Volume 2, Nomer 2, Agustus 2022
Jurnal Teknologi Pembelajaran (JTeP)
https://journal.iaimnumetrolampung.ac.id/index.php/jtep

The Effect of Google Classroom's Assisted Blended Learning Model on Mathematical Concepts Understanding and Mathematical Dispositions

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Article Info
Article History
Received : 11-08-2022
Revised : 17-08-2022
Accepted : 13-10-2022

Keywords:
Blended Learning;
Google Classroom;
Mathematical Concept Understanding;
Mathematical Disposition

Abstract

This research is motivated by the low ability to understand mathematical concepts and dispositions. This study aimed to determine the effect of the Google Classroom-assisted blended learning model on mathematical concepts understanding and mathematical dispositions. The method in this study was an experiment with a quasi-experimental design, and the design used was a post-test-only control group design. The population in this study were all students in class X at SMK Muhammadiyah 1 Metro. The sampling technique used simple random sampling. The data analysis technique used is the normality test, homogeneity test, and hypothesis testing with MANOVA. Based on the results of the hypothesis test with Manova, a sig value of 0.014 was obtained with a predetermined significant level of 0.05, which means that the sig value 0.05 then rejects H_0AB and accepts H_1AB. So, it can be concluded that using the Google Classroom blended learning model is more effective in mathematical concepts understanding and dispositions than conventional learning models.

Introduction

There are many consequences of students' poor learning outcomes, one of which is students' disinterest in learning because this lack of interest makes it difficult for students to accept and understand concepts in mathematics. This is relevant to research conducted by Made Dwi Savitri, I G P Sudiarta, and Sariyasa, which state that the low disposition of students' mathematics creates the perception that mathematics is a difficult subject to understand it will affect student learning outcomes. The mathematical disposition and mathematical concepts understanding are inextricably linked. The disposition of mathematics affects students' understanding of mathematical concepts understanding and can also improve student learning outcomes (Savitri, Sudiarta, and Sariyasa, 2022).

Mathematical concepts, understanding, and dispositions toward mathematics are two important things that students must have. Mathematical concept understanding is the ability of students to master mathematical material and explain it in detail using their language so that it is easy to understand and is an important basis for thinking in solving mathematical problems and problems in everyday life (Ratnasari and Putra, n.d.). The ability to understand mathematical concepts is an important goal in learning, where the material delivered or taught to students is not only to be memorized, but students also need to understand the concept of the material that has been conveyed by educators (Fathonah, Hapsari, and Firmasari 2021).

In learning mathematics, understanding concepts is an important aspect that students must master because understanding concepts is the basis for students to master mathematical communication skills (Herliana, Supriadi, and Widyastuti 2021). Mathematical disposition can be interpreted as an ability that can foster positive feelings in oneself when viewing mathematics, as well as self-confidence, tendencies, and a strong desire to solve mathematical problems. With a mathematical disposition embedded in students, it will form a positive attitude and mindset so that they will always have the desire to learn mathematics, and it will have an impact on student learning outcomes (Nurhayati, Nurfalah, and Zanthy 2020). Mathematical disposition is one of the factors that determine the success of student learning. In addition, mathematical dispositions also have an important role in achieving learning objectives (Mardiah et al., 2020).

Recognizing the importance of mathematical concepts, understanding, and dispositions in learning mathematics requires an innovation that can support the development of mathematical concepts and dispositions in students. One way that can be used to increase students' mathematical concepts understanding and dispositions is to use innovative learning media, which can create a fun and flexible learning atmosphere by utilizing information and communication technology.

Information and communication technology development also impacts the rapid development of information media (devices) and encourages the development of internet-based applications. Technological and internet developments have penetrated the world of education; many positive impacts have been obtained, especially in the effectiveness and efficiency of the learning process, and they can even provide additional insight to students outside of class hours (Dewi et al. 2019). Learning in the 21st century currently requires the world of education to be able to utilize and use technology in carrying out learning so that all students can compete in the world of work in the era of the industrial revolution and have 21st-century skills, which include 4C, namely creativity, critical thinking, communication, and collaboration. As a result, the learning system must be adjusted. One method is blended learning. Blended learning has several advantages, one of which is effectiveness. Initially, learning was only done in the classroom, but now the process can be done online with the help of NGOs, one of which is Google Classroom, so that now the teaching and learning process is not bound by space or time, and students can access it at any time (Maya 2020).

Blended learning is mixed learning that combines face-to-face learning with online learning that utilizes information and communication technology (Nasution, Jalinus, and Syahril 2019). Blended learning is an ideal learning model today. This blended learning model invites students to study independently anytime and anywhere using up-to-date learning content designed by educators. Independent learning is text-based and multimedia-based (Maulida 2022). The blended learning model can create a learner-centered learning process. In the implementation process, involvement in learning will increase students' sense of responsibility (Marito and Riani, 2022). The blended learning model can overcome various online and offline learning limitations. The blended learning model's application demonstrates effectiveness; the blended learning model used with the assistance of various e-learning has the majority of getting very good and precise results in improving learning outcomes (Pratama 2020).

Google Classroom is a multiplatform application that provides modern features that can create ideal learning environments and improve student communication (Solikh, Sulisworo, and Maruto, 2018). Google Classroom is a platform that provides free web services developed by Google to simplify, distribute, and grade assignments without having to meet in person and enable a virtual learning process (Pratama 2020). Using media such as Google Classroom in learning will affect students' interest in mathematics or a mathematical disposition (Friantini and Winata 2020).

The blended learning model assisted by Google Classroom is suitable for increasing students' mathematical concepts, understanding, and dispositions. This is relevant to the research by Feby Inggriyani, Acep Roni Hamdani, and Taufiqulloh Dahlan, stating that the results showed an increase in student interest in learning with an average of 18.78 after being given learning using blended learning. All indicators of interest in learning were very well achieved. good (Inggriyani, Hamdani, and Dahlan 2019). Research conducted by Nanang Supriadi states that the blended learning model is very well used to develop students' mathematical thinking skills in a higher direction than just expecting them to understand the material presented (Supriadi 2020). Research conducted by Fifit Novi Yanti, Farida, and Iip Sugiharta stated that blended learning and e-learning using Edmodo had an increase in solving mathematical problems with moderate classification (Yanti, Farida, and Sugiharta 2019). Research conducted by Dewa Gede Agung Putra Nugraha, I Wayan Puja Astawa, and I Made Ardana stated that blended learning positively affected students' mathematical concepts understanding and procedures (Nugraha, Astawa, and Ardana 2019). Research conducted by Suradi Tahmir, Nasrullah, and Eka Hermia states that using a school-based virtual learning management system with a blended learning model for mathematical disposition is better than the direct learning model (Tahmir, Nasrullah, and Hermia 2021).

Based on the explanation above, the purpose of this study was to determine the effect of the Google Classroom-assisted blended learning model on understanding mathematical concepts and dispositions.

Method

This study uses a quantitative approach to describe "the effect of the Google Classroom-assisted blended learning model on mathematical concepts understanding and mathematical dispositions." In this study, the research method is a quasi-experimental design and a post-test-only control group design. The form of the design in the Posttest Only Control Group Design study can be seen in the following table:

Table 1. Research Design

Group	*Treatment*	*Posttest*
R_1	X_1	O_1
R_2	X_2	O_2

Information:

R_1 : Experimental Group
R_2 : Control Group
X_1 : Google Classroom Assisted Blended Learning Model with caution.
X_2 : Conventional Learning Models
O_1 : Posttest Experimental Group

O_2 : Posttest Control Group

The population used in this study were all class X students at SMK Muhammadiyah 1 Metro, with a total population of 101 students. The sampling technique used simple random sampling. In this study, two samples were taken, namely class X Marketing as an experimental class that would be applied to the blended learning model assisted by Google Classroom and class X Accounting as a control class that would be applied to conventional learning models.

The instruments used in this study were test instruments used to determine students' ability to understand mathematical concepts and questionnaires to determine students' interest in mathematics.

The data analysis technique used in this study was the normality test, homogeneity test, and hypothesis testing with MANOVA using the SPSS 22 program with a significance level of 5%.

Result and Discussion

Data were analyzed descriptively to determine the X_{max} (highest value) and X_{min} (lowest value) values in each experimental and control class. Furthermore, we look for measures of central tendencies, such as the mean (X), median (M_e), and mode (M_o). The researchers also measured the dispersion, such as range (R) and standard deviation (Sd). A description of the observed data and ability to understand mathematical concepts can be seen in the table below:

Table 2. Mathematical Concept Understanding Data

Group	X_{max}	X_{min}	Central Tendency			Group Variance	
			$\overline{X}$	M_o	M_e	R	Sd
Eksperimen	100	54	83	91,67	83	46	13,03
Kontrol	96	38	73	79,17	79	58	16,90

Based on table 2, it was found that the ability to understand mathematical concepts in the experimental class was better than that of the control class in terms of the highest score, lowest score, and measure of central tendency. Furthermore, a description of the observed data on a mathematical disposition can be seen in the table below:

Table 3. Mathematical Disposition Observation Data

Group	X_{max}	X_{min}	Measures of Central Tendency			Group Variance	
			$\overline{X}$	M_o	M_e	R	Sd
Experiment	83	55	71	69,79	70	28	6,69
Control	74	59	67	69,79	68	15	4,43

Based on table 3, the experimental class's mathematical disposition results were better than those of the control class in terms of the highest score, lowest score, and measure of central tendency. Next, a normality and homogeneity test will be carried out before testing the hypothesis with MANOVA. The normality test in this study used the Kolmogorov-Smirnov test with a significant level of 0.05 using the SPSS 22 program. The results of the normality test analysis can be seen in the table below:

Table 4. Normality Test Results

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Class	Statistic	df	Sig.	Statistic	df	Sig.
Concept understanding	Experiment	.148	24	.189	.947	24	.239
	Control	.175	21	.092	.941	21	.228
Mathematical Disposition	Experiment	.110	24	.200*	.966	24	.574
	Control	.180	21	.074	.926	21	.113

According to table 4, the normality test results show that the sig value is less than 0.05. Therefore, it can be concluded that the test data on the ability to understand mathematical concepts and mathematical dispositions are normally distributed. The next step is to analyze whether the two groups have homogeneous variances. The homogeneity test in the study used the Levene test with a significant level of 0.05 using the SPSS 22 program. The results of the homogeneity test analysis can be seen in the table below:

Table 5. Variance Matrix Homogeneity Test

Levene's Test of Equality of Error Variances				
	F	df1	df2	Sig.
Concept understanding	1.624	1	43	.209
Mathematical Disposition	1.575	1	43	.216

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + Kelas

According to table 5, the homogeneity matrix variance test yielded a sig 0.05. Therefore, it can be concluded that the test data on the ability to understand mathematical concepts and mathematical dispositions obtained are homogeneous. Furthermore, based on the results of the SPSS 22 homogeneity test, the Box's M value is obtained, which can be seen in the table below:

Table 6. Box's M Homogeneity Test

Box's Test of Equality of Covariance Matrices[a]	
Box's M	3.900
F	1.234
df1	3
df2	864563.046
Sig.	.296

One of the basic assumptions of the Manova test is the homogeneity test of the variance-covariance matrix. Based on table 6, the box's m homogeneity test obtained a sig value of 0.296, which means that the sig value is 0.05. Therefore, it can be concluded that the data obtained is homogeneous. After obtaining the results of the normality and homogeneity tests, which show that the samples in this study are normally distributed and homogeneous so that the test requirements have been met, the test can be carried out to the next stage, namely the MANOVA test.

The hypothesis test in this study used the MANOVA (multivariate analysis of variance) test using SPSS 22. The results of the hypothesis test can be seen in the table below:

Table 7. Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.995	4014.262[b]	2.000	42.000	.000
	Wilks' Lambda	.005	4014.262[b]	2.000	42.000	.000
	Hotelling's Trace	191.155	4014.262[b]	2.000	42.000	.000
	Roy's Largest Root	191.155	4014.262[b]	2.000	42.000	.000
Model	Pillai's Trace	.185	4.774[b]	2.000	42.000	.014
	Wilks' Lambda	.815	4.774[b]	2.000	42.000	.014
	Hotelling's Trace	.227	4.774[b]	2.000	42.000	.014
	Roy's Largest Root	.227	4.774[b]	2.000	42.000	.014

a. Design: Intercept + Kelas
b. Exact statistic

Based on table 7, a sig value of 0.014 is obtained with a predetermined significant level of 0.05, which means that the sig value is 0.05, so it rejects $H0_{AB}$ and accepts $H1_{AB}$. So, it can be concluded that there is an influence from the Google Classroom-assisted blended learning model on the mathematical concepts understanding and mathematical dispositions. The results obtained have relevance to previous research conducted by Feby Inggriyani, Acep Roni Hamdani, and Taufiqulloh Dahlan, which stated that student interest in learning after learning with the blended learning model through Google Classroom was very strong, as seen from the average results of student learning interest before being implemented as blended learning: 66.70, while after implementing blended learning, the average results of student learning interest increased to 85.48 (Inggriyani, Hamdani, and Dahlan 2019). Research conducted by Fifit Novi Yanti, Farida, and Iip Sugiharta stated that blended learning and e-learning using Edmodo had an increase in solving mathematical problems with moderate classification (Yanti, Farida, and Sugiharta 2019).

Statistical tests of between-subjects effects are used to determine the effect between subjects or the dependent variable. The results of the statistical test for between-subjects effects can be seen in the table below:

Table 8. Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Conceptual Understanding	1038.859[a]	1	1038.859	4.653	.037
	Mathematical Disposition	145.248[b]	1	145.248	4.443	.041
Intercept	Conceptual Understanding	268625.525	1	268625.525	1203.036	.000
	Mathematical Disposition	215303.115	1	215303.115	6585.303	.000
Class	Conceptual Understanding	1038.859	1	1038.859	4.653	.037
	Mathematical Disposition	145.248	1	145.248	4.443	.041

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Error	Conceptual Understanding	9601.452	43	223.290		
	Mathematical Disposition	1405.863	43	32.694		
Total	Conceptual Understanding	282707.000	45			
	Mathematical Disposition	218565.000	45			
Corrected Total	Conceptual Understanding	10640.311	44			
	Mathematical Disposition	1551.111	44			

a. R Squared = .098 (Adjusted R Squared = .077)
b. R Squared = .094 (Adjusted R Squared = .073)

Based on table 8, the sig value for understanding the mathematical concept is 0.037, which means that the sig value is 0.05, so it rejects $H0_{AB}$ and accepts $H1_{AB}$. So, it can be concluded that there is an influence the Google Classroom blended learning model on mathematical concepts understanding. Based on table 8, the sig value of the mathematical disposition is 0.041, which indicates that the sig value is 0.05, so it rejects $H0_{AB}$ and accepts $H1_{AB}$. As a result, it is possible to conclude that the Google Classroom blended learning model affects a mathematical disposition. The results obtained are relevant to previous research conducted by Dewa Gede Agung Putra Nugraha, I Wayan Puja Astawa, and I Made Ardana, which stated that blended learning positively affects students' mathematical concepts understanding and procedures (Nugraha, Astawa, and Ardana 2019). Research conducted by Suradi Tahmir, Nasrullah, and Eka Hermia states that using a school-based virtual learning management system with a blended learning model for mathematical disposition is better than the direct learning model (Tahmir, Nasrullah, and Hermia 2021). Research conducted by Rizki Nurhana Friantini and Rahmat Winata states that learning with the help of Google Classroom has a mathematical disposition with high criteria (Friantini and Winata 2020).

Based on the results of the study, the Google Classroom-assisted Blended Learning model in the experimental class affected students' ability to understand mathematical concepts and their mathematical dispositions better than the control class, which applied conventional learning models. Students who apply conventional learning models tend to be less active in the learning process, especially when questions are considered difficult, conditions in the classroom are less conducive, and limited learning time. It can be seen from the results of the mathematical disposition of students in the control class, which is lower than the experimental class. According to Joko Sutrisno AB's research, a good mathematical disposition can support success in learning mathematics (Ab 2021). In contrast to the experimental class, which applies the blended learning model assisted by Google Classroom, where students are required to be active in the learning process, and the learning process is more enjoyable because it can be accessed by students anywhere and anytime without being limited by space or time. Students can find material from sources other than those provided by educators by utilizing information and communication technologies such as the internet.

By applying the blended learning model assisted by Google Classroom, learning that was previously only done in class can now be done online or offline so that the learning process can be carried out anywhere and anytime without being limited by time and space. In line with the research conducted by Fifit Novi Yanti, Farida, and Iip Sugiharta, which states that blended learning is flexible learning, the blended learning model can create a learner-centered learning process (Yanti, Farida, and Sugiharta 2019). Research conducted by Saifuddin states that the flexibility in blended learning can prevent boredom in students (Saifuddin 2020). However, learning with Google Classroom-assisted Blended Learning has various obstacles in the implementation process, such as a lack of knowledge about technology, the fact that each individual's internet connection is different, and the limited quota that students have, which can be an obstacle in the implementation of learning. As a result, careful planning is required before beginning the learning process for it to proceed smoothly and as planned.

Based on the explanation above, it can be concluded that learning using the Google Classroom blended learning model is more effective in understanding mathematical concepts and dispositions than conventional learning models.

Conclusion

Based on the results of data analysis conducted by researchers regarding the influence of the Google Classroom-assisted Blended Learning Model on mathematical concepts understanding and mathematical dispositions, it can be concluded that: There is an influence of the Google Classroom blended learning model on mathematical concepts understanding and mathematical dispositions. There is an influence of the Google Classroom blended learning model on mathematical concepts understanding. There is an influence of the Google Classroom blended learning model on mathematical dispositions.

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