

Factors affecting the effectiveness of on-line learning in higher education

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ABSTRACT: The Covid-2019 pandemic has severely impacted the learning process in Indonesia drastically changing the way it is delivered in the country. There are strict government regulations in regard to education delivery which every university must follow. Also, students must adapt to the pandemic situation and the changed conditions, often resulting in high levels of stress. The purpose of this study was to find out what factors influence the effectiveness of on-line learning at universities in Jakarta, Indonesia, during the pandemic. In this study, the technology acceptance model (TAM) was used, but modified according to the study objectives and needs. There were 400 participants in the study. A simple random sampling technique was used and data were collected using Google Forms. The results indicate significant relationships between nine of the analysed variables: perceived ease of use, perceived usefulness, attitude towards using, perceived enjoyment, behavioural intention to use, self-efficacy, lecturer's attitude, teaching method and the effectiveness of on-line learning. The relationship between perceived usefulness and behavioural intention did not prove significant.

INTRODUCTION

The Covid-2019 pandemic has significantly changed education delivery in Indonesia. Previously, teaching was conventional, delivered mostly on-campus, while now it is conducted remotely by utilising existing support facilities. At the beginning of the pandemic in March 2020, the Indonesian government implemented an on-line learning policy [1]. At this stage, it is expected that it will massively impact the future of education in Indonesia, and it is possible that the Indonesian learning system in the future will not operate in the same as conditions as before the pandemic.

The implementation of on-line learning provides challenges for education stakeholders, such as lecturers, students, university administration and the wider community, such as parents. In the on-line learning process, lecturers must find ways to continue to deliver previously prepared material, so that it can be conveyed to students and understood properly.

On-line learning cannot be separated from learning media as the media provide the necessary support in the on-line learning process. Therefore, learning media must be adjusted properly, so that students can be helped in understanding the material presented by the lecturer and the predetermined learning objectives can be achieved. Lecturers have to adjust to the nature and characteristics of students demonstrated in the changed circumstances. In addition, the media must be attractive and make it easier for students to use [2].

Students are required to adapt to the changed learning conditions of the pandemic, which for some of them can be difficult and may impact on their mental health [3]. Stress is a common mental disorder experienced by many people. However, it is often unavoidable and can be experienced by any person at any time of their life [4]. Stress affects people differently, and one study found that 16.5% of the respondents reported moderate to severe depressive symptoms, 28.8% reported moderate to severe anxiety symptoms, and 8.1% moderate to critical stress levels in similar critical circumstances. Also, in the first two weeks of the pandemic, women reported having higher levels of stress, depression and anxiety compared to men [3]. The effects of mental health can include fatigue, headaches, poor time management and feelings of isolation [5].

Therefore, to reduce the occurrence of stress in students, more engaging and interesting learning is needed, so that students become more motivated and more eager to participate in on-line learning. In this current study, the modified technology acceptance model includes a construct of perceived enjoyment that has been introduced with the aim of gauging students' perception of enjoyment felt by them in regard to their intentions to use technology or when waiting for the latest technology to be used in on-line learning systems in the future [6].

In the future, it may be possible to develop various forms of on-line learning, especially in view of Industry 4.0 and including the latest technologies, such as virtual reality, artificial intelligence, augmented reality, and others. Across all levels of education, technology can be integrated to support the process of teaching and learning. The ability to take full advantage of these technologies allows higher education institutions to modify teaching to meet student needs, ultimately aiming to provide students with an engaging and satisfying learning experience. Once the latest technologies are adopted to support on-line learning activities, it can lead to better educational outcomes. When students learn on-line through interesting and engaging methods, their motivation increases and they are more willing to take part in on-line learning. Therefore, the enjoyment that students experience in the on-line learning process can help create more effective learning.

The purpose of this study was to find out what factors influence the effectiveness of on-line learning at universities in Jakarta, Indonesia. The results of this study can be used as input and policy material in university-wide initiatives to increase the effectiveness of on-line learning. Students who take part in on-line learning activities, may also be interested in this study as the analysed factors directly relate to the current mode of education, likely to continue beyond the pandemic. It is expected that students will become more flexible and skilful in using on-line learning media, and therefore, even more willing to engage in on-line learning. This study can also be beneficial for lecturers in the evaluation of teaching material and methods, thus improving the quality of teaching to students.

METHOD

In this study, the technology acceptance model (TAM) has been used and modified according to the study objectives and needs. The technology acceptance model introduced by Davis is a model widely used for assessing how new users accept and use new technology [7]. This model was developed from the theory of reasoned action and psychological theory [8]. The theory of reasoned action describes a person's belief in influencing attitudes that lead to an intention and result in certain behaviour. The difference between the original and the modified technology acceptance model is that the original has the following variables: perceived ease of use, perceived usefulness, attitude towards using and behavioural intention to use. While the modified model has been enhanced by additional variables with specific functions. The model developed for this study has two types of variables: those that are related to technical aspects and non-technical.

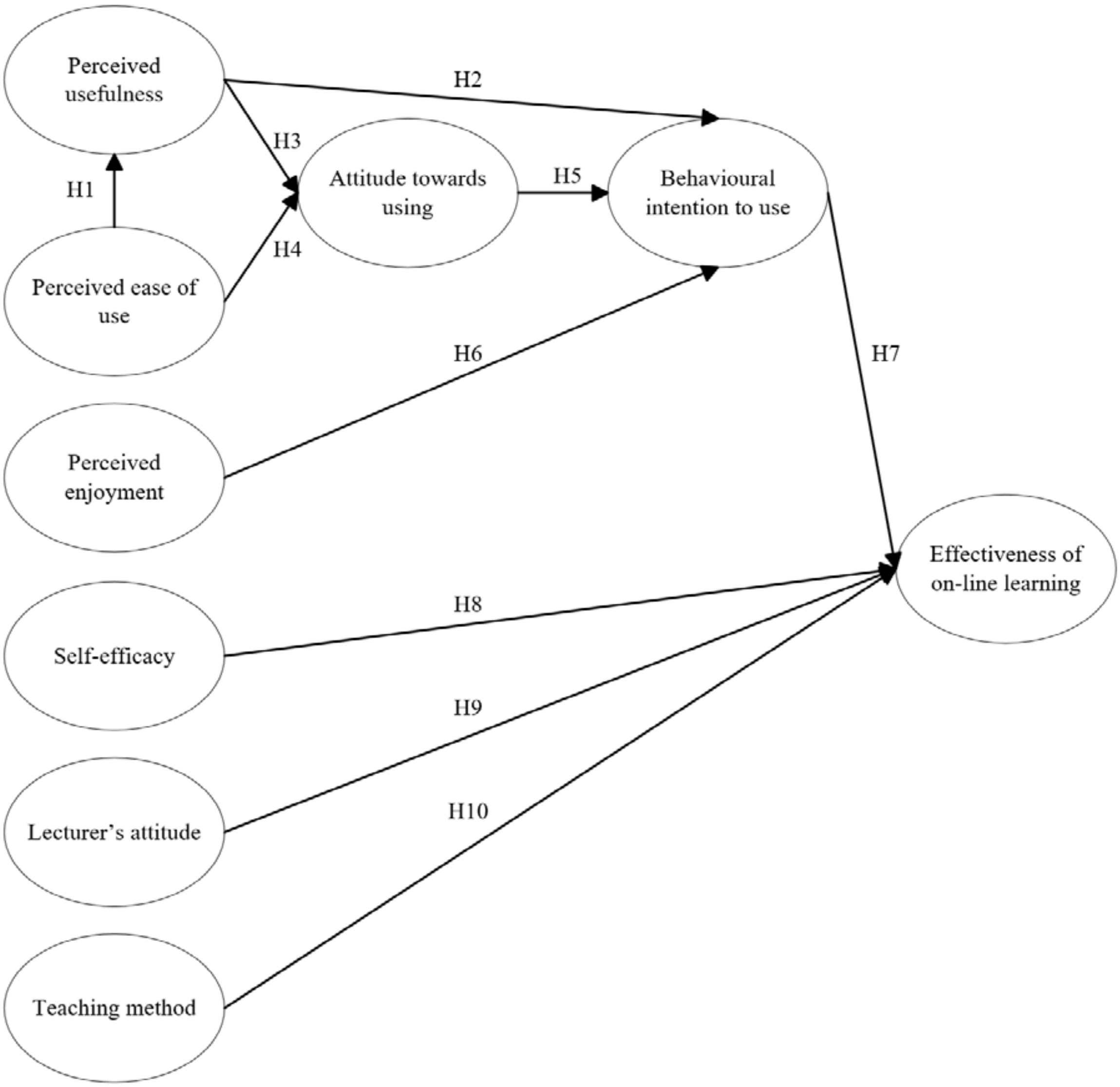

Figure 1: Research model.

RESULTS AND DISCUSSION

Data Collection

In this study, quantitative statistical data analysis was used to investigate the relationship between the selected variables. Data were collected by questionnaires sent to current students in the Jakarta area. The questionnaire included items to be answered in a five-point Likert scale. Respondents were asked to choose one answer only that best suited their specific conditions. The Likert scale used had the following ratings: strongly disagree - 1; disagree - 2; doubtful - 3; agree - 4, and strongly agree - 5.

Data Analysis

Validity testing in research refers to a test to ensure that the selected variables measure what they are supposed to measure, which means that they are valid. According to Algahtani, validity is a measurement to see the accuracy of each construct in the study [9].

In this study, the validity test was carried out on the following items: perceived ease of use, perceived usefulness, attitude towards using, behavioural intention to use, perceived enjoyment, self-efficacy, lecturer's attitude and teaching method. The test was needed to ensure that the variables taken for this study were valid and able to support the research objectives.

Reliability testing refers to a test that aims to check the consistency and stability of each research construct. According to Algahtani, the research method must be tested to ensure reliable results. The measurement results must have high stability and consistency in regard to the study constructs [9].

Population and Sampling

Simple random sampling was used in this study, with the sampling done randomly without regard to the existing strata. The questionnaire was distributed on-line using Google Forms. The population in this study were current students studying at Jakarta. The total number of universities in the Jakarta region is 56 and the total number of current students in that region at the time of sampling was 471,459. The sample size of this case study is based on the Slovin's formula as follows:

$$n = \frac{N}{1 + Ne^2} \quad [1]$$

Where n is the number of elements/sample members; N - number of elements/population members; e - error level (error rate). In this study an error rate of 0.05% was accepted. Hence, the number of elements/sample members was calculated as follows:

$$n = \frac{471{,}459}{1 + 471{,}459 \text{ x } (0.05)^2} = 399.66$$

From the results of calculations using the Slovin's formula above, the number of samples was 400 respondents because the value was rounded up. So the minimum number of respondents in this study was 400 all of them active students from universities in the Jakarta area.

Outer Model Analysis

This outer model is constructed to assess the relationship between latent variables and each indicator in the study. In this section, validity measurements, such as convergent validity, average variance extracted and discriminant validity are described, along with the results of reliability testing. The test was carried out using the SmartPLS 3 software. The structure of the model is shown in Figure 2.

Convergent Validity

The validity test can be seen from the value of the loading factor on each indicator in each construct or variable. In testing the convergent validity, the loading factor value must be more than 0.7 and the average variance extracted value greater than 0.5. Based on the test results using the SmartPLS 3 software, it was established that the loading factor value contained six indicators that were declared invalid because they had a loading factor value below 0.70. The indicators are ATU5 from the attitude towards using variable, BIU1 and BIU5 from the behavioural intention to use variable, TM6 from the teaching method variable, and indicators from the effectiveness of on-line learning variable; namely, EOL5 and EOL6. Invalid indicators from the test results were deleted from the research model structure.

Average Variance Extracted

This section presents the results of the average variance extracted that was tested in this study. If the average variance extracted value > 0.50 then the construct in the study was declared valid. However, if the average variance extracted value < 0.50, then the construct in the study was not valid. Based on the test results using SmartPLS 3, all the average variance extracted values of each variable can be said to be valid, because the value is above 0.50.

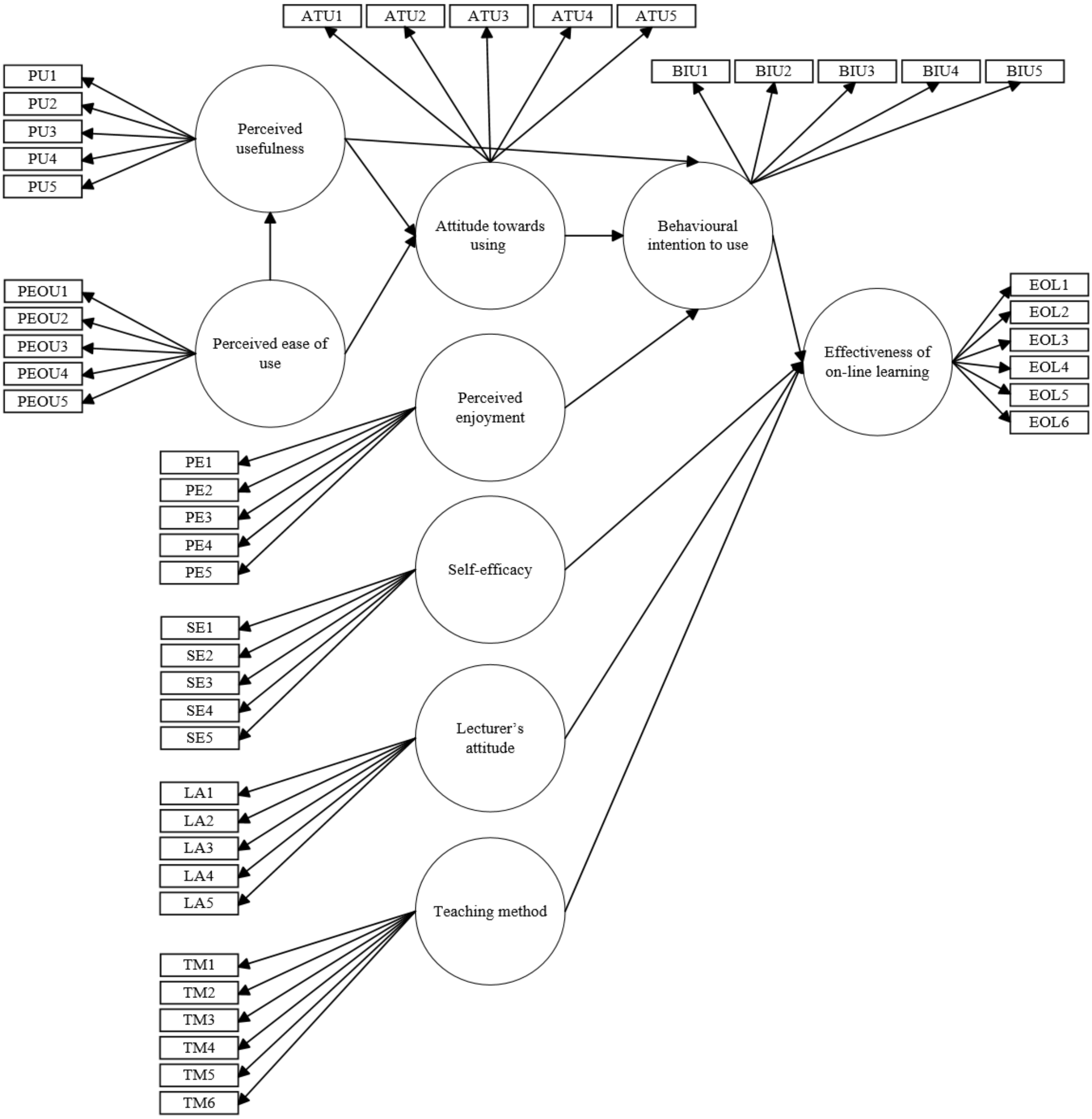

Figure 2: Structural model.

Table 1: Average variance extracted results.

Variable	Average variance extracted
Perceived ease of use	0.589
Perceived usefulness	0.553
Attitude towards using	0.604
Perceived enjoyment	0.660
Behavioural intention to use	0.680
Self-efficacy	0.606
Lecturer's attitude	0.633
Teaching method	0.654

Discriminant Validity

Discriminant validity allows to see the divergence between the measures of the study, when the value of one variable can be compared with another variable. If one variable is greater than the other, it can be said that the indicator of that variable is valid. Based on the test results using the SmartPLS 3 software, the value of each indicator in each variable has a cross-loading value that is greater than the value of the other variable indicators. This means that each construct in this study is valid.

Reliability Test

Reliability tests were also carried out on the measurement model. Reliability testing allows to assess the accuracy and determination of the variables used in the research model. There are two ways to test reliability; namely, by looking at Cronbach's alpha and composite reliability, whose value above 0.70 allows to declare them valid.

Table 2: Cronbach's alpha and composite reliability.

Variable	Cronbach's alpha	Composite reliability
Perceived ease of use	0.825	0.877
Perceived usefulness	0.797	0.861
Attitude towards using	0.781	0.859
Perceived enjoyment	0.870	0.906
Behavioural intention to use	0.765	0.864
Self-efficacy	0.838	0.884
Lecturer's attitude	0.855	0.896
Teaching method	0.867	0.904
Effectiveness of on-line	0.843	0.895

Based on Table 2 above, the value of Cronbach's alpha and composite reliability of each variable in this study is above 0.70, which means that all variables in this study were reliable.

Inner Model Analysis

This section is an evaluation of the structural model (inner model). The structural model (inner model) can be assessed by looking at the *r*-square value. The following are the results of the *r*-square value in this study:

Table 3: *R*-square results.

Variable	*R*-square
Effectiveness of on-line learning	0.556

Based on Table 3 above, the obtained *r*-square value for the effectiveness of on-line learning variable is 0.556. This is influenced by the behavioural intention to use, self-efficacy, lecturer's attitude and teaching method variables. The resulting effect of the behavioural intention to use, self-efficacy, lecturer's attitude and teaching method variables on the effectiveness of on-line learning variable is 56%, while 44% would have to be explained by other factors outside of this study.

Hypothesis Results

In this section, a significance test or hypothesis test are outlined to demonstrate the level of influence of the independent variable on the dependent variable. The significance value used was two-tailed with a significance level of 5% and the *t*-statistics of 1.96. That is, if the *p*-value is less than 0.05 and the *t*-statistics is above 1.96, it can be declared significant. Below are the results of the significance test value using SmartPLS 3:

Table 4: Path coefficients, *p*-values and *t*-statistics.

No.	Hypothesis	Original sample (O)	*t*-statistics	*p*-values	Significance
1	Perceived ease of use → perceived usefulness	0.577	13.970	0.000	Significant
2	Perceived usefulness → behavioural intention to use	0.119	1.601	0.110	Not significant
3	Perceived usefulness → attitude towards using	0.572	13.264	0.000	Significant
4	Perceived ease of use → attitude towards using	0.170	3.318	0.001	Significant
5	Attitude towards using → behavioural intention to use	0.241	3.037	0.003	Significant
6	Perceived enjoyment → behavioural intention to use	0.288	5.149	0.000	Significant

7	Behavioural intention to use → effectiveness of on-line learning	0.108	2.478	0.014	Significant
8	Self-efficacy → effectiveness of on-line learning	0.157	3.158	0.002	Significant
9	Lecturer's attitude → effectiveness of on-line learning	0.182	3.714	0.000	Significant
10	Teaching method → effectiveness of on-line learning	0.485	7.957	0.000	Significant

Based on Table 4 above, of the ten proposed hypotheses, nine were accepted and one was rejected; namely, the relationship between perceived usefulness and behavioural intention to use because the *p*-value and *t*-statistics were not in accordance with the required values for significance.

CONCLUSIONS

The conclusion that can be drawn from this study is that the proposed structural model, which concerns the variables of perceived ease of use, perceived usefulness, attitude towards using, perceived enjoyment, behavioural intention to use, self-efficacy, lecturer's attitude, teaching method and effectiveness of on-line learning, can be considered valid and reliable as the test values for the outer model and inner model are above the required limit value.

The results obtained allowed to accept nine hypotheses. However, the hypothesis regarding the relationship between the perceived usefulness and behavioural intention to use variables had to be rejected because the obtained *p*-value and *t*-statistics were below the significance level.

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