Analysis of Factors Affecting Online Learning Outcomes for Engineering Management Study Program at Institut Teknologi Del

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Abstract. Online learning or e-learning is a solution that Engineering Management study program Institut Teknologi Del can do to continue teaching and learning activities during the Covid-19 pandemic situation as accordance with government policies. In practice, students need adjustments and experience several obstacles that affect student learning outcomes. This study aims to identify and analyze the factors that influence online learning outcomes for undergraduate students of the Engineering Management Study Program at Institut Teknologi Del. The analytical technique used in this research is multiple linear regression analysis. Hypothetic variables to be tested were obtained through literature review and interview with students and lecturers. There are then dependent variables being tested, those are electricity power reliability at student's home, internet network, performance of laptop, mobile device, headset, economic situation, enthusiasm/ interest, independent learning management, commitment and family support. The independent variable is learning outcomes measured by individual's grade point average (GPA) of student during online learning period. The test result confirms that 56.4% on student learning outcome is explained by these ten variables. However, using p-value of 0.005, the laptop and enthusiasm/interest variables are the most significant factors affecting student outcomes during online learning.

Keywords: Online Learning, Learning Outcomes, Influencing Factors, Multiple Linear Regression Analysis

1 Introduction

Accreditation is a form of assessment (evaluation) of the feasibility and quality of a university or study program [1]. According to the assessment matrix of the self-evaluation report and the performance report of the BAN-PT study program, one aspect of the assessment in the accreditation of colleges and study programs is student academic achievement [2]. This academic achievement can be expressed through student learning outcomes. Student learning outcomes are needed as a basis for developing a learning curriculum. In addition, student learning outcomes are also useful in determining the

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best student graduation predicate and also determining the accreditation of study programs and universities [3]. As it is known that the Engineering Management Study Program at the Institut Teknologi Del when this research was conducted still had an accreditation value of C [4]. Based on these facts, it can be concluded that the Engineering Management study program needs to improve its quality.

Indonesia first reported two confirmed cases of Covid-19 on March 2, 2020. To anticipate the rapid spread of Covid-19, the government has issued several policies such as the implementation of large social events. The Covid-19 pandemic has had a devastating impact on all sectors. One of the sectors affected is the education sector where all educational institutions carry out online learning (e-learning). During the Covid-19 pandemic, online learning are considered the most appropiate learning process for students [5]. The Engineering Management Study Program at the Institut Teknologi Del is one of the educational institutions that carry out online learning during the current Covid-19 pandemic. Online learning (e-learning) is an electronic-based learning process. One of the characteristics of online learning is the instructional process that uses an information and communication technology (ICT). As long as online learning is still being implemented, it is necessary to improve the quality of the learning system so that it can encourage students to improve their learning outcomes. In addition to providing statisfaction to students, improving learning outcomes during online learning is currently also helping in creasing the accreditation of the Engineering Management Study Program at the Institut Teknologi Del.

Based on the background described above, this research was conducted to examine the factors that influence online learning outcomes for students. In this study, the statistical analysis used to determine the factors that have a significant effect is to use multiple linear regression analysis. In multiple linear regression analysis, it discusses the relationship pattern of several independent variables to the dependent variable. This study will provide an overview of online learning information during the Covid-19 period as well as any indicators that affect student online learning outcomes.

2 METHOD

This research was conducted at the Engineering Management Study Program at the Institut Teknologi Del. In this study, the unit of data analyzed was the individual and the observed data came from the behavior and experiences of individual students. This research was carried out for a period of four months, from February to June 2022. The population in this study were sophomore of the Engineering Management Study Program at the Institut Teknologi Del. The population size in this study was 42 student where this population size also became the number of samples used in the study.

The analytical technique used in this study is multiple linear regression analysis. Multiple linear regression analysis was conducted to measure the strength of the relationship between two or more variables and to indicate the direction of measuring the strength of the relationship with the dependent and independent variables. The form of the multiple regression equation is as follows:

$$Y = \alpha + \beta 1X1 + \beta 2X2 + \ldots . + \beta nXn + e \quad (1)$$

Where:

Y = Dependent variable

α = Constant

β = Regression coefficient

X = Independent variable

e = Standard error

3 Result and Discussion

Assessment of student online learning is done by determining the online learning component first. The online learning component will be specified in the form of sub-criteria and sub-sub-criteria that are found and summarized based on the literature related to the object under study. Based on the literature read, the authors found that there are 2 criteria that affect online learning, namely facilities and infrastructure and student readiness [5][6][7][8][9][10]. The criteria for facilities and infrastructure have 5 sub-criteria and 11 sub-criteria. Student readiness criteria have 5 sub-criteria and 5 sub-criteria. These sub-sub criteria will be used as parameters in the assessment of student online learning.

Table 1. Factors That Affect Online Learning

Criteria	Sub Criteria	Sub-Sub Criteria
Facilities and Infrastructure [5][6]	Availability of Electricity (X1) [11]	Power Outage
	Internet Network (X2) [5][6]	Internet Access Speed
	Laptop (X3) [5][6]	Screen Size
		Processor Speed
		RAM
		Hard Drive Capacity
	Mobile (X4) [5][6]	RAM
		Internal Memory
		Camera
		Batteray Capacity
	Headset (X5) [12]	Headset
Student Readiness [7][8]	Economi Condition (X6) [13]	Parent's Income Divided by The Number of Dependents
	Enthusiasm/Interest (X7) [14][15]	Enthusiasm/Interest
	Independent Learning Management (X8) [7]	Independent Learning Management
	Commitment (X9) [13]	Commitment
	Family Support (X10) [13]	Family Support

The research data contains ten independent variables and 1 dependent variable. The independent variables are taken from the sub-criteria in Table 1, namely availability of electricity (X1), internet network (X2), laptop (X3), mobile (X4), headset (X5), economic condition (X6), enthusiasm/interest (X7), independent learning management (X8), commitment (X9), and family support (X10). The dependent variable of use in this study is student learning outcomes (Y). The independent variable is based on the student's experience when carrying out online learning. As one example, the internet network variable is measured based on the speed of internet access that students have when carrying out online learning. While the dependent variable is measured based on the online learning outcomes of sophomore of the Engineering Management Study Program at the Institut Teknologi Del in semester 1 to semester 2.

The researchers measure the influence of the independent variable (X) on the dependent variable (Y); multiple linear regression can be used. As a requirement to fulfill multiple linear regression, normality test, multicollinearity test, and heteroscedasticity test were carried out. The normality test aims to determine whether the data obtained are normal or not.

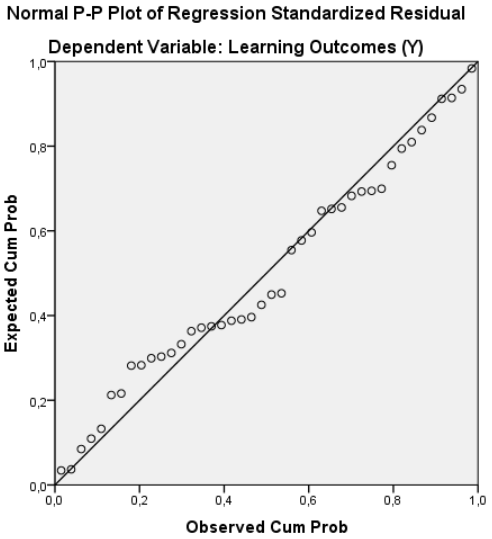

Fig. 1. Normality Test Results

Based on the central limit theorem, samples with a number of more than 30 already have the properties of a normal distribution. The sample in this study was 42 samples. So, thus the variables in the study are normally distributed. This can also be proven through the normality test of the probability plot. Research data is said to be normally distributed if the plotting data (dots) that describe the actual data follow a diagonal line. Next, do a multicolinearity test to determine whether or not there was a strong correlation or relationship between independent variables in a multiple regression model.

Table 2. Multicolinearity Test Results

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Availability of Electricity (X1)	,446	2,241
	Internet Network (X2)	,526	1,902
	Laptop (X3)	,387	2,584
	Mobile (X4)	,655	1,526
	Headset (X5)	,788	1,269
	Economic Condition (X6)	,693	1,443
	Enthusiasm/Interest (X7)	,342	2,928
	Independent Learning Management (X8)	,378	2,642
	Commitment (X9)	,454	2,202
	Family Support (X10)	,606	1,651

a. Dependent Variable: Learning Outcomes (Y)

Based on the results of the multicollinearity test in Table 2 it can be seen that all variables have a tolerance value greater than 0.100 and a value less than 10.00; it means that on all variables there is no multicollinearity symptom. A good multiple regression model does not contain a correlation between the independent variables. Next, do a heteroscedasticity test to determine whether there is an inequality of variance from the residuals for observations in the regression model.

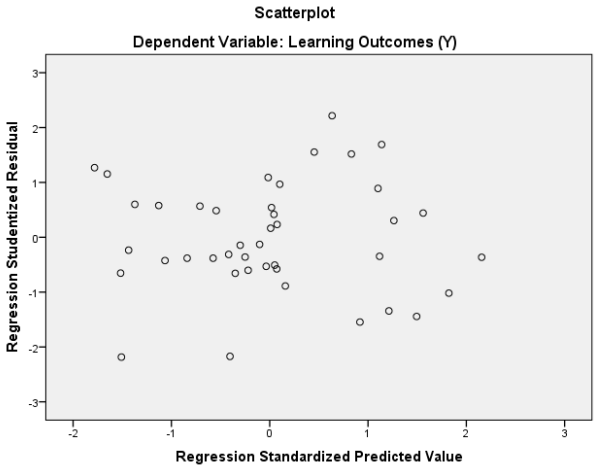

Fig. 2. Heteroscedasticity Test Results

Based on the results of the heteroscedasticity test in Figure 3, it can be seen that the points appear to spread on the X and Y axes, do not form a pattern, and the points spread above and below the number 0 on the Y axis, so it can be ascertained that there is no heteroscedasticity.

After ensuring that the data is normal, there are no symptoms of multicolinearity and heteroscedasticity, then proceed to multiple linier regression analysis. The effect test can be done using the F test and T test. The F statistical test is used to show whether all the independent variables included in the model have a joint effect on the dependent variable. The following are the results of the F-test conducted in the study.

Table 3. F Test Results

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9,633	10	,963	4,012	,001[b]
	Residual	7,443	31	,240		
	Total	17,076	41			

a. Dependent Variable: Learning Outcomes (Y)

b. Predictors: (Constant), Family Suppport (X10), Internet Network (X2), Headset (X5), Mobile (X4), Economic Condition (X6), Availability of Electricity (X1), Enthusiasm/Interest (X7), Comitment (X9), Laptop (X3), Independent Learning Management (X8)

Based on Table 3, it can be seen that the variables of electricity availability (X1), internet network (X2), laptops (X3), cellphones (X4), headsets (X5), economic conditions (X6), enthusiasm/interest (X7), management independent learning (X8), commitment (X9), and family support (X10) jointly affect student learning outcomes. Next, do the T test to determine the effect of each independent variable on the dependent variable. The following are the results of the t-test conducted in the study.

Table 4. T Test Result

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4,614	,869		5,311	,000
	Availability of Electricity (X1)	-,284	,145	-,348	-1,959	,059
	Internet Network (X2)	,042	,159	,043	,265	,793
	Laptop (X3)	,093	,044	,398	2,086	,045
	Mobile (X4)	-,013	,044	-,045	-,305	,762
	Headset (X5)	,058	,119	,066	,491	,627
	Economic Condition (X6)	,110	,097	,160	1,126	,269

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Enthusiasm/Interest (X7)	,239	,114	,426	2,098	,044
Independent Learning Management(X8)	,095	,126	,146	,758	,454
Comitment (X9)	,147	,129	,201	1,145	,261
Family Suppport (X10)	-,151	,165	-,139	-,912	,369

Based on Table 4, it can be seen that the variables that affect online learning outcomes for Engineering Management Study Program at Institut Teknologi Del are laptops (X3) with a significance value of 0,045 and enthusiasm/interest (X7) with a significance value of 0,044. To find out how much influence the independent variables have on the dependent variable, this can be seen from the value of the coefficient of determination (R^2).

Table 5. Coefficient of Determination Test Results

Model Summary[b]

Mode 1	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,751[a]	,564	,424	,49000

a. Predictors: (Constant), Family Suppport (X10), Internet Network (X2), Headset (X5), Mobile (X4), Economic Condition (X6), Availability of Electricity (X1), Enthusiasm/Interest (X7), Comitment (X9), Laptop (X3), Independent Learning Management(X8)

b. Dependent Variable: Learning Outcomes (Y)

Based on the results of the coefficient of determination (R^2) in Table 5, it can be seen that the value of Adjusted R^2 is 0.564. This means that the availability of electricity, internet networks, laptops, cellphones, headsets, economic conditions, enthusiasm/interest, independent learning management, commitment, and family support has an influence of 56.4% on student learning outcomes. Furthermore, to find out the variables that have the greatest influence, it can be seen in the regression coefficient value in Table 6.

Table 6. Regression Test Results

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4,614	,869		5,311	,000
	Availability of Electricity (X1)	-,284	,145	-,348	-1,959	,059
	Internet Network (X2)	,042	,159	,043	,265	,793
	Laptop (X3)	,093	,044	,398	2,086	,045
	Mobile (X4)	-,013	,044	-,045	-,305	,762
	Headset (X5)	,058	,119	,066	,491	,627
	Economic Condition (X6)	,110	,097	,160	1,126	,269
	Enthusiasm/Interest (X7)	,239	,114	,426	2,098	,044
	Independent Learning Management(X8)	,095	,126	,146	,758	,454
	Comitment (X9)	,147	,129	,201	1,145	,261
	Family Suppport (X10)	-,151	,165	-,139	-,912	,369

Based on Table 6, the following multiple linear regression equation is obtained (Eq. 2):

$$Y = 4{,}614 - 0{,}284\,X_1 + 0{,}042\,X_2 + 0{,}093X_3 - 0{,}013X_4 + 0{,}058\,X_5 - 0{,}110\,X_6 + 0{,}239X_7 + 0{,}095\,X_8 + 0{,}147X_9 - 0{,}151X_{10} + e \quad (2)$$

In the laptop variable, there are several students who do not use laptops according to the standards set by the campus. Laptops are one of the most important facilities and infrastructure in the implementation of online learning [5]. The ability of laptops to access the internet allows students to participate in instructional activities that are carried out in the form of video conferencing or in service online classes using learning applications available online [16]. To achieve success it is necessary to have an adequate laptop for online learning. Therefore, there should be a standard of laptop specification that satisfies the minimal requirement to support online learning.

In the variable of enthusiasm/interest in learning, there are some students who are less enthusiastic about participating in online learning. Interest in learning is a sense of liking interest in something or learning activities [17]. Interest in learning has a very big influence on learning outcomes because of interest, someone will be enthusiastic about doing instructional activities [14]. Students' enthusiasm/interest in online learning can be increased in various ways. One of the efforts that can be made to increase student interest in online learning is to hold Achievement Motivation Training (AMT) activities. Motivation to learn is internal and external encouragement to students who are learning to make changes in behavior, generally with several indicators or supporting elements. It has a big role in one's success in learning [18]. Achivement Motivation Training activity aims to provide solutions to problems experienced by students during carry out online learning. This activity can be started by presenting

material on how to increase motivation and tips for effective online learning. The committee can also provide assistance to students by holding discussion forums to discuss the problems experienced by students during online learning and solving them together in groups. This effort will certainly be a major contribution in improving academic quality as has been initiated in terms of improving the curriculum and learning materials [19].

1 Conclusion

Based on the results of the study, there are ten variables that together affect the online learning outcomes in Engineering Management Program at Institut Teknologi Del. Of the ten variables studied, there are two variables that have significant effect on the online learning outcomes for students of the Engineering Management Study Program at the Institut Teknologi Del. These two variables are the laptop performance and student enthusiasm/interest. Based on these two variables, the authors recommend that students should pay attention to laptops specification used for studying and that the study program should hold Achievement Motivation Training (AMT) activities to increase student enthusiasm/interest during online learning. The results obtained will then be used as consideration by stakeholders in developing and updating so that the online learning systems in the study area can be maximized.

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