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Improvement of Students' Critical Thinking Ability through Problem-Based Learning (PBL) Model Class XI MIPA 3 on Temperature and Heat Material

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Abstract. This aim of this research to find out how much the effectiveness of using problem based learning (PBL) model on temperature and heat material to improve students' critical thinking, Student's critical thinking ability is still low. The low fact of students' critical thinking ability is seen from the average score of students' learning outcomes at the learning level of 47.82 with the completeness level of 29.4%. To improve the critical thinking ability, then applied problem based learning model when the learning process. Improvement of learning is conducted through 4 cycles from 12 September to 12 October 2017. The Result of research performance indicator of the research is the increasing critical thinking ability of students who scores above the KKM score of 70 and the completeness of learning by 70% of the number of students. The students' critical thinking ability of, cycle I up to cycle III has increased, it is proved through the result of the test that the students get with the average student at 55%, on the first cycle average of students is 57%, cycle II is 67 % and in the third cycle of 83%. From the analysis result of each critical thinking indicator from the cycle I to III, the ability to give a simple explanation increase 32%, building basic skills, increase 50%, making inference increase 45%, making further explanation increase 30% and ability strategy and tactics increase 30%. The PBL steps in this research are: orientate the students to the problem, organize the students to learn, guide investigate independently or group, develop and present the work, and analyze and evaluate the results of problem solving. This improvement is accomplished by carrying out a classroom action research intended to improve classroom learning and improve the critical thinking skills of students of class XI MIPA 3 on temperature and heat matter. The conclusion PBL improving critical thinking aspect is measured in this study include: providing a simple explanation elementary clarification, building basic skills, making inferences, and making further clarification advanced clarification, strategies and tactics.

Keyword: Problem Based Learning, and critical thinking, action research.

INTRODUCTION

Education has a very important role for all aspects of life and development in every human being. The influence of education can be seen and felt directly in the development of community life, either individually or in groups. The quality of education at this time still becomes a problem which facing the government in an effort to reform the national education system [1]. The efforts are done by the government in renewing the national education system to meet a demand of learning in the 21st century, by restructuring the education system and learning system that has been running for this. According to the arrangement of learning systems, the government has made several innovations and changes in the learning system. One of the changes in the learning system is: shifting the learning management paradigm from the former teacher centered in the more centered on the students centered [2]. This paradigm shift has the meaning that the learning process must be transformed into a lesson based on constructivist oriented learning theory for multiple representations [11].

One of the efforts that must be done by the government on 21st century learning, especially in the education sector to create human quality resources [3], that is by applying or familiarize the culture of critical thinking from an early age, in other words critical thinking has been introduced and applied to the level of primary school education. So the learners have been trained and accustomed to be able to analyze, synthesize, communicate and summarize the information of each problem solving that they face [5].

Critical thinking is an effort to solve problems, decision-making, as an approach, the process of analyzing assumptions and scientific discoveries [3]. Critical thinking implements students to learn in solving problems in the face of challenges, solve problems innovatively and design fundamental solutions. The process of critical thinking can only arise when there is open-mindedness, humility and patience of each one's self. This ability helps a person fully understand an event or a problem they are dealing with. Critical thinking maintains open-mindedness as long as it seeks to gain reason, proof and logical truth [6].

The observation results conducted by researchers in SMA Labshool Jakarta, class through the interview process and direct observation in the learning process activities with the number of students as many as 34 students consists of 12 male students and 22 female students, indicate that critical thinking skills of students are still very low. When the evaluation activity of the rotational dynamics of material assessment by giving the problem description with the criteria about the level of High Order thinking skill (HOTS) students from 34 students, only about 10 students who are able to solve some problems of HOTS type while 24 other students still not able to solve the problem of cognitive type. Beside the problems above also found the problem that when the learning activities of students pay less attention to teacher explanations so that students' understanding of the material described less over control. This is it influences the students less able to complete the level cognitive type problem [6].

The problem above, one of selected learning models in the 21st century of education to improve students' critical thinking ability in this research by using problem based learning model. Problem-based learning model is one of the learning model that is compatible with constructivist learning theory. Constructivist theories of learning states that students must find themselves and transform information in a complex [7]. This is similar to the problem-based learning model, problem-based learning is a learning approach, where the students do authentic problems with the intent to develop their own knowledge, develop inquiry and high-level thinking skills, develop self-reliance and confidence [3].

The results of the research the application of problem-based learning model successfully improves the critical thinking skills of learners. In his research that the class using problem-based learning model has an average of critical thinking ability of 83.24 whereas in the class that does not use problem-based learning model has the average critical thinking ability about 76.15. From the data, it can be concluded that critical thinking ability to problem based learning model is higher than the class that does not use the model [9]. However, the formulation of the problem "whether the students' critical thinking ability can be improved by model Problem Based Learning on temperature and heat materials?

Definition of Critical Thinking

The critical thinking in his book entitled "Critical Thinking" A Student's Introduction, "that critical thinking is a general term given to the various cognitive abilities and intellectual dispositions needed to effectively identify, analyze and evaluate arguments and truth claims; to discover and overcome personal prejudices and biases; formulate and present a convincing problem to support the conclusion; and to make reasonable excuses, intelligent decisions about what to believe and what to do [3]. The critical thinking is "the process of searching, obtaining, evaluating, analyzing, synthesis and conceptualizing information as creativity and taking risk.

Critical thinking allows students to think about their own thoughts and the reasons behind their point of view. Students must be taught to change their thinking from: (a) guessing to estimating, (b) preferring to evaluating, (c) grouping to classifying, (d) believing to assuming, (e) inferring to inferring logically, (f) associating concepts to grasping principles, (g) nothing relationships to nothing relationships among relationships, (h) supposed to hypothesizing, (i) offering opinions without reason to offering opinions with reason to offering opinions with reason, (j) making judgments without criteria to making judgments with criteria. Critical thinking aspects measured in this study include: providing a simple explanation, building basic skills, making inferences, making further clarification, strategies and tactics.

Definition of Problem Based Learning

Problem based learning has 7 steps consist of read the problem, the problem/trigger, brainstorm, discuss and synthesis, formulating learning issue, independent study, and professional practice debate. Implementing PBL in schools and universities are demanding process that requires resources, a lot of planning and organization. The discusses the 12 steps for implementing the "pure PBL", Prepare faculty for change, establish a new curriculum

committee and working group, designing the new PBL curriculum and defining educational outcomes, seeking advice from experts in PBL, planning, organizing and managing. Training PBL facilitators and defining the objectives of a facilitator, introducing students to the PBL program, using 3-learning to support the delivery of the PBL program. This study in each cycle of Problem Based Learning (PBL) steps used the 5 main steps [3]. Namely: (1) orient the students to the problem; (2) organizing students to learn; (3) guide the investigation independently or in groups; (4) develop and present the work; and (5) analyze and evaluate the results of problem solving [12].

METHOD

The research was conducted in SMA Labschool Jakarta, Indonesia. While the subjects in this study were students 3 class consisting of 34 students, 12 male students and 22 female students. The approach used in this study is Action Research with a qualitative approach. While the type of research is used Classroom Action Research (CAR). Class Action Research is a reflective and collaborative action research done for the purpose of improving the quality of classroom teaching practice. This classroom action research consists of four stages, namely (1) planning, (2) implementation, (3) observation, and (4) reflection. After performing the reflection actions that include analysis, synthesis and assessment of the observation of the process and the results of the actions taken, it usually arises problems or thoughts that need to be improved, so it needs to be re-planning, re-action, re-observation, and re-reflection. The stages of this activity continue until a problem is considered complete. Application of learning model is said to succeed percentage of success reached 100%. For the students' critical thinking ability in the research focused on 5 aspects: covering simple explanation (Elementary clarification), building basic skills, making infering, making further clarification, strategy and tactics. Strategies and Tactics, critical thinking skills are analyzed descriptively based on descriptors that appear on the answer sheet about students' critical thinking skills. Students' critical thinking skills are considered to increase if more than 70% of students have achieved KKM score above 70. Students' learning activities are considered to be complete if more than 75% of students in the class enters the active category to know the critical thinking ability of students follow the learning by using Problem Based Learning.

RESULT AND DISCUSSION

The study before implementation of learning with PBL model pre-cycled the first model of direct learning and ended with test. In the implementation of research each cycle using Problem-Based Learning model with the steps. Namely: (1) orient the students to the problem; (2) organizing students to learn; (3) guide the investigation independently or in groups; (4) develop and present the work; and (5) analyze and evaluate the results of problem solving. And in every cycle measured the ability to think critically include: provide a simple explanation (Elementary clarification) (KR1), build basic skills (KR2), make inferences (KR3), make further explanation (Advanced Clarification) (KR4), Strategies and Tactics (KR5). The result of the research from cycle I, cycle II, and cycle III shows the improvement of students' critical thinking ability. This shows in Table 1 and Table 2.

Table 1. Values Percentage of Critical Thinking Skills (CTS)

Cycles	CTS (%)	Category
Pre-cycles	55	Less
I	57	Less
II	67	Enough
III	83	Good

Based on the Table 1, the students' critical thinking ability that has been done in cycle I, the percentage of students who score 73-78 is only 3.9%, 67-72 is only 3.9%. Percentage of students who scored 61-66 were only 4.13%. Percentage of students who scored 55-60 of 5.16%, while the percentage of students who scored 49-54 by 7.22% and the percentage of students who scored 43-48 of 9.28%, then gets 36-42 of 1.3%. In the first cycle of the PBL implementation has not went well, and the aspects of critical thinking has undefined.

In cycle II, the percentage of students who scored 73-78 was only 3.9%, 67-72 was only 3.9%. Percentage of students who scored 61-66 were only 4.13%. Percentage of students who scored 55-60 of 5.16%, while the percentage of students who scored 49-54 by 7.22% and the percentage of students who scored 43-48 of 9.28%. And that gets 36-42 of 1.3%. In second cycle of the PBL implementation began to improve because it's associated with the student worksheet, but the critical thinking aspect has not been maximal because it has started many formulas.

The cycle III, the percentage of students who scored 93-96 was only 1.3%, 89-92 was only 3.9%. The percentage of students who scored 85-88 was only 7.20%. Percentage of students who scored 81-84 of 6.18%, while the percentage of students who scored 77-80 of 13.38% and the percentage of students who scored 73-76 of 3.9% and that gets 68-72 of 1.3%. In third cycle of the PBL implementation has run well and the aspect of critical thinking has increased because it is assisted by making concept maps.

Table 2. Percentage of Critical Thinking Aspects

No	Indicator CTS	Cycle I (%)	Cycle II (%)	Cycle III (%)
1	KR 1	56	71	88
2	KR 2	41	66	91
3	KR 3	44	74	89
4	KR 4	51	71	81
5	KR 5	49	69	79

Based on Table 2, the description of data is stated that for every aspects of the critical thinking indicator increases in each cycle. It is also supported by the application of the PBL model to support students' critical thinking skills, that clearly shows in Figure 1. It is stated that the percentage of critical thinking in the indicators gives a simple explanation in cycle I, cycle II, and cycle III. It has increase of 56% at the beginning of the cycle to 88% at the end of the cycle, then for indicators to build basic skills that originally cycle, 41% to 91% at the end of the cycle, as opposed to increment of 89% at the end of the cycle. The ability to make further explanations increases from the original 51% to 81%, and so does the strategy and tactics increase from 49% to 79%.

The lowest critical thinking ability is the ability to give a simple explanation. By referring to the test results of students' critical thinking skills, many students do not understand what the meaning of the matter is. In addition, students are not accustomed to work on the problem independently by trying first. In the KR 3 indicator that makes the inference also get the lowest percentage, the problem occurs because the students has not been able to argue or analyze the arguments in question.

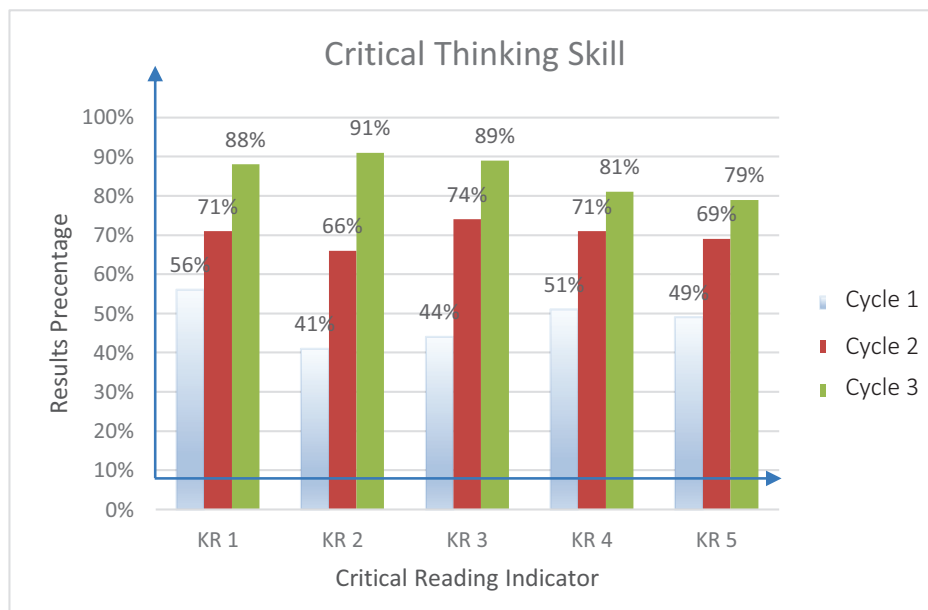


FIGURE 1. Increasing Aspects of Critical Thinking Each Cycle

The learning cycle II and cycle III, where in each cycle it is seen that students' critical thinking ability has been improved. Based on the Figure. 1, bar chart above states that the percentage of critical thinking on the indicator gives a simple explanation of the second cycle up to cycle III increased by 17%, then for indicators to build basic skills increased significantly by 25%, vice versa, making the inference increased by 15%, the ability to make further explanations increased by 10% and so was the strategy and tactics ability increase to 10%. In the second and third cycles, students' critical thinking skills has improved as students able to consider or formulate appropriate criteria in considering answers, answer every question according to the existing facts, able to identify sentences that are not questions, and able to act by providing further explanation of the answer to the question of the problem that has been described. In cycle 2 and 3 besides the students' worksheets, a computer-based concept map according to [10] used as one of the tools of cognitive learning strategy. Students has conclusions and critical thinking skills increased and broader insight model problem based learning model students the opportunity to develop their thinking skills in the face of problems. So it's multi representation in learning basic physics support contextual learning and developing students' critical thinking skills to solve the problems they are facing[11]. The improvement of students' critical thinking skills is supported and corroborated by research that there is an improvement in students' Problem Based Learning (PBL) models in classroom learning.

CONCLUSION

Based on the results of the research conducted during three cycles, it can be concluded that the problem-based learning model can improve students' critical thinking skills. Critical thinking ability of student using problem-based learning model gets improvement because PBL learning gives opportunity for students to develop their thinking ability. The conclusion PBL improving critical thinking aspect is measured in this study include: providing a simple explanation elementary clarification, building basic skills, making inferences, and making further clarification advanced clarification, strategies and tactics. This research was also conducted to obtain input on worksheets that are suitable for use in learning physics in accordance with the 2013 curriculum in force in Indonesia, which emphasizes the assessment of the cognitive, performance and affective domains

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