Journal of Social Research

P-ISSN: 2827-9832
E-ISSN: 2828-335x
http://ijsr.internationaljournallabs.com/index.php/ijsr

Improving Students' Critical Thinking Skills Through The Use Of Pbl-Base Google Sites Learning Media And Review Students' Collaboration Skills

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ABSTRACT

Human Resources (HR) must have the 4Cs (communication, collaboration, critical thinking, and creativity) to be educated in the 21st century. Initial research shows that students' ability to collaborate and think critically still needs to be improved. This research aims to determine the use of PBL-Google Sites learning media to improve critical thinking skills and review students' collaboration skills. The research method uses pre-experiment with a one-group pretest-posttest design. The research sample comprised 63 students in classes 7A and 7B of SMP Negeri 11 Yogyakarta. The instruments used are tests and non-tests. The test instrument uses pretest and posttest critical thinking skills. The non-test instrument uses observation of collaboration skills. The data analysis results show the influence of using Google Sites PBL learning media on students' critical thinking abilities. Judging from the results of the Wilcoxon test, the Sig (2-tailed) value is <0.05, namely 0.000, and there is an effect size value of -0.616, which shows that the magnitude of the effect is in a large category. Students' collaborative skills obtained an average score of 75.14, which is in the good category. Based on the results of data analysis, the Google Sites PBL model learning media can improve students' critical thinking skills and determine students' collaboration skills.

Keywords: *21st Century Learning, Google Sites, PBL, Critical Thinking, Collaboration.*

INTRODUCTION

Science education is a unit of science that examines natural occurrences as facts, ideas, rules, and laws. Students' competencies are developed via hands-on experience in science, enabling them to investigate and comprehend the natural world from a scientific perspective. Science education provides lots of possibilities for pupils to participate actively so that the ideas being studied are genuinely ingrained in and thoroughly understood by the students (Firdaus & Wilujeng, 2018).

Science education must adapt to changing times. Development in communication skills, cooperation with other parties, critical thinking, and creativity is necessary since the difficulties of the twenty-first century are frequently linked to these 4C skills (communication, collaboration, critical thinking, and creativity). Teachers and students may think critically, work together, and adjust to changes in Indonesian education by using 21st-century skills (Kuswandi et al., 2021).

Science education can use 4C skills to ensure that students can tackle a variety of challenges they come across in their everyday lives (Hakim, 2023). One of the characteristics of 21st-century learning is critical thinking. Critical thinking leads to interpretation, analysis, evaluation, and inference. It is a self-regulatory talent. When making decisions, it entails using processes, standards, ideas, and contextual information. (Facione et al., 2020). This skill enables students to gain deep comprehension, investigate concepts, and enhance their problem-solving abilities (Hatuwe et al., 2023). Students must participate in thinking during

the learning process to solve issues by processing and integrating the knowledge they have already learned, in addition to just remembering it (Erfan & Ratu, 2018). Based on the facts, Indonesia still needs to improve several 21st-century competencies, including critical thinking skills. This is demonstrated by the PISA 2022 findings, which show that Indonesia obtained an average science achievement of 383, with an average score of 483–488 (OECD, 2023). This indicates that Indonesian students' average critical thinking ability is still low.

Based on literature studies, students' critical thinking skills were still found to be low. They are rarely encouraged to develop critical thinking skills, often directed at memorizing information rather than understanding it. Students are less involved in analyzing and finding information, so they usually need help diagnosing problems. Students' responses to teacher questions are typically limited to the answers contained in the textbook, and they need to be able to explain the reasons for these answers. Classroom learning rarely uses teaching materials that can make students digest information well.

Critical thinking abilities influence collaboration skills. When students do not collaborate well, their critical thinking abilities are not developed or poor, making them less open-minded. This is supported by (Robbins & Hoggan, 2019), through collaborative learning, students can strengthen their critical thinking skills and actively participate in the education strategy. Collaboration is the ability to carry out tasks with others to build respectful relationships and achieve common goals. Collaboration skills enable passive students to participate more actively in class activities, which facilitates understanding and easier achievement of learning objectives (Khoirunnisa & Sudibyo, 2023), to promote empathy, cooperation, and a supportive learning environment, collaboration skills are essential.

Based on literature studies, students, on average, have low collaboration skills because they tend to have an individualistic attitude (Sajidan et al., 2022). The individualistic attitude of students results in a lack of mutual help, a lack of solidarity, a sense of empathy, and a lack of mutual respect between students (Mithhar & Agustang, 2021). Students tend to assign tasks to their colleagues, which indicates a low level of responsibility and active contribution (Rifqi & Hardianti, 2023).

This demonstrates the significance of teaching students how to collaborate with others and think critically during the learning process. Students with solid collaboration abilities will be more likely to work in groups to address difficulties. One alternative solution to enhancing students' critical thinking and collaboration skills is utilizing Google Sites learning media combined with the Problem-Based Learning (PBL) model.

Google Sites is used because it combines various learning features to make the learning process effective and exciting, and learning objectives can be conveyed well and clearly. In other words, Google Sites provides the flexibility and the opportunity to create a learning experience that is more interactive and dynamic, and meets students' needs (Novfirman & Aulia, 2023). However, using Google Sites in the learning context is still limited because many teachers have yet to utilize this medium's potential fully. They have not realized that Google Sites has advantages in creating exciting and interactive learning experiences.

Google Sites learning media can be combined with the PBL learning model. Students are accustomed to using innovative models such as PBL, which emphasizes the involvement of students in thinking by exploring students' ideas and strategies for solving problems. PBL can encourage active students and make them independent to work together and collaborate

in their groups. PBL can help students develop their natural curiosity so they can ask questions and look for solutions based on the data available, which will enhance their critical thinking abilities and learning objectives (Rinanda et al., 2019).

In his research, Gesy, et al. (2023), show how the use of Google Sites learning resources helps students' critical thinking skills. According to research by (Munayah & Maryanti, 2023), students' critical thinking skills can be improved with a PBL approach with the help of Google Sites media. Research conducted by Sari & Rochmiyati (2023) demonstrates that using Google Sites can significantly enhance students' ability to collaborate effectively. However, this study offers a novel approach by not only focusing on collaboration but also examining how the integration of Problem-Based Learning (PBL) through Google Sites influences students' critical thinking skills—an aspect not deeply explored in previous research. The primary purpose of this study is to investigate how the PBL model, when combined with Google Sites, impacts both student collaboration and critical thinking abilities. The findings of this research are expected to contribute to the development of more dynamic and interactive learning environments, providing educators with a more effective strategy for fostering critical thinking and teamwork among students. This study will ultimately benefit both teachers and students by offering insights into more innovative methods for enhancing 21st-century learning skills.

METHOD

An experimental research design is employed in this research. According to Sugiyono (2017), the experimental research method is a study technique used to determine the impact of a particular therapy on other individuals in carefully regulated settings. This viewpoint holds that experimental research treats study participants and observes the treatment's impact. The research used a one-group pretest-posttest design using a pre-experimental approach. An outline of the study methodology employing a one-group pretest-posttest design, as in Equation 1, is provided below by Sugiyono (2017).

$$\mathbf{O_1 \times O_2} \qquad (1)$$

Information:
O_1 : Initial ability test
X : Giving treatment *(*with PBL-Google Sites learning media)
O_2 : Learning outcomes test

The steps in this research are as follows:

1. Develop critical thinking skills test instruments, collaborative observation instruments, and products (PBL-Google Sites learning media).
2. Instrument and product validation
3. A critical thinking skills test is given to students as a pretest.
4. Students are given treatment in the form of implementing the PBL-Google Sites learning media
5. During the learning process, students' collaboration skills are assessed through collaboration observation sheets
6. A final test, a posttest, is given to students using a critical thinking skills test.
7. Data analysis using the normality test as a precondition

8. Conducted non-parametric Wilcoxon tests, effect size tests, and N-Gain tests and calculated data from observations of collaboration skills.

The research sample consisted of 63 students in classes 7A and 7B of SMP Negeri 11 Yogyakarta who were selected using a simple random sampling strategy because the population in the study was homogeneous. Science learning uses PBL-Google Sites learning media on environmental pollution material. The instruments used are tests and non-tests. The test instrument contains 5 questions describing critical thinking skills: interpretation, analysis, and evaluation indicators. The non-test instrument is carried out by observing students' collaboration skills by filling in an observation sheet consisting of 5 indicators: contributing actively, working productively, being responsible, respecting each other, and flexibility and compromise.

Critical thinking skills data analysis was used using the non-parametric Wilcoxon test, effect size test, and N-Gain test. The Wilcoxon non-parametric test was used to determine the effect of using the PBL model of Google Sites learning media. *The effect size test is used to* determine the effect's magnitude after treatment (Cohen, 1988). Test *the effect size* using the following formula.

$$r=\frac{z}{\sqrt{N}} \qquad (2)$$

The effect size test results are classified using the following r interpretation table.

Table 1. Interpretation of r (Wilcoxon Signed-Rank Test)

r	**Interpretation of Effect Size Values**
0.0 - < 0.10	No effect
0.10 - < 0.30	Small effects
0.30 - < 0.50	Moderate effect
0.50	Large effect

N-Gain defines the increase in students' critical thinking skills for each aspect. The N-Gain data is counted using the following formula.

$$\text{N-Gain} = \frac{\text{Pretest score - Posttest score}}{\text{Maximum score - Pretest score}} \qquad (3)$$

N-Gain results are classified according to the following criteria:

Table 2. N-Gain Criterion

	Criteria
N-Gain ≥ 0.70	Tall
0.70 > N-Gain ≥ 0.30	Medium
0.30 > N-Gain	Low

Source :Hake (1999)

The formula used to calculate data from observations of collaboration skills is as follows.

$$R=\frac{s}{\sum s} \times 100 \quad (4)$$

Information :

R : level of collaboration

S : score obtained

$\sum s$: maximum score

The calculation results are classified according to the following criteria.

Table 3. Student Collaboration Level Category

Average score interval	Category
90 – 100	Very good
75 – 89	Good
65 – 74	Enough
55 – 64	Not good
0 – 54	Very not good

Source : Koyan (2012)

RESULTS AND DISCUSSION

Data on students' critical thinking skills are collected using test instruments, namely the initial test (*pretest*) and the final test (*posttest*). Table 5 shows the results of students' critical thinking skills tests, including minimum and maximum average scores.

Table 4. Pretest-posttest Average Critical Thinking Skills

	N	Mean	Std. Deviation	Min	Max
Pretest	63	51.03	11,953	30	75
Posttest	63	76.43	7,902	60	95

Students' critical thinking scores are presented in Table 5 before and after being given the PBL- Google Sites learning media. Before receiving learning materials, students obtained an average score on the pretest of 51.03. Pretest scores ranged from 30 to 75, with 30 being the lowest score. After treatment, student scores ranged from 60 to 95, with an average of 76.43. After using the PBL-Google Sites learning media, critical thinking ability scores increased. 51.03 and 76.43 are the average student pretest and posttest scores respectively (posttest score > pretest score). This shows an increase in students' critical thinking abilities.

The results suggest that the learning medium can help students become more adept at critical thinking. This is by analysis executed by (Sridhara & Raghunandana, 2019), showing that using *Google Sites* can make a person's thinking power critical because it requires students to comprehend the use of *e-learning media* integrated with *Google applications.* Not only that, according to (Nugraheny et al., 2019), students are also given the freedom to convey ideas after reading the material contained on *Google Sites* to be evaluated as discussion material in learning.

During the prerequisite test, a normality test is carried out. According to (Setyawan & Lestari, 2020), data is usually distributed if the significance value (p) exceeds 0.05 or (p>0.05). The normality test used the Kolmogorov-Smirnov test because the sample consisted of more than 50 participants.

Table 5. Normality Test Results

	Kolmogorov-Smirnov [a]		
	Statistics	df	Sig.
Pretest	0.116	0.63	0.033
Posttest	0.143	0.63	0.003

The normality test findings showed that the pretest and posttest significance values were 0.033 and 0.003, respectively. This indicates a p-value <0.05, which suggests that the data is not normally distributed and cannot be subjected to a t-test. Instead, a non-parametric statistical test, the Wilcoxon test, was used. Table 7 displays the Wilcoxon test findings.

Table 6. Wilcoxon Test Results

Ranks				
		N	Mean Rank	Sum of Ranks
Posttest-Pretest	Negative Ranks	0 [a]	0.00	0.00
	Positive Ranks	63 [b]	32.00	2016.00
	Ties	0 [c]		
	Total	63		

a. posttest < pretest
b. posttest > pretest
c. posttest = pretest

Test Statistics[a]

	Posttest-pretest
Z	-6,921 [b]
Asymp. Sig. (2-tailed)	0,000

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks

Less than 0.05, or 0.000, is a significant value (Sig.) obtained from the Wilcoxon test. The change in students' critical thinking test scores before and after using the PBL-Google Sites learning media teaching tool, or vice versa, shows that its use has an influence. The effect size test was used to collect data in Table 8 to ensure the overall influence on student learning outcomes. This data is used to calculate an impact size value of -0.616, which shows that the influence on students' thinking abilities is in an extensive range.

Table 7. Effect Size Test Results

	Z value	**r**
Critical thinking	-6,921	-0.61657

The critical thinking skills test measures 3 aspects, namely interpretation, analysis, and evaluation. Based on the pretest and posttest analysis, it can be seen that there has been an increase in all aspects of student's critical thinking skills which can be seen in Table 9.

Table 8. Average Pretest-Posttest Score for Each Critical Thinking Skills Indicator

Aspect	Pre-test	Post-test	N-Gain	Category
Interpretation	37.46	57.46	0.32	Medium
Analysis	43.02	56.98	0.25	Low
Evaluation	40.48	67.14	0.45	Medium

Based on Table 9, the value of students' critical thinking skills for each aspect has increased. The interpretation aspect's average pretest score is 37.46 to 57.46, with an n-gain of 0.32 in the medium category. In the aspect analysis, the average pretest score was 43.02 to 56.98, with an n-gain of 0.25 in the low category. In the evaluation aspects, the average pretest score is 0.48 to 67.14, with an n-gain of 0.45 in the medium category.

None of the results obtained showed a high category based on the analysis of each aspect. This was because *the treatment* was only given once when students were not accustomed to using the PBL-Google Sites learning media. If we look at the improvement in each aspect, the evaluation aspect gets the highest score, while the evaluation aspect gets the lowest score. The differences in improving students' critical thinking skills for each aspect can be seen in Figure 1.

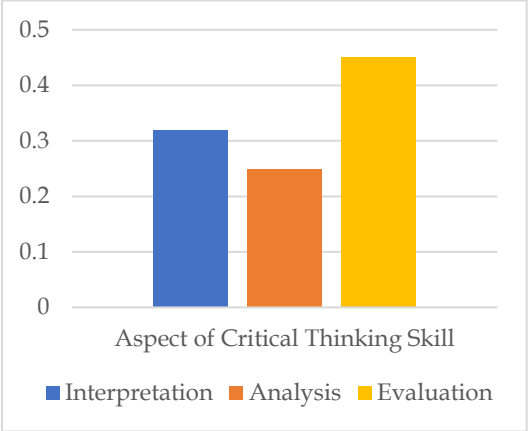

Figure 1. N-Gain value of each aspect

The evaluation aspect received the highest score of 0.45 in the medium category. This shows that some students can assess correct statements and solve problems according to the issues presented. Research conducted by (Setyawan & Lestari, 2020), shows that students have good abilities in evaluating whether information is accurate. They can better sort the information they receive rather than organize themselves about what they should do when facing a problem. Evaluation is the ability of students to consider the credibility of information, namely, the logical strength of the statement or problem's intended inferential connection.

The analysis aspect has the lowest value, namely 0.25. This shows that most students are still unable to identify the best action or solution. According to research conducted by

(Maslakhatunni'mah et al., 2019) , students still appear confused in expressing their arguments and analyzing the causes and consequences of an event. Analysis is the ability of students to identify and describe inferential relationships from the problem information provided.

In addition, this research examines how well students collaborate when using the PBL-Google Sites learning media. Table 10 displays the results of the observation analysis of students' collaboration skills.

Table 9. Collaboration Skills Analysis Results

Indicator	Mean	Criteria
Contribute actively	74.21	Enough
Work productively	76.39	Good
Responsibility	73.81	Enough
Mutual respect	73.81	Enough
Flexibility and compromise	77.51	Good
Average	**75.14**	**Good**

Based on the data above, the average percentage of students' collaboration skills is in the high category, namely 75.14 overall. With a mean score of 77.51, the flexibility and compromise aspect was the best measure of collaborative skills. Meanwhile, with an average score of 73.81, the aspect of responsibility and mutual respect has the lowest level of cooperation ability. The majority of students are still individualists who value the competitiveness of peers over group learning, according to research findings. This also has an impact on science learning outcomes which are challenging and require student collaboration in solving the tasks and problems given (Firman, et al., 2023). The differences in the average presentation of students' collaboration skills in each aspect can be seen in Figure 2.

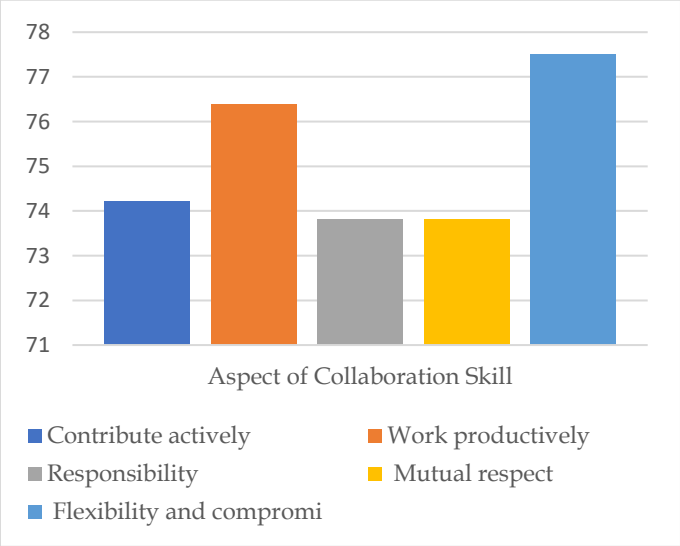

Figure 2. Presentation of average collaboration skills for each aspect

The flexibility and compromise aspects are the highest aspects in the good category. This indicates that most students can accept joint decisions, are flexible in their work, and take criticism and suggestions. This can be seen when the group learning process occurs. Most

students dare to make decisions. Each group member seems able to work flexibly and realizes the tasks are to achieve a common goal. According to Zammi, et al. (2021), the compromise made by students in groups is to discuss every idea or solution obtained. If there is a difference of opinion, they will immediately look for a solution and then take a middle path without harming either party. According to Rahmawati, et al. (2019), students can be flexible and accept comments and input from their group members.

The aspect of responsibility and mutual respect is the lowest in the sufficient category. This shows that many students still must carry out their duties well. In (Nurlisa et al., 2024) opinion, there are still many inactive group members. Only 2-3 members are doing the task while the other group members are passively waiting for answers from their friends. According to (Aninda & Setyawan, 2021), improving the character of responsibility requires habits that educators must carry out throughout the learning process. Apart from that, students also lack focus when interacting with their group friends and prefer playing on their cell phones rather than discussing, which shows a lack of mutual respect (Nurlisa et al., 2024).

Google Sites learning media is combined with an innovative learning model, the PBL model, which can emphasize student involvement by exploring students' ideas and problem-solving strategies. PBL can encourage active students and make them independent to work together and collaborate in their groups (Rinanda et al., 2019). *Google Sites* learning media is an interactive learning media that can facilitate collaboration between students in groups.

CONCLUSION

Based on the analysis and discussion results, using the PBL-Google Sites learning media influences students' critical thinking skills. The effect size value shows the importance of the impact being in a large category and determines students' collaboration skills with an average value of 75.14, namely, the good category. Several things can be used as suggestions to improve further research, namely the hope of using Google Sites learning media in various ways so that it can be used in other science materials. Then, aspects of critical thinking that are still low, such as analysis, should be reapplied, and it is recommended that treatment be provided in more than two meetings so that the effect can be seen more clearly.

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