

Influence of Problem Based Learning Model on the Students Critical Thinking Ability and Biology Competence of Senior High 3 Pariaman

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Abstract – This research intends to determine the effect of Problem Based Learning model on students' critical thinking skills and competences. This study was a quasi-experimental research. The population of the study was the students of class X SMA Negeri 3 Pariaman. Random sample selection is done by randomizing the class. Sample that chosen was class X IA₄ as experimental class that given study treatment based on problem and class X IA₃ as control class that given study treatment usually. Instrument used to consist of critical thinking test, cognitive test, observation sheet of affective and psychomotor. Independent t-test and Mann Whitney U test was used for the analysis. Results showed that there was significant difference ($\text{sig} < 0,05$) between control and experimental group. The conclusion of this study was Problem Based Learning model affected the students' critical thinking skills and competences.

Keywords – Affective, Cognitive, Critical Thinking Skill, Problem Based Learning, Psychomotor.

I. INTRODUCTION

In the 2013 Curriculum, the learning process is organized in an inspirational, interactive, challenging, fun way, motivates students to participate actively, and provides sufficient space for initiative, creativity, skills, physical and psychological development and independence according to their talents and interest of students. In addition, students are required to be able to build their own knowledge (*student centered*). The aim of education in the 2013 curriculum is that students have the competencies necessary for community life. According to the Ministry of Education and Culture (2016), the competence in question is attitude competence (affective) in the form of high religious attitudes and social ethics in social life, knowledge competence (cognitive), and skills

competence (psychomotor) in the form of skills or the ability to apply knowledge.

Biology is a subject that is incorporated in the natural sciences (IPA or science). Science is concerned with finding out about nature systematically, so that learning is not only the mastery of a collection of knowledge in the form of facts, concepts or principles, but is also a process of discovery. Science learning is expected to be able to direct students to fulfill the necessary abilities, in the form of being creative and innovative, able to communicate and collaborate and be skilled in learning and innovating which includes critical thinking and being able to solve every problem (Kemendikbud, 2016: 1-2).

Critical thinking skills are abilities that need to be developed to meet the global challenges of education in the

future. Critical thinking skills are needed for every student to be able to make decisions in everyday life. The ability to think critically is not directly owned by students automatically because students still rarely do activities that can hone / explore their critical thinking skills. Critical thinking skills can be explored through guided exercises, namely through problem solving activities. Activities to explore critical thinking skills will also help develop students' problem solving skills.

Through observations made and interviews with Biology subject teachers in class X SMA Negeri 3 Pariaman, it can be seen that the active role of students in the learning process is still lacking, only a few students show activeness in asking, giving opinions and answering questions. The questions and answers asked by students are still limited to questions and answers at the knowledge level. Afrizon (2012) explains that at least students, who ask questions, comment, argue and explain, show poorly trained critical thinking skills.

Furthermore, it was also found that the learning competence of students was still low. The competency data of students' knowledge obtained from the Biology teacher of SMAN 3 Pariaman shows that the knowledge competency value of class X students in Daily Test (UH) I still has not reached the specified Minimum Completeness Criteria (KKM), which is 75.

One way that can be done to improve Critical thinking skills and learning competencies of students are to start a lesson with a problem or question (Synder and Synder, 2008). Learning starts with problems can through the application of the model of *Problem Based Learning* (PBL). In the PBL model, problems are presented at the beginning of learning and serve as a stimulus for learning activities (Chin and Chia, 2005).

The choice of learning model must also consider the characteristics of the material to be taught. This is because not all materials are suitable and in accordance with a learning model. The material chosen for this research is ecosystem and environmental pollution material. This material is *transferable*, where the concepts in this material can be used for problem solving.

Besides being able to form critical thinking skills, the PBL model can also improve the learning competence of students, both cognitive and affective and psychomotor competencies. This learning model is able to make students actively involved in learning, so that learning becomes meaningful and can improve the learning competencies of students (Zadugisti, 2010).

II. METHOD

This type of research is a quasi-experiment. This research was conducted in two experimental classes, namely the experimental class and the control class. The experimental class was given treatment in the form of the *Problem Based Learning* (PBL) model and the control class was treated with the conventional model.

The population of this study were all students of class X SMA Negeri 3 Pariaman for the 2017/2018 school year. Sampling was done through *random sampling*, by drawing 4 pieces of paper containing class names. The class that was taken first was class X₄ which was designated as the experimental class and the class that was taken second was class X₃ as the control class.

The instruments used in this study were descriptive questions that were adjusted to indicators of critical thinking to determine the value of students' critical thinking skills, objective questions to assess cognitive competence, and observation sheets and assessment sheets to determine the competence of students in affective and psychomotor aspects. The data analysis technique used is the t test for cognitive competence and u test for affective and psychomotor competencies.

III. RESULTS AND DISCUSSION

The data obtained in this study were: 1) critical thinking skills of experimental class and control class students, 2) cognitive competence of experimental class and control class students, 3) affective competence of students in experimental class and control class, and 4) the psychomotor competence of students in the experimental class and the control class.

Data on Students' Critical Thinking Ability Data on students' critical thinking skills are presented in Table 1.

Table 1. Value of Critical Thinking Ability Students'

Class	N	X	X _{max}	X _{min}	S
Experiment	34	59.80	1.Table 66.70	33.33	14.89
Control	35	42.38	87.50	25.00	12.52

Based on Table 1, it can be seen that the average critical thinking ability of students in the experimental class is higher than the control class, namely 59.80 in the experimental class and 42.38 in the control class.

Cognitive Competence Students Data

Data cognitive competence of learners are presented in Table 2.

Table 2. Data Competence Cognitive Students

Class	N	X	X _{max}	X _{min}	S
Experiment	34	52.94	68.00	40.00	9.89
Control	35	46.17	80.00	24.00	12.13

Based on Table 2, it can be seen that the average biology learning competency of students in the experimental class is higher than the control class, namely 52.94 in the experimental class and 46.17 in the control class.

Data on Students' Affective Competencies Data on students' affective competencies are presented in Table 3.

Table 3. Data on Students' Affective Competencies for

Class	N	X	Predicate
Experimental	34	73.28	B
Control	35	58.09	C

Based on Table 3, it can be seen that the total average value the affective domain of students who were filled by observers in the experimental class obtained a higher average than the control class. This shows that the affective competence of students in the experimental class using the model *Problem Based Learning* is higher than the control class with the conventional model.

Student's Psychomotor Competency Data Student's psychomotor competency data is presented in Table 4.

Table 4. Psychomotor Competency Data for

Class	N	X	Predicate
Experimental	34	4. Table Student s79.96	B
Control	35	66.42	C

Based on Table 4, it can be seen that the average domain value The psychomotor of students in the experimental class was higher than the control class. This shows that the psychomotor competence of students in the experimental class using the learning model *Problem Based Learning* is

significantly more influential than the control class using the conventional model.

The PBL model is said to have an effect on critical thinking skills, because significantly different tests show that there are differences in the critical thinking skills of the experimental class and the control class. This is reinforced by the results of descriptive statistics which show that the average critical thinking ability of students in the experimental class is higher than the control class. This condition illustrates that the ability of experimental class students in terms of interpretation, analysis, evaluation and inference is better than the control class. In according to the opinion of Tan (2004: 46), that the PBL model is a learning environment that can be provided by teachers to develop students' critical thinking skills, because PBL provides an opportunity to develop all components or indicators of critical thinking.

In line with the opinion of Hartati and Sholihin (2015: 508) that the problem-solving process in PBL can develop students' critical thinking skills. Duron, et al (2006: 160) and Synder (2008) reveal that critical thinking is the ability to analyze and evaluate information so that students are able to solve simple problems or complex problems.

Critical thinking skills must be developed through the process of direct experience of students in solving problems. If students are accustomed to using critical thinking skills in solving problems, then their critical thinking skills will continue to develop (Aswan et al., 2018). This is in accordance with the opinion of Masek and Yamin (2011), which states that the steps contained in the model *Problem Based Learning* are able to support the development of students' critical thinking skills.

Arend in Supentangingrum (2013: 2015) reveals the PBL model as a model that facilitates students to solve authentic problems so that students are able to compile their own knowledge, be independent, have confidence and hone their high-order thinking skills. PBL is known as a student-centered learning model, so this model provides space to improve students' critical thinking skills, because through the PBL model students investigate themselves and solve contextual problems under the guidance of the teacher (Suyadi, 2013: 130).

In the learning process, PBL is not only a model but also a basis for developing learning media (Jefriadi et al., 2018). In line with the opinion of Sari, et al. (2018) that PBL which is integrated in learning media can increase activities in learning. The increase in learning activities includes all

aspects contained in learning competencies, namely cognitive, affective and psychomotor aspects.

Descriptively, the experimental class students' knowledge was higher than the control class. The Mann Withney test shows that there is a difference in the average between the experimental class and the control class. These two conditions illustrate that the PBL model affects students' knowledge in Biology learning. The knowledge aspect is a very important aspect in the learning competence of students. The knowledge aspect is the main focus of attention of teachers in determining student learning outcomes. So that PBL is able to improve the learning competence of students (Kurniasih et al., 2017; Sapawer and Sumarmin, 2018).

In accordance with the opinion of Sari, et al. (2018: 41) the PBL model is believed to improve student learning outcomes because the PBL model can train students to work together and exchange ideas in the learning process so that students will find it easier to understand a material. The results of observations when learning the PBL model took place showed that students found ideas and ways to solve existing problems. In accordance with the opinion of Degama and Sumarmin (2019), the use of the PBL model can improve student learning abilities.

In accordance with Trianto's opinion (2014: 65) which states that the PBL model was developed to help students develop intellectual skills through involvement in real experiences. The involvement of students in learning activities makes students tend to be more active in exploring their own knowledge. PBL can provide a conducive environment for more meaningful learning, so that it can affect the ability of students to apply their knowledge (Masek and Yamin, 2011: 57; Tan, 2009: 58).

Attitude is a description of a person's behavior in responding to an event, which in this study is the attitude of students towards Biology learning using the PBL model. The results of the attitudes of the experimental class students were also better than the control class. This condition proves the positive effect of the advantages of the PBL Model in creating a pleasant learning environment for students, so that students have more curiosity, discipline and confidence in solving problems, Wulandari and Surjono (2013: 182).

The problems that are raised at the beginning of each lesson can provide a stimulus that stimulates the curiosity of students. This curiosity arises as a result of learning that begins with the provision of interesting issues or problems that are around students. This is in line with the research of Atikasari et al. (2012) stated that learning patterns that focus

on problems and explore knowledge have a positive effect on increasing the analytical skills and curiosity of students to provide solutions to relevant problems.

The results showed that the skills of the experimental class students differed significantly from the control class. Judging from the descriptive statistics, the skills of the experimental class students were higher in all the indicators assessed than the control class. The PBL model encourages students to solve given problems independently, even though it is under the guidance of the teacher, but this model provides space so that students are able to demonstrate the ability to place product composition, the effectiveness of using materials, present product results and try to produce products that are neat.

According to Smith, Ericson and Lubinski in Priadi (2012: 221), the use of the Problem Based Learning (PBL) model provides students the opportunity to develop their psychomotor abilities related to communication, representation, modeling, and reasoning skills. Savery and Dufy (2001: 59) explained that in the PBL environment, students are actively involved in learning to construct knowledge and apply it in skills. Other opinions that support the results of this study are Matthew (2011) and Noviar (2015) who reveal that the PBL model affects the cognitive, affective and psychomotor learning outcomes of students, because in PBL, students are more active and become the center of the learning process.

IV. CONCLUSION

Based on the results of the research and discussion that has been carried out, the following conclusions are obtained:

- a) There is a significant effect of the model *Problem Based Learning* on students' critical thinking abilities.
- b) There is a significant effect of the model *Problem Based Learning* on the learning competence of students in the cognitive domain.
- c) There is a significant effect of the model *Problem Based Learning* on the learning competence of students in the affective domain.
- d) There is a significant effect of the model *Problem Based Learning* on the learning competence of students in the psychomotor domain.

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