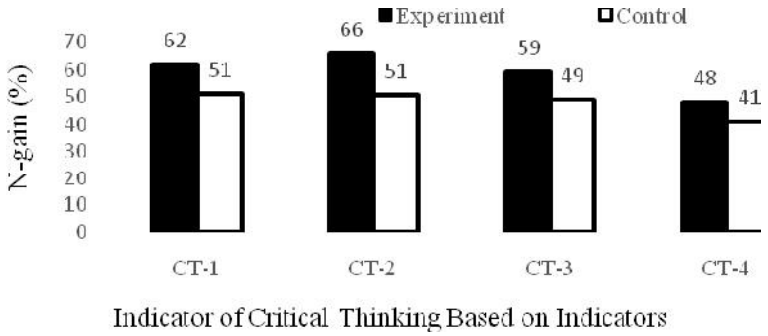

Figure 2. Comparison of% N-gain Critical Thinking Skills Based on Indicators in Both Groups. Indicator CT-1 = clarifying problems, CT-2= concluding and interpreting, CT-3=supporting conclusions and interpretations, and CT-4= evaluating

The percentage of N-gain of critical thinking skill can be described based on each indicator between the experimental group and the control group as shown in Figure 2. The lowest N-gain of critical thinking skills for the experimental group and the control group occurs in the evaluating indicator. This can happen because evaluating activities require a high-level thinking process.

The PBL model can influence critical thinking skills, this can happen because with the PBL model, in the learning process, students are presented with contextual problems, then they make a temporary hypothesis before doing further investigation. Plan and perform a trial to collect the necessary data in troubleshooting. With these activities, students are trained in their level of thinking, more creative and innovative.

CONCLUSIONS

The conclusions obtained based on the results of research that has been done is as follows: (1) Based on the results of the research, it is found that there is a significant effect due to the application of learning problem based learning model to the critical thinking skills of students learning in the students' cognitive domain on Temperature and Heat materials, (2) The percentage increase in learning outcomes for the experimental class is higher than in the control class and is included in the medium category.

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