



The Effect of *Problem Based Learning* Model with the Assistance of *Wordwall* Media on Collaboration and Critical Thinking Skills in Science in Elementary School Students

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ABSTRACT: The problems that occur at Pasrujambe 01 State Elementary School in learning Natural and Social Sciences (IPAS) are suboptimal collaboration skills, low critical thinking skills, teachers being the center of learning, teaching materials only using textbooks, and the use of less innovative learning models and media. Therefore, this study aims to examine the effect of the PBL model with the help of *Wordwall media* on collaboration skills and critical thinking abilities of elementary school students. This type of research is quasi- *experimental research* using a *Pretest Posttest Control Group Design*. The data analysis method used the T-test or *Independent sample T-Test*. The results of the experimental class data analysis for collaboration skills and critical thinking skills showed higher values than the values in the control class. This is reinforced by the calculation of the hypothesis test which states that the results of students' collaboration skills obtained a significance value (*sig 2-tailed*) of 0.001 and collaboration skills obtained a significance value (*sig 2-Tailed*) of 0.000 so that both are less than 0.05. This proves that there is a difference between the control class and the experimental class regarding collaboration skills and critical thinking skills. Thus, it can be concluded that the PBL model with *Wordwall media* has a significant influence on collaboration and critical thinking skills.

KEYWORDS: Collaboration Skills, Critical Thinking Skills, Problem Based Learning Model, *Wordwall Media*.

INTRODUCTION

The learning process at the elementary school level often faces challenges in developing students' collaboration and critical thinking skills. However, the PISA 2022 results show low mastery of these skills among Indonesian students, particularly in literacy, numeracy, and science. This challenge is even more pronounced in Natural and Social Sciences (IPAS) learning, which requires students to solve problems, conduct experiments, and analyze information collaboratively and critically.

To overcome this problem, innovation in learning is needed. The Problem-Based Learning (PBL) learning model is a relevant innovation. PBL emphasizes solving real-world problems, encouraging students to analyze information, evaluate arguments, and develop solutions. This approach inherently facilitates the development of critical thinking skills as students are required to formulate innovative solutions. Research by Nemakhavhani (2024) shows that PBL can increase student engagement, critical thinking skills, and problem-solving abilities. In addition, PBL also supports collaboration skills because students work in groups, share ideas, and reach consensus in solving complex problems.

In the digital era, the use of technology has become essential. *Wordwall*, as an interactive learning application, can be an effective complementary media. "*Wordwall* is a learning application that provides various types of educational games that can be tailored to the subject matter, such as quizzes, games, matching, and other activities (*Wordwall*, 2024)." The use of *Wordwall* not only increases student motivation and engagement, but also provides instant feedback that supports the learning process. The use of interactive media such as *Wordwall* is in line with Edgar Dale's *The Cone of Experience concept*, where more concrete learning experiences and active student interaction can increase learning effectiveness and strengthen understanding and memory.

Previous research supports the synergy between PBL and gamification media. Lestari & Marpaung (2021) showed the positive influence of PBL on improving critical thinking. Yuliani et al. (2022) also stated that PBL influences students' collaboration skills. Regarding media, Chen et al. (2023) found that gamification media (such as *Wordwall*) can enhance collaborative learning, and Purnomo et al. (2022) stated that *Wordwall* positively increases learning motivation.



Based on the above description of the importance of PBL with the *Wordwall application* in relation to improving students' collaboration and critical thinking skills, it needs to be examined in a study. This means that a research study is needed with the title "The Effect of the *Problem-Based Learning* Model with the Assistance of *Wordwall* Media on Collaboration and Critical Thinking Skills in Science in Elementary School Students."

RESEARCH METHODS

This study used a quantitative approach with a quasi - *experimental design* to test the effect of the *Problem-Based Learning* (PBL) model assisted by *Wordwall* media on the collaboration and critical thinking skills of elementary school science students. The quasi-experimental design was chosen because the researcher could not perform full randomization of existing groups (classes), but still allowed for the measurement of treatment effects. The specific design used is a *Pretest Posttest Control Group Design*, involving two groups of students (grade IV A as the control group and grade IV B as the experimental group). Both groups will be given a *pre-test* and post-test to measure changes in the dependent variable. The experimental group will receive PBL treatment with the help of a *Wordwall*, while the control group will use a conventional learning model.

This research will be conducted in the odd semester of the 2025/2026 academic year at SDN Pasrujambe 01, Lumajang, with a population of all fourth-grade students at the school. The sampling technique used is cluster sampling, where the sample unit is a naturally formed class. The independent variable in this study is the PBL learning model with the help of *Wordwall* media, while the dependent variables are collaboration skills (measured by active participation, productivity, responsibility, flexibility, compromise, and mutual respect) and critical thinking (measured by interpretation, analysis, inference, evaluation, explanation, and self-regulation).

Data collection will be conducted through essay tests to measure critical thinking skills (pre-test and post-test), observation sheets to measure collaboration skills during the learning process, and supporting data documentation from the school. Before use, the research instrument will undergo validity testing (content, construct, and empirical validity) and reliability testing (using Cronbach's Alpha) on a similar group of students not included in the research sample, in accordance with good instrument standards (Creswell, 2014).

The collected data will be analyzed using descriptive statistics (mean, standard deviation, min, max, median) and inferential statistics with SPSS version 26 application. Before hypothesis testing, classical assumption tests will be conducted including normality tests (Kolmogorov-Smirnov) and homogeneity of variance tests (Levene's Test). If the assumptions are not met, non-parametric tests (Mann-Whitney U Test) will be considered. Hypothesis testing will include: (1) Initial difference test (pre-test) using *Independent Sample t-test* to ensure group equality at the beginning; and (2) Test of differences in treatment effects on post-test collaboration and critical thinking skills, also using *Independent Sample t-test* or *Mann-Whitney U Test* if the assumptions are not met. The significance level (α) is set at 0.05. If the p-value is less than 0.05, the null hypothesis (no significant effect) will be rejected, indicating a significant effect.

RESULTS AND DISCUSSION

The results of the data analysis on collaboration and critical thinking skills in the experimental class showed a higher average score than the average score obtained by the control class. Before analyzing the effect of PBL with the help of *Wordwall*, a prerequisite test was conducted on the data of students' collaboration skills. The Kolmogorov-Smirnov normality test showed that the collaboration skills data at the initial and final observations for both groups (control and experimental) were normally distributed, because all significance values (Sig.) were greater than 0.05 (0.200 at the beginning, and 0.060 and 0.116 at the end, respectively). Furthermore, the Levene's Test homogeneity test proved that the variance of the collaboration skills data between the control and experimental classes was homogeneous, both at the initial observation (Sig. = 0.136) and the final observation (Sig. = 0.167), because all significance values "Based on Mean" were greater than 0.05. With the fulfillment of the assumptions of normality and homogeneity, the *Independent Samples t-Test* can be continued to analyze the differences in the average collaboration skills between the two groups. The following are the results of the *Independent Samples t-Test* on collaboration skills in the experimental and control classes.



Table I. Independent Samples *t*-Test of Collaboration Skills

		<i>Independent Samples Test</i>								
		<i>Levene's Test for Equality of Variances</i>		<i>t-test for Equality of Means</i>						
		<i>F</i>	<i>Sig.</i>	<i>T</i>	<i>Df</i>	<i>Sig. (2-tailed)</i>	<i>Mean Difference</i>	<i>Standard Error Difference</i>	<i>95% Confidence Interval of the Difference</i>	
									<i>Lower</i>	<i>Upper</i>
Collaboration	<i>Equal variances assumed</i>	1,966	.167	-3,621	48	.001	-7,000	1,933	-10,887	-3.113
	<i>Equal variances not assumed</i>			-3,621	44,891	.001	-7,000	1,933	-10,894	-3.106

Based on table I, the *t*-test results show a significance value (*Sig. 2-tailed*) of 0.001. Because the results of the statistical test show a significance value ($p < 0.05$), H_0 is rejected and H_a is accepted . This proves that there is a significant difference in collaboration skills between the control class and the experimental class. Therefore, it can be concluded that the use of the *Problem Based Learning model with Wordwall* media significantly improves students' collaboration skills.

The results of the analysis of critical thinking ability data on the Kolmogorov-Smirnov normality test show that the data on the *Pretest* and *Posttest* for both groups (control and experiment) are normally distributed, because all significance values are greater than 0.05. The Levene's Test homogeneity test proves that the variance of critical thinking ability data between the control and experimental classes is homogeneous, both in the pre-test and post-test. In the pre-test, the significance value "Based on Mean" is 0.068 (*Sig.* > 0.05), and in the post-test, the significance value "Based on Mean" is 0.386 (*Sig.* > 0.05). This shows that the variance of critical thinking ability data in both groups is homogeneous. Collaboration skills data from the *Independent Samples t-Test* can be seen in table II below.

Table II. Independent Samples *t*-Test of Students' Critical Thinking Skills

		<i>Independent Samples Test</i>								
		<i>Levene's Test for Equality of Variances</i>		<i>t-test for Equality of Means</i>						
		<i>F</i>	<i>Sig.</i>	<i>T</i>	<i>Df</i>	<i>Sig. (2-tailed)</i>	<i>Mean Difference</i>	<i>Standard Error Difference</i>	<i>95% Confidence Interval of the Difference</i>	
									<i>Lower</i>	<i>Upper</i>
Critical Thinking Posttest	<i>Equal variances assumed</i>	.764	.386	-4,348	48	.000	-10,280	2,364	-15,034	-5,526
	<i>Equal variances not assumed</i>			-4,348	46,403	.000	-10,280	2,364	-15,038	-5,522



Based on table II shows a significance value (*Sig. 2-tailed*) of 0.000. Because the results of the statistical test show a significance value of less than 0.05 ($p < 0.05$) in *the posttest* , so H_0 is rejected and H_a is accepted . This proves that there is a significant difference in critical thinking skills between the control class and the experimental class. Therefore, it can be concluded that the use of the *Problem Based Learning model with Wordwall* media significantly improves students' critical thinking skills.

This study shows that the combination of the Problem-Based Learning (PBL) model and Wordwall media has a significant effect in improving the collaboration and critical thinking skills of fourth-grade students. The results of data analysis proved a significant difference in collaboration skills between the experimental and control classes ($p = 0.001 < 0.05$), with the average score of the experimental class being significantly higher. This improvement is supported by the PBL syntax that encourages interaction, communication, and cooperation . Students in the experimental class, when faced with real-life problems, showed active participation in discussions, dividing tasks, and respecting each other's opinions, a behavior rarely seen in the control class which tends to be individualistic. " Collaboration involves individuals working together to achieve a common goal" (Ariyani et al., 2025). The integration of Wordwall further strengthens collaboration, as its interactive features turn tasks into enjoyable experiences and motivate students to communicate and cooperate effectively (Hidayatullah et al., 2023).

In addition, this study also proves that the PBL model with Wordwall significantly improves students' critical thinking skills, as evidenced by the post-test results which show a significant increase in scores compared to the control class. This improvement occurs because PBL intrinsically encourages students to analyze and solve real-world problems. During the PBL phase, students shift from passive to active: they begin to interpret problems, pose questions, generate hypotheses, analyze data, and draw inferences—a process that aligns with Facione's (2011) critical thinking indicators. Wordwall media supports this process by presenting problems in an engaging manner and facilitating students' reflection and organization of thought. "The Wordwall-assisted PBL model has a positive impact on students' critical thinking skills" (Siti et al., 2025), as its interactivity increases motivation and engagement, which are essential foundations for developing critical thinking (Hidayatullah et al., 2023). In contrast to teacher-centered control classes, this approach allows students to develop logical reasoning and in-depth problem-solving.

Overall, this study shows that the PBL model with Wordwall media is an effective learning strategy to improve collaboration and critical thinking skills in elementary school students, emphasizing the importance of adopting a student-centered learning approach supported by relevant technology to achieve 21st-century educational goals.

CONCLUSION AND SUGGESTIONS

Based on the research results and discussion using quantitative methods in the previous chapter, the researcher reached the following conclusions:

- 1) *The Problem-Based Learning model* with the aid of *Wordwall media* has a significant effect on elementary school students' collaboration skills. This is evidenced by the significant difference in student collaboration scores ($p < 0.05$) between the control and experimental classes.
- 2) *The Problem-Based Learning model* with the aid of *Wordwall media* has a significant effect on elementary school students' critical thinking skills. This is evidenced by the significantly different critical thinking significance values ($p < 0.05$) between the control and experimental classes.

Based on the research results, discussion and conclusions above, the researcher provides suggestions and input aimed at improving learning as follows:

- 1) For teachers, it is recommended to use the *Problem-Based Learning model* with *Wordwall media* in science and other subjects. This combination has been proven effective in enhancing collaboration and critical thinking skills. Teachers can utilize *Wordwall's* various interactive features to create activities that encourage group discussions, problem analysis, and critical reflection, and consider the systematic use of rubrics to assess the collaborative process.
- 2) Schools are advised to support the implementation of *problem-based learning models* and the use of digital media such as *Wordwalls* as part of learning innovation. This support can include providing adequate technological infrastructure (internet access, devices), ongoing training for teachers, and facilitating curriculum development relevant to problem-based learning and technology.
- 3) For other researchers, this study can serve as a reference for conducting broader research. This could include research at other educational levels or subjects, the use of more complex *quasi-experimental* or *experimental research designs* , the addition of



other variables such as learning motivation or cognitive learning outcomes, and comparative studies with other digital learning media. Further exploration of contextual factors that may influence the effectiveness of implementation is also needed.

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