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Exploring the Impact of the PBL Learning Model on Students' Critical Thinking Proficiency

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Abstrak

Berdasarkan hasil observasi, masih terdapat guru yang menggunakan model pembelajaran konvensional sehingga tidak efektif dalam meningkatkan kemampuan berpikir kritis siswa. Tujuan penelitian ini untuk menganalisis pengaruh penggunaan model pembelajaran PBL terhadap peningkatan kemampuan berpikir kritis. Penelitian ini menggunakan metode penelitian eksperimen dengan quasi experimental design (nonequivalent groups pretest-post-test design). Pengumpulan data dilakukan dengan tes, pemberian tugas, dan unjuk kinerja. Subjek pada penelitian ini adalah peserta didik kelas XI IPS 2 sebagai kelas eksperimen. Analisis data menggunakan Uji-t Paired dan Regresi Linear Sederhana. Hasil penelitian menunjukkan bahwa rata-rata nilai post-test lebih besar dibandingkan dengan rata-rata nilai pretest. Berdasarkan hasil uji paired sample test diperoleh Sig. (2-tailed) 0,000 < 0,05 sehingga terdapat perbedaan kemampuan berpikir kritis peserta didik di kelas eksperimen sebelum dan sesudah menggunakan model pembelajaran PBL. Berdasarkan hasil uji regresi menunjukkan nilai signifikansi sebesar 0,032 < 0,05 maka terdapat pengaruh penggunaan model pembelajaran PBL terhadap kemampuan berpikir kritis peserta didik pada eksperimen. Terdapat perbedaan kemampuan berpikir kritis siswa sebelum dan sesudah menggunakan model pembelajaran Problem-Based Learning (PBL) pada kelas eksperimen.
Kata Kunci: Model Pembelajaran, PBL (Problem-Based Learning), Berpikir Kritis

Abstract

Based on the observation results, some teachers still utilize conventional learning models, which proved ineffective in enhancing students' critical thinking abilities. This research aimed to analyze the impact of implementing the Problem-Based Learning (PBL) model on the improvement of critical thinking skills. This study employs an experimental research method through a quasi-experimental design (nonequivalent groups pretest-post-test design). Data collection involves tests, assignments, and performance demonstrations. The subjects in this study are students from class XI IPS 2, serving as the experimental group. Data analysis utilizes the Paired t-test and Simple Linear Regression. The research findings indicate that the average post-test scores surpass the average pretest scores. The paired sample obtained results reveal a Sig. (2-tailed) value of 0.000 < 0.05, indicating a disparity in the critical thinking skills of students in the experimental group before and after implementing the PBL learning model. Results of the regression analysis indicate a significance value of 0.032 < 0.05, which means that there is a significant influence of using the Problem-Based Learning (PBL) model on students' critical thinking skills in the experimental class. Students' critical thinking skills experienced improvement after the use of the Problem-Based Learning (PBL) model in the experimental class.
Keywords: *Learning Model, PBL (Problem-Based Learning), Critical Thinking*

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INTRODUCTION

In an era of increasingly intense global competition, it is evident that the excellence of human resources is crucial for a country. The role of teachers is highly significant in shaping individuals of quality and nurturing their inherent potential. Competition in the field of education among nations is becoming more meaningful. In the midst of this era of globalization, many countries are making efforts to enhance their education standards to produce citizens of high quality. As expressed by (Das, 2019; Xursanov, 2021), many countries are currently focused on improving the quality of education to compete in development, both in physical and non-physical aspects, at the international level. Therefore, enhancing the quality of education in a country becomes something of utmost importance and urgency.

Humans need to possess several skills in order to keep up with the changes of the 21st century. These required skills include creativity, innovation, critical thinking, communication skills, and collaboration. The young generation growing up in the current era will become adults in the future and will face the demands of competition in the 21st century. Therefore, they must develop several skills, including problem-solving abilities, critical thinking skills, the courage to ask questions, speaking skills, and the ability to implement research findings (Ahghar, 2012; Care, E., Scoular, C., & Griffin, 2016; Güleç, 2020).

Critical thinking skills are important in the 21st century. Therefore, it is crucial to introduce critical thinking skills to children or students from an early age, especially within the school environment. One effective way to cultivate critical thinking skills is by exposing and solving problems that exist within the school environment. Engaging in problem-solving activities in their surroundings is a way for learners to hone their critical abilities in addressing the issues they may encounter in the future (Fachrurazi, 2011).

Improving critical thinking skills can be retrieved through a series of activities that are carried out regularly or become a habit. (Shanti, M. R. S., Istiyono, E., & Munadi, 2022) recommends various approaches to improve students' critical thinking skills, including: a) increasing the frequency of regular reading activities; b) practicing analytical skills to address issues arising in the students' environment and finding suitable solutions through discussion forums or independent activities; c) observing or examining an object or situation until students have a thorough understanding of both its strengths and weaknesses; d) cultivating curiosity by being more attuned to the surrounding environment, actively asking questions, and reflecting on their experiences. If these activities are carried out consistently, students can improve their critical thinking skills.

In Indonesia, education is generally conducted through formal education. During the learning process, there is interaction between students and teachers. This interaction is crucial to ensuring that the material delivered by the teacher can be well-received and understood by the students. One important element in the learning process is the interaction activities between the teacher and the students (Kyei-Blankson, L., Ntuli, E., & Donnelly, 2019). The occurrence of interaction in the learning process helps students receive and understand the learning material more effectively. Ultimately, this can contribute to achieving the set learning objectives.

Before the learning process begins, a teacher must prepare by planning a lesson or an experiential plan for the students. View the learning activity as an effort to provide experiences to the students through an instructional system with the goal of assisting the students in their learning process (Hero, L. M., & Lindfors, 2019; Keller, H., & Karau, 2013). In lesson planning, one crucial component that a teacher should prepare the selection of an appropriate teaching model. The chosen teaching model should be suitable for the subject matter and the learning objectives that need to be achieved. If a teacher uses a teaching model that is appropriate for the subject matter, it can create a more enjoyable learning environment for the students.

In the learning process, it is crucial to use stimuli to keep students active and enthusiastic about their learning activities. There are various ways to implement these stimuli, one of which is by connecting the learning to students' everyday lives. This approach helps students pay more attention to the issues around them, become more responsive in addressing them, and seek solutions. If a teacher focuses on enhancing critical thinking skills

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in their teaching, students will become adept at finding solutions to problems in their environment (Alsaleh, 2020; Behar-Horenstein, L. S., & Niu, 2011).

After undergoing geography education, students will have knowledge about natural phenomena occurring in their surroundings. Geography education will help develop students' critical thinking skills to formulate solutions or address issues related to the environment. In geography education, there are topics that can enhance the development of critical thinking abilities so that students can solve environmental problems in their surroundings (Silviariza, W. Y., & Handoyo, 2021; Sziarto, K. M., McCarthy, L., & Padilla, 2014).

Using conventional teaching models makes students less active because it does not place them at the center of learning. Conventional teaching models are also ineffective in training students to develop problem-solving skills in their surrounding environment. The responsibilities of a teacher in today's era ideally only include monitoring, evaluation, and tracking the development of students' critical thinking abilities in the learning process (Paul, 1999; Williams, 2005).

Based on the observation results, SMA Negeri 1 Bandung is still using conventional teaching methods for the Population Dynamics topic. The geography teachers at SMA 1 Bandung have not conducted assessments of their students' critical thinking abilities. Therefore, a test has been conducted to measure the students' critical thinking skills. The measurement results can be seen in the following table.

Table 1. Results of Measuring Critical Thinking Ability of Class 11 Students of SMA Negeri 1 Bandung

Critical Thinking Ability Indicator	**Class**			
	XI IPS 1 36 Students	**XI IPS 2 35 Students**	**XI IPS 3 34 Students**	**XI IPS 4 32 Students**
Give a simple explanation(*elementary clarification*)	58	55	53	48
Build basic skills (*basic support*)	58	45	48	45
Draw conclusions (*inference*)	46	53	54	41
Provides further classification (*advance clasification*)	40	41	43	40
Plan strategy and tactics (*strategy and tactics*)	40	43	45	45
Amount	242	237	243	219
Average	48,4	47,4	48,6	43,8
Category	Medium	Medium	Medium	Medium

Source: Pre Research processed by the authors (2022) and refers to indicators of critical thinking skills according to Ennis, Robert H (1990: 68)

Based on the classification of critical thinking levels proposed (Karim, 2015). The preliminary research results indicate that students are still at a moderate level of critical thinking ability. In determining the level of students critical thinking abilities, one can also consider their examination results. The end-of-semester assessment (PAS) scores in the geography subject for students in classes XI IPS 1, XI IPS 2, XI IPS 3, and XI IPS 4 at SMA Negeri 1 Bandung show that they have not yet reached the minimum required scores.

The selection of the problem-based learning (PBL) teaching model is based on several scientific reasons. The PBL teaching model is student-centered, emphasizing scientific problem solving and contextual learning, and it excels in honing students' critical thinking skills. Various advantages arise from the implementation of participant-oriented learning models, one of which is that the learning materials comprehended by participants become more accessible, thereby facilitating the development of their inherent potential (Wright, C. A., & Diener, 2020). The Problem-Based Learning (PBL) model is classified within the realm of scientific learning models. The scientific learning process is tailored to enhance and train participants in problem-solving within their immediate environment. Through experiences and learning within their surroundings, participants are better equipped to construct new concepts derived from their thoughts; these concepts then manifest as knowledge (Sarimuddin, S., Muhiddin, M., & Ristiana, 2021; Yani, A., Ruhimat, M., & Mulyadi, 2019). The

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Problem-Based Learning (PBL) model is contextual; contextual learning requires that a teacher establish a connection between environmental issues and the learning process or materials. Environmental issues around the participants must be linked to the learning theory being implemented within the classroom (Yani, A., Amin, M., Rohman, F., Suarsini, E., & Rijal, 2021). Another perspective, articulated by (Saiful, 2020), asserts that the Problem-Based Learning (PBL) model should effectively cultivate critical thinking skills that can be applied to problem-solving within the participants' environment.

Based on research (Hussin, W. N. T. W., Harun, J., & Shukor, 2018) conducted in the tenth-grade class of SMA Negeri 1 Sentajo Raya, it is evident that the implementation of the Problem-Based Learning (PBL) model can enhance students' critical thinking abilities. A similar study by (Saputra, M. D., 2019) conducted with fifth-grade students at SDN Manggihan and MI Nurul Islam Batur 02 Getasan in thematic learning also suggests a positive influence of the PBL model on critical thinking skills. Likewise, the research findings of (Khairani, S., Suyanti, R. D., & Saragi, 2020) indicate that applying the PBL model in the eleventh grade at SMAN 3 Siak Hulu leads to an improvement in high-level thinking skills in the Indonesian language, particularly in analyzing the systematic structure and language of scientific papers. The uniqueness of this research lies in its unexplored location, as it has not previously addressed the issue of enhancing critical thinking skills through the application of the PBL learning model. Additionally, there is a gap in research on the impact of the PBL model on critical thinking abilities in the context of geography, especially regarding population dynamics issues, which have not been investigated by previous researchers. Therefore, there is a necessity for research that explores the impact of the PBL learning model on students' critical thinking skills, specifically focusing on the subject of population dynamics in geography.

RESEARCH METHOD

The research used a quasi-experimental method because it involved an experimental group that was not selected randomly. In the implementation of quasi-experimental research, the sample group corresponds to the actual conditions or conditions that exist in a real-world situation. In this case, a quantitative approach is employed. In this research, the relationship under examination involves the problem-based learning (PBL) teaching model as the independent variable and critical thinking ability as the dependent variable. In this experimental study, the research employs a non-equivalent control group design with pre- and post-test measures. This design involves a single experimental group that wasn't selected through randomization. Within the experimental group, participants undergo pretesting, receive treatment, and then undergo post-testing. The specific research design to be utilized is outlined in the following table.

Tabel 2. Research Design

Class	Pre-test	Treatment	Post-test
Experiment	O_1	X_1	O_2

Source: Arifin, 2014, p. 77 and the findings of the authors, 2023.

According to (Karim, 2015) in determining the categories of students' critical thinking abilities, they were divided into several categories, including very high, high, moderate, low, and very low. In this research, the paired T-test was used to examine the differences before and after treatment in the experimental class. This hypothesis test is employed to explore the relationship between two variables under conditions involving quantitative data and a normal distribution. Meanwhile, simple linear regression analysis is carried out to determine the relationship between the dependent variable and the independent variable and predict the average value of the dependent variable based on the independent variable. The research instruments employed in this study include documentary studies, essay test questions (test instruments), and non-test instruments. The researcher conducted readability and content validity tests with an expert (Expert Judgment), who is a professor at the Universitas Pendidikan Indonesia. The research instruments were also tested with students from a different school location than the research site. The purpose of instrument testing was to ensure that the instruments used

were suitable for measuring the critical thinking skills of 11th-grade students majoring in Social Sciences (IPS) at SMA Negeri 1 Bandung in the subject matter of Population Dynamics. The research subjects for this study, Class 11 IPS 2, consisting of 35 students, were chosen as the experimental group that received the intervention using the problem-based Learning (PBL) teaching model. The selection of research participants was based on their grades from the odd semester final exams in geography during the 2022–2023 academic year. In this research, the research was conducted at SMA Negeri 1 Bandung. The map of the research location can be seen in the following Figure 1.

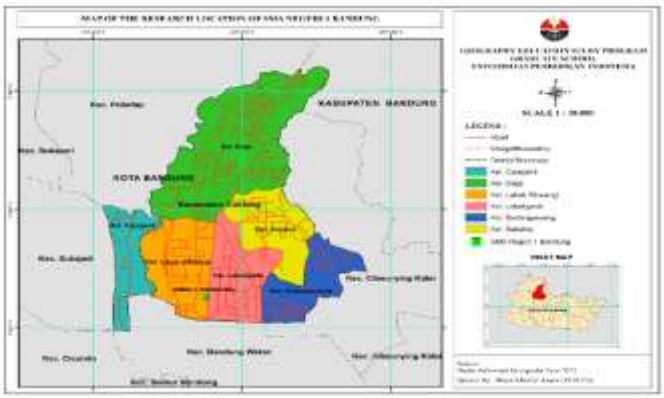

Figure 1. Map of Research Locations

RESULTS AND DISCUSSION

Research Results

The results of the critical thinking ability test for students are in the form of pretest and post-test scores. Both the pretest and post-test consist of 20 essay questions. Each question has been tailored to match the critical thinking indicators related to the subject matter of geography, specifically focusing on population dynamics in Indonesia. This is because the purpose of conducting the pretest and post-test is to assess the level of critical thinking skills among students. The results of the pretest and post-test for students in the experimental class, who used the Problem-Based Learning (PBL) teaching model, can be seen in Table 3.

Table 3. Pretest-Post-test Results of Students' Critical Thinking Abilities in the Experimental Class PBL Learning Model (Problem-Based Learning)

Value	Pretest		Critical Thinking Ability Level Category	Post-test		Critical Thinking Ability Level Category
	F	%		F	%	
80 < Score ≤ 100	0	0	Very High	35	100	Very High
60 < Score ≤ 80	2	5,7	High	0	0	High
40 < Score ≤ 60	32	91,4	Medium	0	0	Medium
20 < Score ≤ 40	1	2,9	Lowly	0	0	Lowly
0 < Score ≤ 20	0	0	Very Lowly	0	0	Very Lowly
Amount	35	100		35	100	
Minimum Value	41,6667		Low	88,3333		Very High
Maximum Value	61,6667		High	98,3333		Very High
Average	52,2381		Medium	93,381		Very High

Based on Table 3, it is evident that the experimental class had a moderate level of critical thinking skills before implementing the Problem-Based Learning (PBL) teaching model. After using the PBL teaching model, students' critical thinking abilities significantly improved, reaching a very high level. In the pretest results, 91% of students scored within the range of 40 < Score ≤ 60, with 8.6% of students falling into the ranges of 60 <

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Score ≤ 80 and 20 < Score ≤ 40. However, in the post-test results, 100% of students scored within the range of 80 < Score ≤ 100, indicating a very high level of critical thinking skills.

The critical thinking abilities of students in the experimental class during the pretest ranged from a minimum score of 41.6667 (moderate) to a maximum score of 61.6667 (high), resulting in an average score of 52.2381 (moderate). When examining students' critical thinking abilities in the post-test, they achieved a minimum score of 88.3333 (very high) and a maximum score of 98.3333 (very high), resulting in an average score of 93.381 (very high). The improvement in critical thinking skills among students is indicated by post-test scores being higher than pretest scores. The overall comparison between pretest and post-test scores can be seen in Figure 2.

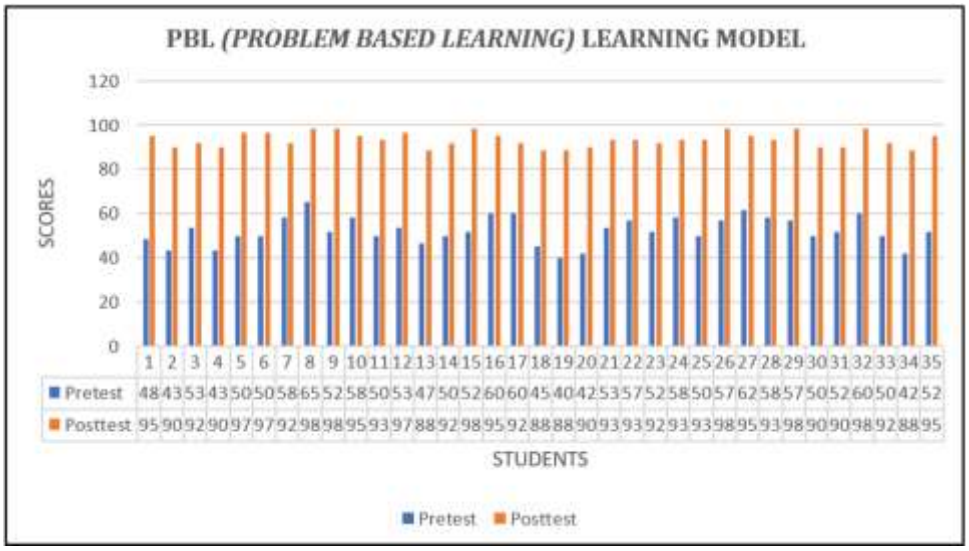

Figure 2. Comparison of Pretest and Post-test Scores of Experimental Class Participants

Based on the above picture, it can be observed that the post-test results of the experimental class students are higher compared to the pretest results. This indicates that the critical thinking abilities of the students before receiving the treatment were at a moderate level. After the treatment, there was a significant improvement in the critical thinking abilities of the students, reaching a very high level. Therefore, to enhance the critical thinking abilities of students, one effective approach is to use Problem-Based Learning (PBL) as a teaching model.

Following an analysis of normality and homogeneity tests, which demonstrated that the data exhibited a normal distribution and homogeneity, a hypothesis test was subsequently conducted to assess the variance in critical thinking abilities among students before and after implementing the Problem-Based Learning (PBL) teaching model. The test results are presented in Table 4.

Table 4. Hypothesis Test Results - Paired Samples Test

Paired Samples Test									
Paired Differences									
		Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Low	Upper			
Pair1	PostPre test	41,14	4,93	,833	39,44	42,83	49,36	34	,000

The criteria for testing are as follows: if the Sig. value < 0.05, then H0 is rejected and H1 is accepted. Conversely, if the sig. value > 0.05, then H0 is accepted and H1 is rejected. Based on Table 4, it was found that Sig. (2-tailed) is 0.000, which is < 0.05. Therefore, it can be concluded that H0 is rejected and H1 is accepted. This means that there is a difference in the critical thinking abilities of the experimental class students before

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and after the treatment using the Problem-Based Learning (PBL) teaching model. This indicates that the post-test results in the experimental class are higher than the pretest results, suggesting that the use of the Problem-Based Learning (PBL) teaching model can enhance students' thinking abilities.

In this research, the instructional model is considered the independent variable (X), while critical thinking ability is the dependent variable (Y). Indicators of the instructional model (variable X) include lesson plans (RPP), teaching modules, student worksheets (LKPD), assessment instruments, and teaching methods. Everything that occurs from the beginning to the end of the learning process is considered the variable X and is evaluated as a whole. Therefore, all assessments, including knowledge, skills, attitudes, and presentations as variables X, will have an impact on variable Y, which is the critical thinking ability or the post-test results of the students.

The assessment of knowledge, skills, attitudes, and presentations is included in the Student Worksheets (LKPD). In the experimental class, the LKPD takes the form of 13 essay questions that encompass all aspects of assessment and are tailored to enhance critical thinking abilities. Providing students with LKPD aims to hone their critical thinking skills throughout the learning process. The results of the assessment of LKPD and the post-test of students in the experimental class can be seen in Table 5.

Table 5. LKPD Scores and Post-test Scores of the Experimental Class

	Average Value				
	LKPD				Post-test
	Knowledge	Attitude	Skills	Presentation	
Gain Score	3433,3333	3420	3419,0476	3425	
Average Score	98,0952	97,7142	97,6870	97,8571	
Amount	391,3537415				3268,33
Average	97,83843537				93,381

Based on the table above, it indicates that the students' knowledge assessment has the highest score among the four assessments conducted. Meanwhile, the lowest assessment in the experimental class is in the domain of skills. The experimental class, as a whole, achieved an LKPD score of 97.83843537, which is higher than the overall post-test results in the experimental class, which received a total score of 93.381. The overall LKPD and post-test scores of the students can be seen in Figure 3.

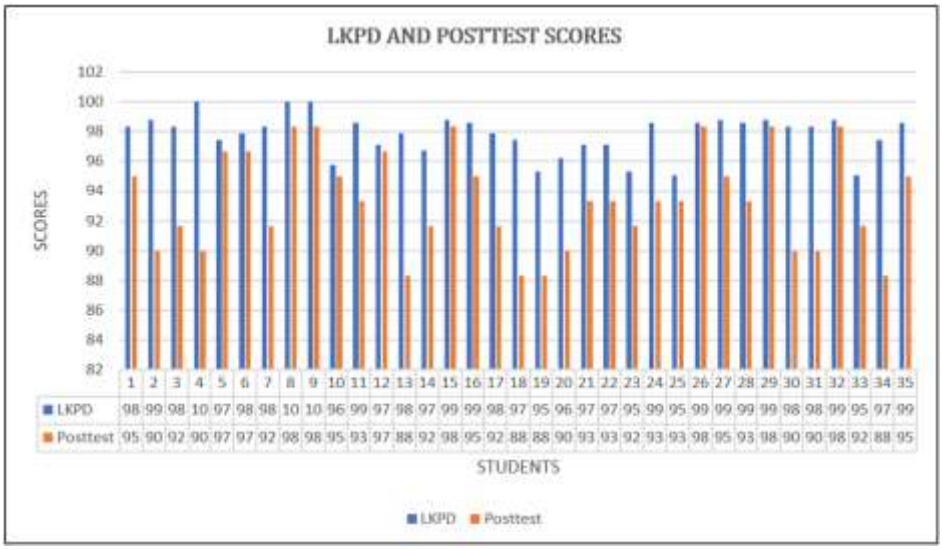

Figure 3. LKPD Scores and Post-test Scores of the Experimental Class

Based on the above picture, it can be observed that the overall LKPD scores of the students are higher compared to the post-test scores. This could potentially impact the hypothesis testing results regarding the influence of the Problem-Based Learning (PBL) teaching model on the critical thinking abilities of the students.

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Both of these scores will be used in testing the hypothesis regarding the influence of the teaching model on the critical thinking abilities of the students.

After conducting an analysis of normality and homogeneity tests that indicated the data followed a normal distribution and were homogenous, a hypothesis test was then conducted to examine the influence of using the Problem-Based Learning (PBL) teaching model on the critical thinking abilities of the students, with the following test results.

Table 6. Results of Hypothesis Test : Simple Linear Regression

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	48,861	1	48,861	5,031	,032[b]
	Residual	320,504	33	9,712		
	Total	369,365	34			

a. Dependent Variable: critical thinking
b. Predictors: (Constant), learning model

From the table above, it is known that the calculated F-value is 5.031 with a significance level of 0.032 < 0.05. Therefore, it can be concluded that there is an influence of the Problem-Based Learning (PBL) teaching model variable (X) on the critical thinking ability variable (Y). This means that the use of the Problem-Based Learning (PBL) teaching model can influence the critical thinking abilities of students. To determine the percentage of the influence of the Problem-Based Learning (PBL) teaching model variable (X) on the critical thinking ability variable (Y), you can refer to the following table.

Table 7. Summary Table for Simple Linear Regression Hypothesis

Summary Model				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,364[a]	,132	,106	3,11645

a. Predictors: (Constant), learning model

The table above explains the correlation coefficient (R), which is equal to 0.364. From the table, the coefficient of determination (R-Square) is obtained as 0.132, indicating that the variable of the Problem-Based Learning (PBL) teaching model (X) in relation to the critical thinking ability variable (Y) has an influence of 13.2%. Based on the calculated coefficient of determination in this study, this influence is considered very weak. Therefore, the relationship between the Problem-Based Learning (PBL) teaching model variable (X) and the critical thinking ability variable (Y) is very weak.

Research Discussion

Based on the research findings, there is a difference in the critical thinking abilities of students in the experimental class before and after implementing the PBL (Problem-Based Learning) teaching model. These findings are consistent with the results of a study conducted by (Saputra, M. D., 2019), which also noted differences in the critical thinking abilities of students before and after participating in learning with the PBL (Problem-Based Learning) model. One of the advantages of the PBL teaching model is its ability to foster the critical thinking skills of students. This occurs because each stage of learning in this model actively hones and guides students to enhance their critical thinking abilities. In line with the perspective expressed by (Hussin, W. N. T. W., Harun, J., & Shukor, 2018), the strengths of the PBL teaching model, through problem-solving, enable students to develop their critical thinking skills.

The implementation of the Problem-Based Learning (PBL) teaching model involves a series of learning stages, all of which are designed to encourage students in the development of their critical thinking skills. The learning process with the PBL (Problem-Based Learning) model commences with the problem orientation step. In this step, students are presented with initial stimuli such as images, videos, questions, or other elements. From these stimuli, students are guided to formulate relevant problems. They are expected to articulate problems based on the context around them. In accordance with the perspective expressed by (Paul, 1999), one strategy

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for enhancing students' critical thinking abilities is to encourage them to discover problems that require solutions (finding problems). In the problem formulation stage, students are expected to analyze the phenomena that arise from the initial stimuli (triggers), thereby sharpening their critical thinking skills.

During the problem orientation, there's an interaction of questions and answers between the teacher and students, or even among the students themselves. The questions and answers discussed are related to the subject matter and the issues being addressed. This process holds its own appeal for students because linking the learning material to real-life situations makes it more engaging. Based on (Ali, 2019), a problem-based learning approach has the ability to motivate students to learn. This opinion is also supported by (Khairani, S., Suyanti, R. D., & Saragi, 2020), who suggests that to enhance students' critical thinking abilities, it is important to increase interaction between teachers and students through the use of various questions. This activity not only trains students to actively participate and ask questions confidently, but it also helps them hone their critical thinking skills.

The next step is the investigation phase. In this step, students are asked to conduct secondary observations from various sources to find solutions to the problems formulated in the previous stage. The investigative or analytical process can help improve students' literacy. Additionally, this stage stimulates students to determine appropriate solutions to the problems they are facing. During this stage, learning still centers around the students and aims to train them in critical thinking and critiquing issues or phenomena in their surroundings. The development of students' critical thinking abilities can be achieved by involving them in problem-solving activities relevant to their environment (Ali, 2019; Saputra, M. D., 2019).

After conducting the investigation, the next step is to develop and present the research findings. In this step, students receive training in processing the information they have gathered from various sources. Once the information is processed, students are then asked to present their findings. During this step, there are many activities that can help students develop their critical thinking skills. As expressed by (Supriyatno, T., Susilawati, S., & Hassan, 2020), critical thinking abilities can be enhanced through various activities, including problem identification, gathering and organizing information, using appropriate language, analyzing data, and evaluating information. Critical thinking skills can also be improved by reading a variety of materials, processing information, and then conveying that information to others.

The research findings that have been presented are then delivered in a presentation. During the presentation process, students have the opportunity to share information with each other, provide opinions, or even critique the analysis results among their groups. In this stage, students are also given stimuli to encourage active engagement in learning. As expressed by (Shim, W. J., & Walczak, 2012), presentation activities have the potential to stimulate students to be more active in their learning and simultaneously build their confidence.

Based on the results, the Problem-Based Learning (PBL) teaching model has a positive impact on increasing critical thinking abilities. This finding is consistent with the research conducted by (Istianah, 2013), which also concluded that the use of the PBL teaching model is effective in enhancing students' critical thinking abilities. The positive influence of the PBL teaching model on students' critical thinking abilities can be observed through the level of enthusiasm students exhibit in observing and analyzing existing problems. In the context of learning with the PBL (Problem-Based Learning) model, students are encouraged to observe problems that are relevant to their environment. The problems presented are typically related to the realities surrounding the students. In this learning process, students are taught to identify and seek solutions to these problems, which ultimately has a positive impact on the development of their critical thinking abilities (Fine, 2015; Hayati, W. I., Utaya, S., dan Astina, 2016). Furthermore, the PBL (Problem-Based Learning) teaching model is also known as a student-centered model that can help prevent students' tediousness during the learning process. Therefore, the use of the PBL teaching model is considered to have a significant influence on students' critical thinking abilities.

The use of the Problem-Based Learning (PBL) teaching model on critical thinking abilities has a limited impact due to several other influencing factors. As mentioned by (Sarimuddin, S., Muhiddin, M., & Ristiana, 2021), factors such as open-mindedness, a healthy level of skepticism, intelligence, humility, and a strong motivation to understand a topic have a significant impact on critical thinking abilities. The lack of skepticism and the inability to remain open to various perspectives can be limiting factors in the influence of the PBL (Problem-Based Learning) teaching model on critical thinking abilities. In the context of learning using the PBL model, a skeptical attitude is crucial, as it helps in critically analyzing problems and seeking accurate solutions.

Other factors that impact critical thinking abilities have also been emphasized (Chukwunemerem, 2023). These factors include physical condition, motivation, the level of anxiety, and the intellectual development of the students. In the context of this research, the interaction between students and researchers is limited to just one meeting or a few short meetings. This creates a level of anxiety among students as they have to quickly adapt to a new environment and instructor. Intellectual factors also play a role, as some students may quickly grasp the material while others may require more time. All of these factors have an impact on critical thinking abilities, which can vary among different students.

Based on the research results, it can be concluded that the use of the Problem-Based Learning (PBL) teaching model has been successful in enhancing the critical thinking abilities of students, especially in the context of geography subjects at the high school level. This research demonstrates the effectiveness of the PBL (Problem-Based Learning) model in improving students' critical thinking abilities, particularly when the taught material is related to population dynamics issues.

CONCLUSIONS

There is a difference in the critical thinking abilities of students before and after using the Problem-Based Learning (PBL) instructional model in the experimental class. After using this instructional model, the critical thinking abilities of students in the experimental class have shown improvement. There is an influence of using the Problem-Based Learning (PBL) instructional model on the critical thinking abilities of students in the experimental class. The Problem-Based Learning (PBL) instructional model can provide a meaningful learning process for students. Students are required to gather information in order to address the environmental issues they encounter. Therefore, the Problem-Based Learning (PBL) instructional model has an impact on the critical thinking abilities of students.

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