Problem-based Learning Implementation Using Blended Learning on Environmental Pollution Concepts

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Abstract

Problem-based learning is a widely used learning model, but how to implement it using blended learning to overcome online learning in junior high school. This article focuses on finding out the effect of problem-based learning implemented by blended learning on students' motivation and learning outcomes. This studey used a quasi-experimental design. The research sample used two classes with a purposive sampling technique. The data collection technique used a post-test instrument test to see the learning outcomes and used a learning motivation questionnaire. The Mann-Whitney U-test of the learning outcomes showed the p-value is less than 0.05, which means that there is a significant difference on student learning outcomes due to the implications of the problem-based learning model with blended learning using Edmodo on environmental pollution. However, the Mann-Whitney U-test of the learning outcomes showed the p-value is more than 0.05, which means that there is no a significant difference on student learning outcomes due to the implications of the problem-based learning model with blended learning using Edmodo on environmental pollution

Keywords: Blended Learning, Cognitive Learning Outcomes, Edmodo, Problem-based Learning

INTRODUCTION

Online learning has been taking place in various countries for a long time (Cann, 2012; Muilenburg & Berge, 2005; Recker et al., 2004), but in Indonesia, it has only developed significantly during the COVID-19 pandemic (Abidin et al., 2020; Anugrahana, 2020; Churiyah et al., 2020; Daniati et al., 2020; Firman & Rahayu, 2020; Fuad et al., 2020). Online learning is learning that uses technology as a medium for interaction between students and educators (Yuangga & Sunarsi, 2020). In addition to using technology, the implementation of online learning policies also requires an adequate internet network connection for an effective learning process (Fikri et al., 2021). Learning innovation in the network is needed; Ambarwati et al. (2020) stated that online learning requires the assistance of Learning Management System facilities and ICT-based devices.

Syarifuddin et al. (2021) explained that online learning could affect students' academic abilities, causing a decrease in learning outcomes followed by low learning motivation. According to Jayawardana and Gita (2020), learning biology in the era of the covid-19 pandemic causes saturation for students because the material is still difficult to understand, so motivation and learning outcomes have decreased.

The interviews and observations at an Indonesian school show that online learning is not optimal because students find it challenging to understand the material. The online learning process uses WhatsApp, so it feels monotonous and uninteresting (Bowles et al., 2020; Maphosa et al., 2020; Nsabayezu et al., 2020). These factors impact students' motivation in learning and affect learning outcomes. Several classes did not complete the minimum completeness criteria based on the final exam scores for the 2021/2022 odd semester. One solution that can be done to overcome these problems is to apply a varied learning model adapted to the online learning.

Problem-based learning is an alternative learning model that can increase learning independence and motivation, affecting learning outcomes (Camelia & Maknun, 2021; Dayeni et al., 2017). Problem-based learning requires students to learn independently in various activities such as solving problems, concluding, and expressing opinions, while the role of the teacher is only as a learning facilitator (Yana et al., 2021). The implementation of problem-based learning is often constrained by insufficient time (Jailani et al., 2017; Nurlaily et al., 2019).

The constrain of time can be solved with blended learning. Blended learning combines face-to-face and online (Utari et al., 2020) and steps asynchronous and synchronous (Suhairi & Santi, 2021). Problem-based learning can be an implementation with blended learning using Edmodo. According to Ningsih (2020), Edmodo has a design similar to Facebook social media, equipped with several learning features, and its application is relatively easy and does not require special skills. This study aims to determine the effect of implementing problem-based learning with blended learning using Edmodo on motivation and student learning outcomes on subject material environmental pollution. This research contributes to an effort to overcome learning problems that arise due to online learning, especially related to student learning outcomes and the absence of support for the learning management system from schools.

METHOD

This study used a quasi-experimental with a quantitative approach. The research was conducted at one junior high school in Indonesia by involving two classes (control and experimental classes), as presented in Table 1.

Table 1. Research design

Class	Treatment	Variable
Control	learning process using WhatsApp group (same with the real condition)	Motivation Cognitive
Experiment	Problem-based learning with blended learning using Edmodo	learning outcome

The research sample was determined by purposive sampling, based on the average value of the odd semester final exam, which was not much different from that of class VII-E (control) and VII-D (experimental). Learning motivation data was collected using a questionnaire, while the cognitive learning outcomes were collected using a posttest. Students' learning motivation data is categorized by referring to Table 2.

Table 2. Motivation category

Interval	Category
13-22	Very low
23-32	Low
33-42	High
43-52	Very high

Learning activities were carried out for four meetings. Three meetings were used for theoretical learning in the science subject matter of environmental pollution, and one last meeting was used as a meeting for taking posttest scores.

Data analysis techniques include analysis prerequisite tests (normality and homogeneity tests) and hypothesis testing (Mann Whitney U test) with the help of IBM SPSS. The normality test used Kolmogorov Smirnov, while the homogeneity test used Levene's test.

Data can be declared customarily distributed and homogeneous if the significance value is > 0.05. The hypothesis is stated to have a significant mean difference if the significance value in the Mann-Whitney test - U test < 0.05.

RESULTS AND DISCUSSION

The data collection results obtained the value of students' learning motivation and posttest scores. Based on these data, it can be seen that the average value of motivation is close to each other (Figure 1), while the posttest value shows that some students have not met the minimum completeness criteria, but in general, the average posttest score shows the difference with the experimental class being higher than the control class (Figure 2).
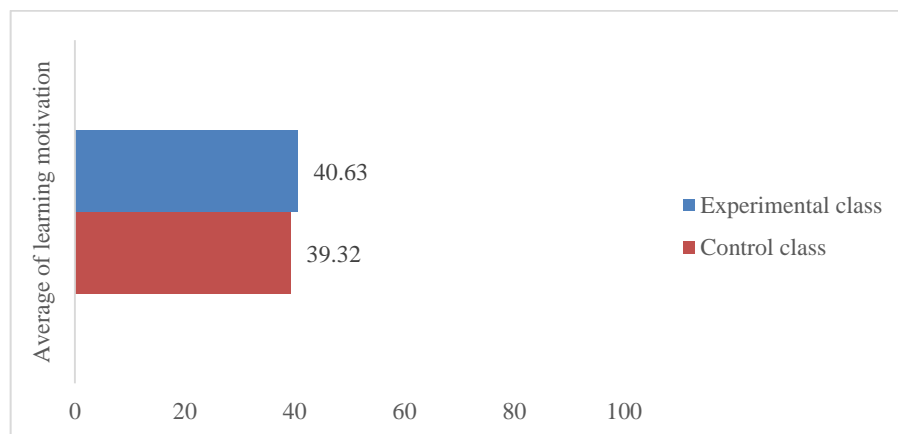

Figure 1. Comparison of the average learning motivation

Based on Figure 1, it can be seen that the average acquisition of learning motivation of students in control and experimental classes is almost the same. Based on Table 2, the average motivation of the two classes is in the high category.
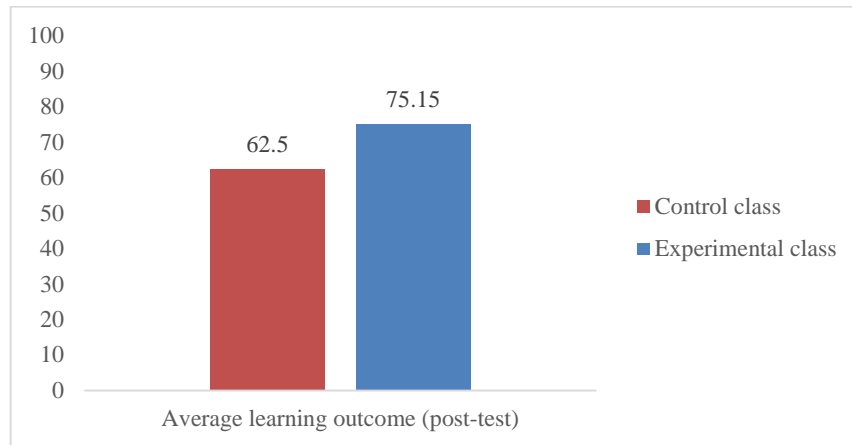

Figure 2. Comparison of the average learning outcome

Based on Figure 2, it can be seen that there is a difference in the average post-test score with a difference of 12.5. The experimental class that received the problem-based learning model treatment with blended learning using Edmodo obtained a higher average post-test score than the control class with the conventional learning model treatment using the WhatsApp group.

Table 3. The result of normality test

	Treatment class	Kolmogorov-Smirnov[a]		
		Statistic	df	Sig.
Learning outcome (Post-test)	Experiment	.163	33	.027
	Control	.096	34	.200[*]
Learning motivation	Experiment	.424	33	.000
	Control	.512	34	.000

Based on Table 4, the normality test results that meet the criteria for normal distribution are the learning outcome variable in the control class and other variables that do not meet the criteria for normality.

Table 4. The result of homogeneity test

	Levene statistic	df1	df2	Sig.
Learning outcome (post-test)	.096	1	65	.757
Learning motivation	13.875	1	65	.000

Table 5 shows that the learning outcomes data can be declared homogeneous while learning motivation is not homogeneous. Based on the results of the prerequisite test, hypothesis testing is carried out using the Mann-Whitney U test.

Table 5. The result of Mann-Whitney U-test

	Learning outcome (post-test)	Learning motivation
Asymp. Sig. (2-tailed)	.022	.076

Grouping Variable: Treatment

Based on table 6, it can be seen that the learning outcome variable shows a significant mean difference. Meanwhile, there is no significant difference in the learning motivation variable. The results of learning motivation showed that the control and experimental classes had the same learning motivation, namely in the high category. Meanwhile, the result of students' cognitive learning outcomes It can be seen that the class that was treated using problem-based learning with blended learning using Edmodo obtained high learning outcomes compared to the control class with the learning model using the WhatsApp group. Implementing blended learning impacts learning during the COVID-19 pandemic (Chung et al., 2022; Santosa et al., 2021), and the use of problem-based learning with the help of Edmodo succeeded in influencing student learning outcomes (Afriani et al., 2019; Hashish et al., 2022; Segbenya et al., 2022).

The average learning outcomes of the experimental class were higher due to the asynchronous preparation of students using Edmodo before the synchronous learning process. Meanwhile, the control class using the WhatsApp group did not have proper preparation to participate in the lesson. Asynchronous activities that implement problem-based learning syntax make student learning more structured to affect success in learning.

Asynchronous activities through Edmodo apply four problem-based learning syntaxes: student orientation to problems, organizing students to learn, guiding investigations in groups, and developing and presenting work. Meanwhile, the last syntax, the analysis related to the process and problem solving, is applied in synchronous learning. The division of problem-based learning syntax in an asynchronous pattern provides more mature learning preparation so that students already have a clear vision of the learning to be carried out in synchronous learning.

The asynchronous session in blended learning helps students in learning preparation (Argyriou et al., 2022; Divjak et al., 2022); students can access learning material and instruction in learning so they can find an overview of the activities in synchronous learning (Argyriou et al., 2022; Saifuddin, 2018). Moreover, in this study, asynchronous activities apply the syntax of the learning model, and the teacher continues to assist in small group discussions through Edmodo.

Apply problem-based learning models in learning that can influence and improve students' cognitive learning outcomes (Nafiah & Suyanto, 2014; Tadesse et al., 2022). Applying problem-based learning syntax through asynchronous with Edmodo provides more time for students to solve problems so that their thinking and understanding skills are more

honed than just learning in class. The activities to solve the problem help improve thinking performance and increase satisfaction in learning (Stockwell et al., 2015). The efficiency of learning time with asynchronous designs is well organized to affect learning outcomes. Problem-based learning based on Edmodo provides broad learning in a complete sense to encourage students to continue learning (Afriani et al., 2019; Hussin et al., 2021; Paliktzoglou & Suhonen, 2018; Wardono et al., 2016).

The asynchronous in the blended learning model requires students to learn independently through various learning sources; it encourages students' understanding of the material to affect learning outcomes. Berga et al. (2021) revealed that the learning style used by students in independent learning through a blended pattern is likely to affect learning outcomes. Learning strategies using blended learning increase students' understanding of learning materials and complete student learning outcomes (Ashraf et al., 2021; Mishra et al., 2022), especially in the implementation of blended learning combined with problem-based learning that can affect motivation and learning outcomes (Hussin et al., 2021; Paliktzoglou & Suhonen, 2018).

The use of Edmodo in blended learning received a positive response from students (Alqahtani, 2019; Alwan, 2017) and played a role in the achievement of learning outcomes (Islam et al., 2021; Noviyanti et al., 2019; Nurhikmah et al., 2018). Likewise, the implementation of problem-based learning with blended learning using Edmodo also positively impacts students. The characteristics of the learning management system have a crucial role in applying blended learning.

The Edmodo application is accompanied by learning features that support providing opportunities to explore, gather ideas, analyze and solve problems for students quickly so that understanding the learning material is better. Purnawarman et al. (2016) state that the various features available in Edmodo are easy to understand and use to provide convenience for users. One of the learning support features in Edmodo is the discussion feature with small groups. The small group discussion is not found on other platforms such as WhatsApp and google classroom (Purba, 2021). The feature of small group discussion in learning helps students in the problem-solving process with the group; students' attention is focused on the material, and students are actively involved in learning and express various kinds of ideas from each individual (Ananda & Kosasih, 2020; Tenda et al., 2021).

The effect of problem-based learning implemented with blended learning Edmodo on cognitive learning outcomes reinforces existing research. However, without a significant effect on motivation, researchers can try using learning media, duration, and intensity

CONCLUSION

Implementing problem-based learning with blended learning using Edmodo has a significant effect on student learning outcomes on environmental pollution material for class VII. This implementation can contribute to new forms of learning after the pandemic.

SUGGESTIONS

Implementation of various learning models with blended learning needs to be carried out at various levels to realize more effective learning and the need for assessment of various other variables in learning, such as learning styles.

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