

Effect of Problem Based Learning Model Towards Students' Critical Thinking and Learning Competences in Grade VIII in SMPN 21 Padang

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Abstract - Learning process still emphasizes on knowledge aspect and materials comprehension, students' active participation is very low, and students' learning competencies are still low too. One way to solve those problems is by doing research using Problem Based Learning model. The purpose of the research was to know the effect of Problem Based Learning model towards students' critical thinking and students' learning competencies. It was a quasi experimental research. The population of the research was students of VIII grade in SMPN 21 Padang in academic year 2017/2018. The samples were taken by using random sampling technique. As a result, class VIII₃ was as experimental class and class VIII₄ was as control class. The instruments used were objective test, critical thinking ability test, observation sheet to see affective aspect and assessment sheet to see psychomotor aspect. The analysis of data used T-test for cognitive competence and *Mann Whitney U* test for affective and psychomotor competences. The result showed that students' critical thinking ability and score in learning IPA of experimental class is better than students' critical thinking ability and score in learning IPA of control class.

Keywords - *Effect, Problem Based Learning, Critical Thinking, Learning Competences.*

I. INTRODUCTION

Education is an effort to humanize people. As a creation of the god, people are provided language ability and intelligence so that they can develop themselves to be cultured creations. Various efforts have been done by government to improve education quality. One of them is by renewing 'The School-Based Curriculum' (KTSP) to 2013 Curriculum. By 2013 Curriculum development which is based character and competences, students are hoped to be productive, creative, innovative, and active through integrated cognitive, affective, and psychomotor competences (Hosnan, 2014).

Implementation of scientific approach in classroom can be done by three recommended learning models. They are

project-based learning model, discovery-based learning model, and problem-based learning model. Ideal demands of 2013 Curriculum towards students' competences are on Graduate Competency Standard included cognitive, affective, and psychomotor aspects (Permendikbud, 2016).

One of subjects in Junior High School (SMP) is Biology which is integrated into Natural Science (IPA) subject. Objective of Biology subject in Content Standard is students can grow scientific attitudes, like honest, objective, opened, persevering, critical, and cooperative. To reach those objectives, learning process should be able to develop critical thinking because professional and qualified human resources will be existed if knowledge is explored deeply by developing critical thinking culture (Yustyan et al., 2015).

Based on observation and interview done on August 8th, 2017 to natural science teacher in grade VIII SMPN 21 Padang, it is known that learning process still emphasizes on cognitive aspects and materials comprehension. All this time, learning process is teacher-centered. Teacher explains learning materials through lecturing and giving exercises in LKS. Consequently, students are less trained in developing critical thinking and problem-solving skills and applying concepts learned in school into real life.

Through observation, it is also known that students' active participation in learning process is still lack. Only a few students are active in asking or answering questions. Questions and answers given are only on knowledge level. According to Afrizon (2012), lack of students who ask questions, give opinions, comment, explain, and consider relevant sources shows critical thinking skill is less trained.

Data of students' cognitive competence obtained from Natural Science teacher in SMPN 21 Padang also show that students' cognitive competence is still under Minimum Criteria of Mastery, which is 75. Average score of students' daily test can be seen in Table 1 below.

Table 1. Average score of Students' Daily Test in Grade VIII SMPN 21 Padang Academic Year 2016/2017

No	Class	N	Average Score
1	VIII ₁	30	72,26
2	VIII ₂	30	69,83
3	VIII ₃	30	73,33
4	VIII ₄	30	74,57

Source: Natural Science teacher in SMPN 21 Padang

One factor causing students' lack of critical thinking skill is selection of learning model and assessment which are not appropriate so that it affects on students' learning outcomes. Based on the problems mentioned above, a technique that can be done to improve students' critical thinking skill and learning competence is by initiating a lesson with a problem or question (Synder and Synder, 2008). It can be done by implementing Problem Based Learning (PBL) model.

The Problem Based Learning model is a learning model which is able to motivate, challenge, and pleasure students as results of learning process by understanding or solving a problem (Norman and Schmidt, 2000). Learning phases in PBL model place students in center of learning so that it will affect on students' cognitive, affective and psychomotor competences (Matthew, 2011).

According to Abanikannda (2016), by using the PBL model, it makes students have experiences in collecting, managing and preparing information which can be used for future. Beside that, it can be used to face and solve complex and real problems. The PBL model is designed to improve students' high level critical thinking skill, especially reasoning skill (Savery, 2006). The high level critical thinking skill is a skill to link, manipulate, and transform background knowledge and experiences for thinking critically and creatively in order to make decision in a new condition. There are four high level mindsets. One of them is critical thinking (Rofiah, 2013).

The critical thinking is an ability to share opinions by organized way through clear and directed process used in problem-solving, decision-making, analyzing assumption, and doing scientific research activities to get deep comprehension so that students understand the meaning of a problem (Johnson, 2014). The critical thinking is also logical thinking in making decision about what should be believed and what should be done (Ennis, 2011).

The use of this model is expected to be able to make students participate actively in learning process so that it can improve their critical thinking skill and learning competence. It is in line with Afrizon (2012), who stated that Problem Based Learning model can improve students' critical thinking skill and learning competences.

II. RESEARCH METHOD

This research used quasi experimental method. In experimental class, Problem Based Learning method was applied in learning science; while, in control class, Direct Instruction was applied. Beside that, research design used in this research was randomized control-group posttest only design.

A. Normality Test

Normality test used was *Kolmogorov-Smirnov* test. Its purpose is to see whether population distributes normally or not. Data distribute normally if significant value is bigger than 0.05 with $\alpha=0.05$ with statistical hypothesis as follow:

H_0 = data are distributed normally

H_1 = data are not distributed normally

Criteria of the test are H_0 is accepted if Sig. value $> \alpha=0.05$, which means it distributes normally. While, H_0 is rejected if Sig. value $< \alpha=0.05$, which means it does not distribute normally.

B. Homogeneity Test

Variance homogeneity test is done by using *Levene's* test. It is to know whether the population has a homogeneous variance or not. It is done by using software SPSS 17. Criteria of the test are H_0 is accepted if Sig. value $> \alpha=0.05$ and H_0 is rejected if Sig. value $< \alpha=0.05$.

C. Hypothesis Test

The purpose of hypothesis testing is to know whether there is an effect of Problem Based Learning model towards students' critical thinking and learning competences. Criteria of the test are if Sig. value > 0.05 so H_0 is accepted and H_1 is rejected and if Sig. value < 0.05 so H_1 is accepted and H_0 is rejected.

D. First and Second Hypothesis Test

Statistical test done for first hypothesis was T-test because data are distributed normally and have homogeneous variance. If the data do not distribute normally and have no homogenous variance, *Mann-Whitney U* test is used. In this research, hypothesis testing was done by using SPSS 17 software.

E. Third and Fourth Hypothesis Test

Statistical test done for the third and fourth hypothesis was *Mann-Whitney U* test. In this research, hypothesis testing was done by using SPSS 17 software. Criteria of the test are if Sig. value > 0.05 so H_0 is accepted and if Sig. value < 0.05 so H_1 is accepted.

III. RESULT AND DISCUSSION

A. Result

1. Data Description of Critical Thinking Skill

In this research, data of critical thinking was obtained from post-test in form of writing test in essay and given to students of both experimental and control classes. It was done at the end of meeting of every basic competency. The result shows that the average score of students' critical thinking skill in experimental class was higher than control class. The average score of experimental class was 77.99. Then, the average score of control class was 72.99. Maximum and minimum scores of experimental class were higher than maximum and minimum scores of control class.

2. Data Description of Cognitive Domain Competences

In this research, data of students' cognitive domain competence was obtained from post-test in form of multiple-choice test given to students of both experimental and control classes. It was done at the last meeting of each

Basic Competence. The result shows that the average score of students' cognitive competence in experimental class was 84.42 and in control class was 78.00. It means that students' average score of cognitive competence in experimental class was higher than in control class. Furthermore, maximum and minimum scores of students' cognitive competence in experimental class was also higher than in control class.

3. Description of Affective Domain Data

In this research, data of affective competence aspect was obtained from observation done by observer by using observational sheet of students' affective competence the result shows that the average score of students' affective competence in experimental class was higher than in control class.

4. Description of Psychomotor Domain Data

In this research, data of psychomotor competence aspect was obtained from students' made-product assessment. The result shows that total score of students' psychomotor competence in experimental class was higher than in control class.

5. Analysis of Research Data

Tests of analysis requirement were done before hypothesis testing. The first test is normality test. It uses *Kolmogorov-Smirnov* test. The second test is variance homogeneity test. It uses *Levene's* test. Both tests are done by assistance of SPSS 17 software. If data distribution is normal and homogeneous, hypothesis testing uses T-test. On the contrary, if data distribution is not normal, variance homogeneity test is not done and the hypothesis testing uses *Mann Whitney U* test.

a. Normality Test

Normality test was done to students' critical thinking and cognitive competence scores of both experimental and control classes. It used *Kolmogorov-Smirnov* test assisted by SPSS software. Criteria of the test are H_0 is accepted if Sig. value $> \alpha=0.05$ and H_0 is rejected if Sig. value $< \alpha=0$.

The result shows that students' critical thinking skill in experimental class had Sig. value 0.200, while in control class had Sig. value 0.141. so, it can be concluded that the data was distributed normally. Meanwhile, students' cognitive competence score in experimental class had Sig. value 0.076 and in control class had Sig. value 0.083. so, it can be concluded that the data was also distributed normally.

b. Homogeneity Test

The variance homogeneity test of students' critical thinking skill and cognitive competence scores in both experimental and control classes used *Levene* test assisted by SPSS 17 software. Criteria of the test are H_0 is accepted if Sig. value $> \alpha=0.05$ and H_0 is rejected if Sig. value $< \alpha=0$.

From the calculation result, it shows that students' critical thinking skill from both experimental and control classes has homogeneous variance with Sig. value 0.431. Meanwhile, the score of students' cognitive domain competence from both experimental and control classes also has homogeneous variance with Sig. value 0.186.

6. Hypothesis Testing

a. Hypothesis of Critical Thinking Skill

This hypothesis testing is used to know the effect of Problem Based Learning model towards students' critical thinking skill. It uses T-test. The result shows that students' critical thinking skill has Sig. value 0.008 with $\alpha=0.05$. It means Sig. value < 0.05 so H_0 is rejected. The hypothesis testing result of students' critical thinking skill can be seen in Table 2 below.

Table 2. Result of Hypothesis Testing of Students' Critical Thinking Skill

Class	Sig	α	Conclusion
Experimental	0,008	0,05	H_0 is rejected
Control			

From the calculation result in Table 2, it can be concluded that Problem Based Learning model gives effect towards students' critical thinking skill.

b. Hypothesis of Cognitive Domain Competence

This hypothesis testing is used to know the effect of Problem Based Learning model towards students' cognitive competence. It uses T-test. The result shows that students' cognitive domain competence has Sig. value 0.004 with $\alpha=0.05$. It means Sig. value < 0.05 so H_0 is rejected. The hypothesis testing result of students' cognitive domain competence can be seen in Table 3 below.

Table 3. Result of Hypothesis Testing of Students' Cognitive Domain Competence

Class	Sig	α	Conclusion
Experimental	0,004	0,05	H_0 is rejected
Control			

From the calculation result in Table 3, it can be concluded that there is a significant effect of using Problem Based Learning model towards students' cognitive domain competence. Students who learn by using Problem Based Learning model have better cognitive domain competence than students who learn using Direct Instruction model.

c. Hypothesis of Affective Domain Competence

This hypothesis testing is used to know whether there is a significant effect of using Problem Based Learning model towards students' affective domain competence or not. It uses *Mann Whitney U* Test. The result shows that students' affective domain competence has Sig. value 0.000 with $\alpha=0.05$. It means that Sig. value < 0.05 so H_0 is rejected. The hypothesis testing result of students' affective domain competence can be seen in Table 4 below.

Table 4. Result of Hypothesis Testing of Students' affective domain competence

Class	Sig	α	Conclusion
Experiment	0,000	0,05	H_0 is rejected
Control			

From the calculation result in Table 4, it can be concluded that there is a significant effect of Problem Based Learning model towards students' cognitive domain competence. Students who learn by using Problem Based Learning model have better affective domain competence than students using Direct Instruction model.

d. Hypothesis of Psychomotor Domain Competence

This hypothesis testing is used to know whether there is a significant effect of using Problem Based Learning model towards students' psychomotor domain competence or not. It uses *Mann Whitney U* test. The result shows that students' psychomotor domain competence has Sig. value 0.001 with $\alpha=0.05$. It means Sig. value < 0.05 so H_0 is rejected. The hypothesis testing result of students' psychomotor domain competence can be seen in Table 5 below.

Table 5. Result of Hypothesis Testing of Students' Psychomotor Domain Competence

Class	Sig	α	Conclusion
Experimental	0,001	0,05	H_0 is rejected
Control			

From the calculation result in table 5 above, it can be concluded that there is a significant effect of PBL model towards students' psychomotor domain competence. Students who learn by using Problem Based Learning model is better than students who are learning using Direct Instruction model.

B. Discussion

1. Students' Critical Thinking Skill Achievements

The application of PBL model gives positive impact towards students' critical thinking skill, in which this learning model can increase students' critical thinking skill. It is in line with research done by Tosun and Teskesenligil (2011), which showed that PBL has positive contribution towards students' critical thinking skill. The positive effect of PBL model towards students' critical thinking skill can be seen from students' average score of critical thinking skill in the experimental class is higher than students' average score of critical thinking skill in the control class. It is caused by students are trained to develop their critical thinking skill through problem-solving activities in the PBL model. Beside that, it is a core of the PBL model.

The core activity of PBL model is on second, third, and fourth phases. It gives opportunity to students to construct their knowledge actively through problem-solving activities and develop it so that they are used to thinking critically (Karim and Normaya, 2015). It is in line with Dewi and Jatiningsih (2015), who stated that the use of TBL model make students able to identify and solve given problems so that this learning model can improve students' critical thinking skill.

In the control class using Direct Instruction model, students' critical thinking skill is lower than in the experimental class using PBL model. Basic difference between PBL model and Direct Instruction model is that the PBL model serves problems in the beginning of learning in order to find learning ideas and concepts. In the PBL model, problems are given in the beginning of learning and function as learning activity stimulus (Chin and Chia, 2005).

2. Students' Cognitive Domain Competence Achievement

The result of statistical analysis showed that students' cognitive domain competence increases after using PBL model. It is visible from the average score of students' learning outcome in experimental class using PBL model is higher than the average score of students' learning outcome in control class using Direct Instruction model. It is caused

by in the experimental class using PBL model, students are given opportunity to construct their knowledge. It is in line with Orhan and Ruhan (2007), who said that PBL model gives positive impact to students' academic achievement.

On the other hand, students' cognitive domain competence in control class is lower than students' cognitive domain competence in experimental class. It is caused by learning process in the control class using Direct Instruction model make students less active in learning process so that the learning has less meaningful.

There are some differences between learning process in experimental class and control class. Consequently, the differences of students' learning outcome in the cognitive competence also exist. Students in the experimental class using PBL model have higher cognitive competence average score than students in the control class using Direct Instruction model. Anderson (2007) stated that students using PBL model in learning process has higher cognitive level. The PBL model gives learning experiences for students to understand learning materials better so that students' achievement also increases. It is also supported by Muspita (2013), who stated that the application of PBL model has positive effect towards students' learning outcomes.

3. Students' Affective Domain Competence Achievement

The result of students' affective domain competence observation done by observer showed that data of students' affective domain competence in experimental class are significantly better than students' affective domain competence in control class. Generally, students' affective domain competence in the experimental class is in 'good' criteria.

The problems given in the beginning of learning process can give stimulus to students to increase their curiosity. The curiosity appears because learning process is initiated by giving interesting issues or problems around students' daily lives. It is in line with Atikasari et al. (2012), who stated that learning pattern focusing on problems and exploring knowledge have positive effect towards improvement of students' analysis skill and curiosity to give solution to relevant problems.

Problem-solving tasks also train students to have discipline. The tasks should be done by students and collected on time so that they become discipline. It is supported by Rusmono (2012), who proposed that PBL

requires students to come on time and inform group member if they cannot come so that it can train students' discipline.

Moreover, this learning model can also train students' self-confidence. Through problem-solving process, students are demanded to collect information through asking or sharing ideas with their friends in a group. As a result, they are more confident in sharing opinions and answering questions from their friends. At the time of presentation, students are trained to be brave in proposing their opinions in discussion. It is in line with Trianto (2014), who stated that PBL model demands students to solve authentic problems so that they can increase their self-confidence.

Direct Instruction model implemented in control class causes students less active in learning process. They are also lack of curiosity and self-confidence. Beside that, students in control class are also less discipline than students in experimental class. Many students are late in entering classroom and collecting task given by teacher. It is caused by they are less trained in discipline.

The difference techniques of learning process in both experimental and control classes cause the difference of students' cognitive domain competence. It is caused by in experimental class, students are given stimulus in form of problem sheets provided by teacher so that their curiosity increases. Besides, they are also trained to be a discipline person and have self-confidence. It is in line with Hande, Muhammed, and Kommatil (2014), the Problem Based Learning applied in small group will provide appropriate environment to develop students' affective and psychomotor competences.

4. Students' Psychomotor Domain Competence Achievement

The result of students' psychomotor competence shows that students' psychomotor competence in experimental class is significantly better than in control class. Wholly, students' psychomotor competence in experimental class is in 'good' criteria.

High achievement of students' psychomotor competence achievement in experimental class is a positive effect of learning by using PBL model, in which students are demanded to develop and present students' creative work in problem-solving activities. It is in line with Dewi and Jatiningsih (2015), who stated that PBL model has a specific characteristic, which is producing a product and present it. When students are creative, students' psychomotor competence will improve because the assessment of students' psychomotor competence is through product

assessment. In making a product in form of poster and mind map, students are demanded to have good creativity to produce a creative product.

Learning process in both experimental and control classes has significant difference. The average score of students' cognitive competence in the experimental class using PBL model is higher than the average score of students' cognitive competence in the control class using Direct Instruction model. Savery and Dufy (2001) explained that in PBL, students' active participation in learning process is to construct knowledge and apply it into skills.

IV. CONCLUSION

Based on the result of the research and data analysis, it can be concluded that there are some effects of problem based learning model towards students' critical thinking skill and IPA learning competence in cognitive, affective and psychomotor domains.

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