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The Significant Factors Affecting Students' Academic Performance in Online Class: Multiple Linear Regression Approach

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ABSTRACT

The COVID-19 pandemic, which began in Wuhan City, China in 2020, has thrown Malaysia's academic sector into disarray. Students' academic performance changes dramatically when they move from face-to-face classes to full implementation of online distance learning (ODL). The purpose of this study is to investigate the factors that affect students' academic performance during the COVID-19 pandemic using Multiple Linear Regression (MLR). The research was carried out at UiTM Perlis Branch, and 54 bachelor's degree students from four faculties were invited to take part. During the analysis, gender, hours students spent in online learning, hours students spent on preparation before class, number of subjects taken, credit hours, hometown areas, and internet connection, act as independent variables whereas CGPA as the dependent variable, were examined. This study was carried out using SPSS software and Excel. The result shows that the hometown areas and hours students spent preparing before class contributed significantly to the model while others did not. It is shown that students who live in rural areas did much better in academic performance than students who live in cities, and the more students spend on preparing themselves before class, the lower is their CGPA. Other factors tend to be insignificant and it might be because of the limited time in collecting data, small sample size and unequally-sized groups. For future research, it is recommended to have more time in collecting data and add more sample sizes by extending it to diploma students to gain more accurate results.

Keywords: *Academic Performance, COVID-19, Multiple Linear Regression (MLR), Online Distance Learning (ODL), Students*

INTRODUCTION

According to a study by Balkhair (2020), the world has witnessed the emergence of a number of illness episodes and scourges, with COVID-19 being the most recent addition to this growing list of unwelcome infections. Malaysia is one of the countries that has been impacted by the COVID-19 pandemic that is currently raging around the world. The Movement Control Order (MCO) 1 was put in place in the country on March 18, 2020 to prevent COVID-19 from spreading through social distancing.

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The COVID-19 pandemic has impacted education at all levels (Nicola et al., 2020). Due to the widespread of COVID-19, students are one of the individuals affected by it. Lim (2020) wrote that Kellin Wong, a caretaker of a college at Universiti Malaysia Sabah (UMS) and a representative of the student committee, said that online learning strategies have already become current input and are utilized each semester in open colleges, but said, a total switch to online learning would come with specific challenges. These challenges make them feel down.

Many students suffer from online distance learning (ODL) because they mostly were used to studying in class. Many factors can contribute to students' academic performance. For example, how many hours they spent in online learning, how many hours they spent on preparation before class, gender, number of subjects taken, number of credit hours, living in rural or urban area and internet connection.

Students' hours in a day of online learning are similar to the hours students take to learn during face-to-face sessions. Although students can learn everything online and can even access class topics anytime since most lecturers make recorded classes, they should still keep up with the class schedule. However, with an average of 1 to 14 hours a day of learning sessions, only 6.5% of students spent 7 to 14 hours a day in online learning (Mahdy, 2020).

The hours students spend on preparation before class begins are crucial. The more they spend studying topics before classes, the more they can get ready to learn from their lecturers. It will also help them to understand more about the topics. In addition, Ng et al. (2016) revealed that studying alone positively correlates with CGPA or academic achievement.

Although much is known about the factors contributing to academic performance from learning process perspectives and learning environment, little is still known about the contribution of gender perspective on academic performance. Hdii and Fagroud (2018) have shown that girls are more likely to perform better than boys in different subjects.

In addition, the number of subjects taken can also affect students' academic performance. To achieve flying colors results, students must know their abilities and limits. With that, they will be able to plan well the number of subjects to be taken. Furthermore, many subjects require a lot of time and effort because many tasks will need to be done, especially during ODL.

The number of credit hours is related to the number of subjects taken. Therefore, the more subjects that students take in a specific semester, the higher the number of credit hours is. On the bright side, if students take more credits each semester, it will reduce their study years and improve their performance (Huntington-Klein & Gill, 2021).

Hence, this study aims to analyze factors that affect students' academic performance in online learning using multiple regression analysis. The factors are how many hours they spent in online learning, how many hours they spent on preparation before class, gender, number of subjects taken in the current semester, number of credit hours in the current semester, living location (urban/rural) and internet connection.

LITERATURE REVIEW

Several studies on the effects of online learning on students' academic performance have been done before using different methods. One study by Gossenheimer et al. (2017) proposed a comparison of the performance of pharmacy students from a Pharmaceutical Care course who were taught in both distance education (DE) and campus-based formats. This study was conducted before the COVID-19 pandemic, and they used variable grades to access students' academic performance. Data were analyzed by using t-test, paired t-test, ANOVA, Mann Whitney U, Pearson's correlation, the Wilcoxon test and non-parametric Mann Whitney U test. Thus far, this study shows that the students' performance was better

in the distance education module, indicating that the distance education can be palatably utilized in Pharmacy Programs.

On the contrary, Mahdy (2020) studied the effect of COVID-19 lockdown on academic performance by centering on veterinary medical students and researchers. Variables like gender, age, educational level, residential area, and total hours spent in online learning were included in this study. All collected data were summarized as descriptive statistics. To determine the impact of COVID-19 lockdown and online learning education amid the widespread lockdown, the Likert Scale was used. This study has shown that the COVID-19 pandemic lockdown negatively affects most participants' academic performance by 96.7% with varying degrees.

El Said (2021) examined the impact of the sudden move from face-to-face to online distance learning due to the COVID-19 lockdown at one of the universities in Egypt. This study compared a course grade between quizzes, mid-term and final exams, and variables like students' level, gender, credit hours, and CGPA were used. A T-test was conducted in this comparison for two groups while a Chi-square test was used to compare grade distribution for both groups. In addition, the effect of gender, credit hours, age, and CGPA was surveyed. However, it is proposed that there was no measurably noteworthy contrast in students' grades. In addition, the impromptu and rapid move to online distance learning at the time of the pandemic did not result in a destitute learning experience as was expected.

Another study by Gopal et al. (2021) identified the variables that influenced students' fulfillment and performance with respect to online classes amid the pandemic period of COVID-19 and built up a relationship between these variables. Independent variables like quality of instructor, course design, instructors' prompt feedback, and expectation of students were included to achieve the objective. The study used a descriptive research design, multivariate statistical analysis technique, the amalgamation of factor analysis, and multiple regression analysis. It is used to analyze the structural relationship between measured variables and latent constructs. The results of this study have various significant practical suggestions for educators, students and researchers. It also contributes to the literature by illustrating multiple factors responsible for students' fulfillment and performance in online classes amid the COVID-19 pandemic.

The multiple linear regression model (MLR) involves one criterion, which is also referred to as response, predicted, outcome, or dependent variable, Y and predictors, p, which is also referred to as independent variables. There are numerous points of interest to analyzing data using a multiple regression model. One of them is determining the relative influence of one or more predictor variables on the criterion value. Besides, it can identify outliers or anomalies. On the other hand, the relapse examination hypothesis can be exceptionally unappeasable since one excluded variable can make all relapse coefficients one-sided to an obscure degree and course (Klees, 2016). This shows that any disadvantage of using a multiple regression model usually comes down to the data being used. Applications of MLR are various and occur in nearly every field, such as engineering, physical and chemical sciences, financial matters, administration, life, biological sciences, social sciences, and academics. The examples below are the applications of MLR in academics.

Previous study on improving online courses performance through customization had been conducted by Sankaran and Sankaran (2016). The dependent variable for this study is online students' performance. The independent variables include communication aptitude, desire to learn, escapism, hours studied, gender, and English as a Second Language. This study confirmed the usefulness of business analytics methods and revealed implications for college administrators and faculties to optimize individual student online learning.

Weidlich and Bastiaens (2018) conducted a study on the impact of transactional distance on satisfaction in online distance learning. The dependent variable in this study is satisfaction in online education. In contrast, the independent variables are TD Student-Teacher (TDST), TD Student-Student (TDSS), TD

Student-Content (TDSC), and TD Student-Technology (TDSTECH) as TD stands for transactional distance. This study revealed TDSTECH is the single most important independent variable or predictor of satisfaction in online distance learning for the chosen population. In addition, mediator analysis revealed that TDSTECH mediates the relationship between TD student-teacher and satisfaction, but not for TD student-content. However, TD student-student shows no significant relationship with satisfaction.

Forson and Vuopala (2019) investigated online learning readiness of students enrolled in distance education in Ghana. The dependent variable is online learning readiness, whereas the independent variables are students' attitude, self-regulated learning, ICT skills, and collaborative skills. The study discovered that distance education students have positive attitude towards online learning. They also possess good self-regulated learning, cooperative and information communication and technology skills relevant for online learning.

Hsu Wang (2019) studied the prediction of online behaviour and achievement by using self-directed learning awareness in flipped classrooms. The dependent variables in this study are the prediction of online behaviour and achievement, whereas the independent variable is self-directed learning factors. The results indicated three things: task value, intrinsic motivation, control of learning beliefs, and metacognition predict achievement. SRL awareness predicts online behaviours to a limited extent, and a combination of SRL awareness and online behaviours indicates that achievement is better than either one of the single-domain models.

Rachmawati et al. (2021) investigated the effect of online learning and parental guidance towards the result of XI social students' learning on Geography courses at SMAN 5 Jember. Independent variables in this study are online learning and parental guidance, and the dependent variable is the study result. This study concluded that online education and parental guidance could affect students' learning outcomes in Geography subject.

METHODOLOGY

This study was conducted among 54 bachelor's degree students of UiTM Perlis. There are seven faculties in this campus which are Faculty of Business and Management (FBM), Faculty of Sports Science and Recreation (FSR), Faculty of Plantation and Agrotechnology (FPA), Faculty of Applied Sciences (FSG), Faculty of Computer and Mathematical Sciences (FSKM), Faculty of Accountancy (FP) and Faculty of Architecture, Planning and Surveying (FSPU). Probability sampling technique was used to selects sample of students. Through single-stage cluster sampling technique as FP was not included as it only offers diploma programs, the only faculties chosen were FBM, FSR, FSG and FSKM. All the bachelor's degree students in the chosen faculties were asked to answer the questionnaire. This study only focused on bachelor's degree students due to the limited time in collecting the data and the number of degree programs is higher than diploma programs in these faculties. Only students from 13 programs were able to complete the online survey "The Impact of COVID-19 on Students' Academic Performance in UiTM Perlis Branch," which was open to participants from 16 programs. This could be because the participants were unaware of the survey's existence because the recruitment period took place during their semester break and ended only a few weeks before the start of their new semester. Starting with 62 participants, data was removed for 6 because they answered the questions incorrectly and for another 2 because they preferred not to reveal certain information that was critical to the research. This brings the total number of people who completed the survey to 54.

The questionnaire was distributed online to the respondents. The questionnaire was modified from Mahdy (2020) which is consists of two parts which are part A and part B. In part A, respondents needed to fill in their information which are gender, hometown area, CGPA and GPA for the current semester. In part B, there are questions about how many hours they spent in online learning, how many hours they spent on preparation before class, number of subjects taken in the current semester, number of credit hours in the current semester, and internet connection.

The method of data analysis systematically applies statistical and logical techniques to describe, illustrate, and evaluate data. It started with formulating the problem, validating assumptions and evaluating the fitted model. During the validating assumptions stage, five assumptions must be met or the process must be redone from the beginning. Throughout evaluating the fitted model, the estimated model was tested with three tests before it could be claimed as the best model and could subsequently be used to forecast values.

RESULTS AND DISCUSSIONS

Formulating the Problem

Formulating a problem determines the constituent parts of a problem, important factors and variables involved, and interrelationships. This section consists of the selected set of variables, the model used, method of fitting and assumptions chosen for the study.

a) Set of Variables

The study analyzed the impact of COVID-19 on students' academic performance by measuring students' CGPA on seven factors which are how many hours they spent in online learning, how many hours they spent on preparation before class, gender, number of subjects taken in the current semester, number of credit hours in the current semester, living in rural or urban and internet connection as shown in Table 1.

Table 1: Set of variables

Variable	Type of variable	Variable Code
Cumulative Grade Point Average (CGPA)	Quantitative continuous	CGPA
Hours students spent in online learning per week	Quantitative continuous	Hours_spent
Hours students spent on preparation before class per week	Quantitative continuous	Preparation_hours
Gender	Qualitative	Gender
Number of subjects taken in the current semester	Quantitative discrete	Subjects
Number of credit hours in the current semester	Quantitative discrete	Credit_hours
Hometown (rural/ urban)	Qualitative	Area
Internet Connection	Qualitative	Int_connection

b) Forming The Model

$$y_i = B_0 + B_1X_{i1} + B_2X_{i2} + B_3X_{i3} + B_4X_{i4} + B_5X_{i5} + B_6X_{i6} + B_7X_{i7} + e_i$$

where

y_i : CGPA

B_0 : the intercept

B_1.....B_7 : The regression coefficient for independent variables

X_{i1} : Hours students spent in online learning per week

X_{i2} : Hours students spent on preparation before class per week

X_{i3} : Gender

X_{i4} : Number of subjects taken in the current semester

X_{i5} : Number of credit hours in the current semester

X_{i6} : Hometown (rural/ urban)

X_{i7} : Internet Connection

e_i : Model's error term or residuals

Table 2: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.556[a]	0.309	0.204	0.23700	2.185

a. Predictors: (CGPA), Hours_spent, Preparation_hours, Gender, Subjects, Credit_hours, Area, Int_connection

Table 3: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.155	7	0.165	2.937	0.013[b]
	Residual	2.584	46	0.056		
	Total	3.738	53			

a. Dependent Variable: CGPA
b. Predictors: (CGPA), Hours_spent, Preparation_hours, Gender, Subjects, Credit_hours, Area, Int_connection

Table 4: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3.364	0.357		9.421	0.000					
	Gender	0.140	0.083	0.227	1.681	0.100	0.291	0.241	0.206	0.822	1.217
	Area	-0.153	0.070	-0.289	-2.168	0.035	-0.285	-0.305	-0.266	0.845	1.183
	Subjects	0.023	0.041	0.083	0.563	0.576	-0.058	0.083	0.069	0.691	1.447
	Credit_hours	-0.014	0.013	-0.177	-1.137	0.261	-0.132	-0.165	-0.139	0.624	1.604
	Hours_spent	-0.001	0.001	-0.065	-.482	0.632	-0.123	-0.071	-0.059	0.828	1.207
	Preparation_hours	-0.009	0.004	-0.287	-2.144	0.037	-0.334	-0.301	-0.263	0.839	1.192
	Int_Connection	0.145	0.074	0.252	1.959	0.056	0.151	0.278	0.240	0.909	1.100

a. Dependent Variable: CGPA

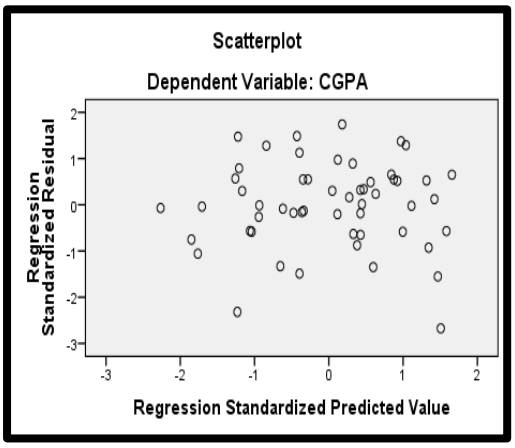

Figure 1: The plot of standardized residuals versus standardized predicted values

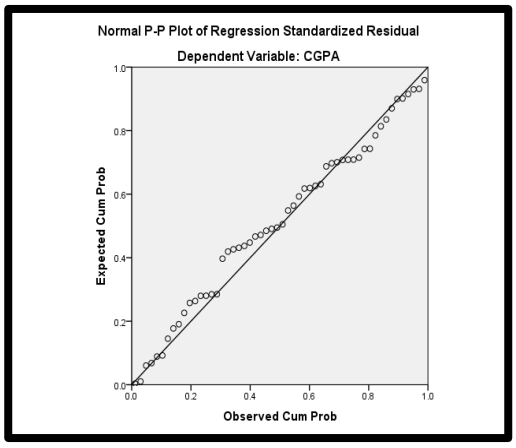

Figure 2: P-P plot

In regression analysis, many assumptions about the model and the Multiple Linear Regression (MLR) model are one of the fussier of the statistical techniques as it makes several assumptions about the data. If one or more assumptions are violated, then the model in hand is no longer reliable and not acceptable in estimating the population parameters (Daoud, 2018). In this study, five assumptions were discussed.

a) The Relationship Between Independent Variables and Dependent Variables Is Linear

Based on Table 4, it shows that gender has a weak positive correlation with CGPA (r = 0.291). Area has a weak negative correlations with CGPA (r = -0.285). Subjects have a weak negative correlations with CGPA (r = -0.058). Credit_hours have a weak negative correlations with CGPA (r = -0.132). Hours_spent have a weak negative correlations with CGPA (r = -0.123). Preparation_hours have a weak negative correlations with CGPA (r = -0.334). Int_Connection has a weak positive correlation with CGPA (r = 0.151). The correlation between the two variables above shows that no factor is controlled or held constant.

b) Checking Multicollinearity

Multicollinearity is when there is a correlation between independent variables in a model. Based on Table 4, there is no multicollinearity as the value of VIF scores are below 10 and the tolerance scores are above 0.1. Therefore, there is no absence of multicollinearity among the independent variables.

c) The Values of the Residual are Independent

The Durbin-Watson statistic in Table 2 shows that this assumption had been met, as the obtained value is close to 2, which is 2.185.

d) The Variance of the Residual is Constant

Figure 1 shows the plot of standardized residuals versus standardized predicted values which shows no obvious signs of funneling, suggesting that the assumption of homoscedasticity has been met.

e) The values of Residuals are normally distributed

The P-P plot (Figure 2) for the model suggested that the assumption of normality of the residuals may have been violated. However, as only extreme deviations from normality are likely to significantly impact the findings, the result was probably still valid.

Evaluate the Model

Evaluating the estimated model is a necessary though often neglected procedure. However, it is a necessary prerequisite before the estimated model can be claimed as the best model and can subsequently be used to forecast values. The following subsections describe some of the commonly used statistical testing procedures.

a) Fitness of the Model

This is a test for the overall fitness of the model. The examination will reveal whether all or part of the independent variables should remain in the model. The test criterion used is the *F-test statistic*. The null hypothesis to be tested states that all coefficients in the model are equal zero, that is

H_0 : The regression model is not significant

H_1 : The regression model is significant

The overall F-test can be found in the ANOVA table in the statistical output. To interpret the F-test of significance, the *p*-value for the F-test must be compared to a 5% significance level. If the *p*-value is less than the significance level chosen, the data provide sufficient evidence to conclude that the independent variables in the model improve the fit.

This means that none of the independent variables provides any information for fitting the model, and hence the model is rejected. From Table 3, the *p*-value 0.013 is less than the significance level of 0.05. The data provide sufficient evidence to conclude that the regression model is significant.

b) Goodness of Fit

The standard measure of the goodness of fit is the *coefficient of determination*, R^2. The coefficient of determination, R^2 shows that 30.9% of the total variation in CGPA can be explained by hours_spent, preparation_hours, gender, subjects, credit_hours, area and int_connection **(Table 2)**. Although the value is small, small R^2 values are not always a problem, and high R^2 values are not necessarily good. A good model can have a low R^2 value. On the other hand, a biased model can have a high R^2 value (Dhakal, 2018).

c) Statistical Significance of the Independent Variables

The independent is significant when the p-value is less than 0.05. Area ($B = -0.153$, $p < 0.05$) and preparation_hours ($B = -0.009$, $p < 0.05$) contributed significantly to the model while gender ($B = 0.140$, $p > 0.05$), subjects ($B = 0.023$, $p > 0.05$), credit_hours ($B = -0.014$, $p > 0.05$), hours_spent ($B = -0.001$, $p > 0.05$) and int_connection ($B = 0.145$, $p > 0.05$) did not. These values are presented in Table 4. From this value, it can be concluded that area and preparation hours are significant variables towards CGPA.

Estimated Model Coefficient

From Table 4, the estimated model coefficient is:

CGPA = 3.364 + 0.140 Gender – 0.153 Area + 0.023 Subjects – 0.014 Credit_hours – 0.001 Hours_spent – 0.009 Preparation_hours + 0.145 Int_Connection

The analysis revealed that the factors affecting students' academic performance are hometown area (rural/ urban) and hours students spent on preparation before class.

CONCLUSION

The pandemic of COVID-19 brings many destructions in academic sector especially towards students and their academic performance, due to the Online Distance Learning (ODL) that is being introduced. The use of ODL mode can have a number of negative consequences for students, which must be avoided.

To find the factors that affect students' academic performance, the hours students spent in online learning and preparation before class, gender, number of subjects taken, credit hours, hometown area and internet connection were analyzed. The results revealed that hometown area residents of urban and rural areas and hours students spent preparing before class play a significant factor in students' academic performance during the COVID-19 lockdown.

The first factor sought to explore whether students' hometown, rural or urban, indeed contributed to the research objective. Findings revealed that students who live in rural areas show much better academic performance than students who live in the city. This presupposes that internet connection in rural areas is much better than in cities since many participants responded in the survey that they have good and moderate internet connection during online learning. The result does not fit with Bauer et al. (2020) that stated students in rural areas may fall behind academically due to slow internet connections or restricted access from their homes. In addition, Wan Jaafar and Maat, (2020) revealed that Rural students' mathematics achievement is moderately influenced by their motivation for mathematics. However, the generalizability of the result was limited due to the unbalanced number of participants who live in rural areas and cities.

Next, the factor sought to investigate the hours students spent preparing before class towards their academic performance. The research showed that the more students spend on preparing themselves, like a revision before class, the lower their CGPA will be. The result does not fit with the theory of Ng et al. (2016) that revealed studying alone is positively correlated with CGPA or academic achievement. This might be because the participants did not manage their time wisely since they were given many assignments and the weight of responsibilities to their family as they mentioned in the Muhammat Pazil et al. (2022). This finding has implications for the participants because a short amount of time spent reviewing the day's topic before class will save hours of ineffective study later.

Findings regarding the hours students spent in online learning, gender, number of subjects taken, credit hours and internet connection in ODL outcomes tend to be insignificant. It might be because of the limited time of collecting the data which was only one month, and also the small sample size with unequally sized groups.

There are several gaps in knowledge and limitation while investigating the factors that affect students' academic performance in UiTM Perlis Branch. For future research, it is recommended to have more time in collecting data and adding more sample size by extending it to diploma students to gain more accurate results.

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AUTHORS' CONTRIBUTION

All authors provided critical feedback and helped shape the research, analysis and manuscript.

CONFLICT OF INTEREST DECLARATION

We certify that the article is the original work. The article has not received prior publication and is not under consideration for publication elsewhere. This manuscript has not been submitted for publication nor has it been published in whole or in part elsewhere. We testify to the fact that all Authors have contributed significantly to the work, validity and legitimacy of the data and its interpretation for submission to Jurnal Intelek.

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