

# The Effectiveness of Problem Based Learning (PBL) in Increasing Student Creative Thinking and Self-efficacy

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**Abstract:** Creative Thinking and Self-Efficacy are needed in mathematics because these factors are the determining factors in the mathematical success. The purpose of this study was to see the influence of Problem Based Learning (PBL) in increasing the ability of student's Creative Thinking and Self-Efficacy on Junior High School at Pekanbaru Riau Province. This research was quantitative with Quasi-Experimental approach. The design of this study is the Randomized Control-Group Post-test Only Design. The population of this research was junior high school student at Pekanbaru Riau Province. The data collection technique is used in this research was a mathematical creative thinking test. The data analysis technique is used in this research were descriptive statistics and ANOVA. The results showed that the Problem Based Learning gave significant influences in increasing the students and self-efficacy. These results were proven from the significant value of ANOVA analysis less 0.05 for creative thinking and self-efficacy.

## 1 INTRODUCTION

One of science which is very important in the development of education and technology is Mathematics. Mathematics is a science that explains abstract concepts to those that can be clearly defined (Himmah et al., 2014). This is because mathematics is not an observation activity, but from ideas, processes, and deductive evidence. to translate this abstract thing, we need an active learning process in teaching and learning mathematics. In learning mathematics, students are brought to observe, guess, do, try, be able to answer the question of why even argue. These principles are expected to be able to realize the goals of creative and critical mathematics learning (Suherman, 2001). According to (Sukmadinata, 2012) creative thinking is a habit of thinking that is embodied in the principles of exploring, reviving imagination, intuition, fostering new potential, opening views that create admiration, stimulating unexpected thinking.

Several national and international studies have found that students' creative thinking skills are still low. This fact is proven by research conducted by the International Student Assessment Program (PISA) team in 2015 which found that Indonesia ranked 69th

out of 76 countries. The PISA results are strengthened by the average 2016/2017 National Exam results in each province in Indonesia are still not as expected. These results indicate that mathematics is still a difficult subject for students. for in Riau Province, the value of the National Mathematics Student Examination in particular in Pekanbaru, the National Exam results are still relatively low.

Based on the problems have found above. The Mathematics Education Experts seek strategy and have found several strategy or models that can make student actively involved in building creative thinking skills. The model can increase creative thinking and self-efficacy student have created by experts is problem-based learning (PBL) model. PBL is a problem-based learning model that enables student can develop the thinking skills. PBL makes student can learn through various real problems in student daily life. PBL goals are how to make students can get and shape their knowledge in various way of learning. (Sungur and Tekkaya, 2006) state that, with the PBL model, students can interact with the environment, classmates which the PBL will guide students in improving their skills.

In addition to creative thinking, self-efficacy is an important variable in learning mathematics because

of students' attitude like self-efficacy one aspect that makes student success in learning mathematics. (Bandura, 1997) says Self-efficacy is an individual believes that student can do something like other friends in the classroom in a certain condition. in other words, self-efficacy is students' confidence in teaching and learning process that makes it get the best result in learning mathematics. Self-efficacy is a concept of the cognitive personal which is had by students and formed from main components, namely students' experience, through observation of other people's experiences, social or verbal media, physical and students' emotional conditions. Students' experience is the source most influential because students' experience about success or failure of students can increase or decrease self-efficacy

The self-efficacy is trust in one's abilities, specifically in the belief in a particular field or concept. Confidence is needed to be able to compete in the globalization era and the work world, as well as in the education world. In teaching and learning process, the teachers are often found that students lack confidence and unsure of their abilities. If this condition doesn't improve, it will give a bad impact on the students quality on future. In the learning activities, they can not answer the teacher question and they usually turned left and right as if looking for support to a friend next to them. The students are seemed to be unsure that he/she could answer the questions given by teachers. Because of the teacher have accountabilities on all problem the student found, the teachers need to always look for a solution to fix education quality.

Mathematics is a subject that could give a solution about how to develop students' confidence. Various studies have been conducted related to the students' self-efficacy. (Pajares and Miller, 1994), (Pajares, 1996) have found that self-efficacy influences student success in mathematics. (Kabiri and Zohuriaan-Mehr, 2003) found that self-efficacy affects mathematical anxiety and mathematical success, namely mathematics anxiety is an influence of mathematical self-efficacy or mathematical performance. (Bandura, 1997) state that self-efficacy is not something that is acquired from birth or permanent from an individual but as a result of cognitive processes through teaching and learning that experienced by students in a certain period. This means that students' self-efficacy can be developed through various strategy because cognitive processes someone occur when teaching and learning process in the classroom. the self-efficacy can be formed and driven through daily activities have done by teachers and students in the classroom.

The PBL model is begun by giving authentic problems to students. According to (Choridah, 2013) PBL model can fix students' mathematical thinking skills on a high level. In the learning process, PBL involves groups of students who are supported to communicate with their friends. when presenting group results, students have understood the materials are asked for communicating with friends and teachers. In PBL, the student is demanded to use the all experience and knowledge have acquired from the various strategy.

PBL will guide individuals and group to investigate students to exchange answers and produce various solutions to existing problems. the ideas conveyed by student come from themselves (original). This strategy can improve students' creative thinking skills. Group discussions have created making students have many experiences through interaction between students and others. Students are also trained to give a suggestion, comment or express opinions in their groups, this activity can increase their verbal abilities. Then, some students present the discussion results in detail to their friend in the classroom. In addition, the experience that acquired from discussing will make students feel satisfied with the achievement of their performance.

## 2 RESEARCH METHOD

This research was quantitative research with a quasi-experimental approach. The design is used in this research was the Nonequivalent Control Group Design where is there are two groups were studied, namely; the treated group (X) and the untreated group. the treated group is called the experimental group and the untreated group is called the control group. The population in this research were students of Junior High School in Pekanbaru consisted of 36 schools.. The samples in these study were Public Junior High School 4 for high level, Public Junior High School 20 for middle level, Public Junior High School 21 for low level. The instruments used in this research were tests of creative thinking skills and students' self-efficacy questionnaires. The data analysis technique that will be used in this study was Descriptive Statistics and Two Way ANOVA.

### 3 RESULT AND DISCUSSION

#### 3.1 Creative Thinking

The scores of students' creative thinking were analyzed through post-test data. The score from the post-test results were presented in the table below. The scores of average and standard deviation were obtained after processing data from the results of the test of students' creative thinking tests based on PBL model.

Table 1: Student Creative Thinking Scores

Score of School Level	Model of Learning					
	PBL			Conventional		
	Mean	SD	N	Mean	SD	N
High	88,6	8,5	31	77,8	6,3	30
Middle	83,4	9,7	41	75,5	6,9	41
Low	79,9	8	39	74,2	3,4	39
Total	83,9	8,7	111	75,9	5,9	110

Based on the table above, students at high level schools have a higher average score of creative thinking of the PBL class, compared to students at the middle school level and low school level students, namely 88.6. In Conventional classes, high school level students get a higher average value of creative thinking compared to middle school level students and low school level students which are 77.83. Then it can be seen whether there are significant differences between the three levels of the school based on learning that uses PBL with conventional. This result can be seen in Table 2.

Table 2: Summary of ANOVA analysis of Creative Thinking

Tests of Between-Subjects Effects			
Source	Mean Square	F	Sig.
Corrected Model	1,028,952	19,063	,000
Intercept	1326446,40	24574,85	,000
Model	31,403	,582	,000
School Level	1,000,635	18,539	,000
Model * School Level	1,700,026	31,496	,003
Error	53,976		

From the results of the calculation, obtained a significant value based on the difference in the model used in the learning of 0.00. This value indicates that there is a significant difference between the experimental class using the PBL Model and control class using the conventional model. Based on the analysis result was obtained a significant value at school levels have used as treatment. From analysis was obtained the significant value of 0.00. This result shows that there is a significant difference between experiment class and control class based on school level, that is; high, middle, and low. Result analysis

shows have happened an interaction between the learning models used with school level used in this research. This result indicates that The PBL learning model can increase the outcome result based on the school level. The next step can be checked which one of the best level for used in the PBL learning model. the result can be seen in Table 3.

Table 3: Scheffe Multiple Comparisons

	(I) IQ	(J) IQ	Mean Difference (I-J)	Std. Error	Sig.
Scheffe	High	Middle	26,104	13,071	,139
		Low	6,8391*	12,956	,000
	Middle	High	-26,104	13,071	,139
		Low	4,2286*	11,272	,001
	Low	High	-6,8391*	12,956	,000
		Middle	-4,2286*	11,272	,001

Based on Table 3 obtained the multiple comparisons between school levels that is; high, middle, and low. From analysis result can be seen that there is significant difference between high level schools with low level. This result is proven from the significant value has obtained is 0.00. There is no significant difference of high level school with middle level school. This result can be checked from the significant value is 0.139. There is the significant difference between middle level schools with low level schools. This result can be seen clearly at Figure 1.

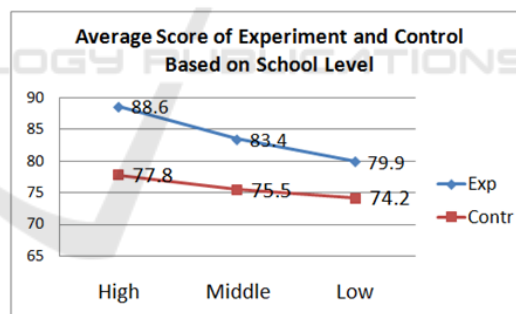


Figure 1: Difference between Experiment and Control Class

Figure 1 shows that the experimental class has a higher average of creative thinking ability than the control class. This result can be generalized as a whole that the group of exponents using the PBL model is better than conventional classes, both from high, middle, and low levels.

#### 3.2 Self-efficacy

Self-efficacy scores are acquired from data analysis uses questionnaire instruments. The score of average, standard deviation, and number of students obtained

after processing data from the instrument in the form of the student self-efficacy questionnaire.

Table 4: Student’s Mathematical Self-Efficacy Score Based on Model of learning and level of schools.

Self-Efficacy	Learning Model					
	PBL			Conventional		
	Mean	SD	N	Mean	SD	N
High	121	10,6	31	119	9,4	30
Middle	113	11,8	41	111	12,0	41
Low	122	10,4	39	104	9	39
Total	117,7	10,9	111	110,67	10,1	110

Based on the table above, in the class of PBL model with low-level students having a higher score of students’ mathematics self-efficacy than the two school levels others, namely 121. In the conventional class students with high-level schools have higher average scores of self-efficacy from the two school levels others that is 118. Then it can be seen whether the comparison between the experimental class self-efficacy is better than the control class. these results can be seen in Table 5.

Table 5: Tests of Between-Subjects Effects

Source	Mean Square	F	Sig.
Corrected Model	1,791,604	16,013	,000
Intercept	2,674,375,337	23903,38	,000
Model	1,914,772	17,114	,000
School Level	646,666	5,780	,004
Model * School Level	2,236,776	19,992	,000
Error	111,883		

Based on the analysis above has acquired the significant difference between experiment class with control class. This result was proven from the analysis result with a significant of 0.00. When viewed from the school level aspect, obtained the significant difference between school levels from experiment class with control class. This result can be seen from significant value was 0.004. From the analysis, the result can be seen the interaction between Model and School levels (Model\*Level Schools). This result shows that there is significant interaction between Model and Level School so that can be concluded that Model and Level School can give different result when Model and School Levels were used simultaneously. For check the difference result of interaction between Model and School Levels, multiple comparisons can describe it as in Table 6.

Table 6: Multiple Comparisons of Self-Efficacy

Dependent Variable: Self-Efficacy					
	(I) IQ	(J) IQ	Mean Difference (I-J)	Std. Error	Sig.
Scheffe	High	Middle	5,28*	1,89	,02
		Low	7,74*	1,87	,00
	Middle	High	-5,28*	1,88	,02
		Low	2,46	1,63	,32
	Low	High	-7,74*	1,87	,00
		Middle	-2,46	1,63	,32

Based on Multiple Comparisons table, it can be seen that there is a significant difference between high levels school with middle school level in self-efficacy. This conclusion can be seen from significant value was 0.021. From the Mean Difference result that viewed from multiple comparisons, the high-level school was higher from middle-level school. The result analysis shows that there is a significant difference between the high-level school with the low-level school, this result can be seen form significant value was 0.021. From the result of Mean Difference, it can be made a conclusion that the high-level school was higher from the low-level school. Based on the result analysis, obtained a comparison between the middle-level school with the low-level school. The result analysis shows that there is no significant difference between the middle school level with the low-level school because of the significant value more 0.05 that is; 0.319. Although no significant difference but Mean Difference shows that the middle-level school is better from the low-level school. For describe clearly comparison of school levels of self-efficacy, figure 2 will show self-efficacy comparison based on the levels school as follow: Figure 2 shows that the experimental class

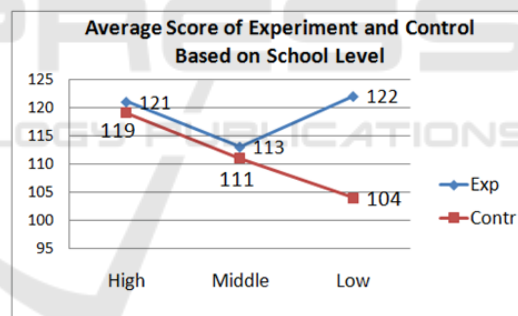


Figure 2: Line diagram between school levels of self-efficacy.

uses PBL model has a higher average than the control class use conventional model. For the high-level school the experimental class is 120 and for the control class is 118, the middle-level school in the experimental class is 112 and for the control class is 111, while for the low-level group the experimental class is 120 and the control class is 103. From this result, it can be concluded that the PBL Model was carried out at the experiment class effectively increase the student’s self-efficacy.

The learning model is very important for increasing learning outcome in teaching and learning process because learning model can give a solution about weakness and deficiency of teaching and learning in the classroom (Risnawati, Andrian, Azmi,

Amir & Nurdin, 2019). Model and strategy of learning actively can increase learning outcome in the classroom (Moravec et al., 2010). Learning model can give a broad direction to the student for solving the problem about bad of learning outcome (Oxford, 2003). The learning will provide a solution about low student motivation, low student outcome, low ability of student during teaching and learning process, and low interest in following the learning process.

PBL is one of learning model can increase learning outcome. From this study, the conclusions have made that problem-based learning can increase the mathematics learning outcome and self-efficacy of mathematics student at junior high school of Pekanbaru, Riau Province. These results show that PBL gives a good effect in giving knowledge to the student to solve a problem in real life. PBL one a model that describes a learning environment with a problem and give a solution to solve it (Roh K H, 2003). PBL gives a positive effect in teaching and learning process, improve student understanding in mathematics subject, this model can increase student ability to use the concept in real life (Padmavathy and Mareesh, 2013). PBL is an effective and efficient model in increasing mathematics student's performance. PBL is a model can give a good solution in solving problems have found with good and effective procedures (Abdullah et al., 2010).

#### 4 CONCLUSION

Based on the results of the research, it was concluded that there were differences in learning outcomes between the Problem Based Learning model applied to the experimental class and the conventional strategy applied in the control class. The results show that PBL can improve learning outcomes in the form skills of the creative thinking and self-efficacy of public junior high school Pekanbaru, Riau province.

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