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The Influence of the Problem-Based Learning Model Assisted by Google Sites Interactive Multimedia on Critical Thinking Skills in the Science Subject of Grade V Elementary School

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Abstract: Critical thinking skills are part of 21st century learning that are important to be applied in the learning process. However, these skills have not been fully mastered by students. Based on the results of observations conducted in one elementary school, students have difficulty working on analytical questions. This study aims to determine the effect of the Problem-Based Learning model assisted by interactive multimedia Google sites significantly on critical thinking skills in the subject of science for grade V of elementary school. This type of research is a quasi-experiment with a nonequivalent control group design. The population in this study were grade V students of SDN 3 Bangunsari Ponorogo totaling 82 students. The research sample was grade V students consisting of a control class and an experimental class, each totaling 30 students. Data analysis used an independent sample t-test. The results showed that there was a difference in the average results of the pretest and posttest of critical thinking skills in the experimental class and the control class. In the experimental class there was an increase of 19.56%. While in the control class it increased by 6.27%. The results of the hypothesis test using the independent sample t-test showed a significance value (2-tailed) of 0.034, which means <0.05, thus Ho is rejected and Ha is accepted. So there is a significant influence of the Problem-Based Learning model assisted by interactive multimedia Google sites on critical thinking skills in the subject of science for grade V of Elementary School. Learning with the Problem-Based Learning model assisted by interactive multimedia Google sites has been proven to be able to improve students' critical thinking skills.

Keywords: PBL, Critical Thinking, Google Sites

PRELIMINARY

21st-century learning skills consisting of collaboration, character, critical thinking, citizenship, creativity, and communication are very important to be applied in student learning activities. 21st-century skills are expected to equip students to improve their learning and innovation skills, utilization of information and technology media, and life and career skills (Mu'minah & Suryaningsih, 2020). However, 21st-century skills

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have not been fully mastered, especially critical thinking skills. The results of TIMSS 2015 and PISA 2022 placed Indonesia at the bottom (Alam, 2023; Suparya et al., 2022). Based on these data, PISA concluded that Indonesian students' thinking skills are classified as very low but still have the opportunity to improve their critical thinking skills because their abilities and potential have not been developed (Lidiawati & Aurelia, 2023). Critical thinking skills are thinking skills needed to solve problems or issues that arise. Critical thinking skills are very important because critical thinkers are able to think logically, answer questions well, and make rational decisions about what to do and what to believe (Susilawati et al., 2020). Norrizqa (2021) explains that critical thinking is a process of searching, creating, evaluating, collecting, and conceptualizing information as a reference with awareness and the ability to be more creative in solving problems. Based on the results of observations made by teachers in grade V at SD Negeri 3 Bangunsari, Ponorogo Regency, students still have difficulty analyzing a given problem. Students tend to have difficulty when working on analytical questions. This is reinforced by the low learning outcomes of students in the Natural and Social Sciences (IPAS) subject of Indonesiaku Kaya Hayatinya material. Students have difficulty working on questions that require high-level thinking skills or Higher Order Thinking Skills (HOTS). Of the 30 students in the class, only 15 students scored above 75. Which means that only 50% of students achieved minimal completion. Therefore, there needs to be learning that can support the development of students' critical thinking skills.

Learning using a variety of models and methods can support the development of critical thinking skills. Teachers can develop learning using constructivism-based strategies and models, such as Problem-Based Learning (PBL) which allows the development of students' critical thinking and problem-solving skills in real-life contexts. The Problem Based Learning model allows students to participate in solving real-world problems, as well as allowing them to work together and develop their own skills (Wardani, 2023). This opinion is reinforced by Sukmawati et al. (2023) who emphasized that the use of the PBL model in grade IV Science subjects can improve students' problem-solving abilities. Science learning or currently known as IPAS has a complex study of science such as the study of the universe, and biological life, so there needs to be a stimulus for learning media that can help students understand these concepts (Serly et al., 2023). So that in the application of the PBL learning model, it is considered more

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effective and efficient if supported by the presence of digital-based interactive learning multimedia, especially by using the Google Sites platform. In this study, interactive multimedia Google Sites will be developed by integrating several platforms consisting of YouTube, educational game quizziz, and canva for education. Where these platforms will be adjusted to the needs of learning materials and characteristics of elementary school students.

The results of previous research conducted by Saputri (2020) showed that the application of the Problem-Based Learning model has been proven to improve the critical thinking skills of elementary school V students. Other studies show that learning with the problem-based learning (PBL) model using audio-visual media can improve students' critical thinking skills (Herlina et al., 2020). These findings are reinforced by Devi & Bayu (2020) who stated that the application of the Problem-Based Learning model assisted by visual media has an effect on critical thinking skills and science learning outcomes. Research related to the application of the Problem-Based Learning model has indeed been widely carried out. However, the use of digital-based interactive multimedia, especially Google Sites, has never been carried out as a supporter in problem-based learning activities to improve critical thinking skills.

Based on the description above, the researcher intends to conduct research activities using the Problem-Based Learning model assisted by interactive digital-based learning multimedia as a step to stimulate the development of students' critical thinking skills. The purpose of this study is to determine the effect of the Problem-Based Learning model assisted by interactive Google sites multimedia significantly on critical thinking skills in the subject of science for grade V Elementary Schools.

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METHOD

This type of research is quantitative research with a quasi-experimental design design of the nonequivalent control group design model (Abraham & Supriyati, 2022). The nonequivalent control group design model has a design that is almost the same as the pre-test post-test control group but in this model the research subjects are not taken randomly (Murdani et al., 2024). In this design, the researcher will provide a pretest to determine the initial state of critical thinking in the control class and the experimental class. After the results of the pre-test are known, the researcher will provide treatment.

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After giving the treatment, it will be continued by giving a post-test to the experimental class and the control class. The research design is described in Table 1 below.

Table 1 Research Design

Class	Pretes	Treatment	Postes
E	O_1	X	O_2
K	O_3		O_4

Sumber: (Abraham & Supriyati, 2022)

The research subjects in this study were 82 fifth grade students of SDN 3 Bangunsari, Ponorogo Regency, in the 2023/2024 academic year, divided into classes V-A, V-B, and V-C. Furthermore, the determination of the experimental class and the control class was carried out using a lottery technique. In determining the two classes as the experimental class and the control class, a homogeneity test was carried out on the two classes to see whether the two classes used as research samples had the same characteristics. The instruments used in this study were teaching modules and LKPD for treatment instruments, and evaluation sheets for critical thinking skills data collection instruments. The evaluation sheets were designed by adopting critical thinking indicators presented in Table 2 below.

Table 2 Critical Thinking Instrument Grid

Critical thinking skills Critical thinking indicators Question indicators	Critical thinking skills Critical thinking indicators Question indicators	Critical thinking skills Critical thinking indicators Question indicators
Elementary Clarification (providing simple explanations) Focusing questions Students are able to formulate several problems in the form of questions	Elementary Clarification (providing simple explanations) Focusing questions Students are able to formulate several problems in the form of questions	Elementary Clarification (providing simple explanations) Focusing questions Students are able to formulate several problems in the form of questions
Basic Support (building basic skills) Observing and considering observation results Students are able to provide appropriate reasons from observation activities on questions	Basic Support (building basic skills) Observing and considering observation results Students are able to provide appropriate reasons from observation activities on questions	Basic Support (building basic skills) Observing and considering observation results Students are able to provide appropriate reasons from observation activities on questions
Inference (making conclusions) Making deductions and considering deduction results Students are	Inference (making conclusions) Making deductions and considering deduction results Students	Inference (making conclusions) Making deductions and considering deduction results

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Critical thinking skills Critical thinking indicators Question indicators	Critical thinking skills Critical thinking indicators Question indicators	Critical thinking skills Critical thinking indicators Question indicators
able to conclude the cause of a problem	are able to conclude the cause of a problem	Students are able to conclude the cause of a problem
Advance clarification (providing further explanations) Defining terms and assessing definitions (determining examples and non-examples) students are able to distinguish the classification of an example of an event, and then provide an appropriate explanation	Advance clarification (providing further explanations) Defining terms and assessing definitions (determining examples and non-examples) students are able to distinguish the classification of an example of an event, and then provide an appropriate explanation	Advance clarification (providing further explanations) Defining terms and assessing definitions (determining examples and non-examples) students are able to distinguish the classification of an example of an event, and then provide an appropriate explanation
Strategy and Tactics (arranging strategies and tactics) Deciding on an action (formulating alternatives) Students are able to provide the right solution to the problems presented	Strategy and Tactics (arranging strategies and tactics) Deciding on an action (formulating alternatives) Students are able to provide the right solution to the problems presented	Strategy and Tactics (arranging strategies and tactics) Deciding on an action (formulating alternatives) Students are able to provide the right solution to the problems presented

Sources: Ennis (Costa, 1985) dan (Suciono, 2021)

The instruments that have been prepared are first tested for validity and reliability before being used for research activities. Validity tests consist of expert validation tests and question trials. Validation of the instrument by experts is intended to determine whether the instrument that has been developed has met the criteria in terms of material, construct, and language aspects. The results of validation by experts are analyzed using Aiken V (Oktariyanti et al., 2021). Knowing whether an instrument is valid or not, you can use the item validity criteria. The following are the expert validity criteria in Table 3.

Table 3 Expert Validity Criteria

Hasil Validitas	Validity Criteria
$0,80 < V \leq 1,00$	Very High
$0,60 < V \leq 0,80$	High
$0,40 < V \leq 0,60$	Fair
$0,20 < V \leq 0,40$	Low
$0,00 < V \leq 0,20$	Very Low

Source: (Pratiwi, 2014)

The results of the expert validity test related to the critical thinking test instrument are described in Table 4 below.

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Table 4 Results of Expert Validity Test of Critical Thinking Instruments

Question Items	Penilai I	Penilai II	s_1	s_2	∑s	n(c-1)	V	Ket
Item-1	4	4	3	3	6	8	High	High
Item-2	4	4	3	3	6	8	High	High
Item-3	4	5	3	4	7	8	Very High	Very High
Item-4	4	5	3	4	7	8	Very High	Very High
Item-5	4	5	3	4	7	8	Very High	Very High
Item-6	4	5	3	4	7	8	Very High	Very High
Item-7	4	5	3	4	7	8	Very High	Very High
Item-8	4	5	3	4	7	8	Very High	Very High
Item-9	4	5	3	4	7	8	Very High	Very High
Item-10	4	5	3	4	7	8	Very High	Very High

Source: expert validity data

Based on table 4 above, it can be seen that the critical thinking test instrument questions have high and very high validity values. So that the instrument can be continued in the test questions. The test questions were carried out outside the research subjects who had almost the same level of quality as the research subjects. The test questions used SPSS 25.0 for windows with a statistical test of Pearson Product Moment correlation with a significance level of 0.05. If the probability value Sig. > 0.05 then it is declared valid. The results of the test questions for critical thinking skills are described in Table 5 below.

Table 5 Results of Critical Thinking Question Validity Test

No. Item Question	R_{hitung}	R_{tabel}	Information
1	0,719	0,308	Valid
2	0,722	0,308	Valid
3	0,582	0,308	Valid
4	0,366	0,308	Valid
5	0,666	0,308	Valid
6	0,689	0,308	Valid
7	0,698	0,308	Valid
8	0,509	0,308	Valid
9	0,624	0,308	Valid
10	0,644	0,308	Valid

Source: test results Product Moment Pearson SPSS 25.0

Based on Table 5, it can be seen that the critical thinking question instrument items are valid because Rcount is greater than Rtable. So that critical thinking questions can be used as research instruments.

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Reliability testing is used to determine the feasibility of the instrument in measuring what is measured and related to trust. Reliability testing is used to determine the level of consistency of a questionnaire that will be used by researchers (Isma et al., 2023). The reliability test in the study used SPSS 25.0 for Windows using Chronbach's Alpha. If the Chronbach's Alpha value> 0.60, then the research instrument is said to be reliable, while if the Chronbach's Alpha value <0.60, then the research instrument is said to be unreliable (Darmawan, 2014). The following presents the data from the reliability test using Chronbach's Alpha in Table 6.

Table 6 Results of the Reliability Test of Critical Thinking Skills Test Questions

Variabel	Chronbach's Alpha	Information
Critical thinking skills	0.827	Reliabel

Source: Cronbach's Alpha test results SPSS 25.0

Based on table 6 above, it is known that the Chronbach's Alpha value of critical thinking skills is 0.827 or greater than 0.60. So it can be concluded that the critical thinking skills instrument is reliable.

Test the prerequisites for data analysis using the normality test and homogeneity test. Normality test with the help of the SPSS program with a significance level of 0.05 with the Kolmogrov-Smirnov test technique. While the homogeneity test is carried out with the help of the SPSS program with the OnewayAnova test technique with a significance level of 0.05. Hypothesis testing using the Independent Sample T-test with the help of the SPSS 25.0 for Windows application.

RESULTS

The data obtained in this study were the results of critical thinking skills tests between the experimental class group using the Problem-Based Learning (PBL) model assisted by interactive multimedia Google sites and the control class group that was not given the model treatment. The questions given were descriptive or essay questions consisting of 10 questions that were in accordance with the indicators of critical thinking skills. Students' initial abilities in critical thinking skills can be measured through a pre-test, while students' final abilities in critical thinking skills can be measured through a

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post-test. Critical thinking skills data from the pre-test and post-test results in both groups (experimental class and control class) can be seen in Table 7 below.

Table 7 Mastery of Critical Thinking Skills Indicators

No	Critical Thinking Indicators	Experimental Class Control Class		Experimental Class Control Class	
		Pretest	***Posttest***	***Pretest***	***Posttest***
1	Focusing questions	49.44%	83.89%	67.78%	75.56%
2	Observing and considering observation results	66.67%	81.67%	64.17%	64.17%
3	Making deductions and considering deduction results	52.78%	71.11%	55.00%	62.22%
4	Defining terms and evaluating definitions	75.83%	85.83%	75.00%	79.17%
5	Deciding on a course of action	52.78%	72.78%	53.89%	66.11%
Avarage (*mean*)		59.50%	79.06%	63.17%	69.44%

Source: results of critical thinking skills test

Based on Table 7, overall there are differences in the results of critical thinking skills before and after the implementation of learning in the experimental class and control class. During the pre-test, it can be seen that in the experimental class the lowest achievement was in the indicator of focusing questions, which was 49.44% and the highest achievement was in the indicator of defining terms and assessing definitions of 75.83%. While the lowest score in the control class was in the indicator of deciding on an action with an achievement of 53.89% and the indicator with the highest achievement was in defining terms and assessing definitions of 75.00%.

The percentage during the post-test in the experimental class showed that the indicator with the lowest achievement was in the indicator of making deductions and considering deduction results with an achievement of 71.11% and the highest indicator was in the indicator of defining terms and assessing definitions of 85.83%. While in the control class the indicator with the lowest achievement was in the indicator of making deductions and considering deduction results with an achievement of 62.22% and the highest indicator was in the indicator of defining terms and assessing definitions of 79.17%. The indicator with the greatest progress in the experimental class is the indicator of focusing questions, which is with progress of 34.45%. The average percentage of the experimental group at the beginning of the test was 59.50%, increasing to 79.06%. Meanwhile, the control class group changed from 63.17% to 69.44%. There was a significant increase in the experimental class.

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Before conducting the hypothesis test using the Independent Sample T-test, a prerequisite test for data analysis was first conducted, including the normality test and the homogeneity test. The normality test and homogeneity test were conducted on the results of critical thinking of students in the experimental and control classes during the pre-test and post-test. A recapitulation of the results of the normality and homogeneity tests are presented in Tables 8 and 9.

Table 8 Normality Test of Critical Thinking Skills Data

Group		Sig	Criteria	Conclusion
Experiment	*Pretest*	0,200	*sig > 0,05*	Normal
	Posttest	0,200	*sig > 0,05*	Normal
Control	*Pretest*	0,076	*sig > 0,05*	Normal
	Posttest	0,108	*sig > 0,05*	Normal

Table 9 Critical Thinking Data Homogeneity Test

Variabel	Levene Statistic	df1	df2	Sig.
Critical Thinking Skills	.647	3	116	.586

Based on Table 8, it can be seen that the data of critical thinking skills test results in the experimental class and control class are normally distributed. The results of the homogeneity test in Table 9 also show a significance level > 0.05, so the data is homogeneous. The results of the hypothesis test with the critical thinking ability variable using the Independent Sample T-test are presented in Table 10 below.

Table 10 Results of Critical Thinking Skills Hypothesis Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Critical Thinking Values	Equal variances assumed	.379	.541	2.172	58	.034	9.23067	4.24935	.72466	17.73667
	Equal variances not assumed			2.172	56.583	.034	9.23067	4.24935	.72013	17.74121

Source: Independent Sample T-test SPSS 25.0 results

The data in Table 10 above can be used to answer the hypothesis and problem formulation. Based on the results of the analysis in Table 10, it is known that the

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significance value (2-tailed) of the t-test is 0.034 which means <0.05. It can be concluded that H0 is rejected and H1 is accepted which means that there is a significant difference in critical thinking skills between the experimental class group and the control class group in the content of the fifth grade elementary school science.

DISCUSSION

Based on the results of the study on the indicators of critical thinking skills, there was an increase in each indicator, especially in the experimental class. The difference in the comparison of the pretest and posttest scores in critical thinking skills from the experimental class and the control class can be seen in Figure 1.

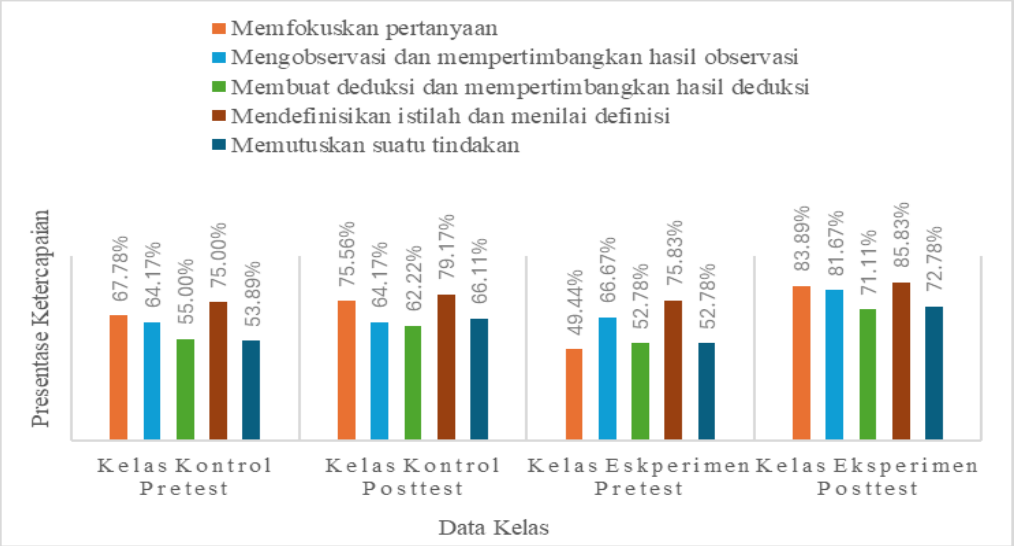

Figure 1 Comparison of critical thinking scores of experimental and control classes

Based on Figure 1, the achievement of critical thinking skill indicators in the experimental class group experienced a significant increase between the pretest and posttest results. The increase in critical thinking skills in the experimental class group was higher when compared to the control class. Based on Figure 1, there was an increase in all indicators of critical thinking skills in the experimental class. The pretest value of the experimental class on the indicator focusing on questions was 49.44%, on the posttest results it increased by 34.45% to 83.89%. The indicator observing and considering the results of observations of pretest values was 66.67%, on the posttest results it increased by 15.00% to 81.67%. The indicator making deductions and considering the results of deductions of pretest values was 52.78%, on the posttest results it increased by 18.33%

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to 71.11%. The indicator defining terms and assessing the definition of pretest values was 75.83%, on the posttest results it increased by 10.00% to 85.83%. The indicator decides an action, the pretest value is 52.78%, the posttest results increase by 20.00% to 72.78%. The findings of the study above are in line with the findings of Mardiyanti (2020) who explained that there was a significant increase in all critical thinking indicators through learning using the Problem-Based Learning model. This further strengthens Febrita's opinion (2020) who stated that the PBL model provides learning that challenges students to work in groups to solve various problems so that they can improve critical and analytical skills.

Based on Figure 1, there are indicators that consistently get the highest scores. These indicators are defining terms and assessing definitions. Both from the experimental class and the control class, the pretest and posttest scores on the defining terms and assessing definitions indicators always get the highest scores compared to other indicators. These findings are similar to research conducted by (Herunata & Widarti, 2020) who explained that in their research the indicator with the highest achievement was the defining terms and assessing definitions indicator of 89.47%. There is a difference in achievement scores in the experimental group and the control class group in the pretest and posttest scores. A comparison of the difference in pretest and posttest scores from the two groups can be seen in Figure 2 Comparison of Gain Scores for critical thinking skills below.

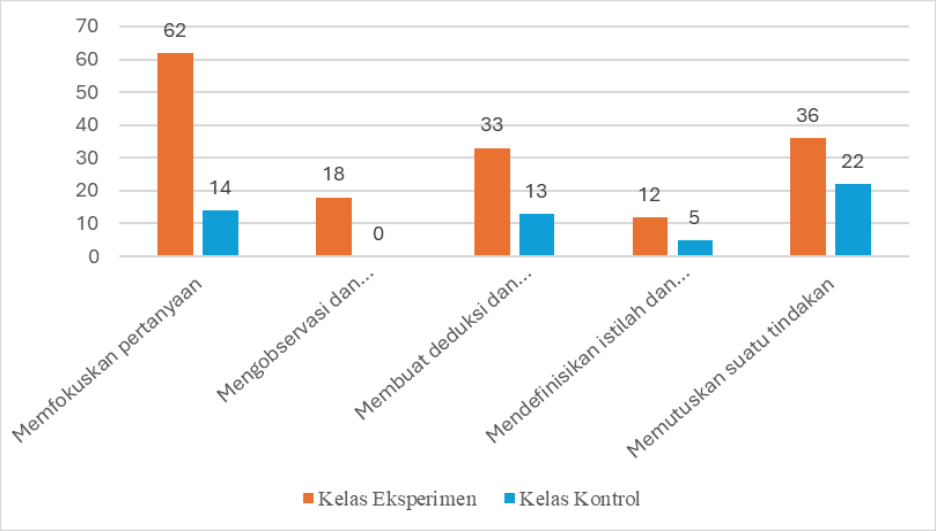

Figure 2 Comparison of Critical Thinking Skills Gain Score

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Based on Figure 2, it can be seen that the experimental class and control class have varying Gain Scores. The Gain Score on the indicator focuses on questions of 62 for the experimental class and 14 for the control class. The Gain Score on the indicator observes and considers the results of observations of 18 for the experiment and 0 for the control class. The Gain Score on the indicator makes deductions and considers the results of deductions of 33 for the experimental class and 13 for the control class. The Gain Score on the indicator defines terms and assesses definitions of 12 for the experimental class and 5 for the control class. The Gain Score on the indicator decides on an action of 36 for the experimental class and 22 for the control class. Based on these results, there was also an increase in critical thinking skills in the control class, although it did not increase significantly. Of all the existing indicators, the experimental class has a higher Gain Score compared to the control class. The results of the study above are in line with the findings of (Rachmawati & Rosy, 2020) which explain that the Gain Score value obtained by the experimental class is higher than the control class. These results are reinforced by Fitriyah & Ghofur (2021) in their research explaining that the Gain Score for critical thinking in the control class is included in the low criteria while in the experimental class it is included in the medium criteria.

The use of interactive multimedia Google Sites can help students to understand the material better. Students are more motivated during the learning process. This can be seen from the enthusiasm of students during the learning process. In line with this, (Karo-Karo & Rohani, 2018) stated that learning media has the function of helping teachers concretize concepts, providing learning motivation to students, and being a stimulus for the development of students' critical thinking. The selection of the Problem-Based Learning model is also considered very appropriate for science material related to the problem of biodiversity conservation. Where in this material the existing problems are very relevant to current conditions. This is a topic that is quite interesting for students to analyze the problem and find solutions that can be done to the problem. In line with this, the results of research conducted by Noviati (2023) explain that the application of the PBL learning model can improve student learning outcomes in science subjects with a completion rate of 92%.

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CONCLUSION

Based on the presentation of the research results that have been analyzed and processed, it can be concluded that the application of the Problem-Based Learning model assisted by interactive learning multimedia Google Sites has a significant effect on critical thinking skills in the subject of science for grade V of Elementary School. This finding is supported by the results of the average percentage of the experimental group at the beginning of the test which was 59.50% increasing to 79.06%. While the control class group changed from 63.17% to 69.44%. There was a significant increase in the experimental class.

The results of the hypothesis test with the critical thinking ability variable using the Independent Sample T-test showed a significance value (2-tailed) of 0.034 which means <0.05. It can be concluded that H0 is rejected and Ha is accepted which means that there is a significant difference in critical thinking skills between the experimental class group and the control class group in the content of science for grade V of Elementary School. The use of interactive learning multimedia Google Sites will be more effective if the ratio of the number of laptops/chromebooks used is greater. In addition, to increase student motivation in learning, educational games contained in interactive multimedia can be developed to be more varied in terms of the number of questions and the form of the questions.

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