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The Influence of Problem Based Learning Assisted by Interactive Worksheets on Critical Thinking Ability in Science Learning for Class V Students at SDN Batu Ampar 09 Pagi

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Abstract: This research aims to evaluate the impact of the Problem Based Learning model supported by Interactive Worksheets on students' critical thinking abilities in science learning. The research method used in this research is quasi-experimental. The research results show that the results of the Independent Sample t-test analysis show that there are differences in the posttest scores for the control class and the experimental class. This shows that the Problem Based Learning model has an influence on students' critical thinking skills at SDN Batu Ampar 09 Pagi. Increased critical thinking skills because the implementation of each PBL syntax was carried out in accordance with the design prepared by previous researchers which was demonstrated based on the results of observations.

Keywords: Interactive worksheets; Learning; Problem based learning; Student

Introduction

Primary school students' critical reasoning abilities are the abilities students need to solve problems (Adiwiguna et al., 2019). Reasoning abilities can be built during school education. The learning carried out must be able to stimulate students' abilities to improve their critical reasoning abilities and be able to learn independently in addition to conveying basic knowledge (Riyana, 2012). Critical reasoning skills are very important for science learning because it is one of the scientific attitudes that students must develop. If students do not have good critical reasoning skills, they will face difficulties in solving problems, which can cause difficulty understanding the concepts taught in science learning.

Students' critical reasoning abilities are low because some students do not listen to the lesson well, causing many students to not focus. This is likely due to the use of less varied models (Marudut et al., 2020; Amalia et al., 2021; Wahyuni et al., 2023). Low critical reasoning ability is caused by the lack of students who ask the teacher about material they do not understand, there are still students who do not concentrate during learning (Yulianti & Gunawan, 2019; Annisa et al., 2019; Rofiq, 2019). The Problem Based Learning model is a learning model that actively involves students and encourages students to learn to solve a problem (Hasyda & Arifin, 2020; Mareti et al., 2021; Munawaroh & Sholikhah, 2022; Hardiantiningsih & Istiningsih, 2023; Ayunda et al., 2023). This model helps students learn to reason critically, because this model is problem-based and provides motivation to solve problems (Putri et al., 2020; Helyandari et al., 2020; Perdinna et al., 2020; Syafruddin & Pujiastuti, 2020).

Sukowati et al. (2023) stated that Problem Based Learning can improve students' critical reasoning abilities, because this model gives students the opportunity to reason broadly to solve problems. Nurkhasanah et al. (2019) research also shows that the problem-based learning model can improve students'

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critical reasoning abilities. Based on several opinions above, it can be concluded that the Problem Based Learning model can improve students' critical reasoning abilities.

Interactive Worksheets are learning tools that display descriptive material, work steps, and interactive practice questions to provide a more meaningful learning experience and train students to experiment directly (Putra et al., 2022). Interactive worksheets are worksheets that are active and can work with various learning media which can create interaction and provide direct learning experiences to students, so that students are always motivated to be active in their learning (Silalahi & Chan, 2022).

Method

Quantitative research is a research method that collects and analyzes data based on numbers and numerical measurements. This approach aims to describe, explain, and test the relationship between variables using statistical analysis (Creswell, 2014). The research method used is quasi-experimental.

Quasi-experimental research method is a method that has a control group, but cannot fully function to control external variables that influence the implementation of the experiment (Sugiyono, 2019). In this study, researchers wanted to see whether there was an effect of the Problem Based Learning model assisted by interactive worksheets to improve critical reasoning skills in grade V elementary school science subjects.

The research design used in this research is Nonequivalent Control Group Design. Nonequivalent Control Group Design is experimental research that uses an experimental class and a control class and there is a pretest and posttest, but the samples used were not taken randomly (Sugiyono, 2015, 2017). See research design in Table 1.

Table 1. Research Design

Class	Pretest	Treatment	Posttest
Experiment	O_1	X	O_2
Control	O_3	-	O_4

The population in this research is the accumulation of class V students at SDN Batu Ampar 09 Pagi, even semester of the 2024/2025 academic year, which consists of 30 class V A students and 30 class V B students. The sample in this research uses a saturated sample, namely the accumulation of class V students. V with a total of 60 students.

Result and Discussion

Results

This research uses a Problem Based Learning model assisted by Interactive Worksheets on critical reasoning abilities in elementary school science learning. Based on the results of the data analysis, descriptive analysis results were obtained as in Table 2 below.

Table 2. Descriptive Analysis Results

Descriptive Test	Experiment class		Control class	
	Pretest	Posttest	Pretest	Posttest
Mean	55.00	90.37	52.17	65.70
Median	53.00	90.00	53.00	67.00
Mode	53.00	90.00	53.00	63.00

Based on Table 2, the mean pretest result for the experimental class was 55.00 and the mean posttest for the experimental class was 90.37, while the mean pretest result for the control class was 52.17 and the mean posttest for the control class was 65.70. It can be seen that there is a difference in the posttest mean of the experimental class and the control class. The experimental class mean is much greater than the control class mean.

Validity Test

This validity test is carried out to determine whether the test instrument used meets the requirements and is suitable for use as a data collector. The validity test results are calculated using product moment assisted by SPSS version 25, with the validity criteria set, namely if $r_{count} \geq r_{table}$, then the test questions are declared valid. If $r_{count} < r_{table}$, then the test questions are declared invalid (Arikunto, 2010). The r_{table} value in this research is 0.361 with N 30 students. Obtained for 12 essay question instruments valid because $r_{count} \geq r_{table}$.

Reliability Test

This reliability test was carried out to find out whether the test instrument used met the requirements and was suitable for use as a data collector. The test instrument is said to be reliable if rii ≥ rtable. The Cronbach's Alpha value according to Arikunto (2010) can be obtained from SPSS version 25 calculations. The rtable value in this research is 0.361 because the number of samples tested is 30 students.

Table 3. Reliability Test Results

Cronbach's Alpha	N of Items
0.732	12

Based on Table 3, it can be seen that the value of r = 0.732 ≥ 0.361 or $r_{count} \geq r_{table}$, which means that the scientific literacy test questions are reliable and suitable

for use as data collectors. There are 12 valid and reliable questions.

Normality Test

The normality test was carried out to determine whether the pretest and posttest results studied were normally distributed or not. This normality test uses the Kolmogorov Smirnov test using SPSS version 25. The analysis technique is as follows: if the 2 tailed sig probability value is ≥ 0.05 then the data distribution is normal and if the 2 tailed sig probability value is < 0.05 then the data distribution is not normal (Ara & Machali, 2016). The results of the pretest and posttest normality tests for classes V A – V B can be seen in the following table.

Table 4. Normality Test

Class		Kolmogorov-Smirnova		
		Statistic	Df	Sig.
Experiment	Pretest	0.129	30	0.200
	Postest	0.154	30	0.068
Control	Pretest	0.152	30	0.074
	Postest	0.148	30	0.090

Table 4 above, using the Kolmogorov-Smirnov test above, shows the results of the pretest data normality test, namely with a probability sig for Class A and Class B of 0.200, 0.068 for the experimental class and 0.074, 0.090 for the control class which is greater than 0.05, then the data is normal.

Homogeneity Test

The homogeneity test is carried out to test that two or more groups of sample data come from populations that have the same variance (homogeneous). Homogeneity testing using the Levene Test can be used if the data to be tested is more than two groups of data or samples (Supardi, 2014).

To find out about homogeneity using the Levene Test, research data can be determined through the sig value on Based on Mean, where if the sig value is > 0.05 then the data in the research is homogeneous, and vice versa if the sig value is < 0.05 then the data in the research is abnormal (Usmadi, 2020). The results of the pretest and posttest homogeneity tests for classes V A – V B can be seen in the table 5. Table 5 above shows the results of the Posttest Data Homogeneity test, namely with a significance value of 0.214 or 0.365 > 0.05. Thus, the Posttest data has a homogeneous variance.

Based on the Paired Samples t-test, a sig value was obtained. (2-tailed) is 0.000 because the sig value. (2-tailed) of 0.000 ≤ 0.05 that Ha is accepted and Ho is rejected, meaning that there is a difference between the control and experimental classes before and after the implementation of the Problem Based Learning model on the critical reasoning skills of class V students at the East Jakarta Elementary School.

Table 5. Data Homogeneity Test

Test of Homogeneity of Variances					
		Lavine Statistic	df1	df2	Sig.
Experiment and Control	Based on Mean	1.560	1	124	.214
	Based on Median	.826	1	124	.365
	Based on Median and with adjusted df	.826	1	119.170	.365
	Based on median and mean	1.510	1	124	.222

Table 6. Paired Sample T-Test Results

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest experiment Posttest experiment	35.367	4.030	0.736	36.871	33.862	48.068	30	0.000
Pair 2	Pretest control Posttest control	13.533	2.933	0.535	14.629	12.438	25.273	30	0.000

N-Gain Test

The N-Gain test is a test to see the effectiveness of using the problem based learning model assisted by interactive worksheets in improving critical reasoning skills referring to the average difference between the experimental class and the control class.

Figure 1 shows that the average N-Gain for the experimental class is higher than the control class. The N-Gain percent value for the experimental class was 78.52% while the control class was 28.34%. It can be concluded that the use of the Problem Based Learning model assisted by interactive worksheets has an effect on improving students' critical reasoning abilities.

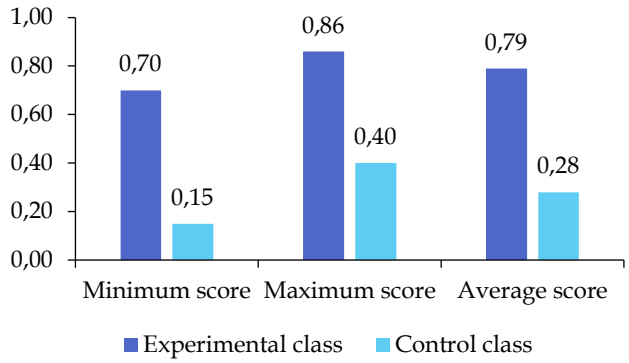

Figure 1. Comparison graph of N-Gain for Experimental Class and Control Class

This finding is in line with Aripin et al. (2021) which shows an N-Gain test value of 0.41 which is categorized as moderate. This indicates that there has been an increase in students' critical reasoning abilities, although not too significant. Apart from that, Afifah et al. (2019) shows an N-Gain test score of 0.59 which is categorized as moderate, which shows an increase in students' critical reasoning abilities.

Discussion

In the teaching process, researchers focus on applying the Problem Based Learning model to students as a treatment. The goal is to understand how students interpret, analyze, identify, evaluate and explain problems according to critical reasoning skills.

Based on the results of the Independent Sample t-test analysis, it shows that there are differences in the posttest scores for the control class and the experimental class. This shows that the Problem Based Learning model has an influence on the critical reasoning skills of students at East Jakarta Elementary Schools. Improving critical reasoning skills because the implementation of each Problem Based Learning syntax assisted by interactive worksheets is carried out well so that it can improve students' critical reasoning abilities.

Statistical analysis is used to provide an overview of improving students' critical thinking abilities. For the average difference test, a sig value was obtained. (2-tailed) is 0.000 because the sig value. (2-tailed) of 0.000 ≤ 0.05 that Ha is accepted and Ho is rejected, meaning that there is a difference between the experimental class and the control class before and after the implementation of the Problem Based Learning model assisted by interactive worksheets on the critical reasoning skills of class V students at Jakarta Elementary School East. The results of this research also reflect similar findings to the study conducted by Ariani (2020). According to his analysis, the use of the Problem Based Learning model can significantly improve the critical reasoning abilities of elementary school students. This finding is also in line with the results of research conducted by Pujianti et al. (2020), Marwah et al. (2021), and Rosita et al. (2023), which shows that Problem Based Learning has a significant impact on students' critical reasoning skills. Apart from that, the application of the Problem Based Learning model has also been proven to increase the overall effectiveness of learning. Apart from that, Prasasti (2020) said that by using the Problem Based Learning model students will be trained to solve problems related to the material. Problem Based Learning is learning that stimulates students to analyze problems and estimate answers to problems. Waraulia (2016) revealed that by using the problem based learning model students play a more active role in learning and reason actively in solving problems. Yunianto et al. (2020), Rahmawati et al. (2022), and Sejati et al. (2023) believes that the problem based learning model has challenging characteristics, because students are invited to reason critically in solving problems.

Conclusion

The conclusion from the results of this research is that the results of the Independent Sample t-test analysis show that there are differences in the posttest scores for the control class and the experimental class. This shows that the Problem Based Learning model influences the critical reasoning skills of students at SDN Batu Ampar 09 Pagi. Increased critical reasoning skills because the implementation of each PBL syntax was carried out in accordance with the design prepared by previous researchers which was demonstrated based on the results of observations. Then, from the homogeneity test, the results of the Pretest data homogeneity test were obtained, namely with a significance value of 0.687 or 0.666 > 0.05. In this way, the pretest data has a homogeneous variance, while the posttest homogeneity test results obtained from the posttest data homogeneity test, namely with a significance value of 0.214 or 0.365 > 0.05. Thus, the Posttest data has a homogeneous variance. For the average difference test, the sig value is obtained. (2-tailed) is 0.000 because the sig value. (2-tailed) of 0.000 ≤ 0.05 that Ha is accepted and Ho is rejected, meaning that there are differences before and after the implementation of the Problem Based Learning model on the critical reasoning skills of class V students at SDN Batu Ampar 09 Pagi. And the influence of the Problem Based Learning (PBL) learning model in science learning on the critical reasoning abilities of grade 5 students at SDN Baru Ampar 09 Pagi has shown significant results. This research found that PBL can improve students' critical reasoning abilities through the use of interactive worksheets that allow students to solve problems that are relevant to everyday life. In this way, students can develop their critical reasoning

abilities by solving the problems presented using logical and rational thinking based on the knowledge and experience they have.

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Author Contributions
D.N.: writing-original draft preparation, analysis, result, discussion, methodology, conclusion; M.: proofreading, review, and editing.

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The authors declare that there is no conflict of interest.

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