Acceptance Of E-Learning Technology By Using The Technology Acceptance Model (TAM) Method

Ibrahim Hasan[1], Sait Abdullah[2*], Darojat Tubagus Ahmad[3]

[1] PT Pos Indonesia
[2] Politenik STIA LAN Bandung, Indonesia
[3] International College of Rajamangala Univesity of Technology Krungthep, Thailand
[*]Corresponding Author:
Email: Sait@poltek.stialanbandung.ac.id

Abstract.

The main aim of the study is to investigate the relationship between the variables included in the Technology Acceptance Model (TAM), and the core variables and the extended variables of the TAM. The research method is a quantitative research that tests hypotheses derived from variables extracted from the Technology Acceptance Model (TAM), which include the variables of perceived ease of use, perceived usefulness, attitude towards use, actual use, e-learning self- efficiency, and a set of variables. complexity To test the relationship between each variable, this study uses statistical tests using structural equation modeling (SEM) application tools SmartPLS. The results of the research hypothesis are (H1) the positive effect of e-learning self-efficacy (learning self-efficacy online) on the perception of comfort (perceived ease of use). (H2) positive effect of e-learning self-efficacy on perceived usefulness (perceived usefulness), (H3) positive effect of complexity on perceived ease of use. (H4) complexity has a positive effect on perceived usefulness. (H5) perception of ease of use (perceived ease of use) the use of e-learning affects the attitude to use (attitude to use). (H6) view of usefulness (perceived usefulness) positive effect of e-learning on usage attitude (attitude towards usage). (H7) perceived ease (perceived ease of use) negative effect on actual use e-learning (actual use). (H8) perceived usefulness of e-learning (perceived usefulness) positively affects actual use (actual use). (H9) usage attitude (attitude towards usage) positive effect on actual usage (actual usage). The practical implication of the research include conducting an extension study of external TAM variables, conducting a study with different objects and subjects and conducting a pretest of the samples to be studied in the prior to the research.

Keywords: *Technology Acceptance Model; SmartPLS and E-learning.*

I. INTRODUCTION

In recent years, there have been major changes in society and industry in the use of digital technology [1]. The use of sensor technology, robots (automated guided vehicles), conveyor belts, drones (unmanned aerial vehicles), QR codes, automation, big data analysis in the logistics industry and supply chain management can improve company performance [2]. The fourth industrial revolution (Industry 4.0), creates more interconnected functional areas across the business ecosystem, leading to value creation. Companies are adopting digital technologies such as big data, radio frequency identification (RFID), cloud computing, internet of things (IoT), and artificial intelligence to respond effectively to the dynamic business environment.Along with the current rapid development of technology and intense competition in the field of technology, this requires all organizations, both public and private, to appear as organizations that are able to adapt and respond quickly to developments in information systems [3]. An educational institution is no exception, improving the quality of education is a very important job of the educational institution. One of the technological developments in the field of education today is the system *e-learning* [4]. E-learning or online learning is an educational concept that uses information technology in the teaching and learning process [5]. In the implementation process, the *system e-learning* Sometimes several obstacles are found that will hinder successful use e-learning as a learning medium in educational institutions [6].

Therefore, universities must know and analyze the level of acceptance of the use of technology by both lecturers and students in implementing learning systems *online* This Acceptance of the use of technology is expected to be in the form of convenience and benefits in the system as well as explaining individual perceptions of the use of information system technology. Acceptance of the use of information

system technology can be a reference for assessing user acceptance of information technology Marikyan, D. & Papagiannidis, [7].Why does the author take Technology Acceptance Model (TAM) as an analytical tool to measure the level of technology acceptance *E-learning?* technology adoption studies investigate how and why people adopt new information technologies [8]. Second Technology Acceptance Model (TAM) is a personal acceptance model developed by Davis (1989) to understand and specifically describe the use and acceptance of technology [9] [10]. TAM is a simple, proven and robust technology acceptance model and is considered the most influential and existing technology acceptance model in the field of information systems research [11] [12].

II. THEORETICAL REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 Technology Acceptance Model concept

Davis (1989) created a model to describe the acceptance of technology that will be used by technology users. This model is known as *Technology Acceptance Model* (TAM). Acceptance Model for Technology Schemes according to McCord (2007), IT (Information Technology) usage behavior begins with a perception of benefits *(utility)* as well as perceptions about the ease of use of IT *(easy of use)*, these two elements are part of Belief [13]. Davis defines usability *(utility)* is based on the definition of the word helpful, namely that it can be used for beneficial purposes. Perception of usefulness *(perceived usefulness)* is a benefit that can be generated by someone when using IT. In the context of organizational utility, it is defined as an increase in individual performance, whether long-term or short-term, that occurs as a result of an opportunity to obtain various monetary incentives, whether they are physical, material, or non-material. According to Davis, another variable that influences a person's decision to use IT is the perception of ease of use of IT. There is no difficulty or need to try hard in ease (easy). Another perception about this heavy use focuses on the user's belief that the IT system used is not utilized with very hard effort.Individual attitudes towards IT use influence perceived usefulness *(Perceived Usefulness)* and perceptions of ease of use of IT (Perceived ease of use) influence individual attitudes towards IT use. Davis (1986) found in TAM that views on ease of use can also be used to reveal information about the functioning of IT itself, but not in the same way [14].

Davis' analysis of this research shows that individuals' perceptions of the ease of the IT utilization process correlate with future IT use as well as the desire to use it in the future. Model TAM (Technology Acceptance Model) by Davis (1989), Charness & Boot (2016) and Theory of Reasonable Action (TRA) by de Camargo Fiorini et al (2018) is a model that shows that several variables of the model TAM and TRA are influenced by personal beliefs about technology of the benefits of use (the benefits of using technology) [14] [15] [16]. Based on the above explanation, TAM (Technology Acceptance Model) is a behavioral theory that assumes that a person's actions and opinions about something determine attitudes and actions. Based on the explanation above, *Technology Acceptance Model* (TAM) is a behavioral theory which assumes that a person's actions and opinions about something will determine the attitudes and actions taken. A person's actions and opinions will influence his attitude towards technology adoption. There are several factors that influence the way people use technology. One of the most important factors is the usefulness & ease of using technology as a resourceful attitude in the context of technology users, which explains why people see the usefulness and ease of use of technology as the norm in technology adoption. The aim of this model is to convey the most important points of user vulnerability to technology adoption. This model establishes the attitudinal factors of ease of use and usability within each variable that can be used to describe relevant aspects of user behavior.

In connection with research related to the level of technology acceptance e- learning, researchers identified two TAM external variables, namely, *e-learning self-efficacy* and *complexity* (complication). These two variables are added to the TAM model as external variables *perceived usefulness*, and *perceived ease of use* which is then tested again for the relationship between the variables. The reason for adding the TAM variable is that it is hoped that it can reveal other variables, apart from the four core variables proposed by Davis (1989) as key factors as well as a broader perspective and better explanation of the technology acceptance process [17]. With the addition of these external variables, a total of six variables are constructed

in the model used in this research, namely: four core variables from TAM, namely: *perceived usefulness, perceived ease of use, attitude toward using*, and *actual usage* as well as two additional variables or expansions e-learning self-efficacy and complexity stated that research on technology acceptance or Technology Acceptance Model variables need to be expanded-external variables that influence variabel *perceived usefulness, perceived ease of use, attitude toward using*, and *actual usage*. Likewise Karahanna et al (1999) suggested the need to add extrinsic variables that influence perceived usefulness and perceived ease of use considering that TAM does not examine in more depth the variables that influence individual beliefs [18].

2.2 Hypothesis Development

As previously explained, measuring the level of acceptance of information technology begins with measuring the variable perceived level of convenience *(perceived ease of use)* and the perceived usability variable *(perceived usefulness)* [19] [20]. In research conducted by Saade et al (2007) and Tangke (2004) the variable perceived ease of use or perceived ease of use of information technology has a positive relationship with the variable attitude toward using or attitudes toward technology use [21] [22]. Ease of using technology creates a positive attitude. towards the use of information technology. Meanwhile, variables *perceived ease of use* in research Jogiyanto (2008) also has a positive effect on the attitude variable (attitude *toward using* and the actual intensity of technology use variable *(actual usage)* [23]. Likewise with variables *perceived usefulness* has a positive relationship with the variable attitude toward using. As confirmed in research Nasution (2004), the level of perception of the usefulness of using information technology will influence positive *attitudes towards* using information technology [24]. This has been proven by previous researchers that if someone feels the benefits of using information technology, that person will have a positive attitude towards using information technology [25]. Meanwhile, other researchers such as Malhotra and Gallenta, 1999, Saade, Nebebe and Tan, 2007 found a positive relationship between the variables *perceived usefulness* and *attitude toward using* [26] [21].

Likewise, research Jogiyanto (2008) states that there is a positive relationship between variables *perceived usefulness* with variabel *actual usage* or actual use of technology [23].Next are variables attitude toward using related to variables actual usage or actual use. Based on research Tan & Teo (2000), that the attitude of using technology has a positive influence on the intensity of actual use of information technology [27]. In line with the expansion of TAM's external variables, namely variables e-learning self- efficacy and complexity or complexity that has been explained previously that Lee et al (2003) state that the variable e-learning self-efficacy is a variable that influences a variable perceived ease of use and variables perceived usefulness [28]. Other research also concludes that there is a positive correlation between self-efficacy with the intensity of use of information technology [29]. Likewise, research Tan & Teo (2000) states that self-efficacy has a positive relationship with the intensity of information technology use [27]. This is related to external variables complexity (complexity), Baria et al (1995) in Jogiyanto (2008) found that the variable complexity or complexity and the variable perception of technology use have a strong relationship [23]. Meanwhile, Davis (1989) found a positive correlation or relationship between variables complexity or complexity and variables of perceived ease of use or ease of use of information technology [10] [23]. variables of perceived ease of use or ease of use of information technology.

H1: *E-learning self-efficacy provide a positive and significant influence on Perceived ease of use.*

H2: *Complexity provide a positive and significant influence on Perceived usefulness.*

H3: *E-learning self-efficacy positive and significant effect on Perceived Usefulness.*

H4: *Complexity provide a positive and significant influence on Perceived ease of use.*

H5: *Perceived Ease of Use of e-learning (Perception of Ease of Use e-learning) has a positive and significant effect on Attitude toward Using e-learning.*

H6: *Perceived Usefulness of e-learning (Perceived Usefulness of e-learning) has a positive and significant effect on Attitude toward Using e-learning (Attitude towards Using e-learning).*

H7: *Perceived Ease of Use of e-learning (Perception of Ease of Use e-learning) has a positive and significant effect on Actual Usage of e-learning (The actual use of e-learning).*

H8: *Perceived Usefulness of e-learning (Perceived Usefulness of e-learning) has a positive and significant effect on Actual Usage of e-learning (The actual use of e-learning).*
H9: *Attitude toward Using e-learning (Attitude when using e-learning) has a positive and significant effect on Actual Usage of e-learning (The actual use of e-learning).*

III. METHODS

The A quantitative approach was used to investigate the relationship among variables in technological acceptance model. The respondents who filled out the questionnaire were collected via Google Form In this study, 285 people were reached, with a breakdown of 57 lecturers and 228 students. Structural equation modeling (SEM) is a statistical technique that allows checking a series of relatively "complex" relationships simultaneously [24]. This complex relationship can be established between one or several dependent variables and one or several independent variables. Dependent and independent variables can be in the form of factors or constructs that are built or formed from several indicator variables or in the form of a single variable that is observed directly in a research process. Basically, SEM is a combination of factor analysis and multiple regression analysis [24] in [25].[26] states that SmartPLS is predictive and only comes from one direction, not recursive, in testing the relationship between constructs. Abdullah & Sutanto (2015) also stated that SEM techniques based on statistical variance are a good choice for research predictions [27]. Predictive research is research that aims to test the influence between variables to estimate the relationship. The hypothesis tested is a partial hypothesis, namely a hypothesis that states only a relational or causal relationship between variables, but relational or causal relationship between one research model (hypothesis model).

The criteria for determining the validity of research results are based on the level of significance for predicting the relationship between two variables or t-statistics.Based on the various characteristics and characteristics of Smart-PLS listed above, the author can determine whether Smart-PLS is suitable for analyzing data from the research the author requested. The next step is to choose an SEM application. There are many apps available for download, including SmartPLS and WarpPLS. The statistical analysis that will be carried out in this writing is SEM-PLS using the SmartPLS v.3.2.7 2018 application. The data manipulation technique used in this research is Partial Least Squares (PLS). PLS is an alternative method Structural Equation Modeling (SEM) variance-based. The advantage of this method is that it does not require assumptions and can be used for small sample sizes. The tool is a software called SmartPLS Version 2 that was developed specifically for the purpose of estimating structural relationships using variance-based estimation. Partial Least Squares Analysis (PLS) is a multivariate statistical technique that makes comparisons between dependent and independent variables [28]. To continue, PLS is a single SEM-based statistical technique designed to produce robust regressions when the data exhibit certain characteristics, such as a large sample size. small, missing data (missing value), or multi-linearity. PLS is soft modeling because it relaxes the assumptions of strict OLS regression, based on the absence of multicollinearity between independent variables [28].

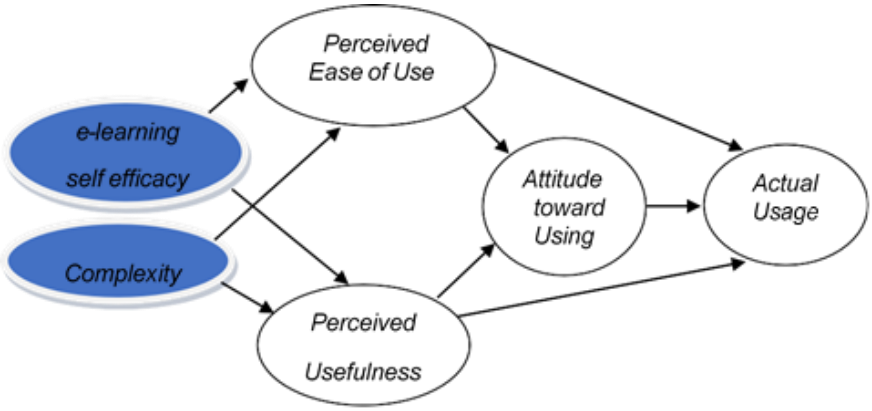

Fig 1. TAM with the Addition of External Variables Source: Author's modification

IV. RESULT AND DISCUSSION

4.5 Test the hypothesis

Test hypotheses through evaluation Inner Model which is done with three type of calculation, PLS Algorithm, Bootstrapping, and Blindfolding [35] [36]. The results of these three calculations are depicted in Figure 4.8, Figure 4.9, and Figure 4.10.

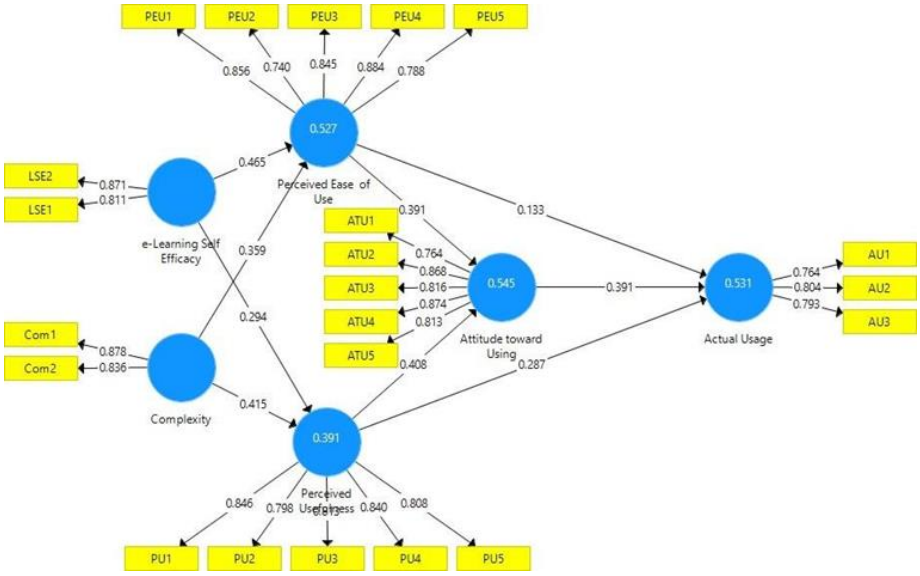

Fig 2. Evaluation result Inner Model with Calculations PLS Algorithm

Source: processed by researchers

The results of the Inner Model Evaluation using PLS Algorithm calculations show the Inner VIF Values as Collinearity criteria, the R Square (R2) value as the level of model accuracy, and the f Square (f2) value which shows the influence or effect of exogenous to endogenous variables [35] [36]. These three values are shown in Table 4.10, Table 4.11, Table 4.12.

	R Square	R Square Adjusted
Actual Usage	0,531	0,524
Attitude toward Using	0,545	0,540
Perceived Ease of Use	0,527	0,522
Perceived Usefulness	0,391	0,385

Table 4.1. Inner VIF Values in the Revised Model

The ideal Inner VIF value for Collinearity criteria is below 3.3 or can also be below 5 [35]. Table 4.1 show that the Inner VIF value in the Revised Model is less than 5, so it meets the Collinearity criteria.

	Actual Usage	Attitude toward Using	Perceived Ease of Use	Perceived Usefulness
Attitude toward Using	2,197			
Complexity			1,423	1,423
Perceived Ease of Use	2,334	1,999		
Perceived Usefulness	2,365	1,999		
e-learning Self Efficacy			1,423	1,423

Table 4.2. Square Values in the Revised Model

Source: processed by researchers

The R Square value shows the level of model accuracy. The level of model accuracy is high if the value is ≥ 0.75 [35] or ≥ 0.67 [37]. The level of model accuracy is declared moderate if it is ≥ 0.50 [35] or ≥ 0.33 [37]. Table 4.2 shows that the level of model accuracy for all variables is moderates if based on the rules of (Chin, et.al., (2003). Meanwhile, if based on Hair et.al (2017) then the Perceived Usefulness variable has a high level of model accuracy [35}. weak or weak, while the other three variables have a medium level of accuracy.

Table 4.3. Square Values in the Revised Model

	Actual Usage	Attitude toward Using	Perceived Ease of Use	Perceived Usefulness
Attitude toward Using	0,148			
Complexity			0,192	0,199
Perceived Ease of Use	0,016	0,168		
Perceived Usefulness	0,074	0,183		
e-learning Self Efficacy			0,321	0,100

Source: processed by researchers

The f Square value shows the influence of exogenous to endogenous variables. A strong influence if the value is ≥ 0.35 and a moderate influence if the value is ≥ 0.15, and a weak influence if the value is ≥ 0.02 [35]. Table 4.3 shows that the Actual Usage variable as endogenous has a weak influence from its two exogenous variables (the Attitude toward Using variable and the Perceived Usefulness variable) and an influence that does not meet the criteria from the Perceived Ease of Use variable. The Attitude toward Using variable, which is endogenous, has a moderate influence from the two exogenous variables (the Perceived Usefulness variable and the Perceived Ease of Use variable).The Perceived Ease of Use variable as endogenous also has a moderate influence from the two exogenous variables (the Complexity variable and the e-learning Self Efficacy variable). Then the Perceived Usefulness variable as endogenous has a moderate influence from the Complexity variable and a weak influence from the e-learning Self Efficacy variable.

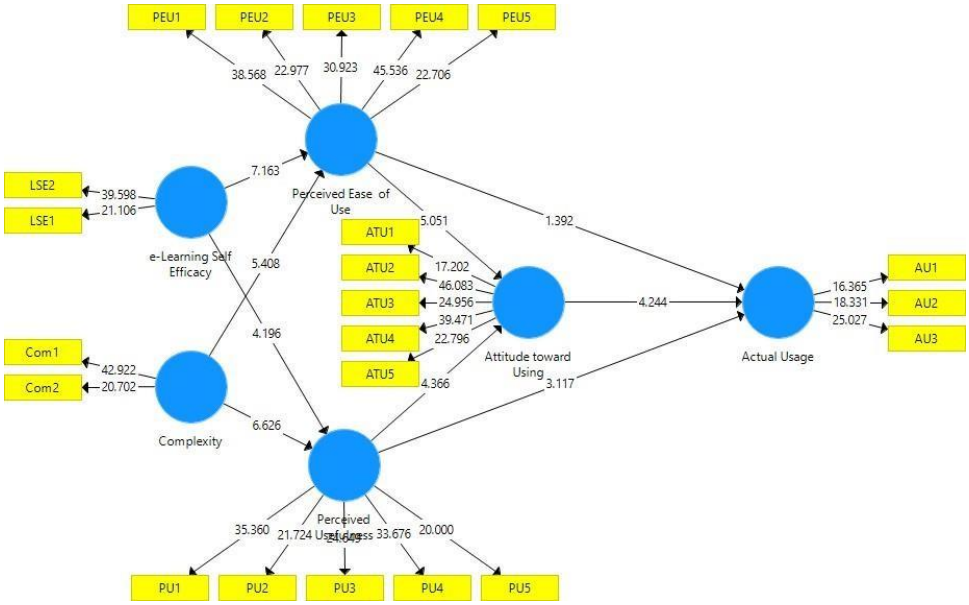

Fig 4.9. Inner Model Evaluation Results with Bootstrapping Calculations

Source: processed by researchers

Table 4.4. Path Coefficient Values in the Revised Model (Sig Level=0.05)

	T Statistics (|O/STDEV|)	*P Values*
Attitude toward Using -> Actual Usage	4,244	0,000
Complexity -> Perceived Ease of Use	5,408	0,000
Complexity -> Perceived Usefulness	6,626	0,000
Perceived Ease of Use -> Actual Usage	1,392	0,165
Perceived Ease of Use -> Attitude toward Using	5,051	0,000
Perceived Usefulness -> Actual Usage	3,117	0,002
Perceived Usefulness -> Attitude toward Using	4,366	0,000
e-learning Self Efficacy -> Perceived Ease of Use	7,163	0,000
e-learning Self Efficacy -> Perceived Usefulness	4,196	0,000

Source: processed by researchers

The Path Coefficient value shows the hypothesis of the significance of the relationship between interconnected variables. The results are significant if the P Value < P Level and T Statistics > T-Significance, where at Sig. Level=0.05, then P Level is 0.05 and T-Significance is 1.96 [35]. Table 4.4 shows that there is an influence relationship between exogenous variables and endogenous variables that is not significant, namely the influence of the Perceived Ease of Use variable on the Actual Usage variable. Meanwhile, the relationship between other variables has a significant influence.The direction of influence of the relationship between each path (Path) between exogenous and endogenous variables is shown in Figure 2 and Figure 3, namely that all paths have a positive influence.

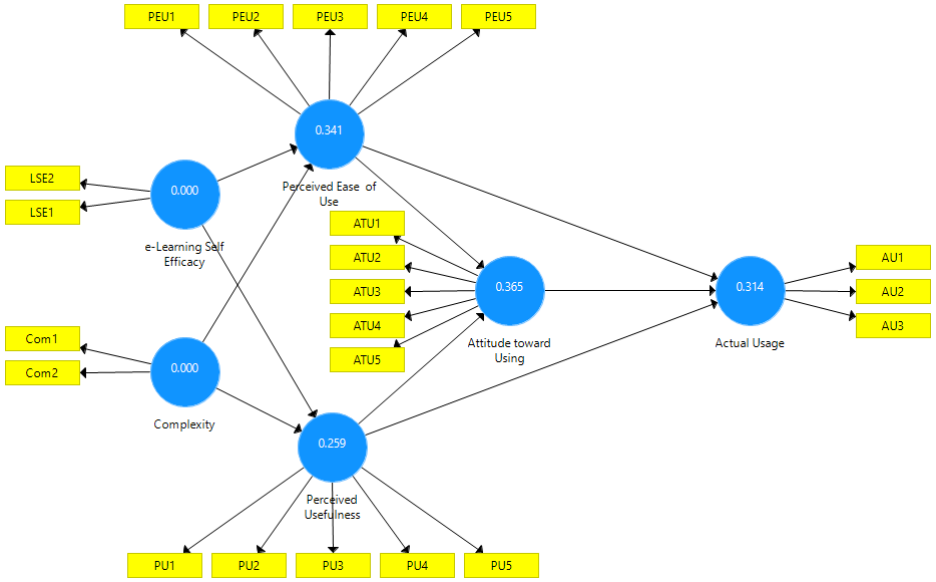

Fig 3. Inner Model Evaluation Results with Blindfolding Calculations

The results of the Inner Model evaluation with Blindfolding calculations aim to show the Q value2 as a predictor of relevance. Q value2 shown in Table 4.5

Table 4.5. Values[2] on the Revised Model

	Q^2 (=1-SSE/SSO)
Actual Usage	0,249
Attitude toward Using	0,520
Complexity	0,221
Perceived Ease of Use	0,499
Perceived Usefulness	0,496
e-learning Self Efficacy	0,163

Source: processed by researchers

Q value[2] shows predictive relevance on endogenous. The model has relevance if the Q value[2] on endogenous variables > 0 [35]. Table 4.4 and Figure 4.5 show that the Revised Model has relevance, because the variables have Q values[2] greater than zero.

4.6 Verdict Hypothesis and final model

Based on the evaluation results shown in Figure 4.8 – Figure 4.10 and Table 4.10 – Table 4.14, the hypothesis decision is shown in Table 4.15.

Table 4.6. Hypothesis Decisions

Hipotesis	***Decision***
H1	Accepted
H2	Accepted
H3	Accepted
H4	Accepted
H5	Accepted
H6	Accepted
H7	Rejected
H8	Accepted
H9	Accepted

As with the results of the hypothesis decision in table 4.15, it can be stated that the relationship between variables in the expansion of the TAM model means that all variable relationships are stated to have a positive relationship, so the hypothesis statement can be accepted, except for the hypothesis statement H7: variable relationship Perceived Ease of Use of e- learning (Perception of Ease of Use e-learning) and Actual Usage of e-learning (The actual use of e-learning) rejected.Meanwhile, the relationship between other variables has a significant influence. As the results of the hypothesis decision were rejected, it can be explained that based on the author's perspective, the initial perception of using the MS Teams application was from the people users or users feel that they have convenience because some of the features provided by the MS Teams application are not that difficult and are easy to learn. In addition, before para users or users using the MS Teams application for teaching and learning purposes, users Online tutorials have been given to both students and lecturers, however, in actual use there are still problems that often occur when operating the MS Teams application, especially when users upload video files often experience problems such as crashing, breaking buffering).

Another thing that happens is that the appearance of the MS Teams operational files should vary, showing the files that were created.import from you-tube, image online or you can also transfer between files stored in files in google drive or files stored on cloud computing that MS Teams provides, but apparently not all users able to use it, especially from users, namely senior lecturers, who in fact require a long time and minimal ability to adapt to the use of this MS Teams application technology. Therefore, based on the previous explanation, the results of the relationship between variables are significant if the P Value < P Level and T Statistics > T-Significance, where at Sig. Level=0.05, then P Level is 0.05 and T-Significance is 1.96 [35]. As shown in Table 4.13, there is one relationship influence between variables that are not significant, namely the influence of variables Perceived Ease of Use to variables Actual Usage. Based on the results trimming hypothesis by discarding paths that are not significant as indicated by the relationship between variables perceived ease of use does not have a significant effect on the variables actual usage (indicated by the missing arrow), the researcher assumes that the relationship between variables can be described in Figure 4. below.

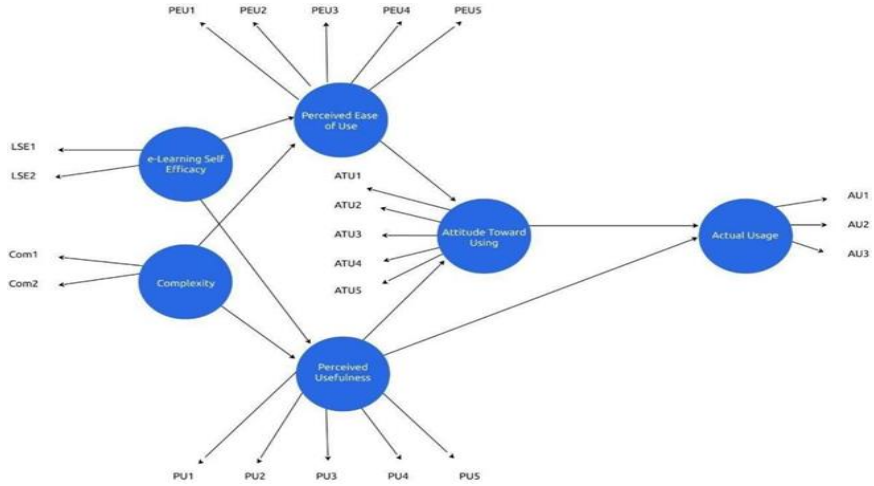

Fig 4. Final research model

Source: Processed by the Author

However, because this research is confirmatory, the final result is to prove the theory or model whether it is appropriate to the context studied or not, therefore if there is a hypothesis that is not fulfilled, then in confirmatory research or the confirmatory stage, it shows that the relationship between the exogenous variable and Endogenous variables are not proven in the context of this research, especially the influence of variables perceived ease of use to variables actual usage. To further prove theoretically and empirically this final model, further empirical research must be carried out by other researchers so that the correlation or relationship between variables in the TAM model can be identified which can be tested on all relationships between variables in TAM and especially relationships between variables. perceived ease of use with actual usage at different research loci.

V. CONCLUSION

The conclusion of the research hypothesis is (H1) the positive effect of e-learning self-efficacy (learning self-efficacy online) on the perception of comfort (perceived ease of use). (H2) positive effect of e-learning self-efficacy on perceived usefulness (perceived usefulness), (H3) positive effect of complexity on perceived ease of use. (H4) complexity has a positive effect on perceived usefulness. (H5) perception of ease of use (perceived ease of use) online learning of use affects attitude to use (attitude to use). (H6) view of usefulness (perceived usefulness) positive effect of e-learning on usage attitude (attitude towards usage). (H7) perceived ease (perceived ease of use) negative effect on actual use e-learning (actual use). (H8) perceived usefulness of e-learning (perceived usefulness) positively affects actual use (actual use). (H9) usage attitude (attitude towards usage) positive effect on actual usage (actual usage).

Several things can be suggested about the results of this study as follows: It is recommended that future studies can develop a similar study by applying it to different research locations, so that the level of correlation between the variables included in the TAM can be tested in different loci. With the increasing number of studies conducted in different locus using the TAM method, the level of significance of the TAM variables is tested. Because there is one hypothesis that is rejected in this study, namely H7, the relationship between perceived ease of use of variables and actual use of variables. Thus, other researchers using the TAM method recommend re-examining the relationship between the variables, especially the perceived ease of use of the variables and the actual use of the variables in the study at different study sites. Other researchers interested in the TAM method are encouraged to further expand the external variables of TAM. The addition of external variables should adapt the use of technology to the e-learning context. By extending the inclusion of the TAM variable, it adds urgency and importance to the study of technology acceptance models. Other researchers advise to pretest it using a smaller sample first to get more accurate and reliable information about the questionnaire.

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