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__Mater._Sci._Eng._306_01208
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Submission date: 13-Mar-2020 11:01AM (UTC+0700)

Submission ID: 1274777584

File name: Modeong_2018_IOP_Conf._Ser.__Mater._Sci._Eng._306_012082_1.pdf (544.42K)

Word count: 3834

Character count: 20432

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Utilization of Multimedia Laboratory: An Acceptance Analysis using TAM

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Abstract. Multimedia is often utilized by teachers to present a learning materials. Learning that delivered by multimedia enables people to understand the information of up to 60% of the learning in general. To applying the creative learning to the classroom, multimedia presentation needs a laboratory as a space that provides multimedia needs. This study aims to reveal the level of student acceptance on the multimedia laboratories, by explaining the direct and indirect effect of internal support and technology infrastructure. Technology Acceptance Model (TAM) is used as the basis of measurement on this research, through the perception of usefulness, ease of use, and the intention, it's recognized capable of predicting user acceptance about technology. This study used the quantitative method. The data analysis using path analysis that focuses on trimming models, it's performed to improve the model of path analysis structure by removing exogenous variables that have insignificant path coefficients. The result stated that Internal Support and Technology Infrastructure are well mediated by TAM variables to measure the level of technology acceptance. The implications suggest that TAM can measure the success of multimedia laboratory utilization in Faculty of Engineering UNIMA.

1. Introduction

Rapid development of current technologies are increasingly encouraging younger generation to follow in its footsteps. Even as educators, teachers also continues to renew their knowledge about technology in order to be able to present the newest learning method and material. Current education problems is that educators are faced with challenges and problems on how to find the best way to convey the concepts to students in order to be useful as an important information. The same thing happened in some instances constrained education like presentation as an interesting learning concept. Like a case in the Faculty of engineering in *Universitas Negeri Manado (UNIMA)*, educators are always trying to present a theory that packed with catchy design media.

In the process of teaching and learning, technology connects all elements of learning –teachers, students, and the teaching materials– so that, can make the output of the education process [1]. Multimedia is a type of technology that is commonly used in the learning process. A combination between text, images, graphics, sounds, animations, and videos with artistic design, multimedia change the learning process become more interesting, allow the user to receive information 60% easier [2]. The process of learning using multimedia doesn't intend to replace the traditional learning process that has long been applied, but this method is used as a learning solution that attract the attention of students by combining some elements of technology in learning.



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The laboratory is a place for student experiment to increase their active and vital participation in the learning process [3]. Herrington & Nakhleh [4] also mentioned that it is important to assess the students' perceptions toward learning instructions in the laboratory to find out the effectiveness about the learning process that has been done. This assessment is conducted to determine the user's response to the technology that being run. So, to answer the response, it needs a theory to measure the level of user's acceptance about technology. Assessment on laboratory utilization is done using the Technology Acceptance Model (TAM) that developed by Davis [5].

TAM is the intention-based models that are specifically intended to explain and/or predict user acceptance of technology [6]. TAM has core variables such as perceived usefulness, perceived ease of use, intention, and actual use. But TAM does not eliminate the possibility of situational variables that indicated can measure the level of technology acceptance. According to the conditions of Faculty of Engineering UNIMA, indicated that internal support and technology infrastructure become situational variables which can be applied as the determinant variable that connected to student acceptance of technology.

Internal support includes support from university's higher ranked officials and lecturers to direct and maximize practice-oriented learning, as well as provide the human resources that functioning as a laboratory assistant. The problems in the Faculty of engineering are some lecture materials that should be balanced with practice but only filled with theory or oral illustration. This is due to the unregulated laboratory utilization schedule and the lack of support from university officials towards the fulfillment of the laboratory needs and encouraging the practice-oriented learning.

Furthermore, the technology infrastructure related with the availability of technology tools, as well as the availability of laboratory support facilities. According to the condition of the multimedia laboratory in the faculty of engineering UNIMA, multimedia equipment is not well balanced with the number of students who often practice in the laboratory. In addition, the other support equipment such as digital camera, video recorder, LCD projector, etc. still need to be held in sufficient quantities for its users.

2. Research Model

In TAM theory, perceived about usefulness and ease of use are mediate the external variables' influence on behavioral intentions and then the actual use of the system can be known [7]. This opinion is evidenced by several studies that use TAM as a reference, among others: an open source e-learning system such as moodle [7, 8], valid measurement scales for predicting user acceptance of information technology [5], Malaysian student and teachers' integrating their technology in teaching and learning [9], interactive learning technologies using clickers in the macroeconomics classes [10], and so on. The proposed research model is presented in Figure 1.

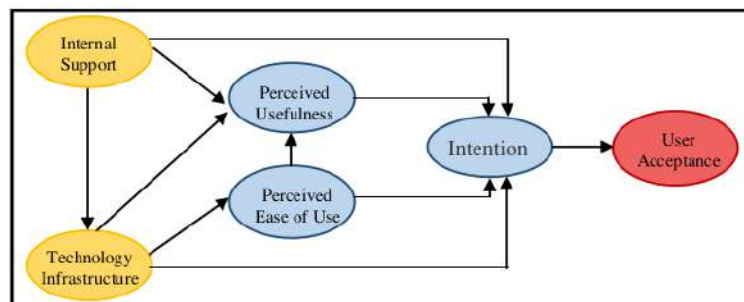


Figure 1. Proposed research model.

2.1 TAM variables

A system can be said to be successful if the system could provide a positive impact for its users. Positive impacts such as usability and ease of use that exist on the system, can support a particular

work for individuals who use it. PU and PEOU are the key factors that affect the behavioral intention to use technology [11]. Thus the hypotheses related with PU, PEOU, and intention are as follows:

- Hypothesis 1: Perceived Usefulness have a positive direct effect on Intention
- Hypothesis 2: Perceived Ease of Use have a positive direct effect on Perceived Usefulness
- Hypothesis 3: Perceived Ease of Use have a positive direct effect on Intention
- Hypothesis 4: Intention have a positive direct effect on User Acceptance

2.2 Internal support (IS)

The physical and social environment variables are selected as situational variables that are believed to be capable affecting the variable of perceived usefulness, ease of use, and user acceptance [12]. The physical environment and the social environment describe the support of university officials and all lecturers to applying strategy on systematic learning. The hypotheses related with IS are provided below:

- Hypothesis 5: Internal support have a positive direct effect on Perceived Usefulness
- Hypothesis 6: Internal support have a positive direct effect on Intention
- Hypothesis 7: Internal support have a positive direct effect on Technology Infrastructure
- Hypothesis 8: Internal support have a positive indirect effect on Intention
- Hypothesis 9: Internal support have a positive indirect effect on User Acceptance

2.3 Technology infrastructure (TI)

Akande [13] revealed that learning can occur through a person's interaction with his/her environment. The environment here refers to the facilities that are available to facilitate the student when learning. Because the facilities are believed to be able to help students to develop a problem solving ability [14]. Thus the hypotheses related with TI are as follows:

- Hypothesis 10: Technology Infrastructure have a positive direct effect on Perceived Usefulness
- Hypothesis 11: Technology Infrastructure have a positive direct effect on Perceived Ease of Use
- Hypothesis 12: Technology Infrastructure have a positive direct effect on Intention
- Hypothesis 13: Technology Infrastructure have a positive indirect effect on Intention
- Hypothesis 14: Technology Infrastructure have a positive indirect effect on User Acceptance

3. Methods

This study used the quantitative method with an ex-post facto approach. The study was conducted in April until June 2017 to find students' perception about the factors that influence the students' acceptance about usefulness of multimedia laboratory. The subject of this study was students who take Multimedia expertise in the Faculty of Engineering UNIMA with 185 total populations. Using Proportional Random Sampling, so the samples are: (i) 4th Semester: 23 respondents; (ii) 6th Semester: 30 respondents; and (iii) 8th Semester: 27 respondents.

The instrument of data collection in this study is questionnaire using Likert scoring, with four choice answers as follows: Strongly Agree (SA), Agree (A), Disagree (DS), and Strongly Disagree (SDS). Path analysis used as data analysis to measuring the relationship between variable and testing the hypothesis. Before testing the hypothesis, first, we take the classical assumptions test to ensure that the data been collected is worth enough to be processed using Path analysis.

3.1 Classical assumption test

Before performing multiple linear regressions testing, it needs to be done a classical assumption test first (Table 1), consisting of: (a) normality test, (b) linearity test, and (c) multicollinearity test. The model that formulated in this study was broken down into 5 substructures and then conducted a classical assumption test. The five substructures models are designed to facilitate the researcher in the process of data analysis.

The data is said to be normally distributed and has a linear relationship when the significance value is greater than the alpha value (Sig. > α), the alpha value is set at 5% or 0.05. Furthermore, the

multicollinearity test is done by looking at the magnitude of the VIF value, if VIF <10, then there is no multicollinearity between the independent and the dependent variable.

Table 1. Classical assumption test result.

Variables		Normality	Linearity	Multicollinearity
Dependent	Independent			
Perceived Usefulness	Internal Support	0.093	0.109	1.261
	Technology Infrastructure		0.153	1.212
	Perceived Ease of Use		0.241	1.045
Technology Infrastructure	Internal Support	0.373	0.554	1.000
Perceived Ease of Use	Technology Infrastructure	0.292	0.078	1.000
Intention	Internal Support	0.982	0.369	1.108
	Technology Infrastructure		0.378	1.130
	Perceived Usefulness		0.257	1.061
	Perceived Ease of Use		0.278	1.103
User Acceptance	Intention	0.637	0.104	1.000

3.2 Multiple regression analysis

After the classical assumption test has been met, then conducted regression analysis to answer the research hypothesis. The decision criteria used if the significance value higher than 0.05 then H₀ is accepted, otherwise if the significance lower than 0.05 then H₀ is rejected.

Table 2. Summary of the influence between dependent and independent variable.

Variables		A	R ²	Sig.
Dependent	Independent			
Perceived Usefulness	Internal Support	1.242	0.313	0.012
	Technology Infrastructure			0.569
	Perceived Ease of Use			0.000
Technology Infrastructure	Internal Support	8.223	0.172	0.000
Perceived Ease of Use	Technology Infrastructure	19.602	0.055	0.036
Intention	Internal Support	6.118	0.252	0.039
	Technology Infrastructure			0.231
	Perceived Usefulness			0.024
	Perceived Ease of Use			0.039
User Acceptance	Intention	10.855	0.079	0.012

The multiple regression analysis in **Table 2** and **Table 3** stated that there are two hypotheses were rejected, the 10th hypothesis and the 12th hypothesis (**Table 4**). Both hypotheses were rejected because they have a significance value greater than 0.05. While the other 12 hypotheses get a significance value lower than 0.05 (see **Table 4**).

3.3 Path analysis

Path analysis that used in this research is a trimming model. The trimming model is a model that's been used to improve a Path analysis structure by removing insignificant exogenous variables, then retesting.

Based on the trimming model analysis, the insignificant path coefficient are TI to PU (Sig = 0.569) and TI to IN (Sig = 0.231) which means greater than 0.05. Therefore, this variable path is excluded from the research model that has been formulated. After elimination, we conducted the regression test again. The improvement of the acceptance model by using trimming model illustrated in **Figure 2**.

Then, the answer of the hypothesis in this study are described in **Table 4**, where the value obtained the result of the second regression analysis after eliminating the insignificant exogenous variables. **Table 4** also describes the acquisition of path coefficient values that have an indirectly effect i.e. H8, H9, H13, and H14.

Table 3. Partial influence of dependent and independent variable.

Variables		Correlation coefficient				Sig.
		Before elimination		After elimination		
Dependent	Independent	β	t-value	β	t-value	
Perceived Usefulness	Internal Support	0.275	2.576	0.299	3.094	0.003
	Technology Infrastructure	0.056	0.533	-	-	-
	Perceived Ease of Use	0.418	4.304	0.415	4.299	0.000
Technology Infrastructure	Internal Support	0.415	4.024	0.415	4.024	0.000
Perceived Ease of Use	Technology Infrastructure	0.235	2.136	0.235	2.136	0.036
Intention	Internal Support	0.221	2.099	0.245	2.362	0.021
	Technology Infrastructure	0.128	1.209	-	-	-
	Perceived Usefulness	0.237	2.300	0.236	2.289	0.025
	Perceived Ease of Use	0.221	2.102	0.254	2.499	0.015
User Acceptance	Intention	0.280	2.579	0.280	2.579	0.012

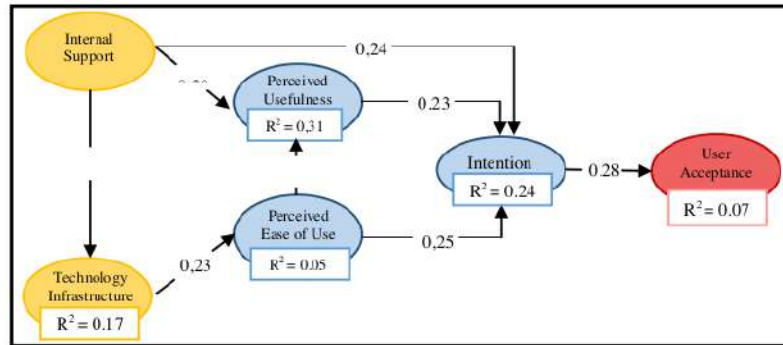


Figure 2. Final model of student's acceptance of multimedia laboratory.

Table 4. Summary of hypotheses tests.

Hi	Relationship	Effects	Sig. Value	B	Decision
H1	PU → IN	Direct	0.025	0.236	Accepted
H2	PEOU → PU	Direct	0.000	0.415	Accepted
H3	PEOU → IN	Direct	0.015	0.254	Accepted
H4	IN → UA	Direct	0.012	0.280	Accepted
H5	IS → PU	Direct	0.003	0.299	Accepted
H6	IS → IN	Direct	0.021	0.245	Accepted
H7	IS → TI	Direct	0.000	0.415	Accepted
H8	IS → IN	Indirect	-	0.100	Accepted
H9	IS → UA	Indirect	-	0.100	Accepted
H10	TI → PU	Direct	0.596	0.056	Rejected
H11	TI → PEOU	Direct	0.036	0.235	Accepted
H12	TI → IN	Direct	0.231	0.128	Rejected
H13	TI → IN	Indirect	-	0.080	Accepted
H14	TI → UA	Indirect	-	0.022	Accepted

4. Results and Discussion

4.1 TAM variables

This research aimed to make TAM as measurement about perceived usefulness, perceived ease of use, intention and situational variables to increasing users' number on multimedia laboratory utilization. The results of the analysis stated that Perceived Usefulness, Perceived Ease of Use, and the Internal Support are the variables that directly affect to the student's intention to use multimedia laboratory. PU has a positive influence on IN with path coefficient of 0.236 (Hypothesis 1) and PEOU has a positive influence on IN with path coefficient of 0.254 (Hypothesis 3). In addition PEOU also has a positive correlation value on PU (Hypothesis 2) of 0.415. Furthermore, IN gives a direct positive effect on UA with coefficient value of 0.280 (Hypothesis 4).

Besides having a direct influence, these four TAM variables have a determinant coefficient (R^2) or an effective contribution based on its substructures. In the first substructure, 31% of PU are influenced by IS and PEOU. This means that 69% of PU is influenced by other factors outside the model formulated in this study. In the third substructure, 5% of PEOU is positively influenced by TI, which means that TI has very little effect on PEOU. There are three variables that together give a positive influence to the intention in fourth substructure, i.e. IS, PU, and PEOU. These three variables provide a coefficient of determination of 24%. This means 76% IN influenced by other variables that are not formulated in this model. Furthermore UA has a coefficient of determination of 7% from IN, which means that 93% of UA is determined by other factors outside this study.

4.2 Internal support

In the research model design, IS has a direct and indirect effect on user acceptance decisions about the technology that has been used. IS has a direct positive effect on the other 3 variables, that is PU, IN, and TI. The path coefficient of IS to PU is 0.299 (Hypothesis 5), IS to IN of 0.245 (Hypothesis 6), and IS to TI of 0.415 (Hypothesis 7). IS also has an indirect effect on IN and UA, with the acquisition of each path coefficient is 0.100 (Hypotheses 8 and 9).

4.3 Technology infrastructure

In the design model on this study, TI has three direct and two indirect effects. However, based on the analysis that has been done, there are two paths from TI that are insignificant, that is direct influence of TI to PU and TI to IN (Hypothesis 10 and 12). Therefore, both paths are removed from model. On a significant path, TI has a direct positive effect on PEOU with a path coefficient of 0.235 (Hypothesis 11), the indirect effect of TI to IN has a path coefficient of 0.080 (Hypothesis 13), and the indirect effect of TI to UA with a path coefficient of 0.022 (Hypothesis 14).

Besides having a direct and indirect effect, TI also has a coefficient of determination (R^2) or an effective contribution to the second substructure. There is 17% TI is influenced by IS, which means there are still 83% other factors outside the IS that are expected to greatly affect the percentage of TI.

5. Conclusions

This research aimed to make TAM as measurement about perceived usefulness, perceived ease of use, intention and situational variables to increasing users' number on multimedia laboratory utilization. Internal support and Technology infrastructure variables which act as a situational variable in this research. IS affected the acceptance of multimedia laboratory utilization indirectly through four lines of calculation, namely: (1) through PU and IN variables; (2) through the IN variable; (3) through TI, PEOU, and IN variables; and (4) through TI, PEOU, PU, and IN variables.

Furthermore, TI variable affected the acceptance of multimedia laboratory utilization indirectly through two lines of calculation, namely: (1) through PEOU and IN variables; and (2) through PEOU, PU, and IN. Thus these two variables have no direct influence on the acceptance of multimedia laboratory utilization, so this study is in line with the explanation of the actual TAM theory which is

stated that the intention as a single variable that directly affected the acceptance of multimedia laboratory utilization [15-17].

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