THE USE OF E-LEARNING IN DISCOVERY LEARNING: ITS INFLUENCE ON STUDENTS' MATHEMATICAL DISPOSITION AND MATHEMATICAL CONCEPT UNDERSTANDING

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ABSTRACT

E-learning, assisted by Google Classroom, can be used to provide material and discussions. This research aimed to analyze the effect of e-learning on mathematical disposition and mathematical concept understanding using discovery learning. This research was experimental research with a non-equivalent control group design. The population of this research was the eleventh-grade science students (168 students). The sampling technique employed was random cluster sampling. Data collection techniques used were interviews, tests, and questionnaires. The test results showed that students in the experimental class obtained an average score of 71.7, while the control class obtained a score of 62.9. The results of the mathematical disposition questionnaire showed that experimental class students were more active and confident in solving problems. Thus, e-learning using discovery learning can improve mathematical disposition and mathematical concept understanding. It is suggested to the teacher to develop this learning for other materials.

PENGGUNAAN E-LEARNING DALAM *DISCOVERY LEARNING*: PENGARUHNYA TERHADAP DISPOSISI MATEMATIS DAN KEMAMPUAN PEMAHAMAN KONSEP MATEMATIS SISWA

ABSTRAK

Kata Kunci:

Discovery learning
E-learning
Disposisi matematis
Pemahaman konsep matematis

Pembelajaran *e-learning* menggunakan bantuan aplikasi *google* classroom dapat digunakan dalam pemberian materi serta diskusi, Tujuan penelitian ini adalah untuk menganalisis pengaruh *e-learning* terhadap disposisi matematis dan kemampuan pemahaman konsep matematis menggunakan *discovery* learning. Penelitian ini merupakan penelitian eksperimen menggunakan desain *non equivalen control group design*. Populasi penelitian ini adalah kelas 11 IPA berjumlah 168 siswa, dengan teknik pengambilan sampel yaitu *cluster random sampling*. Teknik pengumpulan data yang digunakan adalah wawancara, tes, dan angket. Analisis data yang digunakan adalah analisis hipotesis. Hasil tes menunjukkan bahwa siswa kelas eksperimen memperoleh nilai rata-rata 71,7 sedangkan kelas kontrol memperoleh nilai 62,9. Hasil angket disposisi matematis menunjukkan siswa kelas eksperimen lebih aktif dan percaya diri dalam menyelesaikan permasalahan. Dengan demikian, *e-learning* menggunakan *discovery learning* dapat meningkatkan disposisi matematis dan pemahaman konsep matematis. Disarankan kepada guru untuk mengembangkan pembelajaran ini untuk materi lainnya.

1. INTRODUCTION

Mathematics is learning that requires students to be able to find patterns or variables and be able to understand these variables. Understanding a problem requires high accuracy and understanding of the material in question. Mathematics is one of the subject matter that requires concept understanding, not just memorizing a formula. Mathematics is also expected to be able to develop students' critical, creative, systematic, and analytical thinking skills [1]. To grow this ability, the role of the teacher/educator is needed in delivering the material [2]. In the difficult situation where the Covid-19 virus is sweeping the world, many activities have become limited. One of them in the world of education is affected, which requires students to study remotely/from home (online) [3].

Online learning has a lot to learn the first time you use it, so it takes time to get used to it. Online learning also requires the right learning model to achieve learning objectives. Changes in the education system make educational progress dependent on teacher creativity [4]. The selection of learning models that are suitable for student's abilities to make students' understanding of concepts and mathematical dispositions increase [5]. Mathematical disposition and understanding of concepts is an important part of learning mathematics. According to NCTM (1991), a mathematical disposition is related to student behavior, including self-confidence, interest in learning, tenacity, and creativity in solving a problem [6].

Polking in Syaban identifies indicators in mathematical disposition, including perseverance, confidence, good mathematical communication, problem-solving, interest and flexibility in learning, increasing curiosity, and being able to respect the opinions of others [6]. Students' mathematical dispositions have not been fully met, where mathematical dispositions are important things that must be developed [7]. Based on the observations, the researcher found that most students' self-confidence was not good, and their understanding of the questions in the form of stories was not good either. This happens because the learning model is less attractive to most students, causing a lack of understanding of concepts and students' self-confidence. The selection of learning models greatly affects the formation of students' attitudes and abilities [8].

Understanding concepts is a prerequisite or basic part of learning mathematics because mathematical concepts are related, so learning is systematic [8]. Understanding comes from the word understanding, while the concept is an abstract thought to identify several objects [9]. According to Duffin and Simpson in the journal, Nila revealed that understanding the concept is as: using the concept in every situation, explaining the concept, and developing the concept of several consequences [9]. According to Mayer in Mulyono, conceptual understanding focuses on learning as the development of knowledge where students accept and understand a material consistently [10].

In Anggareni, UNDP (United Nations Development Program) 2010 conducted research on the HDI (Human Development Index) in 169 countries, and Indonesia ranked 108th [11]. This shows that the quality of education in Indonesia is still relatively low, according to Lasmawan in Anggareni, identifying several educational problems, namely: education prioritizes the development of cognitive aspects with the orientation of mastery of knowledge as much as possible and ignores the development of social aspects and affective aspects, education does not develop process skills, critical thinking skills, and creatively, and education is not optimal in providing real experience through learning [11]. In improving students' abilities, researchers chose the discovery learning method. The advantages of this method are that students are active in learning, improve and instill discovery abilities, teachers can act as students and discuss together, and the material provided is more embedded in students [12].

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The research on mathematical disposition and mathematical concept understanding ability is still ongoing. One recent study showed a significant relationship between mathematical disposition and mathematical concept understanding ability in junior high school students [1]. The results showed that a high mathematical disposition would improve students' mathematical concept understanding. In addition, other studies have also shown that mathematical disposition influences mathematical reasoning ability in high school students [2]. In addition to the influence of mathematical disposition on mathematical concept understanding, research also shows that mathematical representation is an important factor that affects mathematical concept understanding. Aspects of mathematical disposition also influence one's mathematical representation. Another study mentioned that a positive mathematical disposition would help improve a person's mathematical representation so that the mathematical concept understanding can also increase [3]. In addition to the influence of mathematical disposition on mathematical concept understanding, research also shows that mathematical representation is an important factor affecting mathematical concept understanding. Aspects of mathematical disposition also affect one's mathematical representation. Another study mentioned that a positive mathematical disposition would help improve one's mathematical representation so that the mathematical concept understanding can also improve.

Research on mathematical dispositions has been widely carried out, including investigative learning to foster mathematical disposition abilities [13], problem-based learning to improve mathematical disposition abilities [7], the role of mathematical dispositions on concept understanding [14], improving mathematical disposition abilities with discovery learning models [15]. Based on the previous research, no research specifically combines discovery learning to improve mathematical disposition abilities and concept understanding assisted by Google Classroom.

The purpose of this research was to determine: the difference between the expository model and e-learning using discovery learning on mathematical disposition and mathematical concept understanding, the difference between the expository model and e-learning using discovery learning on disposition, and the difference between the model expository with e-learning using discovery learning on the mathematical concept understanding. Therefore, this research aimed to apply the discovery learning model to improve mathematical disposition abilities. Although this type of investigation had been conducted before, related research gaps could be filled by combining discovery learning models and e-learning to improve mathematical disposition abilities and mathematical concept understanding.

2.   METHOD

The research was an experimental study employing a non-equivalent control group design and was conducted at SMA Negeri 3 Cilegon. The population was the eleventh-grade students of the first semester, consisting of 168 individuals. The design of this research was quasi-experimental with a non-equivalent control group design. The sampling technique implemented was random cluster sampling which obtained the students of classes 11 IPA 4 and 11 IPA 5 as the research samples. The data were collected using interviews, questionnaires, and tests. This research contained three variables: e-learning using discovery learning (dependent variable), mathematical disposition, and mathematical concept understanding (independent variables).

Before the research, the questions were tested first on the twelfth-grade students. The tests performed were the tests of validity, discriminating power, level of difficulty, and reliability. The subsequent tests were the N-gain, normality, and homogeneity tests. The

normality was tested by the Liliofers method, while the homogeneity test was performed by the Barlett method [16]. The last test was the hypothesis test performed by MANOVA (Multivariate Analysis Of Variance) assisted by the SPSS 25 program.
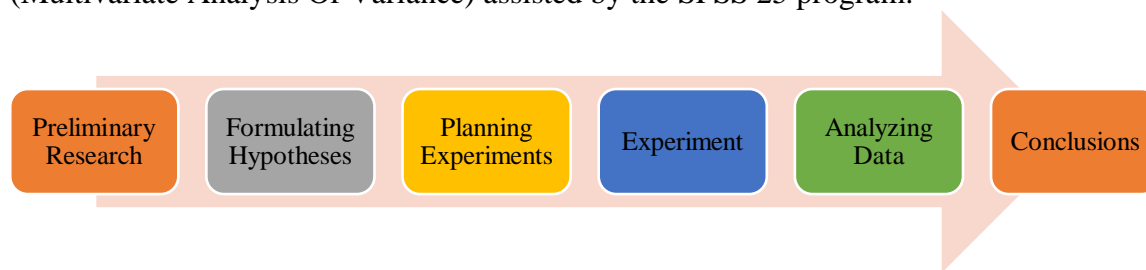

Figure 1. Research Steps

3. RESULTS AND DISCUSSION

The instrument testing concluded that the questions could be used in research. The following is the test data table.

Table 1. Results of Testing Analysis of Test Instruments

No	R_{xy}	$R_{critical}$	Description	Discriminating	Difficulty	Reliability
1	0,490	0,361	Valid	Medium	Easy	
2	0,541	0,361	Valid	Medium	Medium	
3	0,550	0,361	Valid	Medium	Hard	
4	0,230	0,361	Invalid	Low	Hard	
5	0,709	0,361	Valid	High	Medium	Reliable
6	0,557	0,361	Valid	High	Easy	
7	0,65	0,361	Valid	High	Medium	
8	0,214	0,361	Invalid	Low	Medium	
9	0,690	0,361	Valid	High	Medium	
10	0,657	0,361	Valid	Medium	Medium	

Table 1 shows that the questions that can be used for research are items numbered 1, 2, 3, 5, 6, 7, 9, and 10. The difficulty level of this question is 20% difficult, 20% easy, and 60% moderate.

The study was conducted in class 11 IPA 4 as the control class and 11 IPA 5 as the experimental class after completing a series of activities that ended with a posttest and filling out a questionnaire. The n-gain test was performed to look for the maximum value (Xmax) and minimum n-gain (Xmin), average (x), mode (m_o), median (m_e), range (R), and standard deviation (S). Table 2 displays the n-gain test results for the mathematical concept understanding.

Table 2. Results of N-Gain Test Analysis of Mathematical Concept Understanding Ability

Class	X_{max}	X_{min}	Centrally Indented Size			Variance Size	
			$\bar{x}$	m_o	m_e	R	S
Experiment	0,952	0,333	0,578	0,789	0,527	0,619	0,175
Control	0,809	0,250	0,496	0,652	0,521	0,559	0,135

Based on Table 2, the experimental class scores better than the control class. It means the student's conceptual understanding in the experimental class is better than in the control class. Normality and homogeneity tests were prerequisite tests before the hypothesis testing was conducted. This test aimed to determine whether the data were normally distributed and homogeneous. The normality test performed was the Liliofers method, and the homogeneity test was the Barlett method. The following is the n-gain normality test for the mathematical concept understanding.

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Table 3. N-Gain Normality Test Results of Mathematical Concept Understanding

No	Class	N	$\overline{x}$	L$_{observed}$	L$_{critical}$	Conclusion
1	Experimental	36	0,578	0,119	0,148	Normal
2	Control	34	0,496	0,070	0,152	Normal

Table 3 shows the results of the n-gain normality test with the Liliofers method with a significance level of 5% (α = 0.05). L$_{observed}$ from each class is less than L$_{critical}$. Therefore, H$_0$ was accepted, meaning the data was normally distributed. The test for the normality of the mathematical disposition is as follows.

Table 4. Normality Test Results of Mathematical Disposition

No	Class	N	$\overline{x}$	L$_{observed}$	L$_{critical}$	Conclusion
1	Experimental	36	72,423	0,103	0,148	Normal
2	Control	34	63,479	0,121	0,152	Normal

Table 4 shows that the L$_{observed}$ of each class is less than L$_{critical}$ with a significance level of 5% (α = 0.05). Therefore, H$_0$ is accepted. In conclusion, the data were normally distributed. The homogeneity of the n-gain test on the mathematical concept understanding was performed using the Barlett method. Below are the results of the n-gain homogeneity test.

Table 5. The N-Gain Homogeneity Test Results of Mathematical Concept Understanding

No	Class	N	$x^2_{observed}$	$x^2_{critical}$	Result
1	Experimental	36	1,604	3,841	Homogeneous
2	Control	34			

Table 5 shows that $x^2_{observed}$ is less than $x^2_{critical}$ with a significance level of 5% (α = 0,05). Therefore, *H$_0$* was accepted. It was concluded that the data was homogeneous. Next, the data were tested for homogeneity with the Barlett method. Below are the results of the homogeneity test of mathematical disposition.

Table 1. Homogeneity Test Results of Mathematical Disposition

No	Class	N	x^2_{hitung}	x^2_{tabel}	Results
1	Experimental	36	0,787	3,841	Homogeneous
2	Control	34			

Table 6 shows that $x^2_{observed}$ is less than $x^2_{critical}$ with a significance level of 5% (α = 0, 05). Therefore, *H$_0$* is accepted. It was concluded that the data was homogeneous. Hypothesis testing in this research was performed using the MANOVA test assisted by SPSS 25 program. The results of the MANOVA test are summarized in the following table.

Table 2. MANOVA Test Results

	Effect	Value	Hypothesis df	Error df	Sig.
Class	Pillai's Trace	.190	2.000	67.000	.001
	Wilks' Lambda	.810	2.000	67.000	.001
	Hotelling's Trace	.234	2.000	67.000	.001
	Roy's Largest Root	.234	2.000	67.000	.001

Based on the MANOVA test results in Table 7, the Wilks' Lambda p-value is less than the significance level (0.05). Thus, there was a significant difference in the application of Google Classroom with the discovery learning approach to improve the mathematical concept understanding and mathematical disposition. The results of the hypothesis testing 1 and 2 can be seen in the following table.

Table 3. Hypothesis 1 and 2 Testing Results

Tests of Between-Subjects Effects

Source	Dependent Variable	Df	Mean Square	F	Sig.
Class	Mathematical concept understanding	1	1161.124	8.997	.035
	Mathematical disposition	1	1536.343	10.523	.002

Based on Table 8, the p-value of the mathematical concept understanding is less than the significance level with the criteria of 0.05; therefore, H_{0B} is rejected. It could be concluded that there were differences in e-learning on the mathematical concept understanding using discovery learning. The p-value of the mathematical disposition is less than the significance level with the criteria of 0.05; therefore, H_{0A} is rejected. It could be concluded that there was an effect of e-learning on mathematical disposition using discovery learning.

The variables of this research were e-learning using discovery learning (independent variable/x), mathematical disposition (dependent variable/y1), and mathematical concept understanding (dependent variable/y2). The population of this research was the eleventh-grade students of SMAN 3 Cilegon. The researchers performed random cluster sampling and selected 11 IPA 4, which consisted of 34 students as the control class, and 11 IPA 5, which consisted of 36 students as the experimental class. The material in this research was the linear program to determine the effect of e-learning using discovery learning on mathematical disposition and mathematical concept understanding. The data collection techniques used were a questionnaire for mathematical disposition adopted from Wiwit Jayanti and a test for students' mathematical concept understanding. The tests were tested first for their validity, discriminating index, level of difficulty, and reliability. The researchers found seven valid questions out of ten to be used to measure the mathematical concept understanding.

Before learning began, the students were asked to log into Google Classroom and enter the class code or use the link provided by the teacher. The teacher sent videos, files, or images materials. The comment channel was opened so students could interact with other students or the teacher [17]. The materials sent to students are always stored and can be accessed anytime and anywhere to make learning more efficient and systematic [18].

The control class implemented the expository model, delivering the material directly with discussion and question-and-answer methods. The teacher also gave additional assignments to do at home so that the students could better understand the materials. The atmosphere during learning tended to be silent, and many students did not dare to ask questions regarding the material because the methods used were more student-centered [12].

Based on the explanation above, it can be concluded that e-learning affects mathematical disposition and mathematical concept understanding using discovery learning. It can be seen from the results of the posttest and questionnaires in the experimental class that applied the discovery learning model assisted by Google Classroom, which was better than the control class, which uses the expository model.

4. CONCLUSION

Based on the discussion, the researcher concludes that there is an effect of discovery learning assisted by Google Classroom in improving mathematical disposition and mathematical concept understanding. Based on the study's results, teachers must redevelop the discovery learning model using Google Classroom to improve mathematical disposition and concept understanding and provide more varied practice questions. Further

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researchers are expected to pay more attention to the aspects affecting students' mathematical concept understanding and dispositions.

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