

Effectiveness of Problem-Based Learning with The Help of Microsoft Teams to Improve Student Learning Outcomes

Muhamad Badrul Mutammam¹, Evi Novita Wulandari²

¹Universitas Jember

²Universitas Negeri Surabaya

Penulis Korespondensi: badrul@unej.ac.id

Abstract: *One of the learning models that can implement hybrid learning by the objectives of the curriculum in Indonesia is problem-based learning. Hybrid learning can run well with the help of technology. One of the platforms that can be used in learning is Microsoft Teams. This study aims to examine the effectiveness of problem-based learning with the help of Microsoft Teams. This study used experimental research methods with the research population, namely the set of VII classes at SMP Negeri 53 Surabaya. While the research sample is a set of students from a class taken randomly because the classes in the population are relatively homogeneous. Problem-based learning (PBL) assisted by Microsoft Teams effectively improves learning outcomes. This is indicated by an increase in learning outcomes of at least 70 points, the teacher's ability to manage learning gets a score of at least 3 for each assessment aspect, student activities by the ideal time, and students' positive response to learning at least 81.08% for each assessment aspect.*

Keywords: *Problem-Based Learning, PBL, Microsoft Teams*

Abstrak: Salah satu model pembelajaran yang dapat menerapkan *hybrid learning* sesuai dengan tujuan kurikulum di Indonesia adalah pembelajaran berbasis masalah. *Hybrid learning* dapat berjalan dengan baik dengan bantuan teknologi. Salah satu platform yang dapat digunakan dalam pembelajaran adalah Microsoft Teams. Penelitian ini bertujuan untuk menguji efektivitas pembelajaran berbasis masalah dengan bantuan Microsoft Teams. Penelitian ini menggunakan metode penelitian eksperimen dengan populasi penelitian yaitu himpunan siswa kelas VII di SMP Negeri 53 Surabaya. Sedangkan sampel penelitian adalah himpunan siswa dari suatu kelas yang diambil secara acak karena kelas-kelas dalam populasi tersebut relatif homogen. Pembelajaran berbasis masalah (PBL) berbantuan Microsoft Teams efektif meningkatkan hasil belajar siswa. Hal ini ditunjukkan dengan peningkatan hasil belajar minimal 70 poin, kemampuan guru dalam mengelola pembelajaran mendapat skor minimal 3 untuk setiap aspek penilaian, aktivitas siswa sesuai dengan waktu yang ideal, dan respon positif siswa terhadap pembelajaran minimal 81,08% untuk setiap aspek penilaian.

Kata Kunci: *Problem-Based Learning, PBL, Microsoft Teams*

INTRODUCTION

Indonesia has prepared a more suitable educational curriculum change to face challenge of the 21st century. Previously, the curriculum in Indonesia had implemented a content-based curriculum after which it changed to a competency-based curriculum and to keep up with the times the curriculum in Indonesia began to implement *Merdeka* curriculum. The skills that students must have in the implementation of *Merdeka* curriculum are critical thinking and problem-solving, communication, and cooperation, creativity, innovation, and digital literacy (Kristiyani, 2019; Purwadhi, 2019; Sanabria, 2017). Unfortunately, many students still lack sufficient ability such as critical thinking, problem-solving abilities, communication, creativity, and digital literacy skills, which are essential competencies in today's dynamic world (Rusmin et al., 2024). In addition,

improving student learning outcomes remains a major challenge in the learning process in Indonesia. Although the curriculum and learning methods have been continuously updated, student competency achievements often fall short of expected standards. This indicates the need for more effective and innovative learning strategies to comprehensively enhance the quality of student learning outcomes.

One relevant learning model to support the implementation of the curriculum and helps students improve their performance, develop various skills such as—critical thinking, creativity, and problem solving—and improve their learning outcomes is the Problem-Based Learning (PBL) model (Agustina et al., 2017; Faqiroh, 2020; Yew & Goh, 2016). Some research results show that PBL has a significant effect on critical thinking skills, problem-solving skills, communication and cooperation skills, creativity, innovation, and improve students learning outcomes (Akhdinirwanto et al., 2020; Aswan et al., 2018; Deep et al., 2019; Hussin et al., 2018; Maulidia et al., 2019; Najah et al., 2019; Narmaditya et al., 2018; Octafianellis et al., 2021; Sari et al., 2021; Uliyandari et al., 2021; Zielinski, 2017).

PBL is a learning model designed to help students build thinking skills, problem-solving skills, and intellectual skills (Arends, 2015; Yuliana & Firmansah, 2018) and encourage students to become researchers, analytical and innovative (Kassab et al., 2017). The steps of PBL learning are: a) orienting students with contextual problems, at this stage, the teacher conveys learning objectives, explains prerequisite material, and motivates students to engage in problem-solving activities b) organizing students to learn, at this stage, the teacher helps students define and organize learning tasks related to the problem c) guiding individual and group investigations, at this stage the teacher encourages students to gather appropriate information and find solutions to these problems from problems d) develop and present work, at this stage the teacher helps students plan and prepare appropriate artifacts, (e) analyze and evaluate the problem-solving process, at this stage, the teacher helps students to reflect on the investigations and processes they use (Arends, 2015).

However, the implementation of PBL requires technological support to run effectively, especially in the context of online or hybrid learning. Technology is important in various fields including education (Ghavifekr & Rosdy, 2015). In the teaching and learning process, the use of technology can improve interaction between teachers make the learning process more enjoyable, and have a positive effect on learning (Ain et al., 2019; Carstens et al., 2021; Ghavifekr & Rosdy, 2015; Kouser & Majid, 2021; Raja & Nagasubramani, 2018). Therefore, there is an urgent need to explore innovative learning models that integrate technology to improve these competencies and align with the demands of the current educational paradigm. There are many types of applications used in learning, for example: video-based programs, wikis, Microsoft Teams, Google, and others. These applications allow students to interact with each other virtually in a learning environment (Tawafak et al., 2018).

Among these, Microsoft Teams has been widely adopted by schools for distance learning (Olugbade & Olurinola, 2021). Microsoft Teams can be referred to as an

application designed by integrating many different applications into one program or called a learning management system (LMS), Microsoft Teams is made to provide convenience in communicating and collaborating (Douglas et al., 2020; Heath et al., 2020; Hubbard & Bailey, 2018; Rojabi, 2020). Microsoft Teams provides various features that can be used by teachers to interact with students virtually, some of these features are features for video conferencing, posting material in the form of files, links, videos, images, sounds, or words typed directly, creating classes, creating assignments, creating quizzes, conducting assessments (Wea & Dua Kuki, 2020).

Although previous studies have explored the use of PBL and digital tools separately, the integration of PBL with platforms like Microsoft Teams remains under-examined. Previous studies have explored Problem-Based Learning (PBL) and digital tools in education. For instance, Nurazizah et al. (2023) focus to describe and interpret the innovation of the problem-based learning model using Microsoft Teams assisted by fishbone diagrams. This article only focuses on a literature review. Meanwhile, Mariana (2024) highlighted the role of Problem-Based Learning with the help of technology to enhance student problem-solving. However, these studies just focus on describing and interpreting the innovation and enhancing student problem-solving skills but not focus on integrating PBL and technology like Microsoft Teams. Specifically, there is a lack of research examining the effectivity of PBL with the help of Microsoft Teams to enhance students learning outcomes. Based on the description, this research aims to examine the effectiveness of PBL assisted by Microsoft Teams in improving student learning outcomes.

METHOD

This study employed a quasi-experimental research methods using a one-group pretest-posttest design. The population consisted of all seventh-grade classes at SMP Negeri 53 Surabaya. The research sample was selected using simple random sampling, where one class taken randomly because the classes in the population are relatively homogeneous (have the same ability or relatively the same). The experiment was conducted for four meetings in accordance with the lesson plan and one meeting for pretest and one meeting for posttest.

The instruments used include valid learning device instruments, namely a) lesson plans, b) Learning Outcome Tests (LOT), c) observation sheets that the teacher's ability to manage learning, d) student activity sheets, and e) student response questionnaires to learning. The data analysis method used is LOT testing to find out any positive changes before PBL learning with after PBL learning while the teacher's ability to manage learning, student activity and student response to learning is done by analyzing according to predetermined criteria.

Learning is said to be effective if it fulfills 1) improves learning outcomes of at least 70 points, (2) the teacher's ability to manage learning for each aspect in each meeting gets a minimum score of "3", (3) student activities are in accordance with the ideal time

contained in the lesson plan with a tolerance of 10% and (4) the results of students' positive responses to learning reach at least 75%.

The material in this study is the presentation of data. The following learning outcomes and indicators used can be seen in Table 1.

Table 1. Learning Outcomes and Indicators

Learning Outcomes	Indicators
1. Students can formulate questions, collect, present, and analyze data to answer questions.	1. Present data in the form of tables, bar charts, and pie charts
2. Students can use bar charts and pie charts to present and interpret data.	2. Interpret data in the form of tables, bar charts, and pie charts
	3. Solve everyday problems related to presenting and interpreting data

The data analysis technique used in this study is the paired sample t-test to compare the mean scores of pretest and posttest for one sample. This test assesses whether the mean difference between paired observations is statistically significant. Specifically, it tests the hypothesis that the posttest scores increase by at least 70 points compared to the pretest scores. The test statistic is calculated using the formula (Wilkerson, 2008):

$$t = \frac{\bar{d} - \Delta_0}{s_d / \sqrt{n}}$$

where:

- \bar{d} is the mean of the differences between posttest and pretest scores,
- Δ_0 is the hypothesized difference (in this case, 70 points),
- s_d is the standard deviation of the differences,
- n is the number of paired observations (students)

RESULTS AND DISCUSSION

Result

This research was conducted in class VII A of SMP Negeri 53 Surabaya. The number of students in class VII A was 37 students. The following are the results of online learning in this study.

Improved learning outcomes

Before receiving the learning treatment using the Problem-Based Learning (PBL) model, students first took a pretest to measure their initial abilities. The analysis showed that the average pretest score was 22.97. After the learning process was conducted using the PBL model assisted by Microsoft Teams, students were given a posttest to measure their final abilities. The average posttest score obtained was 94.51, indicating a significant increase.

To determine whether this increase was statistically significant and met the criterion of a minimum 70-point improvement, a statistical test was conducted using the paired two-sample t-test. The hypothesized mean difference was set at 70 points, representing the minimum expected improvement in scores. This test compares the pretest and posttest scores of the same group of students to evaluate the effectiveness of the learning method.

The results of this t-test will provide evidence on whether the PBL method assisted by Microsoft Teams effectively improves student learning outcomes.

The first step in the analysis is calculating the difference between posttest and pretest scores for each student. The mean difference (\bar{d}) was found to be 71.54 points, which standard deviation of 5.52 points across 37 students. Using these values, the t-statistic was calculated with the formula:

$$t = \frac{\bar{d} - \Delta_0}{s_d/\sqrt{n}} = \frac{71.54 - 79}{5.52/\sqrt{37}} = 1.70$$

With degrees of freedom $df = 37 - 1 = 36$ and a significance level of 0.05 for a one-tailed test, the critical t value is 1.688. Because the calculated t value (1.70) is greater than the critical t value (1.688), the null hypothesis is rejected. This shows that there is a statistically significant increase in student learning outcomes of more than 70 points after following the PBL learning method assisted by Microsoft Teams. Thus, it can be concluded that the learning method used is effective in improving student learning achievement in the material taught.

1. The results of observations of the teacher's ability to manage learning

The results of observing the teacher's ability to manage learning at the first meeting are as follows.

- The teacher's ability to manage learning activities in the first meeting was generally strong, with most aspects scoring 3 or 4 out of 4.
- Introduction and core activities were well handled, particularly in facilitating group work and presenting data.
- Time management scored slightly lower, indicating a need to monitor pacing more closely in future meetings.
- Motivation scored 3, suggesting potential for more engaging strategies.

The results of observations of the teacher's ability to manage learning in the second meeting are as follows.

- Overall, the teacher demonstrated strong ability to manage learning activities during the second meeting, with most aspects scoring 4.
- The management of breakout rooms and evaluation of student explanations scored slightly lower (3), indicating minor areas for improvement.
- The lesson was effectively concluded with clear communication of homework and next steps.

2. Student Activity

The results of observations of student activity in Problem-Based Learning assisted by Microsoft Teams using hybrid learning on data presentation material in class VII A for two meetings are expressed in percentage form. The results of observations of student activity at first meeting can be seen in Table 3.

Table 3. Results of Observations of Student Activity at First Meeting

Category of Student Activity	Ideal Time (%)	1 st Meeting	Tolerance Interval (%)
Listen and pay attention to the teacher's explanation and answer the teacher's questions	50%	47.5%	$45\% \leq p \leq 55\%$
Form a group	6.25%	6.25%	$5.625\% \leq p \leq 6.875\%$
Participate in learning	43.75%	46.25%	$39.375\% \leq p \leq 48.125\%$

The distribution of student activities during the first meeting shows a balanced engagement aligned with the lesson plan. Students spent adequate time listening to instructions, organizing into groups, and participating in collaborative learning activities. This balanced engagement is crucial in a PBL environment to ensure students are both guided and actively involved in problem-solving processes.

Meanwhile, the results of observations of student activity at second meeting can be seen in Table 4 below.

Table 4. Results of Observations of Student Activity at Second Meeting

Student Activity Category	Ideal Time (%)	2 nd Meeting	Tolerance Interval (%)
Listen and pay attention to the teacher's explanation and answer the teacher's questions	12.5%	1.25%	$11.25\% \leq p \leq 13.75\%$
Form a group	6.25%	6.25%	$5.625\% \leq p \leq 6.875\%$
Understanding the problem on the student worksheet in the form of Microsoft Sway	12.5%	1.25%	$11.25\% \leq p \leq 13.75\%$
Asking the teacher if there are questions	12.5%	1.25%	$11.25\% \leq p \leq 13.75\%$
Discussing completing the student worksheet in groups	37.5%	3.75%	$33.75\% \leq p \leq 41.25\%$
Presenting the results of group discussions and following the class discussion by responding to the work of other groups	12.5%	1.25%	$11.25\% \leq p \leq 13.75\%$
Revise their solutions based on the teacher's evaluation.	6.25%	6.25%	$5.625\% \leq p \leq 6.875\%$

In the second meeting of Problem-Based Learning (PBL) assisted by Microsoft Teams, students were highly engaged in group discussions, spending 37.5% of the ideal time on this activity, as seen in Table 5. This aligns well with the results in Table 1, where the teacher's ability to manage learning received high scores, indicating that the teacher effectively facilitated group work. However, activities like listening to the teacher's explanations (1.25%) and asking questions (1.25%) were lower than expected, suggesting that students were more focused on problem-solving within their groups than passively listening to the teacher. This shift is consistent with the PBL approach, which emphasizes student-driven learning over traditional lecture-based instruction.

While group discussions were effective, the time spent presenting group results and interacting with other groups was lower than anticipated (1.25%), indicating an area for improvement. Table 1 shows that the teacher successfully managed time and activities, but incorporating more opportunities for inter-group sharing could further

enhance peer learning. Additionally, the 6.25% of time spent revising solutions based on teacher feedback suggests that students were responsive to the guidance provided. Overall, the second meeting showed strong student engagement in PBL, but there's room to improve interaction and time management across different activities.

3. Students' positive response to learning

From the student response questionnaire filled out by 37 students after attending the lesson, the results are shown in Table 5 below.

Table 5. Student response after attending the lesson

No.	Responded Aspect Statement	Student response		Percentage	
		Agree	Disagree	Agree	Disagree
1.	I feel happy with this learning atmosphere	34	3	91.90%	8.10%
2.	I find it easier to understand the material presented by the teacher	32	5	86.49%	13.51%
3.	I take an active part in the discussion	30	7	81.08%	18.91%
4.	I found new and fun things in this lesson.	32	5	86.49%	13.51%
5.	I am interested in learning like this again	34	3	91.90%	8.10%
6.	This lesson added to my knowledge	32	5	86.49%	13.51%
7.	I feel that the use of Microsoft Teams is very helpful in learning	35	2	94.59%	5.41%
8.	I am more motivated by the way the teacher relates learning to everyday problems.	33	4	89.19%	10.81%
Total				88.51%	11.49%

The results of the student response questionnaire following PBL assisted by Microsoft Teams indicate that the majority of students gave positive feedback toward the learning process. About 91.90% of students expressed happiness with the learning atmosphere, and 86.49% found it easier to understand the material presented by the teacher. Additionally, 81.08% actively participated in class discussions, and 86.49% found the lesson enjoyable and enriching their knowledge. Student interest in similar future learning was also high at 91.90%. The use of Microsoft Teams was perceived as very helpful by 94.59% of students, and 89.19% felt more motivated by how the teacher connected the material to real-life problems. Overall, the average positive response rate reached 88.51%, indicating that the teaching method was well received and supported the effectiveness of learning.

Discussion

The implementation of Problem-Based Learning (PBL) assisted by Microsoft Teams in this study resulted in significant improvements in student learning outcomes. The comparison of pretest and posttest scores revealed an increase of at least 70 points, demonstrating the effectiveness of PBL in enhancing students' understanding of the material. This aligns with the objectives of PBL, which aims to engage students in active problem-solving and critical thinking. Additionally, 81.08% of students gave positive feedback on the learning experience, indicating high levels of satisfaction and engagement with the PBL approach. This mirrors findings from previous studies, such as Hussin et al. (2018) and Yew & Goh (2016), which also highlighted the positive impact of PBL on student engagement and academic performance.

The teacher's ability to manage the PBL sessions was a critical factor in the success of the learning process. Observations of the teacher's performance showed scores of 3 and 4 for various aspects, such as setting clear learning objectives, guiding students during group work, and providing feedback. The teacher effectively used Microsoft Teams to facilitate learning for both in-person and remote students, ensuring that all students participated actively. However, minor challenges were noted in time management, particularly during group discussions and feedback sessions. These findings align with previous research by Akhdinirwanto et al. (2020), which also identified time management as a challenge during PBL sessions, suggesting that better pacing could enhance the overall effectiveness of the learning process.

When comparing the findings of this study with those of previous research, several similarities can be observed. The positive improvement in learning outcomes aligns with the results of Yew & Goh (2016), who found that PBL significantly enhances students' critical thinking and problem-solving abilities. Similarly, the high levels of student satisfaction in this study (81.08%) are consistent with findings from Nieven (1999), who emphasized that positive student responses are a key indicator of effective learning. This suggests that PBL, when well-implemented, can lead to meaningful improvements in student learning outcomes and experiences.

However, there were also some differences between this study and previous research. While many studies have explored the effectiveness of PBL in face-to-face or fully online settings, fewer studies have examined its implementation in a hybrid learning environment using platforms like Microsoft Teams. The findings from this study provide valuable insight into how Microsoft Teams can be used to effectively manage both in-person and online student participation in PBL. While other studies such as Olugbade & Olurinola (2021) have focused on platforms like Zoom or Google Classroom, this study demonstrates the potential of Microsoft Teams in bridging the gap between remote and on-site learning, offering a more inclusive approach to hybrid education.

Finally, the study supports the effectiveness of PBL and Microsoft Teams in enhancing student learning outcomes and engagement. The substantial improvement in posttest scores and the positive feedback from students demonstrate the potential of PBL to foster active learning. However, the study also identified areas for improvement, particularly in time management and inter-group interactions. Future research should address these challenges by exploring more structured methods for time allocation and creating additional opportunities for peer-to-peer interactions. By refining these aspects, the PBL approach, supported by platforms like Microsoft Teams, can continue to enhance the learning experience and be effectively applied in hybrid educational settings.

CONCLUSIONS AND SUGGESTIONS

This study aimed to evaluate the effectiveness of Problem-Based Learning (PBL) with the help of Microsoft Teams in improving student learning outcomes, engagement, and teacher-student interaction with hybrid learning. The findings confirmed that Microsoft Teams-assisted PBL resulted in significant improvements in student learning outcomes, as evidenced by a

minimum increase in post-test scores of 70 points. In addition, high levels of student satisfaction and positive feedback (81.08%) supported the effectiveness of this approach in promoting student engagement and motivation.

The study also highlighted the effective management of teachers in the learning process, although there were still some areas that needed improvement, such as time management during group discussions. This is in line with the aim of examining how PBL can be implemented effectively with the help of digital tools such as Microsoft Teams. Although teacher performance was generally good, improvements in pacing and peer interaction are areas that need further attention in future PBL implementations.

Comparing the findings with previous studies shows consistency in terms of the positive impact of PBL on student outcomes and engagement, especially when supported by technology. Nevertheless, this study contributes to the literature by providing insights into the use of Microsoft Teams in a hybrid learning setting using PBL, which provides valuable perspectives on research on digital tools in education.

In conclusion, PBL with Microsoft Teams has proven to be an effective method for enhancing student learning and engagement in a hybrid learning setting. However, to better understand the potential of this approach, future research should focus on optimizing time management and encouraging more intergroup discussions. These improvements will further strengthen the effectiveness of PBL in hybrid classrooms, helping to achieve the overall research goal of improving learning outcomes through innovative and inclusive teaching methods.

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