Student's Acceptance and Actual Use of E-Learning System in a Post-COVID Era Through Technology Acceptance Model

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Abstract. The COVID-19 pandemic has pushed the transition of learning activities in universities into distance learning. This leads to extensive use of e-learning, which became one of key things to sustain the ongoing teaching and learning activities during the pandemic. With the return of classroom learning, the actual use, and students' intentions on using e-learning system is unknown, and it could affect e-learning system's effectiveness. Based on the problem, a quantitative research and analysis is conducted on students' acceptance, use intentions, and actual use of e-learning system using Technology Acceptance Model (TAM) with three adopted external constructs of Learnability, Self-efficacy, and Social Norm. The questionnaire result processing is conducted by utilizing Structural Equation Modelling (SEM). The findings are students' perception of e-learning system's usefulness, ease of use, and students' attitude towards the e-learning system affects their behavior intentions, and actual use of e-learning system. This finding also resulted on two proposed suggestions on adding minimum content requirements and standard operational procedure in course content management with the aim to increase its learnability and students' attachments and adding a user tour feature with the aim to increase both learnability and ease of use of e-learning.

1 Introduction

In information age, data is really an important asset for a company, especially in helping to achieve its strategic goals [1], [2]. But in fact, in the Fortune 2021 survey, 1000 companies have reported declines in key metrics used to measure data success, such as progress in managing data as business assets, compete for data and analytics, use data to drive distance learning through online platforms offers plenty of advantages over traditional learning inside a classroom. Its most influential advantages lie in its accessibility, students' flexibility on scheduling, and learning adaptability. Another benefit of learning through online platforms are improved flexibility in education delivery, improved focus on learner

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centredness, greater access to knowledge, improved knowledge archival capabilities, and improvements in general knowledge management [1], [2]. E-Learning or Electronic Learning is an essential tool that is implemented by various educational institutions around the world [3]. The use of E-Learning is recognized as an important and integral part of educational activities [4]. The availability of various E-Learning systems allows the integration of materials, assessment modules, collaboration tools, and these systems have become a key part of instruction delivery in university environment [5].

However, regardless of the presented advantages, the effectiveness of an E-Learning system or any learning management systems in general relies on its usage by the students [6]. This research utilizes the Technology Acceptance Model (TAM) as its base model and a few external constructs which was adopted referencing to previous research that has been done before to further understand the acceptance and actual use of ITENAS E-Learning system in National Institute of Technology in Bandung. This research aims to propose further improvements on various aspects of ITENAS E-Learning system can be made based on the result of this research.

2 Materials and Methods

2.1 Technology Acceptance Model (TAM)

Technology Acceptance Model or TAM is a model that was designed to analyse and understand factors that influence acceptance of computer technology usage [3]. TAM is developed by Davis (1989) with the basics of reasoning action theory that mentions that social behaviour is supported by an individual's attitude that is designed to predict information system usage [4]. So far, TAM represents the most established and substantial foundation of technology acceptance, and a theory that is influential to explain an individual's acceptance towards a certain information technology [5], [6]. TAM also has been used extensively to recognize the factors affecting the technology acceptance of technology in various contexts [7]. Until now, TAM has been widely used in information technology research. Two main factors in TAM are Perceived Usefulness (PU), and Perceived Ease of Use (PEOU), which both are the most common factors that are used to explain user's behaviour intentions (BI), and actual use (AU) [8].

2.2 Structural Equation Modelling

Structural Equation Modelling (SEM) is a part of statistical technique that is very commonly used in research with its capabilities to model latent variables, various type of error measurements, and to test proposed theories [9]. SEM explains various calculations that accompany assumptions from an analysed system, with parameters based on statistical observations. This enables SEM model to explain calculations based on the parameters on latent variable analysis or observed variables [10]. SEM model provides effective tools to evaluate latent variables on its measurement model and test its relationship between structural model's latent variables [11].

2.3 Related Research

2.3.1 Learnability → Perceived Usefulness

Learnability (LE) is defined as the difficulty level faced by the users that try to attain knowledge related to their work [12]. Learnability can also represent the time that users need to learn the technology to get started and use it for their needs [13]. Ali et al. (2018) conducted research to understand and predict students' academic performance with the adaptation of cloud computing. This study shows that learnability, knowledge application, and knowledge sharing have a positive impact on usefulness of cloud computing technology, which shows that the use of knowledge and technology helps the students to solve academic problems in educational environment [14]. Therefore, we proposed the following hypotheses:
H1: Learnability positively impacts the perceived usefulness of ITENAS E-Learning system.

2.3.2 Self-efficacy → Perceived Ease of Use

Self-efficacy (SE) refers to a person's belief in their ability to finish a certain task utilizing a computer. Based on the result of the research conducted by Alfadda & Mahdi, self-efficacy positively impacts Zoom's ease of use on its use in language learning environment [15]. A study by Ching-Ter et al. on university students' behavioural intention to use GETAMEL e-learning system in Azerbaijan resulted that students' self-efficacy impact the ease of use of e-learning positively, consequently, leads to students' intention to use GETAMEL e-learning system [16]. Thus, we proposed the following hypotheses:
H2: Self-efficacy positively impacts the perceived ease of use of ITENAS E-Learning system.

2.3.3 Social Norm → Perceived Usefulness & Perceived Ease of Use

Ibili et al. explains that social norm (SN) is a subjective belief on the users' needs to use a new system. Ibili et al. also conducted a study on math teachers' perceptions towards augmented reality tutoring system, which results on social norm has a positive impact on math teacher's perceived usefulness and perceived ease of use, which elaborates that by knowing the capacity of augmented reality on online group making and its usage in collaborative application between teachers can increase the impact of social norms [17]. In research conducted by Revythi & Tselios, it resulted that social norm significantly impacts both perceived usefulness and perceived ease of use in Greece's higher education level. This explains that social influence impacts users' acceptance of a technology and how it shapes users' attitude towards a technology [18]. Therefore, we proposed the following hypotheses:
H3: Social Norm positively impacts the perceived usefulness of ITENAS E-Learning system.
H4: Social Norm positively impacts the perceived ease of use of ITENAS E-Learning system.

2.3.4 Perceived Ease of Use → Perceived Usefulness & Attitude Towards Use

According to Davis (1989), Perceived Ease of Use (PEOU) explains levels of users'

belief on using a certain technology is easy and effortless. PEOU measures the users' belief that a certain system is easy and stress-free [19]. Research on Alipay's mobile payment conducted by Li et al., perceived ease of use was found to have a positive impact on perceived usefulness [20]. Lee et al. also performed research on virtual reality technology adoption which explains the importance of perceived ease of use as a factor on influencing perceived usefulness on the technology adoption [21]. Based on previous research results, we proposed the following hypotheses:
H5: Perceived Ease of Use positively impacts perceived usefulness of ITENAS E-Learning system.
H6: Perceived Ease of Use positively impacts attitude towards use of ITENAS E-Learning system.

2.3.5 Perceived Usefulness → Attitude Towards Use & Behaviour Intentions of Use

Davis (1989) stated that Perceived usefulness (PU) explains users' levels of trust that a system helps on increasing work performances of the users. Perceived Usefulness shows that people will use several computer systems if the usage of those systems are able to increase their work performance even when there is a positive or negative feeling when that system is being used [19]. According to research conducted by Wahab found that perceived usefulness affects attitude towards use and increase both students' attitude and acceptance to utilize e-textbook and Course Management System (CMS) [22]. Based on previous research results, we proposed the following hypotheses:
H7: Perceived usefulness positively impacts attitude towards use of ITENAS E-Learning system.
H8: Perceived usefulness positively impacts behaviour intentions of use of ITENAS E-Learning system.

2.3.6 Attitude Towards Using → Behaviour Intentions of Use

Salloum et al. stated that attitude has a meaning of levels of individuals' feeling towards E-Learning system whether it's a positive or a negative feeling. Salloum et al. also conducted research on students' acceptance on E-Learning technology which shows that the students' attitude positively impacts on their behaviour towards E-Learning system. The result is since the students show positive attitude towards using E-Learning system which leads to behaviour intentions to use the E-Learning system to increase positively [23]. Based on these findings, we proposed the following hypotheses:
H9: Attitude towards use positively impacts behaviour intentions of use of ITENAS E-Learning system.

2.3.7 Behaviour Intentions of Use → Actual Use

Behaviour intentions refer to the intention on continuous use of a particular system now and in the future. Salloum et al. also found that behaviour intentions of use positively impact actual use, which means that with the increasing of users' intentions, it will simultaneously increase the actual use of a system [23]. Al-Maroof & Al-Emran also found that behaviour intentions of use of Google Classroom impact its actual use of the system [24]. Another finding shows that there's a significant impact of students' behaviour intentions of use towards actual use of Zoom application in language learning environment [15]. Based on

these findings, we proposed the following hypotheses:
H10: Behaviour intentions of use positively impacts actual use of ITENAS E-Learning system.

3 Research Methodology

The target population for this study is the current students at National Institute of Technology in Bandung, Indonesia, with over 7000 students enrolled and assigned as active students spread on 13 different majors. After target population is decided, the size of sample needs to be put into consideration. For this research, Inverse Square Root Method is utilized to decide the sample size. With 5% significance level and expected Pmin of 0,21-0,3, the sample size for this research is 69 samples.Based on the sample size, data collection was conducted in November 2022 by using Google Form as a platform for respondents to answer various questions that has already decided beforehand. This survey was distributed to 13 different majors within National Institute of Technology. The accepted response that was collected was 81 responses, which is over the sample size for this research. After the response required based on the sample size is collected, the next step is to proceed to various testing necessary, where the first test conducted is outer model testing consisting of both reliability and validity checks of indicators for each construct. The second test that needs to be conducted is the inner model testing to assess the impact of variables' relationships, as well as to collect findings based on the proposed hypotheses. These steps were performed with the assistance of SmartPLS.

4 Results

4.1 Outer Model Analysis – Outer Loadings

The calculation on outer loadings in outer model analysis was done by running the PLS-SEM algorithm within Smart PLS software. The requirement for an indicator to be considered valid in this test is that indicator must have a score at least 0.7. When an indicator has an outer loading score below 0.7, an elimination of that indicator needs to be done. Out of all indicators, there are in total 4 indicators that is eliminated based on its outer loadings score that does not meet the minimum of 0.7.

4.2 Outer Model Analysis – Average Variance Extracted (AVE)

To find the variance value of each construct, the AVE calculation is conducted, where every indicator needs to have minimum AVE score of 0.5. Result of the AVE calculation shows that every construct passed the minimum AVE score of 0.5, which states that constructs of this study have good convergent validity.

4.3 Outer Model Analysis – Reliability Testing

The goal of conducting reliability test is to find the reliability of each construct based on the indicators of the constructs. The minimum score for a construct to be considered as reliable is 0.7 on both Cronbach's Alpha and Composite Reliability, but Hair (2021) stated that if there is a construct that has 0.6-0.7 its still acceptable in exploratory research environment.

Table 1. Reliability Testing Result and AVE Score

Construct	Cronbach's Alpha	Composite Reliability	AVE Score
Actual Use	0.886	0.891	0.815
Attitude Towards using	0.668	0.669	0.750
Behavior Intentions of Use	0.723	0.732	0.726
Learnability	0.625	0.676	0.570
Perceived Ease of Use	0.889	0.891	0.819
Perceived Usefulness	0.740	0.757	0.655
Self-Efficacy	0.787	0.807	0.597
Social Norms	0.814	0.836	0.727

4.4 Outer Model Analysis – Discriminant Validity

Discriminant Validity testing is conducted to find that every indicator from each construct is distinct and can only represent its own construct. To perform this step, Heterotrait-monotrait Ratio (HTMT) is utilized, where the score cannot be higher than 0.9.

Table 2. Discriminant Validity Result

	AU	ATU	BI	LE	PEOU	PU	SE	SN
AU								
ATU	0.855							
BI	0.791	0.924						
LE	0.780	0.975	0.795					
PEOU	0.562	0.898	0.660	0.827				
PU	0.625	0.828	0.502	0.582	0.666			
SE	0.488	0.773	0.551	0.693	0.809	0.661		
SN	0.408	0.593	0.512	0.573	0.542	0.574	0.639	

4.5 Coefficient of Determination (R2)

One of the steps on conducting inner model analysis is through coefficient of determination. The result of this calculation is to find the effect of exogenous variables on predicting the value of its endogenous variables. Hair (2021) stated that Coefficient of determination has certain qualifications, where if the R2 score is equal or above 0.95 (substantial), 0.50-0.75 (moderate), and 0.25-0.50 (weak).

Table 3. R^2 Calculation Result

Construct	R-Square	Classification
Actual Use	0.410	Weak
Attitude Towards using	0.541	Moderate
Behavior Intentions of Use	0.419	Weak
Perceived Ease of Use	0.504	Moderate
Perceived Usefulness	0.354	Weak

4.6 Path Coefficient Analysis

The next step in the analysis of inner model is the path coefficient analysis through bootstrapping process. This calculation produces P values, T statistics, path coefficient values, and standard deviation. To determine the significance of constructs' relationships, T

statistics and P values must be above a certain value. For the P values, its value must be below 5% or 0.05. As for the T statistics, based on the calculation with P values of 0.05, and degree of freedom of 79, it needs to be above or the same value as 1.99 for the relationship to be classified as significant.

Table 4. Path Coefficient Calculation Result

Hubungan Variabel	Original sample (O)	Sample mean (M)	Standard deviation	T statistics	P values
ATU → BI	0.648	0.641	0.107	6.049	0.000
BI → AU	0.640	0.638	0.090	7.083	0.000
LE → PU	0.090	0.120	0.129	0.700	0.484
PEOU → ATU	0.530	0.532	0.103	5.164	0.000
PEOU → PU	0.373	0.357	0.125	2.977	0.003
PU → ATU	0.298	0.293	0.104	2.852	0.004
PU → BI	-0.002	0.022	0.173	0.010	0.992
SE → PEOU	0.624	0.631	0.072	8.632	0.000
SN → PEOU	0.145	0.143	0.100	1.447	0.148
SN → PU	0.248	0.254	0.151	1.640	0.101

5 Discussion

H1: Learnability → perceived usefulness

Students' perception of the usefulness of ITENAS E-Learning system may be influenced by other unknown factors that have yet to be discovered. With the positive relationship between the two variables, there will be an increase of students' perceived usefulness if the learnability is increased, even though the increase will not be substantial due to its path coefficient value. This finding is supported with the f2 value of learnability towards perceived usefulness is at 0.8%, which means that learnability has little impact on perceived usefulness, and there are possibilities of other unknown factors outside of the existing variables in this research that has an effect on perceived usefulness of ITENAS E-learning system, such as the usefulness of ITENAS E-learning system is affected because of its mandatory nature in ITENAS environment, this makes that the students does not consider the level of difficulty on using ITENAS E-learning system. Based on this analysis, hypotheses H1 is rejected.

H2: Self-efficacy → perceived ease of use

Students' confidence of their ability on utilizing ITENAS E-learning system affects their perception that ITENAS E-learning system is easy to use. Because of the positive relationship, with the increasing of students' self-efficacy on computation skills, it will also improve students' ease of use perception in ITENAS E-learning system with the improvement being substantial. This result is supported with the value of f2 is 57.7% based on the calculation result, which means self-efficacy has a substantial effect towards perceived ease of use, and there are still other factors that affecting perceived ease of use outside of this research. Based on the analysis result, H2 hypotheses is supported.

H3: Social norm → perceived usefulness

Student perceptions of the usefulness of the ITENAS e-learning system may be influenced by other factors that are not yet known. With the positive relationship that the 2 variables have, if there is an increase on students' social norm, there will al so be an increase on students' perceived usefulness towards ITENAS E-Learning system, where small increase will appear. These findings are supported with the calculated f2 value of 7.2%. This

explains how social norms little impact on perceived usefulness have, while other unknown factors may have a more positive impact on perceived usefulness, for example that usefulness of ITENAS E-Learning system is impacted with how the teachers utilize the ITENAS E-Leaning system in teaching activities. Based on this analysis, hypotheses H3 is declared to be not supported.

H4: Social norm → perceived ease of use

A student's subjective opinion regarding the use of the ITENAS e-Learning System does not affect the student's perception of the ease of use of the ITENAS E-Learning System. Student perceptions of ease of use may be influenced by other unknown factors. Since the relationship between the two variables is positive, as students' social norms increase, students' perception of the ease of use of the ITENAS e-Learning system also increases, albeit only slightly. There are no other e-learning systems that students use during their learning activities. This means that no inter-system comparisons have been made between the ease of use of other e-learning systems and her ITENAS e-learning system. Based on this analysis, the H4 hypotheses is stated to be not supported.

H5: Perceived ease of use → perceived usefulness

A students' perception of the ease of use of the ITENAS e-Learning System influences their perception of the usefulness of the ITENAS e-Learning System. A positive relationship between the two variables and an increase in students' ease of use perception significantly increases students' perception of usefulness of the ITENAS e-learning system. In the f2 calculation, the value of f2 is 12.7%, and perceived ease of use does not significantly affect perceived usefulness. This means that there are still unknown variables that affect perceived usefulness. Based on this analysis, the H5 hypotheses is supported.

H6: Perceived ease of use → Attitude towards use

Students' ease of use perception of the ITENAS e-Learning System influences their attitude towards the ITENAS e-Learning System. If the relationship between the two variables is positive and the ease of use of the ITENAS e-Learning system increases, so does students' attitude toward the ITENAS e-Learning system, resulting in a significant increase. These findings are supported with the calculated f2 value of 43.2%, which means that perceived ease of use has a substantial impact on attitude towards use, and there are still unknown factors that can impact attitude towards use outside of this research. With the analysis result, H6 hypotheses is stated as supported.

H7: Perceived ease of use → Attitude towards use

The ease of use of the ITENAS e-Learning System influences the attitude of students towards the ITENAS e-Learning System. Due the positive relationship between these two variables, with the increase of students' perceived ease of use, their attitude towards ITENAS E-Learning system increases substantially. Perceived of ease of use, however, does not significantly affect attitudes toward use, with its f2 of 13.6%, which means there are still other unknown variables that as more effect towards attitude towards use. Based on the analysis, hypotheses H7 is accepted.

H8: Perceived usefulness → behaviour intentions

The ties between perceived usefulness and behaviour intentions of use is insignificant and negative. In other words, the student's perception of the usefulness of the ITENAS e-learning system does not affect their intention to continue using the ITENAS e-learning system. Because of the negative relationship, if there is an increase on students' perceived usefulness, there will be a slight decline on their behaviour intentions of use towards ITENAS E-Learning system. Hence, this result does not support H8 hypotheses.

H9: Attitude towards use → behaviour intentions

The ties between attitude towards use and behaviour intentions of use has a significant

impact, with a positive relationship. In another words, students' attitude towards ITENAS E-Learning system impacts their behaviour intentions towards ITENAS E-Learning system. With the positive relationship of the two variables, with the increase of students' attitude, their intentions toward ITENAS E-Learning system will also increase substantially. This result is supported with the f2 value of 47.5%, which means attitude towards use has a high effect towards behaviour intentions of use with the possibility of unknown factor that influences behaviour intentions of use. With this result, H9 hypotheses is supported.

H10: Behavioural intentions of use → actual use

The relationship between behaviour intentions and actual use has a large positive impact. In another words, students' intention to use ITENAS E-Learning system affects their actual use of ITENAS E-Learning system, and with the increase of students' behaviour, students' actual use will also increase substantially. Behaviour intention of use also have an effect of 69.6%, which have a big effect on actual use, with the possibility of other unknown factors that influence the actual use. Based on this analysis, H10 hypotheses is supported.

6 Conclusions

This research has a goal to understand students' acceptance and the use of the existing ITENAS E-Learning system after COVID-19 pandemic period in National Institute of Technology is over. It was found that out of 10 proposed hypotheses, there are 4 hypotheses which is not supported in this study. A few recommendations are proposed based on the result found. The first recommendation is to make minimum content requirements and Standard Operational Procedure (SOP) on college course content management to improve system's learnability. We believe that by having a content management minimum requirements and standardized content in a course, it can make the usage of ITENAS E-Learning system easier for the students' as well as able to increase, students' attachments, actual use, and the quality of life of ITENAS E-Learning system. The second recommendation is to add User Tour, or Tool Tip to increase learnability, and increase the ease of use of ITENAS E-Learning system from students' perspective.

There are a few limitations that were faced during this study. The small sample size in this research might impact the result of this study. With the bigger sample size, it is possible to get a higher accuracy of the result which can affect the overall study. Lack of interview activity is the second limitation faced in this study. With interview activity, the result of the study can be validated even further based on the result of the interview. The third limitation is the relatively short amount of time in this research. With the longer time to conduct various activities like data collecting and data processing, it can provide a better result.

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