



Online or Blended Learning: Any Differences in Chemistry Learning Outcomes?

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Abstract

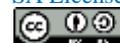
The world of education continues to evolve with changes in time and circumstances. Currently, the education sector faces a challenge due to the Covid-19 pandemic, which has resulted in a shift towards distance learning and online education. With the improvement in the situation, limited in-person learning has been resumed with blended learning. This shift in learning methods and models may impact student learning outcomes. The study aimed to investigate the difference in learning outcomes between online and blended learning, as well as identify any obstacles encountered. A survey-based ex post facto method was used for the study. The population consisted of 43 tenth-grade students (from the Social Science department of State Senior High School 1 Panggarangan) were selected using simple random sampling. Data was collected through documentation and interviews. A nonparametric Wilcoxon test was used for data analysis, and interview results were analyzed descriptively. The results of the Wilcoxon test showed a significant difference in learning outcomes (sig 0.000, $p < 0.05$) between online and blended learning, with the latter producing better results. Network constraints, difficulty in comprehending material, excessive assignments, and lack of parental support were identified as obstacles in online learning. The study highlights that online learning may not be appropriate for high school students, particularly in schools facing internet access constraints and low motivation.

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INTRODUCTION

The COVID-19 pandemic has brought significant changes to the education system, leading the Indonesian government to switch to distance or online learning in response to the pandemic. The quality of education needs to be evaluated to maintain the standards of the learning process, as the application of different learning models affects the learning outcomes (Aisyah, 2016; Langitasari et al., 2021; Virgana et al., 2019). Initially, full online learning was adopted during the early stages of the pandemic, which trains students in technological literacy and independent learning (Handarini & Wulandari, 2020). Online learning platforms such as Google Meet, Zoom Meetings, Google Classroom, and WhatsApp groups have been used in online learning (Habibi, 2020; Hijriyati et al., 2022; Utomo et al., 2020).

As the COVID-19 situation improved in Indonesia, especially in Banten Province, the government allowed schools to hold face-to-face learning (PTM) with the decision of the Banten Provincial Education and Culture Office. The implementation of PTM began on September 1, 2021 (Disdikbud Banten, 2021) and employs a blended learning model, which combines face-to-face and online learning with technology. Blended learning combines the benefits of both approaches (Fahlevi, 2022; Zebua & Harefa, 2022). In the online learning

process, students can listen to learning videos and complete related questions, while in face-to-face learning, students can discuss with peers and receive evaluation and reinforcement from the teacher (Fatimah et al., 2020).

Given the changes in the learning system during the pandemic, it is necessary to evaluate the learning system to determine its effectiveness and identify any obstacles to improve the quality of learning. Previous research has shown that online learning outcomes are better than blended learning outcomes for adult students (Maskar et al., 2020). This study aims to examine the differences in learning outcomes between the online learning model and the blended learning model, and to analyze the obstacles faced. The study will be conducted using high school students as the sample, which differs from previous studies that used adult students. The results of this study will provide an overview of the learning outcomes of the two models and can be used as an evaluation to improve the quality of education.

METHOD

The present study employed a survey research type *ex post facto* research design. The aim was to describe a phenomenon that had occurred and investigate a specific cause of the phenomenon, like a study reported earlier for different cases (Widarto, 2013). The population consisted of all 10th-grade social students at State Senior High School (SMAN) 1 Panggarangan. The sample, drawn using simple random sampling techniques, comprised 43 students equally split between 10th-grade social 3 and 10th-grade social 4.

Data was collected using documentation and interview techniques. Documentation techniques were utilized to gather data on students' daily assessment results from online learning and blended learning. The interview method was employed to obtain information about students' perceptions related to online learning and blended learning.

Data analysis of daily assessment results was conducted using inferential statistics through Wilcoxon tests with the aid of SPSS 24 Software. Normality and homogeneity tests were performed as a prerequisite for hypothesis testing. The hypotheses tested in this study are outlined below. Interview results were analyzed using descriptive analysis to explain the specific causes of the phenomenon. The results of the interviews provided realistic findings on the implementation of the applied learning model and could serve as evaluation material for learning improvement.

RESULTS AND DISCUSSION

The data for this study were collected through daily assessments of online learning and blended learning, with the aim of ensuring that researchers did not manipulate the sample. In addition, interviews were conducted to gather student perceptions of online learning and blended learning. The initial step was to test the data for prerequisites, such as normality and homogeneity, before proceeding with hypothesis testing. The results of these tests are presented in Tables 1 and 2, respectively.

Table 1 Test of normality

	Model of learning	Kolmogorof-Smirnov ^a			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
Learning Outcome	Online	0.234	43	0.000	0.788	43	0.000
	Blended	0.183	43	0.001	0.874	43	0.000

^aLilliefors significance correction

Table 2. Test of Homogeneity variance

		Levene			
		Statistics	df1	df2	Sig.
Learning Outcome	Based on Mean	0.732	1	84	0.395
	Based on Median	0.957	1	84	0.331
	Based on the Median and with adjusted df	0.957	1	83.852	0.331
	Based on trimmed mead	0.832	1	84	0.364

As shown in Tables 1 and 2, the normality test revealed that the data is not normally distributed, with a significance (sig) value less than 0.05. However, the results of the data homogeneity test indicated that the data is homogeneous, as the sig value was greater than 0.05. Given the non-normal distribution of the data, a non-parametric hypothesis test, the Wilcoxon test, was applied. The Wilcoxon test is a paired-sample test used to determine differences between two related sets of data. The results of the Wilcoxon test are presented in terms of rank data and significance statistics in Table 3.

Table 3. Ranks Wilxocon test results

		N	Mean rank	Sum of Ranks
Learning outcome of blended learning – online learning	Negative ranks	6a	7.08	42.50
	Positive ranks	36b	23.90	860.50
	Ties	1c		
	Total	43		

- a. Learning outcome of blended learning < online learning
- b. Learning outcome of blended learning > online learning
- c. Learning outcome of blended learning = online learning

Table 4. Hypothesis test results with Wilxocon

Learning outcome of blended learning < online learning	
Z	-5.771 ^b
Asymp. Sig. (2-tailed)	0.000

- a. Wilcoxon signed ranks test
- b. Based on negative ranks

The results of the study (refer to Table 3) showed that the number of samples varied with the use of online learning and blended learning. A rank analysis was performed on 43 samples and it was found that 36 samples showed a positive rank, 6 samples showed a negative rank, and 1 sample showed a tie. A positive rank indicates that blended learning outcomes were greater than online learning outcomes, while a negative rank shows the opposite. Ties indicate that blended learning and online learning outcomes were equal. The results show that a majority of samples experienced a positive rank, indicating that blended learning has a strong influence on learning outcomes.

The Wilcoxon test results (refer to Table 4) showed a significant difference (sig values = 0.000, $p < 0.05$) between online learning and blended learning with regards to learning outcomes. This supports the acceptance of H1 (there are significant differences) and rejection of H0 (there are no significant differences). Thus, it can be concluded that blended learning has a more positive effect on learning outcomes compared to online learning. This conclusion is supported by previous studies (Murtini et al., 2021; Santosa et al., 2021; Yatni, 2019; Yustina et al., 2020) which found that blended learning can improve learning outcomes and students' scientific literacy (Banila et al., 2021; Khery et al., 2019, 2020). However, this conclusion contradicts the findings of Maskar et al. (2020), who found that online learning outcomes provide better results than blended learning. The discrepancy in results could be attributed to the difference in the study population, as Maskar et al. (2020) conducted their

study on adult learners, while the current study was conducted on high school children who are not adult learners.

The study also explored the causes and effects of the results through student interviews. The results showed that students preferred blended learning over online learning due to various obstacles in online learning such as network constraints, difficulty in understanding the material, numerous tasks, boredom, and lack of parental support.

Difficult to understand the material. The study found that the online learning process was often conducted asynchronously, meaning that students and teachers did not engage in interactive learning. The platforms utilized were primarily WhatsApp groups and Google Classroom, where the teacher would provide a self-made learning video followed by practice questions for the students. Despite the opportunity for students to ask questions, the study noted that students still faced difficulties in comprehending the material delivered through the media. This was supported by previous research (Fikri et al., 2021; Kartiwi & Rostikawati, 2022; Prasetyo et al., 2022) which showed that online learning could be more effective if it utilized more interactive media to facilitate students' understanding. To address this issue, the study recommends incorporating media that would allow direct interaction between students and teachers.

Lots of tasks and boredom. The students reported that online learning feels more like a chore than blended learning. This has led to boredom and a decreased interest in participating in online learning. The high number of assignments associated with online learning also contributes to students procrastinating and eventually having a backlog of assignments. In order to enhance learning outcomes, it is crucial to increase student motivation. This aligns with the perspective expressed by Suraida et al. (2022) that learning motivation plays a significant role in determining student learning outcomes.

Lack of parental support. Students reported missing online classes due to their need to assist their parents. Some parents view online learning as an extension of the school holidays. Parental support plays a role in online learning outcomes, as stated by Suraida et al. (2022).

The results of this study indicate that there are several obstacles that hinder the effectiveness of online learning, resulting in low learning outcomes. These findings serve as a basis for evaluating various learning models and selecting the most effective one, with the ultimate goal of ensuring the quality of education.

CONCLUSION

The results of the Wilcoxon test hypothesis showed that blended learning is more effective in improving learning outcomes compared to online learning. This conclusion was reached based on the higher number of positive ranks and a significant statistical value ($\text{sig} = 0.000$, $p < 0.05$). The interviews conducted further corroborated these findings by revealing various obstacles that hindered the effectiveness of online learning, including network constraints, difficulties in understanding the material, excessive workload, and lack of parental support. The results of this study provide evidence that the implementation of online learning in high schools may be challenging, particularly in schools with limited internet access and low student motivation.

RECOMMENDATIONS

This research is limited to surveys, not experimental research. This study also used a small population and sample of research making it difficult to generalize widely. In addition, in this

study, the data used were only cognitive learning outcomes data. Subsequent research can conduct other similar studies either using survey methods or even experiments with a larger number of populations and samples so that the results of the study can be generalized widely. Furthermore, the learning outcomes measured should not only be cognitive but also psychomotor and affective learning outcomes. In addition, it is necessary to develop interactive learning media and tools to foster motivation and student learning outcomes.

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