Influence of Problem Based Learning Model on Elementary School Students Critical Thinking Abilities

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Abstract

This research is a quantitative study employing a pre-experimental design method aimed at determining the impact of implementing problem-based learning models on the critical thinking abilities of fifth-grade students at SD Negeri Kedungringin 1 Beji Pasuruan. The population and sample consisted of 30 fifth-grade students. Data were collected through observation sheets and pre-test and post-test assessments in natural science subjects. The data were analyzed using descriptive and inferential statistical techniques with SPSS Windows version 27. Pre-test and post-test results indicated an improvement in average critical thinking abilities. The average pre-test score was 47, categorized as low, while the post-test score averaged 84, categorized as high. Inferential analysis using the paired sample t-test yielded data with Sig. < α = 0.05 (0.026 < α = 0.05), rejecting H0. This implies that implementing problem-based learning models has a significant effect on critical thinking abilities in natural science subjects among fifth-grade students at SD Negeri Kedungringin 1 Beji Pasuruan.

Keywords: Problem Based Learning, Critical Thinking Skills, Elementary School, Natural Sciences

Abstrak

Studi ini merupakan penelitian kuantitatif yang menggunakan metode desain pre-eksperimental untuk mengeksplorasi dampak dari penerapan model pembelajaran berbasis masalah terhadap kemampuan berpikir kritis siswa kelas V di SD Negeri Kedungringin 1 Beji Pasuruan. Sampel terdiri dari 30 siswa di kelas tersebut. Data dikumpulkan melalui lembar observasi serta tes pre dan post dalam mata pelajaran IPA. Analisis data menggunakan dua teknik statistik: deskriptif dan inferensial dengan bantuan program SPSS versi 27. Hasil pre-test dan post-test menunjukkan peningkatan signifikan dalam rata-rata kemampuan berpikir kritis. Nilai rata-rata pre-test menunjukkan kategori rendah (47), sementara post-test menunjukkan kategori tinggi (84). Hasil analisis inferensial menggunakan uji-t paired sample test menunjukkan bahwa Sig. < α = 0.05 (0.026 < α = 0.05), sehingga H0 ditolak. Kesimpulannya, penerapan model pembelajaran berbasis masalah memiliki pengaruh positif terhadap kemampuan berpikir kritis melalui mata pelajaran IPA pada siswa kelas V di SD Negeri Kedungringin 1 Beji Pasuruan.

Introduction

Education is crucial in shaping intelligent generations capable of navigating dynamic social changes. The ability to think critically is paramount in the fields of Natural and Social Sciences Education [1]. The objective of this research is to gain a better understanding of how problem-based learning (PBL) models can enhance students' critical thinking abilities. Characteristics of PBL, such as students actively engaging in the learning process and applying concepts in real-world situations, indicate that PBL can assist students in developing analytical and critical thinking patterns [2]. By encouraging students to actively participate and apply ideas to real-world situations, PBL is expected to enhance their critical thinking abilities [3].

In the realm of educational development, current challenges have arisen regarding students' critical thinking abilities, particularly at the elementary education level. Students often encounter difficulties in applying their knowledge critically, solving problems, or evaluating information accurately. In the fifth grade of SDN Kedungringin 1 Beji, this issue is further exacerbated by the lack of interaction and student participation in Science and Social Sciences learning. Therefore, research is needed to gain a better understanding of these problems and the most effective solutions for them. Consequently, the urgency of this research lies not only in enhancing the quality of IPAS learning but also in contributing to the formation of students as individuals capable of thinking critically and independently in the face of continually evolving global changes [4].

In the concept of critical thinking according to [5] , There are six main indicators such as explanation, interpretation, analysis, inference, evaluation, and self-regulation. Analysis divides information into smaller parts and examines how they relate to each other. Inference requires the ability to draw conclusions based on information, while evaluation demands skills in assessing the quality and relevance of arguments. Explanation refers to the ability to articulate thoughts in detail and clarity, while self-regulation emphasizes conscious control over the thinking process. Overall, these skills form the foundation of effective critical thinking.

The critical thinking abilities of elementary school students are still suboptimal. This can be observed from the OECD 2019 report, which states that according to the Programme for International Student Assessment (PISA) results in 2018, Indonesia ranked 7th from the bottom [6]. Based on PISA reporting, the percentage of students repeating grades in Indonesia is highest at the elementary school level, ranging from 9% to 12%. This percentage is higher compared to the junior high school or high school levels, which have a range of 1% to 2%. The report also mentions that students who repeat grades at the elementary school level and continue to do so at the junior high school or high school levels range from 2% to 5% [7].

Based on the pre-research observation of the Science and Social Sciences learning process in the fifth grade of SDN Kedungringin 1 Beji, Pasuruan Regency, the learning model has not yet been optimal. Observations of critical thinking abilities were conducted using a critical thinking skills test instrument provided to fifth-grade students. Test results were calculated using predetermined criteria. Students' critical thinking abilities have not developed because conventional lecture methods are still being used, resulting in pre-research test results

indicating that 7% of students are classified as having high critical thinking skills, totaling 2 students; 30% are classified as having moderate critical thinking skills, totaling 9 students; and 63% are classified as having low critical thinking skills, totaling 19 students. The pre-research test consisted of 5 essay questions. Out of 30 students who took the test, it was evident that the majority had low critical thinking abilities. Students were less capable in reasoning, argumentation, and problem-solving in their surrounding environment. Thus, the IPAS learning process at SDN Kedungringin 1 Beji has not been optimal in developing critical thinking abilities. One possible solution is to utilize the Problem Based Learning (PBL) teaching model.

Several scholarly journals support the view that PBL can be effective in enhancing students' critical thinking abilities. One relevant journal is [8], where an in-depth study investigates the impact of PBL implementation in elementary school science learning. The research findings noted a significant improvement in students' critical thinking abilities, with measurable enhancements observed through indicators such as reflective questioning, ability to ask questions, and problem-solving skills. Several studies support this concept. For example, a study published in [9] explores the impact of PBL on the development of problem-solving skills among elementary school students. This research indicates that students who undergo problem-based learning experience significant improvements in their ability to identify problems, develop problem-solving strategies, and evaluate alternative solutions. The fifth-grade level at SDN Kedungringin 1 Beji serves as a crucial context for understanding how PBL can be integrated into IPAS learning. In an effort to analyze the PBL model, this study aims to evaluate its impact on students' critical thinking abilities.

Through this approach, students are not only actively engaged in learning but also learn to formulate relevant questions, analyze information, and make decisions based on evidence obtained from real-world situations. This research aims to enhance our understanding of how task-based learning models (PBL) can improve students' critical thinking abilities in the fifth grade of SDN Kedungringin 1 Beji. By integrating the conceptual framework of PBL and specific focus, PBL can achieve this goal [10]. By detailing the steps of PBL implementation and identifying measurements of critical thinking skills, this research will provide practical guidance for educators and policymakers in implementing learning strategies focused on developing critical intellectual skills among fifth-grade students. In the study conducted by Resti Fitria Ariani, titled "The Influence of Problem-Based Learning Model on Students' Critical Thinking Abilities in Elementary Schools in Science Subjects," in 2020, there is a possibility that the critical thinking skills of elementary school students can be enhanced as a result of implementing problem-based learning models. In this research, the study location encompasses elementary schools in general, while the researcher specifically focuses on SDN Kedungringin 1 Beji, Pasuruan Regency.

In the Problem-Based Learning (PBL) paradigm as outlined by Richard I. Arends in his book "Learning to Teach," [11], there are five key indicators. First, Orienting Students to Problem involves introducing students to the issues they face, providing context, and learning objectives. Second, Organizing Students to Learn emphasizes coordinating students' learning activities, helping them form structure and focus in problem exploration. Next, Assisting Individual or Group Investigation involves guiding research both individually and in groups, leading students through the investigative process. Then, Developing Artifacts or the Work and Presenting Them includes developing artifacts or solutions and the ability to present them effectively. Finally, Analyzing

and Evaluating the Problem Solving Process emphasizes analysis and evaluation as integral parts of problem-solving efforts, ensuring that students can critically reflect on and evaluate the learning process. Overall, PBL not only creates deep learning experiences but also fosters the development of students' analytical and problem-solving skills.

This research is expected to make a significant contribution in offering solutions to several challenges faced in the context of Natural Sciences learning in the fifth grade of SDN Kedungringin 1 Beji. By focusing on the implementation of the Problem-Based Learning (PBL) model, this research is expected to provide a solution to enhance students' critical thinking abilities. PBL, with its nature of requiring students to collaborate, analyze, and solve problems, is expected to create space for active student engagement, enabling them to apply knowledge in real-world situations, and deepen their problem-solving skills.

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Metode

The type of research is Pre-Experimental One Group Pretest-Posttest Design. This type of research is conducted only on one group without a comparison group. The following is the table of One Group Pretest-Posttest Design:

Tabel 1. *One Group Pretest-Posttest Design*

Pretest	Treatment	Posttest
O_1	X	O_2

Notes:
O_1 : Pretest before treatment
O_2 : Posttest after treatment
X : Pre Experimental Group

Population is a general collection that includes objects or subjects with specific qualities and characteristics predetermined by the researcher for analysis and conclusions. The population in this study comprises all fifth-grade students at SDN Kedungringin 1 Beji. On the other hand, a sample is a portion of the total number and characteristics present in the population. Based on the definition of a sample, the research sample consists of 30 fifth-grade students. Furthermore, since every population member is given treatment, this research employs total or saturated sampling technique[12].

There are three variables in this study: variable Y1 (pre-test), variable X (treatment), and variable Y2 (post-test). Before being subjected to the problem-based learning model treatment, the subjects' critical thinking abilities were first measured (Y1) by 30. Then, variable X is given the treatment, and another test is conducted subsequently. After collecting the measurement results, a comparison is made between the conditions before and after the treatment.

The first step in data analysis is the normality test, which determines whether the research data is normally distributed or not. The Shapiro-Wilk normality test, used in this study, is considered normal if the significance value (p-value) is greater than 0.05. Next, hypothesis testing for normality is conducted. This hypothesis test uses a paired sample t-test with a significance level of 0.05. The research results show that H0 is accepted and Ha is rejected if the probability is < 0.05, and H0 is rejected if the probability is > 0.05. Finally, a paired sample t-test is conducted to determine whether there is a relationship between the pre-test and post-test. This is done if the significance value is less than 0.05, and conversely if the significance value is greater than 0.05.

In assessing, researchers utilize instruments to evaluate students' critical thinking abilities. Here is the instrument for assessing students' critical thinking skills:

Tabel 1. *Critical Thinking Abilities*

No	Indicator	Sub-Indicator

1	Interpretation	Categorizing and clarifying the meaning of arguments.
2	Analysis	Analyzing arguments.
3	Inference	Drawing conclusions.
4	Evaluation	Evaluating the quality of arguments made
5	Explanation	Presenting arguments
6	Self-Regulation	Checking and correcting oneself

Results and Discussion

The aim of this study is to investigate the influence of the Problem-Based Learning model on students' critical thinking abilities in the Natural Sciences subject at SD Negeri Kedungringin 1 Beji. The results from the sample of 30 students indicate the impact of the problem-based learning model. The data analysis results demonstrate the following:

Tabel 4. *The Calculation Result of the Mean*

Vari abel	N	Me an	Med ian	Mo dus	Nilai Mini mum	Nilai Maxi mum	Std. Devi asi
Pre-Test	30	47	48	50	33	54	6,366
Post-Test	30	84	86	88	50	96	8,773

Source: Data processed by the researcher, 2024

Based on the table above, the highest value before the test is 54 and the lowest value is 33. The data analysis results show a mean of 47, median of 48, mode of 50, and standard deviation of 6.366. The average values of pre-test and post-test changed, with a mean of 84, median of 86, mode of 88, and standard deviation of 8.773. Therefore, in the Natural Sciences subject at SD Negeri Kedungringin 1 Beji, critical thinking ability V is influenced by the problem-based learning model.

Furthermore, this study will discuss the results of analysis and research data regarding the problem-solving skills of fifth-grade students at SD Negeri Kedungringin 1 Beji using the Problem-Based Learning model in the Natural Sciences subject. The pre-test data in this study originated from a descriptive test of 6 questions on the topic of the human respiratory system. Before taking action, the frequency of critical thinking is divided based on the Natural Sciences subject:

Table 5. *Students' Problem-Solving Abilities on the Pre-Test*

No	Value Range	Frequency	Percentage
1	30 - 39	5	16,7%
2	40 - 49	10	33,3%
3	50 - 59	15	50,0%
	Total	30	100,0%

Source: Data processed by the researcher, 2024

From the table above, it can be concluded that there are 5 students (16.7%) who scored between 30-39, 10 students (33.3%) who scored between 40-49, and 15 students (50%) who scored between 50-59. After implementing the Problem-Based Learning model to evaluate critical thinking abilities in the Natural Sciences subject, the researcher provided a test consisting of 6 descriptive questions to the students. Below is the frequency distribution of critical thinking abilities through the Natural Sciences subject after the implementation of the action:

Table 6. *Students' Problem-Solving Abilities on the Post-Test*

No	Value Range	Frequency	Percentage
1	50 - 59	1	3,3
2	60 - 69	0	0,0
3	70 - 79	6	20,0
4	80 - 89	18	60,0

5	90 - 100	5	16,7
	Total	30	100,0

Source: Data processed by the researcher, 2024

From the data in Table 6 above, it can be concluded that there is one student (3.3%) who scored between 50-59, six students (30%) who scored between 70-79, there are eighteen students (60%) who scored between 80-89, and five students (16.7%) who scored between 90-100.

Normality Test

In this study, a normality test is used to determine whether the distribution of the dependent variable, independent variable, or both in the regression model follows a normal distribution. This is done using SPSS Statistics 27 for Windows and the one-sample Kolmogorov-Smirnov test method. Measurements are made by comparing the Asymp Sig. (2-tailed) value [13] with the predetermined value of 5%. If the Asymp Sig. (2-tailed) value is greater than 0.05, the conclusion drawn is that the data follows a normal distribution. Below are the results of the normality test:

Table 7. *Normality Test Result*

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		30
Normal Parameters[a,b]	Mean	0
	Std. Deviation	1,42146299
Most Extreme Differences	Absolute	0,128
	Positive	0,082
	Negative	-0,128
Test Statistic		0,128
Asymp. Sig. (2-tailed)[c]		,200[d]
Monte Carlo Sig. (2-tailed)[e]	Sig.	0,240
	99% Confidence Interval	Lower Bound	0,229
		Upper Bound	0,251

Source: SPSS output data processed by the researcher, 2024

The result of the normality test from Table 7 shows that the Asymp Sig. (2-tailed) value is 0.200. This value indicates a value greater than 0.05. Therefore, it can be concluded that the data in this study follows a normal distribution.

Hypothesis Testing
Partial Test (t-test)

The t-test is used to evaluate the validity of statements in the hypothesis, indicating the extent to which the independent variable influences the dependent variable individually. The significance level used in this test is 0.05. If the significance value (sig.) exceeds 0.05, then the null hypothesis (Ho) is accepted and the alternative hypothesis (Ha) is rejected. Conversely, if the significance value (sig.) is less than 0.05, then the null hypothesis (Ho) is rejected and the alternative hypothesis (Ha) is accepted. Below are the results of the t-test conducted using SPSS Statistics 27 for Windows software:

Table 8. *T-test Result*

Variable	t_{value}	t_{table}	Sig.	Explanation
Pair (*Pretest-Posttest*)	2,351	2,048	0,026	H0 is rejected and Ha is accepted.

Source: SPSS output data processed by the researcher, 2024

The result of the t-test in Table 8 regarding the influence of the Problem Based Learning model on critical thinking abilities in

the Natural Sciences subject among fifth-grade students at SD Negeri Kedungringin 1 Beji shows that the obtained t-value is 2.351. Then, this t-value is compared to the critical t-value (t-table), where the degrees of freedom (df) is (N - Variable - 1) or (30 - 1 - 1) = 28 at a significance level of 5%, which is 2.048. Therefore, since the obtained t-value is greater than the critical t-value (2.351 > 2.048), the alternative hypothesis (Ha) is accepted. However, this result shows a significance of 0.026, where 0.026 < 0.05. As a result, the null hypothesis (Ho) is rejected, and the alternative hypothesis (Ha) is accepted.

Discussion

The results of the pre-test and post-test analyses show an improvement in the problem-solving abilities of fifth-grade students at SD Negeri Kedungringin 1 Beji when using the Problem-Based Learning model during the learning process, compared to the pre-test scores without treatment. The average score in the pre-test was 47, while in the post-test, the average score increased to 84. The difference in scores between the pre-test and post-test indicates a more significant improvement in the post-test compared to the pre-test. This indicates a positive impact of implementing the Problem-Based Learning strategy on students' problem-solving abilities in the Natural Sciences subject in fifth grade at SD Negeri Kedungringin 1 Beji.

This is in line with the study [14] which examined the Effect of the Problem-Based Learning model on the learning outcomes of fifth-grade students in the mathematics subject at SD Negeri Gandekan Surakarta. The study found that the learning outcomes in mathematics using the Problem-Based Learning model integrated with authentic assessment for fifth-grade students at SD Negeri Gandekan Surakarta experienced improvement. It was observed that the percentage increase in mathematics

problem-solving skills was 56.71% for cycle 1 and 80.5% for cycle 2.

Problem-Based Learning is an instructional approach that places students in an active role to solve real-world problems. In this context, the study indicates that the implementation of Problem-Based Learning at SD Negeri Kedungringin 1 Beji has a significant impact on improving students' critical thinking abilities. The data analysis results show an increase in the average scores on the post-test compared to the pre-test, indicating that students have developed their critical thinking skills after participating in learning with the PBL model[15].

Based on the theory of Problem-Based Learning, learning is centered around problem-solving, where students are challenged to solve real-world problems. This encourages students to develop their analytical, critical, and problem-solving skills. In the context of this research, students were given the opportunity to solve problems related to the human respiratory organ through the Problem-Based Learning approach. Through this process, students not only learn about the taught material but also develop their critical thinking skills as they have to analyze problems, explore possible solutions, and draw conclusions from the information they acquire [16].

The t-test results indicate a significant difference between the pre-test and post-test scores, with the calculated t-value being greater than the critical t-value. This suggests that there is a significant influence of implementing the Problem-Based Learning model on enhancing students' critical thinking abilities. Therefore, the alternative hypothesis (Ha) is accepted, which states that the PBL model has a significant impact on students' critical thinking abilities [17]. The findings of this study are consistent with the theory of Problem-Based Learning, which emphasizes the importance of problem-based learning in developing students' critical

thinking skills at the elementary school level. The Problem-Based Learning model can be an effective learning approach in enhancing students' critical thinking abilities at the elementary school level[18].

Conclusion

From the results of this study, it can be concluded that the implementation of the Problem-Based Learning (PBL) model has a positive impact on the critical thinking skills of fifth-grade students in the subject of natural sciences at SD Negeri Kedungringin 1 Beji. The pre-test and post-test data show a significant improvement in students' critical thinking skills after participating in learning using the Problem-Based Learning model. This is supported by statistical analysis indicating a significant difference between the pre-test and post-test results, indicating that the PBL model is effective in enhancing students' critical thinking skills. Therefore, this research contributes significantly to understanding the influence of the PBL model on the development of students' critical thinking skills at the elementary education level.

It is hoped that the Problem-Based Learning (PBL) model will be more widely implemented in the learning process at SD Negeri Kedungringin 1 Beji and other schools as well. This can help enhance students' critical thinking skills overall. There is a need for training and mentoring for teachers to effectively implement the PBL model in their teaching. Teachers also need adequate support and resources to conduct PBL-based learning effectively. Further research can be conducted to measure the effectiveness of the PBL model in enhancing students' critical thinking skills in various levels of education and other subjects. This can provide a deeper understanding of the potential of the PBL model in improving the quality of education.

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