



The Effect of the Problem Based Learning Model on Students' Critical Thinking Skills in Geography at SMAN 1 Trenggalek, Indonesia

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Abstract

The findings showed that the Problem Based Learning model has a positive and significant effect on students' critical thinking skills, the result of the significance (2-tailed) in the two comparison classes, namely the experimental class and the control class, is 0.000. In addition, there is also a probability that shows a number of 0.000 less than 0.05, on the critical thinking ability of students, the results of the average obtain score in the experimental class are (20.2) while the class that is used as the control class is (7.7). Based on these data, it can be proved that H₀ is rejected and H₁ is accepted. This can be interpreted that this problem-based learning model affects students' ability to think critically in the learning process of Geography subjects at SMAN 1 Trenggalek. This is because the syntax of the PBL learning model is able to encourage students' critical thinking skills, so that students' critical thinking skills can increase. Therefore, this learning model is highly recommended to be implemented in the learning process of Geography subjects.

Keywords: Problem Based Learning; critical thinking ability; SMAN 1 Trenggalek.

Introduction

Problem Based Learning (PBL), a learning model that can hone students' reasoning abilities through real-world problems. PBL uses problems as a learning resource in learning activities. According to Rusman (2013), Problem Based Learning can be interpreted as a learning model that can motivate students to be more skilled and creative in improving critical thinking based on a real problem through investigation. This makes this model have different characteristics from other learning models.

In PBL, there are identical learning activities from this model. This activity focuses on the process of solving problems faced scientifically through learning stages or syntax. The stages or syntax of this model consist of (1) introducing students to a problem, (2) guiding students to be able to learn something, (3) guiding student activities when conducting individual or group investigations, (4) explaining and building a creation, and (5) studying and assessing a problem-solving activity.

The application of this problem-based learning model aims to increase effectiveness in learning. This statement is supported by Sumarmi (2012) that learning activities that focus more on students are assumed to be effective learning. Learning is said to be effective if it can involve students in every learning activity in the classroom. With the application of the problem-based learning model, students will also be trained in improving reasoning capabilities to determine the solution to the problem they are facing. This makes PBL have its own advantages compared to other learning models.

The application of the PBL learning model in learning activities has a number of advantages when matched with other models. According to Sanjaya (2011), the benefits of using PBL include: 1) Problem-solving, a relatively good way for students to better understand the content of the lesson, 2) giving students a sense of satisfaction because students can get new knowledge about the lesson, 3) student learning activities can be improved, 4) students can learn more about how to respond to new problems, 5) in developing their new resilience, students can be more responsible, and 6) students' ability to think critically is also more developed by solving problems.

In addition to what has been mentioned earlier, there are also other advantages that this model has in its application. Another advantage is that it can improve students' capabilities in critical thinking, because PBL is designed to direct students to be able to participate directly in the process of problem-solving activities, either working individually or in groups. This process will encourage students to have the ability to solve problems in real everyday conditions. In addition, students also could improve their own insight through learning activities centered or oriented to an existing problem.

Currently, every student must be able to apply critical thinking during the learning process. Students are assumed to be able to think critically if they can think broadly and deeply in a trusted decision-making. In line with Ennis' opinion in Sudaryanto (2008) which states that critical thinking is a process in determining a logical decision about something that is being believed and done. Glaser in Fisher (2007) also defines critical thinking capability as deep-thinking behavior related to problems that are within the scope of a person's insight, skills in evaluative and logical reasoning techniques and the nature of skills in using these techniques.

Students must have the ability and critical thinking skills so that students are able to determine their own ideas or ideas to face and handle a problem, one of which is during geography learning activities at school. Understanding theory and critical thinking skills are needed during geography learning activities, currently geography subjects require students to think at a high level. This aims to enable students to combine theory with practical activities while in the field. In learning activities, students can be said to think critically if they can think deeply about the problems presented by reasoning to determine reliable decisions based on supporting evidence and conclusions or subsequent decisions that result.

The research taken is about how PBL affects students' ability to think critically and has been carried out by several researchers before. One of them is a study by Alfi (2016) which states the results of his research that this model affects the ability of high school students to think critically. Similar research has also been conducted by Amin (2017) which shows that there is an influence of the use of PBL on critical thinking capabilities and geography learning outcomes. In addition,

Herzon (2028) also concluded based on the results of his research that the PBL learning model has an influence on students' skills in critical thinking

Related research related to the use of PBL learning models in critical thinking capabilities has been done by many previous researchers. Based on the results of these studies, it can be concluded that there is an impact of the use of the PBL learning model on students' critical thinking capabilities. Based on these conclusions, the researcher wants to retest and prove for himself how the use of the PBL learning model affects students' critical thinking capabilities, especially geography learning activities at the high school level.

Methods

This research can be said to be a pseudo-experiment (quasi-experiment), because the researcher cannot fully control, cannot manipulate, control and randomize the relationship between cause and effect of the action applied to the research subject. Control group pretest-posttest is a design chosen by the researcher with the aim that the researcher can measure the difference in critical thinking capabilities shown from the control group and experimental group. The test implementation activities were carried out on two occasions, both at the beginning of the learning activities (pretest) and at the end of the learning activity (posttest) (Tabel 1).

Table 1. Research Design

Class	Pretest	Treatment	Posttest
Control	P1	X1	P2
	P1		
Experiment		X2	P2

Information:

P1 : Results of the score Pretest

P2 : Results of the score Posttest

X1 : Using conventional models

X2 : Using the PBL model

The research subjects used grade XI students of SMAN 1 Trenggalek. There are three study groups in class XI of the social studies program at SMAN 1 Trenggalek, including classes XI IPS I, XI IPS II, and XI IPS III. Based on the three study groups, the researcher only selected two study groups that will be used as research subjects, namely XI IPS II as the control class and XI IPS III as the experimental class determined by the lottery technique. The selection of the study group as the subject in this study is based on the average ability of almost the same students. The following is a table of the average capabilities of grade XI students of the social studies program at SMAN 1 Trenggalek. The average daily test scores of Classes XI Social Studies Programme of SMAN 1 Trenggalek can be seen in Table 2.

Table 2. The Average Daily Test Scores of Classes XI Social Studies Programme of SMAN 1 Trenggalek

No	Class	Value
1	XI IPS I	85
2	XI IPS II	81
3	XI IPS III	80

The researcher's data is the ability of students to think critically which will be collected based on the implementation of the pretest and posttest. Initial data of students were obtained from the implementation of a pretest which was carried out once when the research subjects had not been given treatment. The final data of students was obtained from the implementation of the posttest which was carried out once after the research subject was given treatment. Based on the acquisition of these two data, the gain score calculation is then carried out. Gain score is used to determine the difference between the results of the pretest and posttest scores in each individual in the control and experimental groups. The researcher then used the results of the calculation of this gain score data in testing the hypothesis.

Researchers use treatment and measurement instruments to facilitate data collection. The treatment instruments are conventional RPP and the model to be tested. The measurement instrument is in the form of test questions where each item represents an indicator of students in achieving critical thinking skills.

Before conducting the research, the researcher carried out a validity and reliability test. Content validity is selected by the researcher in validity testing with the intention of assessing whether the instrument can describe the scope of the concept to be measured and how well a sample of the instrument presents this total coverage. The measurement of the validity of the questions is carried out according to the scoring guidelines considered by experts. Reliability tests are carried out to find out whether the instrument can be used continuously with consistent data acquisition, so that it can be said to be reliable.

Based on the test results, students' critical thinking capabilities will be obtained. The data is then presented in the number distribution that can be seen in Table 3.

Table 3. Distribution of the Number of Students' Critical Thinking Capabilities

Classification	Score	Qualification
A	85 – 100	Excellent
B	75 – 84	Good
C	65 – 74	Enough
D	40 – 64	Less
E	<40	Very Less

In Table 3, the critical thinking ability in students is qualified into several which will later be used as a reference score. Data analysis uses prerequisite tests and hypothesis tests. The prerequisite test can be interpreted as a test that is carried out before the hypothesis of the analysis test is carried out. Prerequisite tests include normality tests and homogeneity test. The implementation of the normality test aims to assess whether the data distribution is normal or not, while the implementation of the homogeneity test is to assess whether the data obtained is classified as homogeneous or not.

The researcher took advantage of the SPSS program using the Kolmogorov-Smirnov One-Sample statistics for the normality test and the Levene's Test statistics to conduct the homogeneity test. The data can be said to be normally distributed or homogeneous if the value proves the number ≥ 0.05 . Meanwhile, the data is not normally distributed or classified as homogeneous if the value shows a figure of < 0.05 .

A hypothesis test is a test to determine whether a hypothesis is acceptable or not. The purpose of conducting a hypothesis test is to see the influence of the independent variable on the bound variable. The researcher used the SPSS program with Independent Sample t-test statistics to process the data.

Results and Discussion

Table 4 shows a description of the pretest scores of students' critical thinking skills in the experimental class.

Table 4. Distribution of the Number of Pretest Scores of Students in Experimental class

Classification	Value Range	Information	Sum	Percentage (%)
A	91 – 100	Very High	0	0
B	75 – 90	Tall	2	8
C	60 – 74	Quite High	16	64
D	41 – 59	Low	7	28
E	<40	Very Low	0	0
Sum			25	100

Table 4 presents the findings of the initial critical thinking capability of participants in the experimental class. The percentage obtained was 2 (two) qualifications that were very prominent during the pretest activity. The highest percentage is a C classification (quite high) of 64% with a total of 16 students. The percentage in the D (low) classification is 28% with a total of 7 students and the percentage in the B (high) classification is 8% with a total of 2 students. The number of students for the very high and very low categories is 0. Therefore, the initial mean of critical thinking ability of experimental class students before the treatment is applied is 64. Table 5 shows a description of the pretest scores of students' critical thinking ability in the control class.

Table 5. Distribution of the Number of Pretest Scores of Control Class Students

Classification	Value Range	Information	Sum	Percentage (%)
A	91 – 100	Very High	0	0
B	75 – 90	Tall	1	4
C	60 – 74	Quite High	18	72
D	41 – 59	Low	6	24
E	<40	Very Low	0	0
Sum			25	100

Table 5 presents the results of the acquisition of data on the initial critical thinking capability of students in the control class. The highest percentage is the C classification (quite high) of 72% with a total of 18 students. The percentage in the D (low) classification is 24% with the number of 6 students and the percentage in the B (high) classification is 4% with the number of 1 student. The number of students for the very high and very low categories is 0. So, the initial mean of critical thinking capability of control class students before the treatment was applied was 64.5.

Figure 1 shows a comparison of student initial capability data (pretest) between the experimental class and the control class.

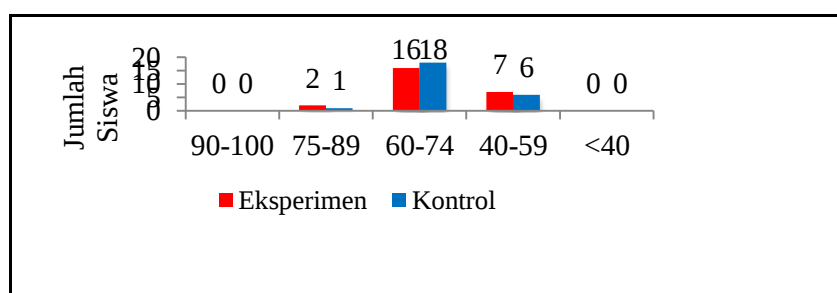


Figure 1. Comparison Diagram of Pretest Experimental Class and Control Class Values

Figure 1 shows the sum of the pretest experimental class and control class values. There are differences in the number of each classification or range of critical thinking capability values. The largest number is found in the C classification (60-74) including 16 experimental class students and 18 control class students. In classification D (40-59), the number of experimental class students is 7 students and control class students are 6 students. The number in classification B (75-89) consists of 2 experimental class students and 1 control class student. None of the experimental class and control class students were included in the A (90-100) and E (<40) classifications. Table 6 shows a description of the posttest scores of students' critical thinking abilities in the experimental class.

Table 6. Distribution of the Number of Posttest Scores of Experimental Class Students

Classification	Value Range	Information	Sum	Percentage (%)
A	91 – 100	Very High	4	16
B	75 – 90	Tall	21	84
C	60 – 74	Quite High	0	0
D	41 – 59	Low	0	0
E	<40	Very Low	0	0
Sum			25	100

Table 6 shows the results of the data obtained on the final critical thinking ability of students in the experimental class. The highest percentage is classification B (high) of 84% with a total of 21 students and the percentage of classification A (very high) of 16% with a total of 4 students. The number of students for the very high, moderately high, and very low categories is 0. So, the final mean of critical thinking ability of experimental class students after the treatment was applied was 84.2. The description of the posttest scores of students' critical thinking capabilities in the control class can be seen in Table 7.

Table 7. Distribution of the Number of Posttest Scores of Control Class Students

Classification	Value Range	Information	Sum	Percentage (%)
A	91 – 100	Very High	0	0
B	75 – 90	Tall	12	40
C	60 – 74	Quite High	13	60
D	41 – 59	Low	0	0
E	<40	Very Low	0	0
Sum			25	100

Table 7 presents the results of the data obtained on the final critical thinking capability of students in the control class. The highest percentage is classification C (quite high) with a total of 13 students and the percentage of classification B (high) with a total of 12 students. The number of students for the very high, low, and very low categories is 0. So, the final mean of critical thinking capability of control class students after applying treatment is 72.2. Figure 2 shows a comparison of student final capability data (posttest) between the experimental class and the control class.

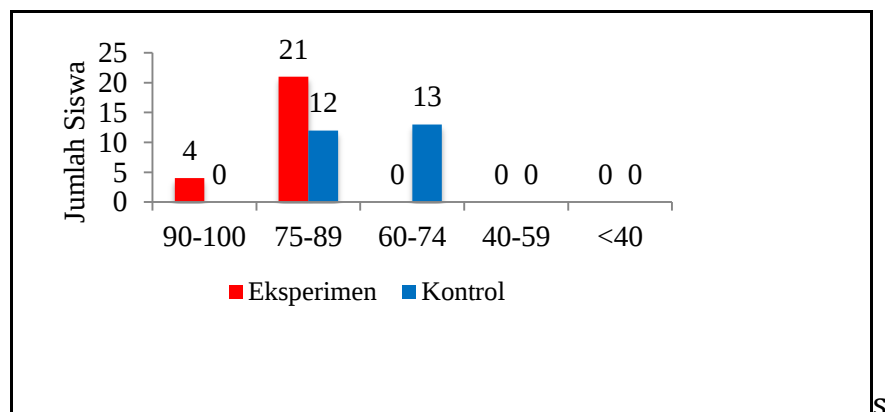


Figure 2. Comparison Diagram of Posttest Experimental Class and Control Class Scores

Figure 2 shows the total posttest scores of the experimental class and the control class as a whole. There are differences in the number of each classification or range of critical thinking capability values. The number in classification B (75-89) includes 21 experimental class students and 12 control class students. In classification C (60-74) includes 13 students in the control class and the number in classification A (90-100) includes 7 students in the experimental class. None of the experimental class students were included in the C (60-74), D (40-59), and E (<40) classifications, while the control class students were not included in the A (90-100), D (40-59), and E (<40) classifications.

The results of obtaining average scores based on critical thinking indicators in experimental class students experienced several improvements. Indicators that have an increase in the average score in formulating problems, reasoning, deduction and induction. Average indicator scores formulate problems and induce pretest to 2 then increases to 3 on posttest. The average indicator score provides arguments and induces pretest is 3 then increases to 4 on posttest. The average score on the indicators of evaluating and deciding and implementing did not increase.

The results of obtaining the average score based on the critical thinking indicator in the control class students did not experience significant gains. Indicators that have an increase in the average score only formulate a problem. The average score of the indicator formulates the problem in the pretest 2 then increases to 3 in the posttest. The average score on the indicator stated that arguments, deductions, inducements, evaluations, and decisions and actions did not increase.

The gain score is a value resulting from the gap between pretest and posttest scores. Table 8 presents an analysis of the gain score data for students in the control class and the experimental class.

Table 8. Description of Average Data of Pretest, Posttest, and Gain Score

Class	Average Pretest	Average Posttest	Average Gain Score
Experiment	64,0	84,2	20,2
Control	64,5	72,2	7,7

Table 8 shows that the average gain score carried out in the experimental class is 20.2, while the average gain score in the control class is 7.7. There was a significant difference in the gain score in the experimental class and the control class. The comparison is described in Figure 3.

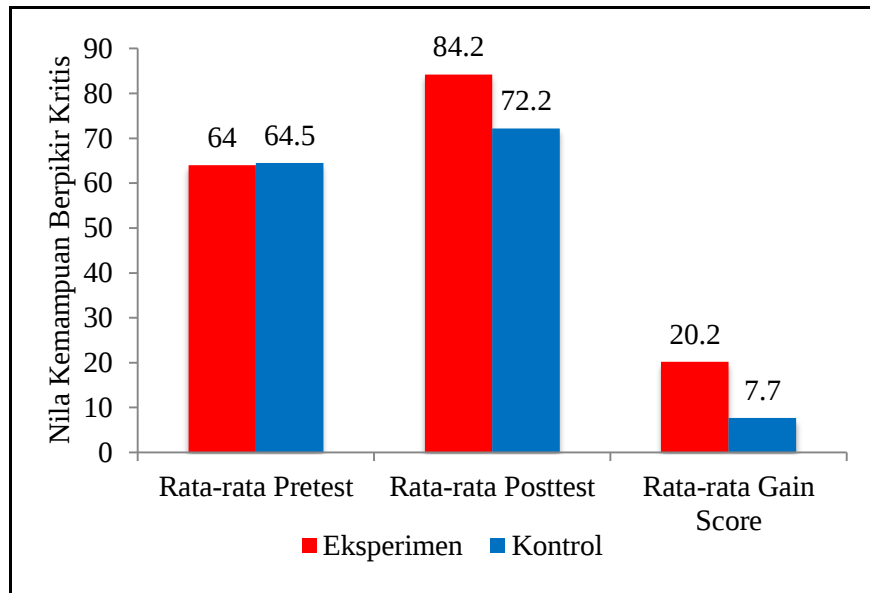


Figure 3. Comparison Chart of Average Pretest, Posttest, and Gain Score

Figure 3 illustrates the comparison of the average pretest, posttest, and gain scores between the exemplary class and the control class. In the experimental class, the average gain score is higher than that of the control class. This proves that the GI learning model can have an effect on students' critical thinking process.

The Problem-Based Learning (PBL) model is designed to enhance students' critical thinking skills through a structured series of steps. These steps align with six critical thinking indicators: formulating problems, providing arguments, inducing, deducting, evaluating, and making decisions to address problems and take actions. By applying the PBL model, students are encouraged to collaborate in groups and actively participate in solving real-world issues. The process involves stages such as focusing on problems, guiding learning, fostering individual or team experiences, presenting outcomes, and evaluating the problem-solving process.

This study identified significant improvements in four critical thinking indicators when using the PBL model. The increase in these indicators was measured through the gain score deviation between pretest and posttest results in the experimental class. The indicators show marked improvement formulating problems, providing arguments, inducing, and deducting. Each of these improvements is closely tied to the structured implementation of the PBL model.

First, the PBL model significantly aids students in formulating problems by promoting critical thinking throughout the learning process. From the planning phase to evaluation, students are actively engaged in identifying and defining problems. This hands-on approach helps them understand the importance of problem-solving in real-world contexts. Maryati (2018:65) emphasizes that PBL encourages students to approach problems using scientific methods, which allows them to acquire relevant knowledge and develop actionable solutions. Teachers play a vital role in presenting engaging and contextual problems that resonate with students' daily lives, making the learning process both meaningful and motivating.

Second, PBL enhances students' ability to provide arguments based on facts. Group discussions, a core element of the PBL model, serve as a platform for students to analyze problems collaboratively. These discussions encourage students to express their opinions, critique their peers' ideas, and evaluate arguments against theoretical frameworks (Mujiyati, 2018:100). By engaging in these activities, students develop the ability to construct evidence-based arguments, a key component of critical thinking.

Third, the PBL model strengthens students' capacity for deduction. Teachers support this by motivating students to ensure their solutions are fact-based and by guiding them in eliminating irrelevant information. Mushoddik (2016) found that students who effectively identify problems experience notable improvements in their deductive reasoning abilities. This stage is crucial in helping students draw logical inferences and articulate the reasoning behind their decisions.

Fourth, PBL encourages students to develop their induction skills. Through structured activities, students learn to manage and present their findings systematically. This involves gathering reliable data, analyzing it, and developing knowledge independently (Rakasiwi, 2017). The PBL model aligns with the scientific approach of the K13 curriculum, which emphasizes active student participation. Students are required to observe, ask questions, collect data, evaluate it, and communicate their findings, all of which train them to think scientifically and critically.

Despite the overall improvements, certain indicators, such as evaluating and making decisions, showed less pronounced progress. This may be attributed to the challenges in implementing the PBL model. Sanjaya (2011) notes that PBL requires significant preparation time, which can limit its effectiveness in short duration learning sessions. In addition, the final stages of evaluation and decision-making demand more time than is often available in typical classroom settings. Wijayanti (2013) highlights similar challenges, pointing out that time constraints can hinder the optimal delivery of conceptual material in PBL activities.

Ultimately, the PBL model proves to be a powerful tool for fostering critical thinking. Setyorini, Sukiswo, and Subali (2011) observe that PBL encourages students to address real-world problems, such as analyzing economic disparities between developed and developing countries. These activities help students understand the interconnectedness of issues like education, population growth, health, technology, and industrial development, enabling them to propose solutions with both positive and negative implications.

In summary, the PBL model effectively enhances students' critical thinking skills by aligning its stages with critical thinking indicators. It motivates students to actively participate in formulating

problems, inducing, and providing arguments, thereby fostering deeper learning. Through PBL, students not only engage more actively in the learning process but also develop the ability to build knowledge independently, paving the way for more advanced and critical problem-solving skills.

Conclusions

From hypothesis test and description, then PBL is A learning model that focuses on problems that require real-world research so that students are required to improve critical thinking skills and be actively involved in solving the problems they face. The main problem in learning activities is using the conventional learning model of lectures, questions and answers, and assignments. This shows that there is no difference between UKBM learning and the provision of practice questions. This problem can be explained by applying the Problem Based Learning (PBL) method. The subjects taken in this study are class XI IPS 2 and class XI IPS 3 SMAN 1 Trenggalek even semester of the 2021/2022 school year. This research is a type of quasi experiment, the design used in this experimental research is a type of pretest-posttest control group design. The data analysis used from the form of quasi experiment research is by using an inferential static method with the help of SPSS 16.00 for Windows. Quantitative data was taken from the students' critical thinking capability test after being given treatment. The result of this study is that the Problem Based Learning (PBL) learning model has a significant effect on students' critical thinking capabilities, with a significance value (2-tailed) in the experimental class and control class is 0.000. Based on these provisions, the probability value is $0.000 < 0.05$, while the average gain score of critical thinking ability of experimental class students is greater (20.2) than that of the control class (7.7).

Data Availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

All authors in this publication declare no conflict of interest regarding the title, data, location, and results of the research.

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Supplementary Materials

This study does not include any supplementary materials.

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