



EFFECTIVENESS OF PROBLEM SOLVING LEARNING MODEL ON STUDENTS' CRITICAL THINKING SKILL

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Abstract

The purpose of this research was to know the effectiveness of problem solving learning model to the critical thinking of student. The population of the research was students grade X at one of high school in Medan academic year 2013/2014 that consist of three classes in which there are 30 students each class. The research's sample was two classes by using cluster random sampling technique. First class as experiment class by implementing problem solving learning model and second class by implementing conventional learning model. The method that used in implementing model was experimental quasi with randomized control group pretest-posttest design. Data of critical thinking skill was collected by essay test. Data was analyzed by using a normalized gain value, N-gain. The result of research showed that learning based problem solving is effective in improving the critical thinking of students in learning material "Straight Motion" and was include in high category.

Key words: problem solving learning model, critical thinking skill.

INTRODUCTION

The globalization era with high development of sciences and technology, provide many benefits and convenience for human in carrying out the daily activities such as in communication, travelling, diseases detecting and etc. However, beside all of the positive impact, there are more complex problem such as global warming and degradation of moral. it identifies that the challenges for future generation will be more difficult. Tinio (2003) stated that one of skill needed to face challenges in future is higher order thinking or sometimes called critical thinking.

The word critic comes from Greek (*kritikos*) and kriterion (Paul, Elder & Bartell in Suriadi, 2006). Word *kritikos* means judgment, whereas kriterion means standard. So, etymologically, word 'critic' means 'a judgment based on standard'. Thus etymologically critical thinking means mental activity that done by someone to be able give a judgment with using certain standard.

There are several definition of critical thinking that presented by experts, such Chaffee (Suriadi, 2006) defined critical thinking is thinking to observe the process of thinking itself systematically. It means not only think of intentionally but also investigate how we and others use an evidence or logic. Moreover, Chaffee stated that only with critical thinking, organized thinking about the thinking process themselves and others thinking processes that will equip children to deal with the information they hear and read, the experience they had, and the decisions they make every day. This means with critical thinking allows children to analyze their thinking to make sure that he has found a choice and make a smart conclusion. According to Ennis (2000), critical thinking is rational and reflective thinking that is focused on what is believed and done. Rational means have confidence and view supported by the evidence standard, actual, adequate, and relevant. Reflective means considering actively, perseveringly and carefully all the alternative before taking a decision. This is supported by



Achmad (2007) stated that critical thinking is apply the rational, high thinking activity, which include analyze, synthesize, identify the problem and its solution, making conclusion and evaluation.

Critical thinking has become one competency educational purpose in many countries. In Indonesia, the importance of critical thinking achievement has been expressed in School-Based Curriculum (KTSP) and Regulation of National Education Minister. The Minister of National Education Number 23 of 2006 about Graduating Standard Competence for Educational Unit of Elementary and Secondary there are several competencies related to the critical thinking skill, which is that graduates should be able to: (1) construct, use, and apply the information about surroundings logically, critically and creatively; (2) show the thinking skill of logic, critic, creative and innovative; (3) show the high curiosity and realize their potential; (4) show problem solving skill; (5) show the skill of identify the natural and social phenomenon in surroundings; and (6) show the skill to learn independently according to their potential. Thus, the importance of critical thinking in education is competencies that should be achieved and necessary tools to construct the knowledge. To achieve these competencies, the students need to be given learning activities that lead to critical thinking skills and based on the meaningfulness of learning that are adjusted to the context of their environment. To improve the critical thinking skill is needed a quality learning with implementing learning model that leads to these competencies.

Related to the process and its result, there are crucial problem that faced by education nowadays, which is how to empower the students critical thinking skill through the learning (Marzano, 1993). This needs to be done as pointed out that many students who have no a high level of critical thinking skills. Generally in the learning process, more emphasizes the aspect of memorizing the knowledge. This is supported by (Raka, 2005) that stated the learning process still oriented and focused on paradigm of information forwarding which only involve the low-level thinking, that is memorizing. Learning takes place in conventional and looked the students as an object and teacher as subject that dominates the learning (teacher centered).

The learning process, especially physics that took place during this time are still conventional. Teacher gives more material through lecturer, exercise, and assignment rather than learning process that focus on students (student centered). These learning process shows that learning is not based on the assumptions of the nature of learning, the nature of the learner and the nature of teacher. The impact occurs learning only allows students achieve a low-level of knowledge, which is memorized as stated by Raka (2005). These conventional learning is strongly suspected as a barrier to students' critical thinking skill.

Physics is a part of sciences and one of compulsory learning that given from elementary school up to senior high school level. Physics is a branch of sciences that related with the way to find the nature systematically trough the discovery process so it should be able to do physics learning so that the students can have the experience of how to find a concept. When it is done will stimulate the development of students' critical thinking skills.

Critical thinking skill is not a skill that can develops itself along with the physical development of human beings. These skills must be trained through a stimulus that requires a person to think critically. School as an institution of education provider has a responsibility to help students develop critical thinking skills.

One of learning model that give a chance to students have experiences discovery a concept and develop the critical thinking is problem solving model. Problem solving learning model is one of model that make students to do problem solving creatively, actively, respect to diversity that occur

during problem solving process, in other word problem solving learning model is learning model that uses real-world problems as a context for students to learn about problem solving skill and critical thinking to get knowledge and essential concept.

RESEARCH METHOD

The population of the research was students grade X at one of high school in Medan academic year 2013/2014 that consist of three classes in which there are 30 students each class. The research's sample was two classes by using cluster random sampling technique. First class as experiment class by implementing problem solving learning model and second class by implementing conventional learning model. The method that used in implementing model was experimental quasi with randomized control group pretest-posttest design. The test that used to measure the critical thinking skill is essay with topic of Straight Motion. This test includes indicators of critical thinking with the components of taking conclusion, solving the problem and synthesizing (Achmad, 2007).

The effectiveness of implementing problem solving learning model in improving the critical thinking skill is determined based on the average of normalized gain score, *N-gain*. The high-low of *N-gain* can be classified as below : (1) If $N-gain > 70\%$, then *N-gain* that resulted is in a high category; (2) If $30\% \leq N-gain \leq 70\%$, then *N-gain* that resulted in medium category; and (3) If $N-gain < 30\%$, then *N-gain* that resulted is in low category (Hake & Richard 2002).

RESULT AND DISCUSSION

Test of effectiveness of problem solving learning model in increasing the critical thinking involve 30 students for each group, experiment group and control group. Critical thinking skills represented by % *N-gain* in topic Linear Linear Motion. The result of normality test, homogeneity test, and two averages different test % *N-gain* between experiment group and control group in topic Straight Motion are shown in the Table 1.

Table 1. Result of Normality Test, Homogeneity Test, and Two Averages Different Test % *N-gain* Skills of Thinking that Reach by Experiment Class and Control Class

Experiment Class				Control Class				Variance % <i>N-gain</i> _{Eks} with % <i>N-gain</i> _{Cont}	<i>P</i>
Average of initial test	Average of end test	<i>N-gain</i> (%)	Distribution % <i>N-gain</i> _{Exp}	Average of initial test	Average of end test	<i>N-gain</i> (%)	Distribution % <i>N-gain</i> _{Cont}		
30,50	82,08	75	Normal	30,00	65,00	47	normal	homogen	0,000 (significant)

Information: maximum Skor = 100

According to Table 1 that % *N-gain* Skills of critical thinking of student in topic Straight Motion both the experimental class and control class normally distributed and homogeneous variants. Because % *N-gain* critical thinking skills both groups were normally distributed and homogeneous variants, the significance of differences in % *N-gain* enhancement of critical thinking skills between

the two groups using different test (t-test). Different test results showed that the application of problem solving learning model can significantly improve students' critical thinking skills.

Based on Table 1 it can be seen that the % N-gain critical thinking skills achieved experimental group by 75%, including in the high category, whereas the control group reached 47%, including in the medium category and it can be seen that the acquisition of critical thinking skills that the experimental group achieved higher than the control group. N-gain critical thinking skills to experiment group and control group is shown in Figure 1. Based on % N-gain, it can be seen that the acquisition of critical thinking skills achieved experimental group and the control group it can be concluded that the application of the model of learning problem solving in topic Straight Motion can be more effective in improving students' critical thinking skills than the use of conventional learning models.

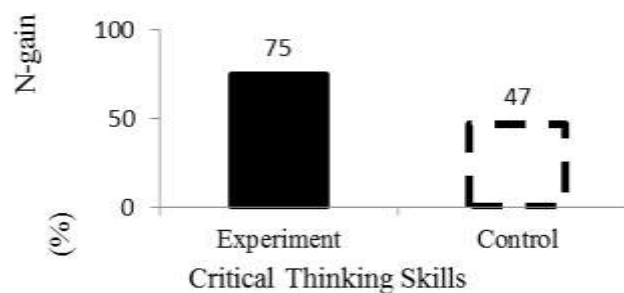


Figure 1. N-gain of Critical Thinking Skills of Experiment Group and Control Group

The percentage of N-gain critical thinking skills can be translated to any component indicator thinking skills between the experimental class and the control class as shown in Figure 2. Based on Figure 2, it appears that the N-gain for each component of critical thinking (concluding, solve problems, synthesize and analyze) the achieved experimental class, respectively for 72%, 74%, 76% and 71%, while % N-gain achieved control class in a row 37%, 52%, 41% and 45%. Based on Figure 2, from the comparison of % N-gain critical thinking skills are achieved, it appears that the application of the learning model of problem solving in the topic Straight Motion more effectively improve every component of critical thinking skills than the use of conventional learning models.

Based on Figure 2, is reviewed based on the indicators in each component of critical thinking skills turned out to be N-gain highest in synthesizing and solve the problem components. This is possible because the stages of problem solving through experimentation, students are required to be able to combine the parts of the results of its investigation and combine it with all the supporting information so that students can create new ideas in order to solve his problems.

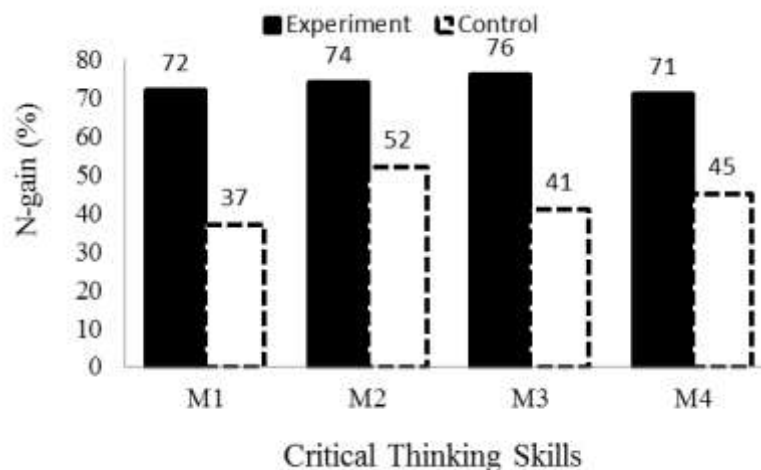


Figure 2. Comparison of N-gain for indicator every component of Critical Thinking Skills between Eksperimen Group and Control Group. Indicator M1=conclude, M2=solve the problem, M3 = synthesis and M4= Analyzing

Through the process of problem solving, students more easily understand a concept, acquire and deepen the essential concepts, so that ideas can be developed and implemented emerge through thinking skills. This is supported by Simanjuntak (2012) which states that students are accustomed to solving problems, it is easier to construct knowledge and are used to solve the problem, it is easier to construct knowledge and to explore ideas related to concepts that are emerging ideas can be developed. This is because the thinking skills, students construct learning environments and select appropriate strategies, students become more critical and become independent learners, realize that they can meet the intellectual needs of their own, find a lot of information by their own hands, and realize that when they will face the problem of trying to find a way out. This is consistent with that presented by Scriven & Paul (1987) which states that the critical thinking skills is an intellectual process of conceptualization, application, analysis, synthesis and evaluation of active and proficient on information obtained from observation, experience, reflection, reasoning, or communication as a guide to believe and act. This skill is characterized by intellectual values that are universal, ie clarity, accuracy, consistency, accuracy, suitability, evidence of the true, good thinking, depth, breadth and fairness. This was confirmed by Elder (2007) revealed that the characteristics of someone who has the skills of critical thinking, namely: give question and can bring important issues and formulate it clearly and precisely; can gather and assess relevant information and use abstract ideas to interpret it effectively; can conclude and provide a good solution and the test based on relevant criteria and standards; have thought of the notion of openness, recognition and other values; and be able to communicate effectively with others to solve complex problems.

CONCLUSION

Based on the results of this study concluded that the application of problem solving learning model can significantly improve the skills of critical thinking on the topic Straight Motion and included in the high category, in other words, that the application of learning models of problem solving can be more effective in improving students' critical thinking skills.

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