The Effectiveness of Blended Learning: The Impact of Student's Characteristics and Digital Literacy on Student Performance

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ABSTRACT

Blended learning plays an important role in providing flexibilies to study in terms of time and place. This paper scrutinizes the impact of student characteristics and digital literacy on student performance. It is intended to evaluate the significant predictors of student characteristics and digital literacy as independent variables, and student performance as dependent variables. A survey was conducted to 43 respondents that take Introduction to Management course at Universitas Andalas, Indonesia. The data is then collected including student characteristics, digital literacy and student performance. Data is then analyzed using logistic regression model. The final score of students are utilized as a indicator for student performance. We employed gender, and student type, as indicator to measure student characteristics. The results show that student characteristics and digital literacy give insignificant impact on student performance in blended learning.

Keywords: *Blended learning, Student characteristics, Digital literacy, Student performance*

1. INTRODUCTION

Nowdays, university benefits from advances of digital technology such as online application, mobile gadget, and telecommunications to involve the students with diverse of learning tools [1]. One of the learning types called as blended learning [2] which combines technologies into the learning activities, and expected to solve some lacks of "campus based" study. [3]

Since Covid 19 Pandemic hit the world, the needs to implement blended learning system is getting crucial. Students are encouraged to study at home instead of university or school. The blended learning system can mitigate Covid 19 outbreak. The blended learning is able to lessen physical attendance by using video conferencing to organize smaller groups that enable a proper social distancing. Blended learning provides students flexibilities to study in terms of time and place. Nevertheless, adopting blended learning inevitably upgrades the student learning experience [4]. Joy and Garcia [5] propose more educators that learners will study better from digital-based system.

Blended learning effectiveness has several basic factors. One of the challenges is about how user is able to utilize the digital tools and assuring students' commitment given the individual learner characteristics and come across technology [6]. Not all students are familiar with blended learning. Students are equipped with digital literacy tend to accept blended learning method compared to their peer. Students are essential tools in any learning process and thus, their characteristics influence their capability to effectively continue learning process.

As digital technology contributes significant part in blended learning, it is expected that students require a particular level of digital literacy for them to study creatively [7]. Previous research was carried out to explore the effect of characteristics of learners and design features on student performance. Guskey [8] revealed that planning assessment enabling planners to determine the necessities, pondering student's characteristics, investigating contextual problems and collecting data. The learner characteristics being analyzed for blended learning effectiveness include gender and student's type.

This study aims to examine the impact of student's characteristics and digital literacy on student performance. The following sections elaborate an overview of blended learning, review the concept of digital literacy, point out the measurement of student performance, depict the research method, disclose the results, and conclude the paper.

1.1 Student's Characteristics
1.1.1 Gender

Recent studies revealed that student characteristics like *gender* have significant contribution in academic context [9]. However, only limited study reviews performance of male and female students in blended learning process. Previous study in Saudi Arabia Universities showed that blended learning plays in a gender-segregated context, Alebaikan [10] discussed that blended learning had the chance to improve the quality of learning. Traditional guidance through live circuit TV for female students taught by male lecturers would be better sustained by online tools, like discussions and course announcements [11]. Therefore, the benefit of assisting interaction between educators and learners would be more effective in blended learning activities by male educators in this broader context. This result is similar to Albalawi [12] findings that Saudi lecturers believe that online instruction will expand the quality of teaching in the gender segregated Saudi educational institution.

Other study from China revealed that, a gender difference indicates in preference of blended learning, with male students 41.5% less likely than female students to select blended learning. The choice for learning mode also impacts the preference of students. Unlike conventional campus-based study, students who select blended learning own a higher probability of selecting this option [13]. In the context of gender, we propose the 1st hypothesis as follows:
H1: Male students are likely to achieve high performance on blended learning

1.1.2 Types of students

Basically, types of students can be divided into local student and international students. In fact, local students are students who have nationalities according to the location of the university where they study. Meanwhile, international students are students who prefer to carry out their next level of education in a country other than their own country.

A survey was conducted to 4,000 international students recommends they are more confident that Covid-19 can not obstruct their aspiration of degree program abroad. The study is undeniable to motivate students to begin their blended learning to campus-based study when that is more viable. [14]

Furthermore, international students may apply online learning particularly during covid 19 pandemic. Having combination of independent learning and online learning, it is expected that the final score of international students will increase. In the context of student types, we propose the 2nd hypothesis:
H2: International students are likely to achieve high performance on blended learning

1.2 Digital Literacy

The use of digital system in educational institution promotes the growth of digitally literate learners, who are able to run sufficiently and innovatively in technological contexts in student's life. Apparently, Digital literacy has been noted by Lankshear and Knobel [15]. A prevalent definition depicts digital literacy as the

"Awareness, attitude and capability of individuals to properly utilize digital devices and facilities to identify, access, manage, integrate, evaluate, analyze and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of particular life situations, in order to allow constructive social activities; and to reflect on this process.

Subsequently, the virtual world has changed the culture in various fields of human life, including education. The changes clearly influence educational institutions, such as schools and universities. Since digital technology is developing massively, it requires adjustments in education level. Moreover, majority of the generation of learners come from Z generation, whom are digital and media literate. Therefore, digital literacy is essential to support learning activities in educational institutions.

The attributes of digital literacy are then described in European Commission's Digital Competence Framework [16] It consist of five parts of digital qualification: information and data literacy, communication and collaboration, digital content creation, safety, and problem solving.
Encourage students to use digital devices as a place to learn, will enable them to enhance their digital literacy, and certainly improve their final score. In the context of digital literacy, we propose the 3rd hypothesis as follows:
H3: Digitally literate students are likely to achieve high performance on blended learning

1.3 Student Performance on Blended learning
The implementation of blended learning allows student to combine between independent study and

"face to face" study at school, and may improve their final semester score. The Student performance is a product of the learning process reached by the students after the students involve particular courses [17]. The assessment of student performance focuses on two main activities. Firstly, observe the process and show the skill. Secondly, evaluate the results of the students.

The form of assessment is carried out by observer when students undertake activities in class or create a work in accordance with their learning objectives. The skills displayed by students are the variables being assessed. Assessment of student competences is based on a comparison between student performance and predetermined targets. The assessment process is started from preparation, assignment completion, and final result is achieved
.

2. METHODOLOGY

2.1 Research Design
The research design used in this study is explanatory with a quantitative approach because it explains the nature of a particular relationship, or determines differences between groups between two or more factors in one situation [18]. Therefore this research will explain the reciprocal relationship between the dependent variables of student performance and the independent variables such as gender, type of students, and digital literacy. The study used a cross-sectional time horizon. To answer the problem statement and to test the hypothesis, the study uses STATA Regression Logistic program.

2.2 Sample
The population of this study was all students take introduction to Management course, Universitas Andalas, Indonesia. The sample criteria for this study are students that have applied blended learning during covid 19 pandemic. The number of respondents' data for this study are 43 students.

2.3 Data Collection Method
Data is obtained from final grade of Introduction Management class. Furthermore, survey is also conducted to gather data for digital literacy. The questionnaires are then distributed to students that have already implemented blended learning.

2.4 Variables and Indicators
There are two types of variables used in this research, namely independent variable (X) and dependent variable (Y). those variables can be described on table below:

Table 1
Operational variables

No	Variable	Definition	Indicator	Scale
1	Student performance (Y)	Product of the learning process reached by the students after the they involve a specific courses.	$\geq 80 - 100 = A$ $\geq 75 < 80 = A-$ $\geq 70 < 75 = B+$ $\geq 65 < 70 = B$ $\geq 60 < 65 = B-$ $\geq 55 < 60 = C+$ $\geq 50 < 55 = C$ $\geq 45 < 50 = D$ $<45 = E$	Ordinal
2	Gender	Characteristics of women, men, girls and boys that are socially constructed	Male = 1 Female = 0	Nominal
3	Types of student	The origin of the student, either local or international	Local = 1 International = 0	Nominal
4	Digital literacy	A set of individual abilities and skills in using digital media, communication tools, network, and use them wisely in daily life.	High digitally literate = 1 Sufficient digitally literate = 2 Low digitally literate = 3	Ordinal

2.5 Data Analysis

2.5.1 Test validity and reliability
A questionnaire is concluded to be valid if the question contained in the questionnaire is able to express the items that will be measured by the questionnaire. An instrument is said to be valid if the r value is greater than r table which is a standard or reference (r count> r table). Reliability testing is done to find out whether the indicator or questionnaire used is reliable or reliable as a measuring instrument.

2.5.2 Multicollinearity Test
In the multicollinearity test, an indication of a strong correlation between independent variables is indicated by a correlation number that exceeds 0.8.

2.5.3 Model Analysis
Model analysis using binary regression logistic methods can be seen from the output results. The

output results will show the value of the error coefficient, z (z-score for the test of β - 0), p> | Z | (p-value for z-test), and costant

2.5.4 Overall Model Test (Overall of fit)
If the block value is member 0> block member value - 1 means the regression model is good. Log likelihood in the logistic regression model is similar to the definition of "sum of square error" in the regression model so that the decrease in likelihood shows that the regression model is getting better.

2.5.5 Statistic test
a. Simultaneous Test
LR (likelihood ratio) is used as a substitute for the F-test which is useful to test whether all the slope of independent regression coefficients jointly influence the dependent variable.

b. Partial Test
If the significance value is prob> chi2 $\geq$ 0.05 then H0 is accepted and Ha is rejected, which means that the independent variable affects the dependent variable

2.5.6 Goodness of Fit Test
The Goodness of Fit test is undertaken to show how much variation of the dependent variable can be explained by the model, the indicator that can be used to find out the value of the goodness fit test is pseudo R2

2.5.7 Odds Ratio Analysis
The risk measure or tendency to experience "success" between a category with another category, is defined as the ratio of odds for xj - 1 to xj - 0. This odds ratio states the risk or tendency of the influence of observation with xj - 1 is several times compared with xj - 0. For independent variables with continuous scale, the interpretation of the Bj coefficient in the logistic regression model is that every increase in c unit on the independent variable will cause Y = 1. It is exp (c.Bj) times greater

3. RESULT AND DISCUSSION
An instrument is concluded to be valid if the r value is greater than r table which is a standard or reference (r count> r table). The value of r count is the correlation of the respondent's answer to each question for each variable, while the table with the number of respondents is 43 people with a significance level of 5%, the r table value is obtained by df (degree of freedom) = n - 2. So df = 43 - 2 = 41, then r table = 0.1603. This study is said to pass the validity test because there are several valid items because the value of ir-corr has shown a value greater than the value of r table. While the reliability test is

obtained by Cronbach's Alpha 0.7348, which means the reliability test of the study is in the moderate category.

The multicolinearity test is conducted to see the relationship among independent variables. The multicolinearity test is shown by pearson correlation like table below

Table 2
Pearson correlation test

	Gender	Types of student	Digital literacy
Gender	1.000		
Types of student	-0.0209	1.000	
Digital literacy	-0.0068	-0.1155	1.000

The output of this study shows that there is no correlation between independent variables because there are no numbers that exceed 0.8 so it can be concluded that the research of this model is free from multicollinarity.

The analysis of order logistic model can be described on the table below:

Table 3
Order logistic model

```
Iteration 0:   log likelihood = -28.856468
Iteration 1:   log likelihood = -28.261013
Iteration 2:   log likelihood = -28.257776
Iteration 3:   log likelihood = -28.257776


Logistic regression                 Number of obs   =        43
                                     LR chi2(3)      =      1.20
                                     Prob > chi2     =    0.7536
Log likelihood = -28.257776          Pseudo R2       =    0.0207
```

Student Performance	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Gender	-.1259111	.6565975	-0.19	0.848	-1.412818	1.160996
Typeof Student	1.117877	1.175353	0.95	0.342	-1.185771	3.421526
Digital literacy	.2706592	.6398172	0.42	0.672	-.9833595	1.524678
_cons	-1.7762	1.554969	-1.14	0.253	-4.823883	1.271483

The coefficient (or parameter estimate) for the variable male is -0.1259111. This means that for a one-unit increase in female (in other words, going from female to male student), we expect a 1.482498 decrease in the log-odds of the dependent variable student performance holding all other independent variables constant. For variable type of student – For every one-unit increase in international students (so, for every additional point on the student performance), we expect a 1.117877 increase in the log-odds of student performance, holding all other independent variables constant. For variable digital literacy – For every one-unit increase in digital literacy, we expect a 0.02706592 increase in the log-odds of student performance, holding all other independent variables remain constant.

When a binary outcome variable is constructed applying logistic regression, it is assumed that the logit transformation of the outcome variable has a linear relationship with the predictor variables. This induces the interpretation of the regression coefficients tricky. Hence, it is needed to transform logistic regression into odds ratio like table below:

Table 4
Odds Ratio Model

```
Logistic regression              Number of obs   =        43
                                 LR chi2(3)      =      1.20
                                 Prob > chi2     =    0.7536
Log likelihood = -28.257776      Pseudo R2       =    0.0207
```

Student Performance	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Gender	.8816933	.5789176	-0.19	0.848	.2434561	3.193113
Typeof Student	3.058356	3.594646	0.95	0.342	.3055105	30.6161
Digital literacy	1.310828	.8386905	0.42	0.672	.3740524	4.593664
_cons	.1692802	.2632255	-1.14	0.253	.0080355	3.566138

Assuming all other variables in the model do not change or are constant, each variable can be interpreted as follows:
a. Male students will tend to increase the probability of 0.881 times to be able to achieve excellent performance compared to female students
b. Student type-international students will tend to increase the probability of 3,058 times to be able to achieve excellent performance compared to local students
c. High-medium Digitally literate students will tend to increase the chances of 1,310 times to be able to achieve excellent performance compared to low digitally literate students

From the table 4 above, it is seen that P>Z for gender is 0.848, so the value is greater than 0.05. therefore, H1 is not supported: male students are likely to achieve high performance on blended learning. In this case, female students also get high performance on blended learning since they are also familiar with blended learning using some digital platforms such as zoom, google meet, and i-learn system. Furthermore, P>Z for type of student is 0.342, the value is also bigger than 0.05. Thus, H2 is not supported: International students are likely to achieve high performance on blended learning. It seems either local and international students have the same level academic performance. Both of them achieves high performance on blended learning since they obtain very good middle term examination and final term examination. Subsequently, P>Z for type of student is 0.672, the P >z value is also bigger than 0.05. Thus, H3 is not supported: digitally literate students are likely to achieve high performance on blended learning. In fact, most of the students do not take formal course on digital and information technology.

But they learn digital autodidact via Youtube and internet. As a result, most of students in that take Introduction to Management course, have almost equal capabilities in operating technological tools in learning process. The value of pseudo *R2* (R *Square*) is 0.020, it means only 2% of independent variables (gender, student's type, and digital literacy) affect student performance on blended learning. While, the rest value of 98% is affected by other variables.

4. CONCLUSION
An effective blended learning method is essential in carrying out advanced pedagogical method by applying digital tools in learning process. Student characteristics and digital literacy are factors for student performance in blended learning. Some student characteristics and digital literacy are considered in blended learning process. Variable gender, student's type, and digital literacy influence insignificantly on student performance in Management Department, Universitas Andalas Indonesia.

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