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Factors of using e-learning in higher education and its impact on student learning

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ABSTRACT

This research was conducted to evaluate the adoption of e-learning in higher education and its impact on students. The quantitative research design was used in this study, and the Technology Acceptance Model (TAM) was used with two external variables Perceived Enjoyment (PEN) and Perceived Self-Efficacy (PSE), to analyse the validity and reliability of items and to test the hypotheses. This study was conducted among 592 undergraduate students who were selected using a random sampling technique. The findings of this study have successfully proven all ten hypotheses. It was evident that the students enjoyed E-learning's adoption, which had succeeded in increasing students' motivation to learn, increased students' confidence, and expanded students' knowledge.

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1. INTRODUCTION

The development of science and technology, particularly ICT, also has a lot of potential impacts on the current progress of learning. Primary, secondary, and special education may use ICT to help learners' learning processes. The quality presented is indeed the pace and ease of obtaining information or resources, other than multimedia tools that can improve the interactive representation of an educational process [1],[2]. The implementation of e-learning is now a requirement rather than merely a right or temptation. In the current circumstance, e-learning is unavoidable due to the virus outbreak, making it compulsory to avoid face-to-face interactions. E-learning has many benefits, such as providing a more convenient service that facilitates learning through electronic or online space, enabling users to access flexible education and learning content, making learning processes more accessible, enhancing learning performance, and promoting learning experiences.

Moreover, e-learning assists the improvement of the quality of the education system as it involves the use of internet technologies in the delivery of learning. The main criteria of e-learning are: (i) e-learning is a network capable of updating, distributing, and sharing teaching and information materials, (ii) sending end users the information by using standard computers. However, the term e-learning is related to the use of the internet and the interpretation of educational technology. E-learning is a system of education that uses electronic applications to support the internet media, computer networks, and stand-alone computing teaching

and learning processes. However, it cannot be denied that internet-based learning is among the widely used e-learning platform today [3].

In earlier research [4], a study on the readiness of several universities to use the E-learning Readiness (ELR) model on the application of e-learning systems found that five ELR factors, namely human resources, finance, infrastructure, innovation, and organizations influence the instructors' perceived ease of use and perceived usefulness of the e-learning system and consequently their actual use. The study, however, found that instructors are not yet ready for the implementation of e-learning. These findings raise the question of whether the use of e-learning will succeed or not. In order to address this particular issue, more research needs to be conducted to find out how e-learning technology is embraced by users. The level of usage can be described by the degree of consumer acceptance of technology. The use of technology is high when the level of user acceptance is high, and when the principle [5] applies to it, it can be assumed that the implementation of e-learning is successful. Therefore, the confidence level of user acceptance of the e-learning program is evaluated in this study. The performance quality of e-learning programs is expected to be achieved.

Online learning is practiced in almost all universities and tertiary institutions across the globe over the last ten years. Since then, it has adopted the traditional approaches to teaching and learning, allowing students to use a digital system that manages courses, materials, discussions, and assignments and tests through the internet [6],[7]. Universities worldwide have invested millions of dollars in designing and maintaining their e-learning programs. Moodle and Blackboard are among the popular online learning systems. Many universities use their personally-developed e-learning systems. Therefore, it is vital to know the underlying reasons as to why students choose or avoid using the e-learning system to ensure that it is fully implemented and its benefit is enjoyed [8],[9]. Online education and e-learning are characterized by an Internet connection to facilitate the delivery of teaching content, communication, and collaboration in a virtual environment between students and teachers. Furthermore, e-learning also provides face-to-face contact with academic staff [10].

Theoretical Background

Technology Acceptance Model (TAM) is a theoretical framework that has been widely used in various fields such as industry and education that supports information technology processes. Many academicians in education have used TAM to clarify consumers' adoption of technology, including e-learning, immersive learning tools, digital libraries, and e-journals. TAM provides different factors to track external influences on to central inner values: perceived usefulness (PU) and perceived ease of use (PEOU). [11] stated that the perceived ease of use is the extent to which a person believes that using a particular system would be effort-free and valuable to the degree a person believes using a particular system would improve his employee's productivity. Each of these values impacts the mind-sets of consumers towards the use of information systems (IS).

While e-learning is a resource to improve education and training, it is of no use unless users embrace it as a learning tool. As e-learning uses computer technology, TAM is commonly used and expanded in an e-learning area of study. The two TAM constructs (perceived usefulness and ease of use) were used to assess the acceptance of student websites as a practical learning resource by university students. The findings showed that the website's perceived usefulness and ease of use are essential factors for accepting and using the website as a secure and effective learning technology. In order to know an e-learning engineer's acceptance, Bauwens (2020) suggested a construct that tests the degree to which one assumes a specific system is free of threats to privacy and health [12],[13]. Their empirical analysis promotes the perceived quality of engineers' intention to use e-learning, suggesting that students must be assured that they are free of the threats to privacy and safety.

Research model & hypotheses development

The conceptual model and related hypotheses are depicted in Figure 1.

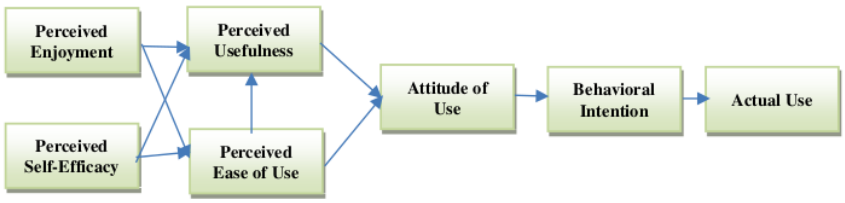

Figure.1 Research Model

Based on the figure 1, the preceding literature analysis, a conceptual model was established by merging TAM with PEN and PSE to examine the intents of students to adopt and implement E-learning technologies in online learning.

Perceived Self-Efficacy (PSE)

The user's understanding of self-efficiency is his ability to use this content to accomplish a topic. Regarding PUS, the user understands everyone's potential for using e-learning. Regarding self-efficacy, the [14] study shows that the key to explaining the use of technology in classroom education is self-efficacy. [15] research showed that users have an excellent mindset to e-learning, including awareness of self-efficacy, pleasure, utility, and purpose of using the behavior. It was then suggested the following hypotheses:

H1: PSE has a direct and robust effect on the use of e-learning by PUS

H2: PSE has a direct and robust influence on PEOU's use of e-learning.

Perceived Enjoyment (PEN)

Perceived Enjoyment is how instructors believe that e-learning teaching is a good and enjoyable activity. Davis and colleagues' findings demonstrate that people's intention of using computers is impacted by their perceptions of improving work performance and their entertainment level [16]. The results indicate that responsiveness and perceived gratification play a significant role in shaping users' attitudes and expectations in online learning media [17]. Therefore, concerning e-learning, we can postulate a positive relationship between perceived pleasure and e-learning intent. Thus, the third and fourth hypotheses are as follows:

H3: The PEN has positive and direct effects on the PUS of e-learning.

H4: PEN has positive and direct effects on the PEOU of e-learning.

Perceived Ease of Use (PEOU)

PEOU is defined as how effortlessly technology is to be used [18]. In this study, the e-learning of PEOU is interpreted by how easy it is for users to use E-learning. The analysis shows that the acceptance of technology is growing as PEOU increases [19]. This study identifies the PEOU traits for the educational use of E-learning and the impact of PEOU on PUS and ATU. The following hypotheses were then proposed:

H5: PEOU has positive and direct effects on the E-learning PUS

H6: PEOU has positive and direct effects on ATU e-learning.

Perceived Usefulness (PUS)

PUS are described as how users feel a particular system will enhance productivity [20]. PUS E-learning is defined in this study as the extent that users believe the use of e-learning will improve educational performance. Literary review in various academic fields has emphasized the significance of PUS in the development of new technologies [21]. The research uses PUS characteristics to examine the effect of E-learning on students and the impact of PUS on ATU and BI. The following hypotheses were then proposed:

H7: PUS has positive and direct effects on ATU e-learning

H8: PUS has substantial and direct effects on e-learning BI.

Attitude of Use (ATU)

Several studies on ATU regarding technology acceptability have shown that ATU can improve BI [22]. In studying online, PEOU and PUS [23], affect ATU. In this analysis, the feature of ATU is to test students' acceptability of E-learning. The following theory was formulated:

H9: ATU has positive and direct effects on e-learning BI

Behavioral Intention (BI)

BI is a behavioral propensity in the future to continue using a tool [24]. Several studies have studied BI's acceptance of technology, and results showed that BI has a strong relationship with AU [25]. Researchers have investigated the BI attributes of actual use in this study. Then the following hypothesis was suggested:

H10: BI has a positive and direct impact on the E-learning AU.

Actual Use (AU)

The full range of modern technologies is AU. The intensity and length of the use of technology can be assessed. According to [26], the AU systems offer substantial practical significance for information and

technology impact assessment. AU defines the time and frequency of usage that interacts with advanced technologies [27]. In this study, researchers measured students' AU based on the time allotted to e-learning.

2. METHOD

Participant

Questionnaires were distributed to 592 undergraduate students from universities in Indonesia, aged between 18 to 23. The respondents were surveyed about their experience using the E-learning during the Covid-19 pandemic from September 2021 until January 2022. The study was well-balanced in gender (58% women and 42% men). As university students, the answers varied across the research.

Data Collection

The university students were asked to share their online learning experience during the Covid-19 pandemic through various learning activities in Indonesia. This study aims to clarify the main objectives of this project: to find out the effectiveness of the use of E-learning during the Covid-19 pandemic in Indonesia. The university's findings can be used by the university to evaluate the effectiveness of e-learning in Indonesia. Besides, the findings could also inform the Indonesian Ministry of Education on the effect of online learning in Indonesia. In this study, the researchers worked with the university to help distribute the questionnaire to university students, and it only took 10-13 minutes for the respondents to fill out the questionnaire. A total of 600 respondents have filled in the questionnaires, but it turned out that only 592 responds fulfil the criteria. Eight were incomplete and thus excluded from the study. The questionnaire used a Likert scale between 1 (in strong disagreement) and 5 (strong agreement) to measure 26 items in the model construct. The constructs used in this questionnaire are shown in Appendix A.

Measures

In this study, data analysis was conducted using the Structural Equation Modelling (SEM) method. The Smart PLS version 3.0 program [28]. PLS is a well-known method for the evaluation of the path coefficients of structural models and has become more popular with marketing research in general, in the last decade, due to its ability to model latent structures in irregular and small to medium sample size conditions [29]. Nevertheless, PLS research has been carried out and has proven appropriate as one element in this study. The PLS algorithm mechanism is also used to evaluate the set, weight, and path coefficients and determine the hypothesis's significance by using the bootstrap method (5000 sample). The measurement model is accurate and effective for the empirical validation protocol for the structural model dependency structure [30]. Finally, the blindfold technique was used for developing and evaluating the reliability of the theoretical frameworks.

3. RESULTS AND DISCUSSION

Data that had been collected and suitable for processing are subsequently tested using Smart PLS 3.0.

Results

3.1. Measurement Model Evaluation

The evaluation of the measurement model (outer model) is carried out to find out the relationship between latent variables and the indicators being studied to explain each indicator associated with the latent variable. This is related to the validity and reliability of the instruments used [31]. The validity of these instruments was tested using discriminant validity and convergent validity.

Table 1. Measurement Instrument

Constructs	Items		Sources
Perceived Self-Efficacy	PSE1	I feel confident in myself when I teach e-learning	[32]
	PSE2	I am happy with e-learning	
	PSE3	I feel anxious before I teach e-learning.	
Perceived Enjoyment	PEN1	E-learning as a tool is satisfactory	[33]
	PEN2	E-learning is enjoyable as a teaching resource	
	PEN3	The use of e-learning as a method is encouraging.	
Perceived Ease of Use	PEOU1	I consider e-learning easy to use	[34]
	PEOU2	E-learning courses are accessible to schedule and coordinate.	
	PEOU3	I can easily and intuitively use E-learning in my classes.	

	PEOU4	The graphical interface design of e-learning components is clear and comprehensible.	
	PEOU5	The e-learning platform makes it easy for me to achieve my goals.	
Perceived Usefulness	PUS1	E-learning increases the work efficiency	
	PUS2	The use of E-learning helps me to save time.	
	PUS3	Using E-learning helps to increase one's work performance.	
	PUS4	Using E-learning makes my job easier.	
Attitude of Use	ATU1	It is a good idea to use e-learning	
	ATU2	E-learning is a pleasant way to learn.	
	ATU3	The use of e-learning is a positive idea.	
Behavioral Intention	BI1	I expect to continue using e-learning to promote classes.	
	BI2	I plan to use e-learning as much as possible in my classes.	
	BI3	I will discuss the positive benefits of e-learning in my classes.	
	BI4	I expect that in the next I would use e-learning.	
Actual Use	AU1	I use E-learning on a daily basis	[35][33], [36]
	AU2	I use E-learning frequently	
	AU3	I use E-learning to help my studies.	
	AU4	I use E-learning in my group.	

Based on table 1, the validity of these instruments was tested using discriminant validity and convergent validity.

3.2. Convergent Validity

Research results for [37] are evaluated by evaluating the loading factor value of every indicator in the displayed structure

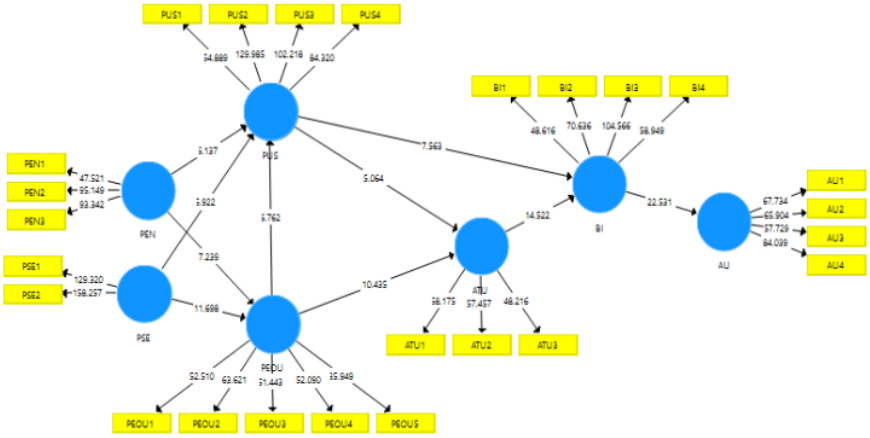

Figure 2. Outer Loading Model

Based on figure 2, all indicators have a loading factor value that satisfies the validity criteria, more significant than 0.70 (> 0.70). This subsequently implies convergent validity. The load of the PSE3 indicator is below the minimum level (< 0.70), which means that both indicators must be eliminated. It is in line with the statement from [38], where each indicator is a good item if it has a loading factor above 0.70.

3.3. Discriminant Validity

The table 2 belowed provides the results of an assessment of discrimination based on each indicator's cross-loading factor. The correlation value of the indicator with the intended construct should, according to Chin (2010), be higher than the significance level of the identifier with other constructions. Table 2 shows that the indicator X has a significant load factor with ATU1, ATU2, and ATU3, which are higher than the load

factor outside the loading factor, i.e., the ATU1 to BI (0.609), ATU1 to PEN(0.490), ATU1 to PEOU (0.523), ATU1 to PSE(0.495), ATU1 to PUS (0.503). The ATU1 can, therefore, be described as a valid discriminant.

Table 2. Cross loading testing

Indicator	ATU	AU	BI	PEN	PEOU	PSE	PUS
ATU1	0.848	0.557	0.609	0.49	0.523	0.495	0.503
ATU2	0.858	0.575	0.551	0.487	0.486	0.431	0.397
ATU3	0.823	0.505	0.524	0.486	0.517	0.426	0.37
AU1	0.556	0.854	0.543	0.37	0.541	0.498	0.428
AU2	0.56	0.875	0.533	0.458	0.559	0.497	0.469
AU3	0.566	0.865	0.503	0.441	0.541	0.51	0.49
AU4	0.57	0.883	0.566	0.423	0.599	0.546	0.469
BI1	0.543	0.487	0.811	0.492	0.527	0.514	0.517
BI2	0.563	0.495	0.873	0.44	0.522	0.437	0.437
BI3	0.599	0.58	0.896	0.48	0.555	0.494	0.469
BI4	0.579	0.545	0.839	0.421	0.507	0.5	0.453
PEN1	0.475	0.413	0.44	0.838	0.411	0.489	0.482
PEN2	0.533	0.432	0.476	0.9	0.483	0.507	0.508
PEN3	0.518	0.437	0.497	0.901	0.493	0.525	0.517
PEOU1	0.525	0.543	0.517	0.472	0.819	0.546	0.531
PEOU2	0.519	0.538	0.517	0.421	0.852	0.478	0.46
PEOU3	0.482	0.512	0.505	0.41	0.835	0.44	0.443
PEOU4	0.497	0.528	0.522	0.5	0.827	0.55	0.539
PEOU5	0.469	0.548	0.488	0.355	0.804	0.424	0.393
PSE1	0.491	0.532	0.525	0.531	0.546	0.934	0.556
PSE2	0.514	0.573	0.54	0.547	0.567	0.938	0.564
PUS1	0.47	0.479	0.478	0.492	0.511	0.506	0.877
PUS2	0.438	0.479	0.5	0.503	0.525	0.562	0.929
PUS3	0.459	0.48	0.495	0.536	0.528	0.558	0.915
PUS4	0.465	0.491	0.509	0.535	0.527	0.539	0.899

Based on Table 2, the loading factor values of all indicators ranged between 0.804 and 0.938. This proves that sufficient requirements have been established as all values exceed 0.70 (> 0.70), implying convergent validity. As an observed variable in the measuring model, there are 25 valid indicators (items). After completing the iteration process, discrimination validity was examined based on the cross-loadings from the final iteration of the measuring model.

3.4. Cronbach's Alpha, Composite Reliability & AVE

Instrument reliability testing is performed by evaluating the composite reliability value (CR), Average Extracted Variance (AVE), Alpha Cronbach, and Rho A values, as shown in Table 3.

Table.3 Reliability test measurement model

Indicator	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
ATU	0.797	0.800	0.881	0.711
AU	0.892	0.894	0.925	0.756
BI	0.877	0.879	0.916	0.732

PEN	**0.854**	**0.859**	**0.912**	**0.775**
PEOU	**0.885**	**0.889**	**0.916**	**0.685**
PSE	**0.858**	**0.859**	**0.934**	**0.876**
PUS	**0.926**	**0.927**	**0.948**	**0.820**

From the results in Table 3, composite reliability (CR) coefficients surpassed the basic threshold of 0.881 to 0.948 (> 0.7). The Cronbach Alpha coefficient ranged from 0.797 to 0.926. All coefficients were higher than the lower limit (> 0.7) and were acceptable. Rho A has the lowest score of 0.800 and the highest score of 0.927, which are also higher than 0.7. The average Extracted Variance Value (AVE) was between 0.711 and 0.876. This shows that the AVE value achieved was higher than the minimum recommended score. The reliability tests showed excellent internal consistency.

3.5. Structural Model Evaluation

The determination coefficient (R Square) is usually used to measure the model's predictive power to evaluate the structural model. This is the square correlation between the actual value and the prediction of particular endogenous buildings. The coefficients represent the combined effects on latent endogenous variables of exogenous variables. Since the range of R Square is 0-1 with higher values suggesting a higher prediction point, it is challenging to create an appropriate thumb rule for R Square. This is because the values PEN on the complexity of the model and the discipline of research.

Table.4 R Square

Indicator	R Square	R Square Adjusted
ATU	0.402	0.400
AU	0.382	0.380
BI	0.505	0.504
PEOU	0.404	0.402
PUS	0.477	0.474

As presented in table 4, PSE and PEN are possible to prove 0.404 PEOU variants with satisfactory results. PSE, PEN & PEOU will then jointly describe 0.477 PUS variants to include sufficient levels, then PUS to ATU with a sufficient number of levels. ATU to BI reveals a variation of 0.505 to an acceptable level, and finally BI to AU 0.382 to a reasonable degree of BI to AU 0.382.

Table 5.Hypothesis Testing

Hypothesis	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Decision
ATU -> BI	0.525	0.526	0.036	14.522	**0.000**	Supported
BI -> AU	0.618	0.619	0.027	22.531	**0.000**	Supported
PEN -> PEOU	0.275	0.277	0.038	7.239	**0.000**	Supported
PEN -> PUS	0.265	0.266	0.043	6.137	**0.000**	Supported
PEOU -> ATU	0.467	0.469	0.045	10.435	**0.000**	Supported
PEOU -> PUS	0.267	0.268	0.040	6.762	**0.000**	Supported
PSE -> PEOU	0.436	0.436	0.037	11.698	**0.000**	Supported
PSE -> PUS	0.287	0.286	0.048	5.922	**0.000**	Supported
PUS -> ATU	0.236	0.237	0.047	5.064	**0.000**	Supported
PUS -> BI	0.282	0.282	0.037	7.563	**0.000**	Supported

On the table 5 displays the findings and is accompanied by Figure 2. The hypothesis regarding the interaction between the buildings was checked for the strength between the structures listed in the conceptual framework. To use it, the structural equation model was tested by calculating the path coefficient between structures and by evaluating the significance of the path coefficient and the level of importance. In Smart PLS, T values were calculated using the bootstrap method and a two-tail t-distribution table to evaluate the critical level of the direction. Path coefficients and significance rates were reached by using Smart PLS with 5000 samples. Bootstrapping.

Table.5 and Figure 2 show that H1 through H10 hypotheses are supported by structural models where each hypothesis reinforces one another. The first hypothesis (H1) shows that with the support of t-value 5.922 (> 1.65) and P-value 0.000 (< 0.05), PSE has a significant positive effect on EFA. The second hypothesis (H2) indicates that PSE has significant effect of 11.698 (> 1.65) and 0.000 (< 0.05) t-values on the PEOU. The PEN hypothesis also has a significant and positive impact on the PEOU with a t value of 6.137 (> 1.65) and the P-value of 0.000 (< 0.05), with a t-value of 7.239 (> 1.65) and a P-value of 0.000 (< 0.05) in the 3rd hypothesis (H3) PEN. The fifth hypothesis of the PEOU with a t-value of 6,762 (> 1,65) and a p-value of 0,000 (< 0,05), and the sixth hypothesis that a PEOU has an impact on ATU with t-value of 10,435 (> 1, 96) at P of 0,000 (< 0,05) which was positively affected. In the seventh hypothesis, in which PUS affects ATU significantly and positively with the t value of 5.064 (> 1.65) and the value P of 0.000 (< 0.05), a hypothesis of PUS 8 with the value t 7.563 (> 1.65) and the value P of 0.000 (< 0.05) was also significantly positive in BI. Besides, the ninth hypothesis of ATU on BI showed a positive and meaningful effect of t 14,522 (> 1.65) and P 0,000 (< 0,05), and the tenth hypothesis (H10) of BI on AU indicated the highest positive value of t 22,531 (1,65) and P of 0,000 (< 0,05). Based on the results, the ten hypotheses were accepted.

Discussion

This study aimed to examine the dimensions of the TAM model for implementing e-learning in higher education by studying the factors influencing the willingness of students to use e-learning. BI is one of the critical factors in AU E-learning. The effectiveness of such a sample is controlled by the participation of university students in the model. Therefore, it is essential to evaluate university students' acceptance to ensure that students adopt this learning platform at the end of the course. An important finding of this research is that the external variables, namely Perceived Enjoyment (PEN) and Perceived Self-Efficacy (PSE), play a crucial role in specifically impacting the understanding of the advantages and expectations of ease of use. Each exciting outcome of this research seems to be that external variables, pleasure perception, and self-efficacy are considered to play a significant role in impacting the perception of e-learning advantages and perceptions of ease of use.

Based on the ten hypotheses that were tested, it turned out that the results showed that all hypotheses were proven and accepted, and thus this study was successful. Although there are many determinants in research, it does not affect the truth of this research results. Two external construct variables, namely PSE and PEN, also significantly influence the results on PEOU and PUS, as mentioned in hypotheses 1 to 2 between PSE to PUS and PEOU, the results were supported by the findings from [14] according to [15] and [8]. The PSE is a reflection of students' self when using e-learning and this has a direct impact when thinking about aspects of usefulness in using e-learning. Meanwhile, this PEOU shows that student efficacy is important in determining how to think about the ease of using e-learning. In hypotheses 3 and 4, PEN has a significant positive effect on PEOU and PU the were results were supported by [16] and according to [39], [40], so perceptions of pleasure in students have an impact on students' decisions that by using e-learning comfortably and being able to explore creativity. In hypotheses 5 and 6, PEOU has a significant positive effect on PUS and ATU. This finding is concurrent with the findings in [41]–[43] according to [44].

In hypotheses 7 and 8, PUS has a direct positive effect on ATU and BI. This finding is similar to the findings in [41], and related to [45]. The last two hypotheses, the 9th hypothesis, which is ATU on BI, showed significant, positive effect, similar to the findings in [46], [47] to support [48]–[50], and the 10th hypothesis of BI on AU, the highest significant value is the findings from [51] supported by [52], [53]. These further strengthening the truth of this current research findings.

4. CONCLUSION

The results of this current study have shown that students enjoy their e-learning experience and have posited that e-learning is an effective teaching and learning method to help the teaching and learning process. E-learning aims to promote interactive, positive, and generative education. This finding suggests that e-learning

is a student-centered learning approach that could increase students' understanding, confidence, and knowledge development.

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