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Blended Learning Method Using Google Classroom: Improving Students' Conceptual Knowledge

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ABSTRACT

The 21st century demands the integration of technology into the learning process to improve the quality of innovative and meaningful education. One rapidly developing approach is the use of the Blended Learning method, which combines face-to-face and online learning, to encourage students' conceptual understanding of the subject matter. This study aims to analyse the relationship between the application of the Google Classroom-based Blended Learning method and students' conceptual knowledge abilities in physics. This study was conducted at SMA Negeri 1 Siabu, Mandailing Natal Regency, with a population of Grade XI 1 students. The sampling technique used was purposive sampling, selecting 30 students as the research sample. The instruments used included a conceptual knowledge test and a questionnaire on students' perceptions of Google Classroom usage. Data analysis was conducted through correlation tests after meeting the prerequisite test criteria. The results of the study indicate a very positive relationship between the Blended Learning method using Google Classroom and students' conceptual knowledge ability, as shown by a correlation value (R) of 0.9935 and a coefficient of determination value of 98.65%. These findings indicate that the integration of technology through digital learning platforms can significantly improve students' conceptual understanding in physics learning.

Keywords: ***Blended Learning, Google Classroom, Conceptual Understanding.***

I. INTRODUCTION

Indonesian education has undergone complex transformations in an effort to improve the quality of educational services, one of which is through curriculum reform, which has been revised 12 times since 1947, with the Merdeka Curriculum being the latest version (Rejeki, 2023). Improving the quality of education in 21st-century learning requires the integration of technology into the learning process through innovative approaches such as blended learning using Google Classroom, to enhance students' understanding of physics material and their active participation in the learning process (Siregar, 2025). Technology-integrated learning in physics education (Fadilah, 2024) is a blended learning method using Google Classroom.

The blended learning method using Google Classroom is a learning method that combines face-to-face and online learning (Derlina, 2020). The consistent implementation of the blended learning method using Google Classroom requires support from facilities and infrastructure to enhance the effectiveness of the learning process. Learning methods that utilise digital technology create an interactive learning experience, especially in the physics learning process (Siregar, 2024). Physics learning using the blended learning method with Google Classroom has been proven to improve physics learning outcomes, especially for high-ability students (Ernawati, 2022). In the blended learning method using Google Classroom, there are several online learning platforms that can be used in the physics learning process according to student needs and available infrastructure. One of the online learning processes that can be used in the blended learning method using Google Classroom is Google Classroom (Isnaniah, 2021).

The Google Classroom online learning platform facilitates flexible interaction between teachers and students, supports collaboration, and enables efficient distribution of materials and collection of assignments (Isnaniah, 2021). The application of Google Classroom in the learning process encourages student independence and engagement, with 95% of students actively participating (Febriani, 2021). Additionally, Google Classroom saves time and strengthens communication between teachers and students through direct notifications (Amalia, 2021). At the university level, the use of Google Classroom in the course 'Learning and Teaching' at IPTS achieved an effectiveness rate of 77.05% based on the pre-test/post-test method (Hastini, 2024).

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Thus, it is proven that the physics learning process in 21st-century education using the blended learning method with Google Classroom, supported by the Google Classroom platform, is a strategic choice for effective, interactive, and relevant learning. The research conducted focused on enhancing students' conceptual knowledge. In a literature review, Husnwati et al. emphasised that the blended learning method using Google Classroom improves learning outcomes, conceptual understanding, creativity, and thinking skills, although the availability of infrastructure remains a challenge (Husnawati, 2024).

II. METHODS

This study was conducted at SMA Negeri 1 Siabu, located at JL. Aek Milas Kec. Siabu, Kab. Mandailing Natal. The study was conducted in May.

The population in this study was all grade XI students, while the research sample was grade XI-1 students at SMA Negeri 1 Siabu. The sample was obtained based on the results of a field check prior to the study. The variables in this study consisted of an independent variable, which in this study was blended learning using Google Classroom, symbolised by (X), and a dependent variable, which in this study was students' conceptual knowledge, symbolised by (Y).

The sampling method used in this study was purposive sampling, which involved selecting 30 students from class XI-1 as the research sample. The research method is a scientific technique for collecting relevant data for the purpose of discovering, developing, and proving specific knowledge that can be used to interpret, understand, and predict problems in the research topic. The data collection techniques used in this study were tests and questionnaires. The type of questions used was multiple choice, while the questionnaire format used in this study was a structured questionnaire. The measurement scale used was the Likert scale. The following is the distribution table of students' conceptual knowledge when using the blended learning method using Google Classroom.

Table 1. Distribution of Conceptual Knowledge

Range of Values/weights	**Category**
<75	Not enough
77-83	Enough
84-92	Good
93-100	Very good

Before conducting field trials, researchers conducted trials with 34 students from classes other than the one being studied to ensure the consistency and validity of the questionnaire. There were 20 statements regarding blended learning using Google Classroom. Each student was asked to respond to each statement using the following indicators: (1) never, (2) rarely, (3) often, and (4) always. (Sugiono, 2016)

Data analysis in this study was conducted using a quantitative approach in the form of a correlational prerequisite test. Correlational studies are conducted to determine the existence, meaning, and closeness of the relationship between two or more variables. The researcher also used descriptive statistical methods to describe the collected data.

III. RESULTS AND DISCUSSION

The instruments used in this study have undergone testing to ensure their suitability and appropriateness in measuring the variables under study, namely the relationship between the application of the Google Classroom-based Blended Learning method and students' conceptual knowledge abilities. The initial stages included testing the validity and reliability of the instruments. The validity test results showed that the calculated value was 0.848, while the table value at a significance level of 0.05 was 0.444. Since the calculated value was greater than or equal to the table value, it can be concluded that the instruments used met the validity requirements and were suitable for use in field data collection.

Furthermore, the reliability test yielded a value of 0.892. This value indicates that the instrument has a very high level of consistency in measuring the research variables, as the value exceeds the minimum reliability threshold. This indicates that the test questions and questionnaires used have high reliability and can produce stable and trustworthy data.

After the instruments were declared valid and reliable, the data obtained from the field were then tested through several prerequisite tests for analysis, namely normality, homogeneity, and linearity tests. These three tests aim to ensure that the data meet the basic assumptions before further statistical tests are conducted. The normality test was used to see if the data was normally distributed; the homogeneity test to determine if the variance between data groups was homogeneous; and the linearity test to ensure that the relationship between the independent and dependent variables was linear.

Volume 04, Issue 02, June-December 2025
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Once the prerequisites were met, hypothesis testing in the form of regression and correlation tests was conducted. The analysis results showed a very strong positive relationship between the application of the Blended Learning method using Google Classroom and an increase in students' conceptual knowledge. Thus, this method has been proven to be effective as a 21st-century learning approach that supports students' conceptual understanding more optimally.

1. Prerequisite Test.

a. Normality Test

The first prerequisite in this study is that each variable must be normally distributed, so a normality test must be conducted first. If the significance of the data is greater than 0.05, then the data is normally distributed. Conversely, if the data is less than 0.05, then the data is not normally distributed. The normality test in this study was conducted using Shapiro Wilk, taking into account the sample size. In blended learning using Google Classroom, the W-value was 0.9322 and the significance level was 0.05, with a W-table value of 0.9308. Meanwhile, for conceptual knowledge, the W-value was 0.9362 and the W-table value was 0.9308. This indicates that both data sets are normally distributed.

b. Homogeneity Test

The homogeneity test aims to determine whether a group of data has the same variance or not, especially when the data comes from two or more groups that are being compared. This test is important to ensure that the data has a uniform level of dispersion before further statistical analysis such as ANOVA or regression is performed. If the data is homogeneous, the results of the analysis will be more valid and can be interpreted more accurately. Homogeneity tests are typically conducted using Levene's Test or Bartlett's Test, with decision criteria based on the significance level (p-value). In this study, the data was found to be homogeneous, as shown in Table 2 below:

Table 2. Data Homogeneity Test

	Blended learning using Google Classroom (X)	**Conceptual Knowledge (Y)**
Mean	85.10	87.80
Variance	67.6103	58.4414
Observations	30.00	30.00
Df	29.00	29.00
F	1.1569	
P(F<=f) one-tail	0.3487	
F Critical one-tail	1.8608	

The table above shows that the data is homogeneously distributed with a significance value of 0.05, while the linearity value obtained is 0.3487. This indicates that the data is homogeneously distributed..

c. Linearity Test

The linearity test is used to determine whether data is linear or not. In the calculations, the researcher used Ms. Excel and found that the significance value was 0.9234, which indicates that the value is > 0.05. Based on this data, there is linearity between the independent variable, namely the blended learning method using Google Classroom, and the dependent variable, namely students' conceptual knowledge.

2. Hypothesis Test

Hypothesis testing is a procedure in statistical analysis used to determine whether there is sufficient evidence in the sample data to accept or reject an assumption or initial conjecture (hypothesis) about the population. In the context of quantitative research, hypothesis testing is conducted to provide an objective basis for decisions regarding the data that has been collected and analysed. The initial assumption being tested is called the null hypothesis (H_0), while the alternative assumption is called the alternative hypothesis (H_1). This process involves specific statistical tests selected based on the objectives and type of data used.

In this study, hypothesis testing was conducted using regression analysis, which aims to determine the effect or relationship between the independent variable (the application of Blended Learning using Google Classroom) and the dependent variable (students' conceptual knowledge). Regression testing not only helps to determine the direction and strength of the relationship between variables but also provides information on whether the relationship is statistically significant. The decision to accept or reject the null hypothesis is determined based on the significance value (p-value). If the p-value is smaller than the significance level (e.g., 0.05), then H_0 is rejected, meaning there is a significant relationship between the variables being studied. According to Sugiyono (2017), the guidelines for interpreting correlation coefficients are outlined in Table 3 below:

Volume 04, Issue 02, June-December 2025
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Tabel 3. Coefficient Interval Table

Coefficient Interval	Relationship Level
0.00-0.199	Very Low
0.20-0.399	Low
0.40-0.599	Currently
0.60-0.799	Strong
0.80-1.00	Very Strong

The correlation analysis in this study used a simple linear regression test. The regression test must be performed to predict the strength of the linear relationship between the independent variable (X) and the dependent variable (Y). The results of the regression test in this study are shown in Table 4 below:

Table 4. Regression Test

Regression Statistics	
Multiple R	0.9935
R Square	0.9870
Adjusted R Square	0.9865
Standard Error	0.8422
Observations	29.0000

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	1.0000	1449.0570	1449.0570	1.1569	0.0056
Residual	27.0000	19.1499	0.7093		
Total	28.0000	1468.2069			

		Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept		10.1382	1.7276	6.1019	0.3487	6.9971	14.0866	6.9971	14.0866
X	71.0000	0.9234	0.0201	45.2004	0.0056	0.8674	0.9499	0.8674	0.9499

The correlation value can be analysed from the multiple R, which is 0.9935, meaning that the correlation value between X and Y is in the very strong category, as shown in Table 3. The coefficient of determination for the study is 0.9865 or 98.65%, meaning that variable X can explain 98.65% of Y, with the remaining 1.35% influenced by other factors. This indicates that the blended learning method using Google Classroom has a significant impact on students' conceptual knowledge. The calculated F value is 1.1569 with a significance of 0.0056, where alpha < 0.05. Therefore, it can be concluded that there is a significant influence between variables X and Y. Meanwhile, the regression equation can be seen from the coefficient table with the regression equation being Y = 10.1382 + 0.9234X. This means that if X is 0, then Y is 12.69, and when X increases by 1, Y increases by 0.9234. If X is positive, the relationship between variables X and Y has a positive effect.

After conducting the research, it was found that the blended learning method using Google Classroom has a very strong relationship with the improvement of students' conceptual knowledge. The results of this study are in line with the research by Rahma, Hamdunah, and Juwita (2023), which found that blended learning using Google Classroom can improve students' academic achievement, as seen from the discussion of students' assignments and the results of their final tests, where they were able to answer the questions asked in accordance with the indicators of conceptual understanding. Hartati (2023) and Graham and Halverson (2019) noted that the improvement in the average conceptual understanding of students is because it can provide

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specific motivation for students to understand the material concepts, encourage cognitive engagement, effort, and perseverance when completing assignments, curiosity, and the use of cognitive strategies.

III. CONCLUSIONS

Based on the results of data analysis and discussion, it can be concluded that there is a very strong relationship between the application of the Google Classroom-based Blended Learning method and students' conceptual knowledge abilities. This is indicated by a multiple correlation coefficient (multiple R) of 0.9935, which falls into the very high category, and a coefficient of determination of 98.65%, meaning that 98.65% of the variation in students' conceptual knowledge can be explained by the implementation of Blended Learning using Google Classroom. The remaining 1.35% is influenced by factors outside the scope of this study. The regression equation obtained, Y = 10.1382 + 0.9234X, indicates that every increase in the use of Blended Learning will be followed by a significant increase in students' conceptual knowledge.

This finding provides empirical evidence that the integration of digital learning technology, particularly Google Classroom, can have a positive impact on improving students' conceptual understanding, especially in physics, which requires a combination of theoretical understanding and application. This aligns with the demands of 21st-century learning, which emphasises innovation, collaboration, and the use of technology in the learning process. Therefore, the implementation of Blended Learning should be continuously promoted in school environments, supported by teacher training and adequate technological infrastructure, to create a learning process that is more effective, adaptive, and relevant to the needs of the times.

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