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Critical Thinking Disposition and Independent Learning of Teacher Candidates in Online Learning for Geometry Materials

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Abstract

This study aims to look at the effect of independent learning on mathematics learning achievement, 2) the effect of critical thinking disposition on mathematics learning achievement, and 3) the effect of joint learning independence and critical thinking disposition on mathematics learning achievement during online lectures for the Analytical Geometry course. flat 4th semester students of Mathematics Education Study Program, FKIP UMPRI. This type of research is quantitative using an ex post facto approach. The research population amounted to 27 people. Data analysis technique using multiple linear regression. The findings of the research are: 1) There is an influence of independent learning on the achievement of 4th semester students of the Mathematics Education Study Program FKIP UMPRI in online lectures for the Basic Analytical Geometry course. 2) There is an influence of critical thinking disposition on the achievement of first semester students of Mathematics Education Study Program FKIP UMPRI in online lectures for the Field Analytical Geometry course. 3) There is an effect of learning independence and critical thinking disposition together on student achievement in online lectures for the Field Analytical Geometry course. From the results of R Square = 0.669 x 100% = 66.9% which shows that student achievement in online lectures is for the eye Field Analytical Geometry course can be explained by independent learning and critical thinking disposition of 66.9%.

Keywords: Critical Thinking Disposition, Independent Learning.

INTRODUCTION

Critical thinking is a type of thinking that is involved in solving problems, designing conclusions, predicting possibilities, and deciding on actions (Taube,1997). It is appropriate if critical thinking is called the basis for preparation for the 21st Century (Chen et al, 2017) The concept of critical thinking according to some experts is grouped into two dimensions, namely disposition and critical thinking skills (Bell and Loon, 2015; Facione, 2000).

A person's ability to generate logical conclusions by carrying out objective reflection activities so that an argument or solution to a problem is known as critical thinking skills (Chen et al, 2017;Angeli and Valanides, 2009) while the disposition of critical thinking is defined as the use of critical thinking in the form of motivation. internal consistency to involve problems and make decisions (Facione et al, 2000). In line with this (Bell & Loon, 2015a) states that critical thinking disposition is a measure of critical thinking tendencies. Taube (1997) states that critical thinking skills will be valuable if used, therefore the disposition to think productively and critically about problems is absolutely necessary. This is reinforced by Dian (2018) that critical thinking disposition is the most important aspect because it is the initial step in developing critical thinking skills.

Someone categorized as having a critical thinking disposition related to a particular problem, question or problem has the following characteristics: (a) clarity in stating questions about the clarity of a problem; (b) diligent in seeking relevant information (c) rational in selecting and applying criteria, (d) orderly (order) in working on complex problems; (e) focus

on paying attention to the main problem; (f) persevering (persistent) despite the difficulties; (g) precision (carefully) taking into account the subject and the circumstances (Facione, 1990, 2011). During the Covid-19 pandemic, lectures were conducted online. Of course, the implementation of online lectures has changed the teaching style of lecturers, which was originally done in conventional classrooms, turned into online lectures using platforms such as WhatsApp, Google Classroom, Edmodo, Zoom Meeting and so on.

The implementation of lectures at the Mathematics Education Study Program of the University of Muhammadiyah Pringsewu which was carried out mostly used the Google Classroom and Google Meet platforms, both synchronously and asynchronously. The implementation of online lectures like this will certainly have a special effect for students who are not quick to adapt to the current conditions of lectures. From the results of the study, it was found that there were many complaints when carrying out online learning because compared to face-to-face lectures, online learning required students to be active and critical in studying the topics studied (Badjeber, 2020). Another complaint about online learning is that it is difficult to communicate with the teacher, and feels burdened because of the relatively large task load, as well as the difficulty of understanding the material provided (Fatmawati et al., 2021).

From some of the complaints above, of course, an independent learning attitude is very important for students. This is because in online lectures students are required to learn and understand the material on their own and look for other learning resources that are relevant to the lecture material independently (Makur et al., 2021) In online lectures, the main character who plays an important role in teaching is no longer a lecturer but students who must be active to learn independently and explore their abilities in learning activities (Nursaptini et al, 2020). So that the independence of student learning is highly demanded to be able to achieve learning achievement.

Someone who has independent learning means that he can motivate himself to learn and of course has his own desire to learn, besides that he is certainly able to solve his learning problems with a full sense of responsibility for his obligations to learn. Meanwhile, a student who is independent in learning is actively involved in maximizing opportunities during learning, actively controlling everything he does, evaluating and planning something deeper in learning and willing to be active in the learning process (Banat, 2020)

According to (Arifin Maksum and Ika Lestari, 2020) learning independence is an important factor in online learning because of the awareness to learn by not depending on others and being responsible for achieving the desired goals. A person has high learning independence, he will not depend on others when studying (Hendrik et al, 2021) and takes the initiative to find relevant learning resources to study so that the quality of learning becomes better. If students have high learning independence in current online lectures, surely the many learning tasks do not make them burdened but make them motivated to learn and complete them and with these assignments students can understand more about the material being taught.

Learning independence is an important factor that determines the success of students in the lecture process they do (Sudiana, Fatah, and Khaerunnisa 2017). Learning independence is also a factor that can improve academic achievement because with independence learning can organize and monitor learning effectively, manage time to complete tasks, and obtain higher scores in science learning (Octaria et al., 2020)

From the description above, the aspects of learning independence and critical thinking disposition are two aspects that are important factors of learning achievement. So in this study, 1) the effect of learning independence on student achievement in online lectures, 2) the effect of critical thinking disposition on student achievement in online lectures, and 3) the effect of learning independence and critical thinking disposition together on student achievement in

online lectures. . Student achievements in online lectures are seen especially in the Field Analytical Geometry course.

RESEARCH METHODS

This type of research is quantitative research with an ex post facto approach. This research was conducted at FKIP Muhammadiyah University of Pringsewu in the even semester of the 2021/2022 academic year. The research population was 27 4th semester students of the Mathematics Education Study Program, FKIP Muhammadiyah University Pringsewu who took online lectures for the Field Analytical Geometry course. The sampling technique used a saturated sample. Methods of data collection using the method of tests and questionnaires. The critical thinking disposition questionnaire uses indicators, namely: 1) clarity, 2) rationale, 3) orderly, 4) diligent, 5) focused, 6) persistent and 7) precision while the learning independence questionnaire uses indicators, namely: 1) self-confidence, 2) Discipline, 3) Initiative, 4) Responsibility, and 5) Motivation.

The data analysis technique used multiple linear regression analysis. The purpose of regression analysis is to determine a statistical model that can be used to predict the values of the dependent variable based on the values of the independent variables (Budiyono, 2009). Before being analyzed using regression, prerequisite tests were carried out, namely normality test using Kolmogorov-Smirnov, heteroscedasticity test using the Glejser method, autocorrelation using the Durbin-Watson method, multicollinearity using the Tolerance (TOL) and Variance Inflation Factor (VIF) method, and linearity using the Lagrange Multiplier method.

RESULTS AND DISCUSSION

This study uses instruments in the form of 2 types of questionnaires and achievement tests. The two questionnaires in question are critical thinking dispositions and independence questionnaires. The results of the instrument trial, obtained 5 questions for the achievement test, 16 statements for the students' critical thinking disposition and 18 questions on the learning independence questionnaire. Test instruments and questionnaires were then given to 27 3rd semester students who took geometry lectures at the Mathematics Education Study Program, FKIP UMPRI, in online lectures.

After the instrument was given to students who took the field analytic geometry course and data on achievement tests, independent learning, and critical thinking dispositions were obtained, then the data were analyzed. Before using multiple linear regression analysis, a prerequisite test was carried out first. The prerequisite tests carried out were 5 conditions, namely as follows.

The normality test was carried out using the *Kolmogorov-Smirnov* method with the help of SPSS statistic 25. The hypotheses for the data normality test were:

H_0: Data comes from a normally distributed population

H_1: Data comes from a population that is not normally distributed

The results of the normality test can be seen in Table 1 below.

Tabel 1. One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		27
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	4.71817369
Most Extreme Differences	Absolute	.157
	Positive	.141
	Negative	-.157
Test Statistic		.157
Asymp. Sig. (2-tailed)		.087[c]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.

The criteria for testing the hypothesis at a significance level of 5% or = 0.05 is that H0 is accepted if the significance number (sig) > then the data is normally distributed. From Table 1 it can be seen that the sig value obtained from the results of the normality test using the Kolmogorov-Smirnov method is 0.087 more than 0.05 (sig = 0.087> 0.05) so that H0 is accepted. Therefore, it can be concluded that the data comes from a normally distributed population.

The heteroscedasticity test was carried out using the Glejser Method assisted by SPSS version 25. The hypothesis for the heteroscedasticity test was as follows:
H_0: The model does not contain heteroscedasticity symptoms
H_1: The model contains symptoms of heteroscedasticity
The results of the heteroscedasticity test can be seen in Table 2.

Tabel 2. Uji heteroskedastisitas

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	9.706	6.599		1.471	.154
	Kemandirian (X1)	-.263	.145	-.683	-1.818	.082
	Disposisi Berpikir Kritis (X2)	.193	.153	.474	1.262	.219

a. Dependent Variable: VarRes2

Seen in Table 2 that the value of sig. of learning independence 0.082 is greater than 0.05 and sig. Disposition of critical thinking 0.219 is greater than 0.05 then H_0 is accepted. This means that the regression model does not contain symptoms of heteroscedasticity.

The autocorrelation test was carried out using the Durbin-Watson method assisted by SPSS version 25. If the value in the Durbin-Watson table is more than *dU* and less than 4 – *dU*, then there is no autocorrelation. The results of the autocorrelation test can be seen in Table 3

Table.3 Results of Autocorrelation Test

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.300[a]	.090	.014	8.19906	.504

a. Predictors: (Constant), disposisi berpikir kritis, kemandirian
b. Dependent Variable: Prestasi

It can be seen in Table 3 that the Durbin-Watson (d) value is 0.504. For dU < d < 4-dU then 1,590 < d < 2,410, while the value of d = 1,873 so that d lies between dU and 4-Du (1,590 < d = 1,873 < 2,410). It can be concluded that the regression equation model does not have autocorrelation.

For the multicollinearity test using the Tolerance (TOL) and Variance Inflation Factor (VIF) methods with the help of SPSS. If the VIF value is < 10, then there are no symptoms of multicollinearity. The results of the multicollinearity test can be seen in Table 4

Table 4. The results of the multicollinearity

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	7.533	10.512		.717	.481		
	Kemandirian (X1)	.513	.231	.517	2.226	.036	.256	3.904
	Disposisi Berpikir Kritis (X2)	.346	.244	.329	1.420	.169	.256	3.904

a. Dependent Variable: Presatasi (Y)

It can be seen in Table. 4 that the VIF (Variance Inflation Factor) value is 1.008. Because VIF = 3.904 is not more than 10 (VIF = 3.904 < 10) then the model is declared to have no symptoms of multicollinearity.

For linearity test using the Lagrange Multiplier method with the following hypothesis:
H_0: Linear regression model
H_1: Non-linear regression model
The results of the linearity test can be seen in Table 5

Table 5. Result test of linieritas

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.300[a]	.090	.014	8.19906

a. Predictors: (Constant), disposisi berpikir kritis, kemandirian

b. Dependent Variable: Prestasi

From Table 5, it can be obtained the coefficient of determination (*R* Square) of 0.090 so that Chi Square = *R* Square x number of samples = 0.90 x 27 = 24.3 while *Chi Square* table with df = (0.05;27) = 40.113. Because Chi Square (0) < Chi Square table (40,113) then H_0 is accepted. This means a linear regression model.

Based on the description above, it can be concluded that all prerequisite tests are met. So it is continued by testing the multiple linear regression hypothesis. In Table 6 below, the results of multiple linear regression analysis are presented

Table 6. Regression Equation

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	7.533	10.512		.717	.481
	Kemandirian (X1)	.513	.231	.517	2.226	.036
	Disposisi Berpikir Kritis (X2)	.346	.244	.329	1.420	.169

a. Dependent Variable: Presatasi (Y)

Based on the results of the analysis using SPSS 25 in Table 6, it is obtained that the price of b_0 = 7.533 b1 = 0.513 where b1 is the coefficient of the X_1 variable (Learning Independence), and b2 = 0.346 where b_2 is the coefficient of the X_2 variable (critical thinking disposition) so that it can be arranged in The presumptive regression equation is

$$Y = 7.533 + 0.513X_1 + 0.346X_2$$

From the regression equation above, the constant value of 7.533 states that if there is no learning independence and critical thinking disposition, the learning achievement is 7.533. Regression coefficient X_1 is 0.513 states that every change in learning independence by 1 unit will increase achievement by 0.513 units. The X_2 regression coefficient of 0.346 states that every change in critical thinking disposition of 1 unit will increase achievement by 0.346 units.

These results are in line with the opinion of Novianti (2021) which says that there is a significant influence between student learning and learning outcomes. In line with Novianti's research, Harling (2020) found that there is a positive and significant relationship between learning discipline and achievement and Winata's research (2021) that learning discipline has

a positive effect on student achievement in online lectures for the Introduction to Basic Mathematics course.

Tabel 7. Table Anova

model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1169.876	2	584.938	24.255	.000[b]
	Residual	578.790	24	24.116		
	Total	1748.667	26			

a. Dependent Variable: Presatasi (Y)

b. Predictors: (Constant), Disposisi Berpikir Kritis (X_2), Kemandirian (X_1)

While in Table 7, it can be seen that sig. of 0.000 is smaller than 0.05, then there is an effect of independent learning and thinking disposition on the achievement of 4th semester students of the Mathematics Education Study Program FKIP UMPRI in online lectures for the Field Analytical Geometry course.

Table 8. Coefficient of Determination

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.818[a]	.669	.641	4.91083

a. Predictors: (Constant), Disposisi Berpikir Kritis (X2), Kemandirian (X1)

Furthermore, Table 8 is presented which is used to calculate the coefficient of determination, namely the number used to see a measure of how accurately the predicted linear regression model can explain the linear relationship between the variables in X1 and X2 with Y. Based on the results of the analysis using the SPSS 25 program in Table 8, R Square = 0.669 x 100% = 66.9% which indicates that online lectures for Basic Analytical Geometry courses can be explained by independent learning and critical thinking disposition of 66.9%, the remaining 32.1% is explained by other factors not examined in this study. this research.

CONCLUSION

Based on research and data analysis, it can be concluded that 1) There is an influence of independent learning on the achievement of 4th semester students of the Mathematics Education Study Program FKIP UMPRI in online lectures for the Basic Analytical Geometry course. 2) There is an influence of critical thinking disposition on the achievement of first semester students of Mathematics Education Study Program FKIP UMPRI in online lectures for the Field Analytical Geometry course. 3) There is an effect of learning independence and critical thinking disposition together on student achievement in online lectures for the Field Analytical Geometry course. From the results of R Square = 0.669 x 100% = 66.9% which indicates that student achievement in online lectures is for subjects Field Analytical Geometry course can be explained by independent learning and critical thinking disposition of 66.9%.

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