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THE EFFECT OF USING PROBLEM BASED LEARNING MODEL ON CRITICAL THINKING ABILITY WITH MODERATOR VARIABLE OF LEARNING MOTIVATION

Nurhayati[1], Pupu Saeful Rahmat[2], Yeyen Suryani[3]
[1,2,3] Department of Economics Education, Kuningan University, Indonesia
Email: nurhayati@gmail.com

ABSTRACT

The ability of critical thinking is a skill in depth and logic with various scientific activities for making decisions. There is a need to develop critical thinking skills for students at school to increase sensitivity, respect differences of opinion, and improve communication skills. This research aims to determine the differences in critical thinking ability of students who receive problem based learning model and students who receive lecture method; differences in critical thinking ability of experimental class students who have low, medium and high learning motivation; and the effect of interaction between using problem based learning model and learning motivation on critical thinking ability of class VIII students in Social Sciences Subjects at Kalimanggis 2 State Junior High School. The research method used was a quasi-experimental method with a factorial design. The research subjects were 48 students of class VIII of Kalimanggis 2 State Junior High School, divided into class VIII.A (experiment) and class VIII.B (control), each with 24 people. Data collection techniques used field research with instruments in the form of tests and questionnaires. Hypothesis testing used two-way analysis of variance. Based on the research results, it can be seen that there were differences in critical thinking ability of students who received problem based learning model and students who received lecture method; there were differences in the critical thinking ability of students in experimental class who had low, medium and high learning motivation; and there was an interaction between the use of problem based learning model and learning motivation on critical thinking ability of class VIII students in Social Sciences Subjects at Kalimanggis 2 State Junior High School.

KEYWORDS *Problem Based Learning Model, Critical Thinking Ability, and Learning Motivation*

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INTRODUCTION

21st century education has a strategic role in improving the quality of competitive human resources in the era of globalization. 21st century education requires everyone to be competitive in various fields of life. Therefore, education in the 21st century must constantly adapt to changing times. 21st century education encourages students to acquire important and useful skills to better deal with changes and developments over time. (Fakhri et al., 2022)..

The most important aspect of 21st century education is to encourage students to have a strong foundation of knowledge and understanding to become lifelong learners. The skills that remain important in the 21st century relate to the four pillars of life (*learning to know*, *learning to do*, *learning to be and learning to live together*). These four include specific skills that need to be strengthened by learning such as critical thinking, innovation and creativity, problem solving, and other skills. (Fakhri et al., 2022)..

Critical thinking means thinking in the right direction or considering the most appropriate answer or solution to a problem. Critical thinking helps students become more active in the learning process. Critical thinking refers to the process of thinking in more detail or in a deeper direction. Critical thinking requires students to continuously improve their ability to analyze problems, find solutions to problems, and provide new ideas that can provide a new picture of the problem solution. (Ariani, 2020).

Equipping students with critical thinking skills is one of the expected outcomes of education. Critical thinking helps students make confident decisions about their lives. In other words, critical thinking improves students' ability to adapt to new situations, develops self-evaluation skills, and helps students stay informed and overcome difficult conflicts. If students have strong critical thinking skills, they will be able to achieve the competency standards set in the curriculum. (Armana et al., 2020).

Based on pre-research conducted in class IX SMP Negeri 2 Kalimanggis to measure the extent to which the level of critical thinking skills of students in social studies subjects by referring to the five-scale Benchmark Assessment (PAP) criteria can be explained in table 1.1 as follows:

Table 1.1 Test Results of Students' Critical Thinking Skills in Social Studies Class IX SMP Negeri 2 Kalimanggis School Year 2023/202 4

Value	Category	Frequency	Presentation
90 - 100	Very High	0	00,00%
80 - 89	High	0	00,00%
65 - 79	Medium	6	25,00%
55 - 64	Low	8	33,33%
0 - 54	Very Low	10	41,67%
Total		**24**	**100%**
Average		**-**	**49,76**

Source: Pre-research (2023)

Based on table 1.1 above, it can be seen that the critical thinking skills of students in Social Studies Class IX SMP Negeri 2 Kalimanggis are still in a very low category. This is as the frequency of students in the very low category (0-54) is 10 people (41.67%); the frequency of students in the low category (55-64) is 8 people (33.33%); the frequency of students in the medium category (65-79) is 6 people (25.00%); and there are no students in the high category (80-89) and very high category (90-100). The overall student average only reached 49.76, which is in the category of not passing because it is less than 65.

The results of interviews with social studies teachers in Class VIII SMP Negeri 2 Kalimanggis show the low critical thinking skills of students, especially in learning economics. Teachers did not succeed in creating conditions that support the critical thinking process, as seen from the dominant teaching and learning activities in the form of class discussions that only focus on the material without paying attention to learning objectives. (Slameto, 2015). As a result, students are not trained to think critically and are only accustomed to receiving information without looking for alternative solutions. If not addressed, this can hinder students' ability to solve problems and apply knowledge in real life (Jessica, 2018). (Jessica, 2018). Therefore, a paradigm shift is needed from teaching to learning, with the application of learning models that vary and suit the needs of students (Rusman, 2018). (Rusman, 2018). One effective model is Problem Based Learning (PBL), which emphasizes giving problems as the first step of learning.

The goal of the PBL model is to develop critical thinking skills, problem solving skills, and the ability of students to actively build their knowledge. The PBL model can also develop students' learning independence and social skills. Learning independence and social skills can be formed if students collaborate to identify relevant information, strategies, and learning resources to solve problems. (Hosnan, 2014).

Research shows that the Problem Based Learning (PBL) model effectively improves students' critical thinking skills compared to conventional learning models. Several studies have found that students who use PBL have higher critical thinking skills, as shown by (Armana et al., 2020), (Bangsa et al., 2022), (Fakhri et al., 2022), (Supriyanto et al., 2022), (Festiawan et al., 2021), (Permana et al., 2021), (Putri et al., 2021), and (Darmawati & Mustadi, 2023). However, (Asokawati et al., 2023) found no effect of PBL on critical thinking skills. In addition to the learning model, learning motivation also affects critical thinking skills. Students with high learning motivation tend to have better critical thinking skills, as shown by (Sardiman, 2018). (Sardiman, 2018), (Cholisoh et al., 2015), and Festiawan et al. (2021), although Bangsa et al. (2022) found the opposite result. The combination of PBL and high learning motivation can have a stronger impact on students' critical thinking skills, as shown by Supriyanto et al. (2022) and Festiawan et al. (2021), although Bangsa et al. (2022) found that online-based PBL had no effect on critical thinking skills when viewed from student learning motivation.

The formulation of the problem in this study is to determine whether there are differences in critical thinking skills between students who use the Problem Based Learning (PBL) model and the lecture method, as well as differences in critical thinking skills among students with different learning motivations in classes that

use PBL. In addition, this study also examined the interaction effect between the PBL model and learning motivation on students' critical thinking skills. The purpose of the study was to describe the differences in critical thinking skills between students using the PBL model and the lecture method, as well as among students with low, medium, and high learning motivation. The study also aimed to describe the interaction effect between PBL and learning motivation on critical thinking ability. Theoretically, this study is expected to contribute to the science of education related to the effect of PBL on critical thinking skills with learning motivation as a moderator variable. Practically, this research is expected to make students more active and creative, motivate teachers to use innovative learning methods, provide references for educational institutions for educational improvement, and add to the repertoire of knowledge for other researchers related to PBL, learning motivation, and critical thinking skills.

Based on the explanation that has been presented, it can be assumed that the use of *problem-based learning* models affects students' critical thinking skills moderated by learning motivation. For this reason, the authors will conduct research by determining the title, namely "The Effect of Using *Problem Based Learning* Models *on* Critical Thinking Skills with Learning Motivation Moderator Variables (Quasi Experiment on Class VIII Students of Social Studies Subjects at SMPN 2 Kalimanggis)".

Hypothesis

According to Sekaran & Bougie (2017), a hypothesis can be defined as "A logically predicted relationship between two or more variables expressed in the form of a testable statement". In accordance with this definition and the framework, the following hypothesis can be determined:

1. There is a difference in the critical thinking skills of students who get the problem-based learning model with students who get the lecture method.
2. There are differences in students' critical thinking skills in experimental classes that have low, medium, and high learning motivation.
3. There is an interaction between the use of problem-based learning model and learning motivation on students' critical thinking skills.

RESEARCH METHOD

Research Methods

This study uses a quasi-experimental method to determine the effect of the problem-based learning (PBL) model on students' critical thinking skills, with learning motivation as a moderator variable (Noor, 2014).Noor, 2014). The experimental design used was a 2 x 3 factorial design, which included two learning models (PBL and lecture) and three levels of learning motivation (high, medium, low).Suharsaputra, 2012).

This research involves three types of variables: independent variable (problem-based learning model), dependent variable (critical thinking skills), and moderator variable (learning motivation). (Hamalik, 2015) (Sardiman, 2018). Each variable has clear definitions, indicators, and measurement instruments.

Objects and Subjects of Research

The research objects include the problem-based learning model, learning motivation, and students' critical thinking skills. (Sugiyono, 2020). The research subjects were VIII grade students of SMPN 2 Kalimanggis, with a total of 64 students divided into two classes: experimental class (VIII.A) using the PBL model and control class (VIII.B) using the lecture method. (Arikunto, 2019).

The data used in this research is quantitative data which includes the results of critical thinking ability tests and learning motivation questionnaires. Primary data sources come from students of grade VIII of SMPN 2 Kalimanggis.

Data Collection Technique

Data were collected through tests and questionnaires. Tests were used to measure students' critical thinking skills, while Likert-scale questionnaires were used to measure students' learning motivation.

The research instruments were tested for validity and reliability (Priyatno, 2016). The validity test used Pearson's product moment correlation, while the reliability test used Cronbach's Alpha technique. The results show that all instruments are valid and reliable (Nunnally in Ghozali, 2016).

The level of difficulty of the questions was analyzed to determine the level of difficulty of each item. The results of the analysis showed that the questions were in the difficult, medium, and easy categories. The differentiating power of the questions was also analyzed to ensure the ability of the questions to distinguish students with high and low abilities (Winarsunu, 2020). The results show that most of the questions have differentiating power.

Data were analyzed using classical assumption tests (normality and homogeneity) and hypothesis testing with two-way analysis of variance (ANOVA).Kusnendi, 2018). This analysis was used to test the effect of learning models and learning motivation on critical thinking skills, as well as the interaction between the two variables.

RESULT AND DISCUSSION

Research Results

The pre-test and *post-test* data can provide information about the effect of the treatment given. The following is the research data obtained from the experimental class using the PBL learning model and the control class using the lecture method.

Description of Research Data

Description of *Pretest* Data

The initial test was given to two groups of research subjects, namely the experimental group and the control group before treatment. Based on the data processing of the initial test results *(pretest) of the* control group and the experimental group, the data obtained are presented in the table as follows:

Table 4.1. **Results of *Pretest* Data Analysis of Experimental and Control Classes**

Class	N	Total Score	Xmin	Xmax	Average
Experiment	24	1180	20	80	49,17
Control	24	1173	27	67	48,89

Based on the table above, it can be seen that the experimental class using the PBL model and the control class using the lecture method have scores that are not much different. The experimental class using the PBL model has a total number of 24 students obtained a total score of 1180 and an average of 49.17 with the highest score of 80 and the lowest score of 20; while in the control class using the lecture method with a total number of 24 students obtained a total score of 1173 and an average of 48.89 with the highest score of 27 and the lowest score of 67.

Description of *Posttest* Data

After being given different treatments between classes using the PBL model and classes using the lecture method, where from the data processing of the final test results of the control and experimental classes the following results were obtained:

Table 4.2. Results of *Posttest* Data Analysis of Experimental and Control Classes

Class	N	Total Score	Xmin	Xmax	Average
Experiment	24	2126	73	100	88,61
Control	24	1900	67	100	79,17

Based on the table above, it can be seen that the experimental class using the PBL model and the control class using the lecture method have different scores. The experimental class using the PBL model which has 24 students obtained a total score of 2126 and an average of 88.61 with the highest score of 100 and the lowest score of 73; while the control class using the lecture method with 24 students obtained a total score of 1900 and an average of 79.17 with the highest score of 100 and the lowest score of 67.

N-Gain Description

To determine the increase (*gain*) of students' concept understanding by using the PBL learning model in the experimental class and the use of lecture learning methods in the control class, the calculation of normalized gain (*N-gain*) is used. The results of the N-gain data analysis can be seen in the following table:

Table 4.3 Results of *N-Gain* Data Analysis of Experimental and Control Classes

Class	*Pretest*	*Posttest*	Gain	*N-Gain*	Criteria
Experiment	49,17	88,61	39,43	0,76	High
Control	48,89	79,17	30,29	0,54	Medium

From the table above, it can be seen that the *gain* value in the experimental class is 39.43 with an *N-gain value of* 0.76 including high criteria and in the control class the *gain value is* 30.29 with an *N-gain* value of 0.54 including moderate criteria. Thus, it can be concluded that the increase in students' critical thinking skills in the experimental class using the PBL learning model is higher than the increase in students' critical thinking skills in the control class using the lecture method or in other words the *Problem Based Learning* (PBL) learning model is more effective in improving critical thinking skills compared to the lecture method.

Description of Learning Motivation

From the results of the total score of each respondent's questionnaire (students in the experimental class), the average is 40.12, this score is obtained from the number of questionnaires given, namely 20 statement items that measure learning motivation compared to the number of students, namely 24 people (in the experimental class). As for determining the category of learning motivation, the following is presented in the table below:

Table 4.4 Recapitulation of Learning Motivation Categories

Score	Category	Frequency	Percentage (%)
> 67	High	9	37,5
34 - 67	Medium	14	58,33
< 34	Low	1	4,17
Total		**24**	**100**

From the table above, it is known that of the 24 students in the experimental class, 9 people or 37.5% were included in the high motivation category; as many as 14 people or 58.33% were in the medium category, while as many as 1 person or 4.17% of students were in the low learning motivation category.

Statistical Prerequisite Testing

Normality Test

The data that has been obtained through the *pretest* and *posttest of* the two classes is then calculated and analyzed to determine the next step in conducting research. Calculations and analysis carried out include normality test, homogeneity test. The results of the calculation and analysis of the research data in the control class and experimental class are as follows.

Normality Test of Pretest and Posttest of Critical Thinking Ability

Normality testing is carried out using the *One Sample Kolmogrov-Smirnov Test* with the provision that if the significance value is greater than $\alpha = 0.05$, it is declared normal. Conversely, if the significance value is smaller than $\alpha = 0.05$, it is abnormal. The following results of the normality test with the help of SPSS Version 21 *For Windows* can be seen in the table as follows:

Table 4.5. Critical Thinking Ability Data Normality Test Results

One-Sample Kolmogorov-Smirnov Test

		Pretest Exp	Posttest Exp	Gain Exp	Control Pretest	Control Posttest	Control Gain
N		24	24	24	24	24	24
Normal Parameters[a,b]	Mean	49.2500	88.5833	39.4583	49.0833	79.2917	30.3333
	Std. Deviation	17.2078	10.2952	17.3555	14.7173	12.1242	21.97363
Most Extreme Differences	Absolute	.135	.166	.251	.152	.178	.181
	Positive	.135	.134	.119	.142	.178	.181
	Negative	-.115	-.166	-.251	-.152	-.154	-.120
Kolmogorov-Smirnov Z		.663	.813	1.232	.745	.872	.886
Asymp. Sig. (2-tailed)		.771	.522	.096	.636	.433	.412

a. Test distribution is Normal.

b. Calculated from data.

Based on the results of the normality test above, the significance for the experimental class *pretest was* 0.771; the significance of the experimental class *postest was 0.*522; and the significance of the experimental class gain was 0.096 while the significance for the control class *pretest was 0.*636; the significance for the control class *postest was 0.*433; and the significance of the control class *gain was 0.*412. All significance values are greater than 0.05, so it can be concluded that the *pretest, postest,* and *gain* data in the experimental and control classes are all included in the normal category or all data are normally distributed.

Normality Test of Learning Motivation

Normality testing is carried out using the *One Sample Kolmogrov-Smirnov Test* with the provisions that if the significance value is greater than α = 0.05, it is declared normal, otherwise if the significance value is smaller than α = 0.05, it is abnormal. The following results of the normality test with the help of SPSS Version 21 *For Windows* can be seen in the table as follows:

Table 4.6

Normality Test Results of Learning Motivation Data

One-Sample Kolmogorov-Smirnov Test

		Motivation
N		24
Normal Parameters[a,b]	Mean	55.1667
	Std. Deviation	17.27946
Most Extreme Differences	Absolute	.138
	Positive	.134
	Negative	-.138
Kolmogorov-Smirnov Z		.676
Asymp. Sig. (2-tailed)		.751

a. Test distribution is Normal.

b. Calculated from data.

Based on the results of the normality test, the significance value for learning motivation data is 0.865. The significance is greater than 0.05, so it can be concluded that the learning motivation data is normally distributed.

Homogeneity Test

In addition to data must be normally distributed, an absolute requirement that must be met is that the data must be homogeneous. The homogeneity test in this study was carried out with the help of the *SPSS Version 21 For Windows* program. The basis for decision making in the homogeneity test uses the ANOVA Test calculation. With the provisions if the sig value> 0.05, then the data is homogeneous, otherwise if the sig value <0.05 then the data is not homogeneous. The following are the results of the homogeneity test between the experimental class critical thinking ability data and the control class and the following learning motivation data:

Table 4.7
Homogeneity Test Results

ANOVA

		Sum Squares	ofdf	Mean Square	F	Sig.
Gain Exp	Between Groups	6358.958	21	302.808	1.064	.593
	Within Groups	569.000	2	284.500		
	Total	6927.958	23			
Control Gain	Between Groups	9676.333	21	460.778	.645	.765
	Within Groups	1429.000	2	714.500		
	Total	11105.333	23			

Based on the results of the homogeneity test above, the significance value for the *gain value* with motivation is 0.593, when compared to α = 0.05 the significance value of 0.593 is more than 0.05 or 0.593> 0.05, it can be concluded that the data used meets homogeneous requirements. Likewise, the results of testing the control gain value data with motivation value data show a significance value of 0.765, when compared to α = 0.05 the significance value of 0.765 is more than 0.05 or 0.765> 0.05, it can be concluded that the data used meets homogeneous requirements Thus, it can proceed to hypothesis testing in the form of *two-way* anova.

Hypothesis Testing

After the two groups have the same or homogeneous variants, then test the hypothesis using the *two ways anova* test of the SPSS program. The following table shows the results of hypothesis testing using the *two ways anova test*.

Table 4.8 Hypothesis Test

Tests of Between-Subjects Effects

Dependent Variable: Critical Thinking

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3184.698[a]	5	636.940	1.982	.101	.150
Intercept	26638.007	1	26638.007	82.878	.000	.758
Model	50.866	1	50.866	13.158	.000	.061
Motivation	1176.000	2	588.000	8.829	.002	.033
Model * Motivation	981.948	2	490.974	11.528	.000	.063
Error	13499.302	42	321.412			
Total	78892.000	48				
Corrected Total	16684.000	47				

a. R Squared = ,191 (Adjusted R Squared = ,095)

Based on the results of hypothesis testing using the *two-way anova* test, the results are explained in the following description:

First Hypothesis: Differences in Critical Thinking Skills between Students who received PBL Model and Students who received Lecture Method.

Based on the *test of between subjects effects* above to determine the difference in critical thinking skills of students who get the PBL model with students who get the lecture method, it is known that the F value is 13.158 and the significance value is 0.000. The significance value of 0.000 is smaller than $\alpha = 0.05$ or $0.000 < 0.05$, which means that there is a difference in the critical thinking skills of students who get the *problem-based learning* model with students who get the lecture method. Thus the first hypothesis is accepted.

Second Hypothesis: Differences in Critical Thinking Ability between Students with Low, Medium, and High Learning Motivation in Classes with *Problem Based Learning* (PBL) Model.

Based on the *test of between subjects effects* above to determine the difference in critical thinking skills between students who have low, medium, and high learning motivation in classes that get the *Problem Based Learning* (PBL) model, the F value is 8.829 and the significance value is 0.002. The significance value of 0.002 is smaller than $\alpha = 0.05$ or $0.002 < 0.05$, which means that there are differences in students' critical thinking skills in experimental classes that have low, medium, and high learning motivation. Thus, it can be concluded that the second hypothesis of this study is accepted.

Third Hypothesis: Interaction Between *Problem Based Learning* (PBL) Model and Learning Motivation in Affecting Students' Critical Thinking Ability

Based on the *test of between subjects effects* to determine the interaction between the *Problem Based Learning* (PBL) model and learning motivation in

influencing students' critical thinking skills, it is known that the F value is 11.528 and the significance value is 0.000. The significance value of 0.000 is smaller than $\alpha = 0.05$ or 0.000 <0.05, which means that there is an interaction between the use of *problem-based learning* model and learning motivation on students' critical thinking skills. Thus it can be concluded that the third hypothesis is accepted. To see the difference in the effect of high, medium and low learning motivation on critical thinking skills, it can be seen from the post hoc test results as follows:

Table 4. Post Hoc Two ways Anova test

Multiple Comparisons

Dependent Variable: Critical Thinking Ability Score

Tukey HSD

(I) Learning Motivation	(J) Learning Motivation	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Low	Medium	-3.40	2.724	.429	-9.95	3.14
	High	-10.59*	3.779	.018	-19.67	-1.52
Medium	Low	3.40	2.724	.429	-3.14	9.95
	High	-7.19	4.103	.194	-17.05	2.67
High	Low	10.59*	3.779	.018	1.52	19.67
	Medium	7.19	4.103	.194	-2.67	17.05

Based on observed means.

The error term is Mean Square(Error) = 94.793.

*. The mean difference is significant at the .05 level.

Further analysis with the post hoc test shows that there is a difference in average (*mean*) between low and high learning motivation which is 10.59 with a sig value of 0.018 < 0.050, meaning that there is a significant difference between low motivation and high motivation. While between low and medium learning motivation has a mean of 3.40 with a sig value of 0.429 < 0.050, meaning that there is no significant difference between low learning motivation and moderate learning motivation. And high and moderate learning motivation has a mean of 7.19 with a sig value of 0.194 < 0.050, meaning that there is no significant difference between high motivation and moderate motivation. Furthermore, in the poshoc test section, the difference in each motivation can be seen from the *Harmonic mean* value produced by each method in the same or different subset columns. Here are the results of the calculation:

Table 4 Homogeneous Subsests

Critical Thinking Ability Score

Tukey HSD [a,b,c]

Learning Motivation	N	Subset

		1	2
Low	9	78.28	
Medium	14	81.68	81.68
High	1		88.88
Sig.		.612	.119

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 94.793.

a. Uses Harmonic Mean Sample Size = 14,759.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05.

The test results above show that there is no difference in critical thinking ability between students who have low learning motivation (column subset 1) and critical thinking ability between students who have moderate learning motivation (column subset 1); then, there is a difference in critical thinking ability between students who have low learning motivation (column subset 1) and critical thinking ability between students who have moderate learning motivation (column subset 2); there is no difference in critical thinking ability between students who have moderate learning motivation (column subset 2) and critical thinking ability between students who have high learning motivation (column subset 2).

Discussion

Research on the effect of using PBL learning model on students' critical thinking skills with moderator variables of learning motivation was conducted by taking two classes as research subjects, namely classes that use PBL learning model and classes that use lecture learning method. In this study, the research subjects were class VIII.A and class VIII.B which amounted to 24 students each. Normality test using *one-sample kolmogorov-sminrnov test the* results show that the data is normally distributed both data obtained from experimental and control classes. Furthermore, the homogeneity test was carried out with the results showing that the variable variants were declared homogeneous. Furthermore, to discuss the problem formulation is described as follows:

Differences in Critical Thinking Ability of Students who Get PBL Model with Students who Get Lecture Method

Based on the results of statistical testing and analysis that has been done, it is known that there are differences in the critical thinking skills of students who get the *problem-based learning* model with students who get the lecture method. Where the average increase in critical thinking skills of experimental class students using the PBL learning model is higher than the increase in critical thinking skills of classes using the lecture method.

This is in line with the results of previous studies, namely 1) groups of students who studied with the PBL model had better critical thinking skills than groups of students who studied with conventional models. (Armana et al., 2020)2) classes that apply online-based PBL models have a greater average score of 77.0 than classes that do not apply online-based PBL models of 72.1. (Bangsa et al., 2022)3) there is a significant difference in the critical thinking skills of experimental group students with the control group. (Fakhri et al., 2022); 4) PBL learning strategy is better than *inquiry* on students' critical thinking skills. (Supriyanto et al., 2022); 5) there is a significant difference in students' critical thinking skills between the experimental class and the control class, where the average of the experimental class is greater than the average of the control class. (Festiawan et al., 2021); 6) the application of the STEM approach with the PBL model can improve students' critical thinking skills. (Permana et al., 2021); 7) PBL has a significant positive effect on critical thinking skills (Putri et al., 2021). (Putri et al., 2021); and 8) there are differences in students' critical thinking skills between groups using PBL and groups using expository. (Darmawati & Mustadi, 2023)..

During the learning process carried out with the treatment material using the PBL learning model in the experimental class and the lecture method in the control class showed that the critical thinking skills of students in both classes experienced differences. The difference in critical thinking skills is shown by the average value of the final ability in the class using the PBL learning model is 88.61 and the average increase (*gain*) in critical thinking skills is 39.43; while in the class using the lecture learning method the average value of the final ability is 79.17 and the average increase (*gain*) in critical thinking skills is 30.29. From the average value of the final ability and the increase *(gain), it* can be seen that the critical thinking skills of experimental class students who used the PBL learning model were superior to the critical thinking skills of control class students who used the lecture learning method.

Based on the findings in the field during the research process, it is known that students in the experimental class using the PBL learning model, students are required to be able to play a more active role in obtaining opportunities to build their own knowledge so as to gain more understanding and in the learning process is more varied such as group work so that thinking skills can be more developed.

A higher increase was obtained by the class that used the PBL learning model than the class that used the lecture method. This is due to several factors such as students in classes that use PBL learning models can work together actively in groups to complete tasks from the teacher. Students have responsibility in learning and their curiosity increases. In addition, students' self-confidence becomes high and they are able to develop new ideas to answer questions about learning materials.

Furthermore, in classes that use the lecture method, students are actively required to find solutions to the problems obtained. Student responsibility can be formed but students are less able to develop ideas and curiosity about learning materials because students are afraid of being wrong in their opinions and only fixate on the problems that must be solved. In contrast to students in classes that use PBL learning models, students are required to be able to solve a problem in groups by answering questions and finding answers. Students are more active in

finding the match of question cards with answers so as to create a more pleasant atmosphere. While classes that use the lecture method, students learn in groups and are conditioned to be able to explore the material more deeply, to then be presented in front of other participants, but in this method only certain students have the highest role, for students who tend to be passive more to follow the opinions of active students only.

In applying the PBL model, at the beginning of learning students are given problems and they must be responsible for solving the problems given based on their prior knowledge. In line with the theory of Jerome S. Bruner in Rusman (2016) which states that:

Discovery learning is in line with the active search for knowledge by humans and in itself provides better results, trying to find solutions to problems on their own and being supported by accompanying knowledge and producing knowledge that is truly meaningful.

Furthermore, the problems given are related to the material taught and cannot be separated from students' daily lives, so that students' minds are more open to real life. Thus students have a learning experience. According to Moffit in Rusman (2016), problem-based learning is a learning approach that uses real-world problems as a context for students to learn problem-solving skills.

Based on this description, the application of the *problem-based learning* model makes it easier for students to understand the concept of the material taught because students build their own knowledge. In contrast to the application of the lecture method where students only receive material so that knowledge will not become meaningful knowledge causing low learning outcomes of a material. Analyzing the research results and trying to compare them, it is clear that the learning outcomes of students who take part in learning with the PBL model are better than students who take part in learning with the lecture method. This can be seen from the average score previously described. Thus, it can be concluded that learning by using the PBL learning model is better and superior to the lecture method in terms of improving students' critical thinking skills.

Differences in Critical Thinking Ability Between Students with Low, Medium, and High Learning Motivation

Based on the results of statistical testing and data analysis, it is known that there are differences in the critical thinking skills of students in experimental classes who have low, medium, and high learning motivation. Where the critical thinking skills of students with high motivation have an average value of increasing critical thinking skills higher than the average critical thinking skills of students with moderate and low learning motivation. In other words, learning motivation affects the improvement of students' critical thinking skills.

This is in line with the results of previous studies, namely 1) there are differences in high achievement motivation and low motivation on students' critical thinking skills. (Supriyanto et al., 2022)2) there are differences in students' critical thinking skills between those with low, medium, and high learning motivation (Cholisoh et al., 2015). (Cholisoh et al., 2015); and 3) learning motivation has a

significant positive effect on students' critical thinking skills. (Festiawan et al., 2021).

In addition to the use of the Problem Based Learning model, an equally important factor in improving student learning outcomes is student motivation itself. According to Donald in Kompri (2016), motivation is an energy change in a person's personality characterized by the emergence of affective (feelings) and reactions to achieve goals. Learning motivation is an encouragement that comes from within (instrinsic) and from outside (extrinsic) students so that it can create enthusiasm and passion in learning. In learning, the motivation factor has an important influence. The higher the motivation of students to learn, the higher the learning outcomes obtained by students, and vice versa. For this reason, teachers must be able to increase learning motivation in students to study diligently so that they get optimal learning results.

Learning motivation affects the improvement of students' critical thinking skills and the quality of learning in the classroom. Students who have high motivation tend to be more active in learning, making communication more effective, facilitating forums and increasing enthusiasm so that their thinking skills develop and students become easier to understand the material being taught.

Interaction Between Problem Based Learning (PBL) Model and Learning Motivation in Influencing Students' Critical Thinking Ability

Based on the results of statistical testing and analysis that has been done, it is known that there is an interaction between the use of *problem-based learning* models and learning motivation on students' critical thinking skills. This means that the *problem-based learning* model and learning motivation have an interaction in terms of improving students' critical thinking skills. This shows that when students in classes that use PBL learning models have high learning motivation, their critical thinking skills will increase more than if students have low learning motivation.

This is in line with the results of previous studies, namely 1) there is a significant interaction between PBL learning strategies and achievement motivation on students' critical thinking skills. (Supriyanto et al., 2022) and 2) there is a significant interaction between PBL learning model and learning motivation on students' critical thinking skills (Festiawan et al., 2021). (Festiawan et al., 2021).

Through the PBL learning model, teachers help students gain information, ideas, skills, ways of thinking, and expressing ideas. The PBL learning model serves as a guideline for learning designers and teachers in planning teaching and learning activities. Nevertheless, based on the statistical findings of the author's research results and supported by several findings of previous research results, and the findings in this study are also in line with several other studies such as research conducted by Bangsa at al (2022); Supriyanto et al (2022); which concluded that there is a strong main effect of independent variables and moderator variables on related variables, thus strengthening the existing interactions. This means that learning methods have a strong or significant interaction with learning motivation on improving students' critical thinking skills.

In other words, the interaction is due to the dominant influence of learning model from learning motivation on students' critical thinking skills, or vice versa,

the influence of learning motivation is more dominant than the learning model on students' critical thinking skills. The group of students who studied in a class that used the PBL learning model and had high learning motivation had better critical thinking skills than the group of students who studied in a class that used the lecture method.

Based on the results of research on the effect of using *problem-based learning* models on students' critical thinking skills with moderator variables of learning motivation, several things were found as follows:

1. Based on the results of the study, it shows that not all students learn if the teacher is not in class.
2. Then the next finding shows that students do not learn new material if it has not been explained by the teacher.
3. Other findings show that students when expressing opinions there are differences, namely giving up easily and not trying to convince first.

CONCLUSION

Based on the results of the study, the authors concluded that there is a significant difference in critical thinking skills between students using the problem-based learning (PBL) learning model and students using the lecture method, with students using PBL showing superior critical thinking skills. In addition, there were differences in critical thinking skills among students in the experimental class who had low, medium, and high learning motivation, with highly motivated students showing greater improvement. Also, there was an interaction between the use of PBL model and learning motivation on critical thinking skills, where students with high learning motivation using PBL showed a more significant improvement.

The suggestions given are as follows: For students, it is important for teachers to increase their learning motivation, as research shows that not all students learn effectively without the presence of the teacher. For teachers, they should provide in-depth understanding and explanation when introducing new material so that students understand and are motivated. Teachers also need to train students to have confidence in expressing opinions. For school principals, it is important to cooperate with teachers in overcoming students' difficulties by providing training on innovative learning models such as PBL, especially in social studies subjects, to encourage students to keep learning even without the presence of the teacher. For future researchers, it is expected to develop other learning models that can improve students' critical thinking skills and learning outcomes.

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