

A Case Study Investigating Perceived Usefulness and Perceived Ease of Use: Determinants of Attitude towards Using ICT for Self-Paced Learning among Science Undergraduates

Jian Heng Tan¹, Priscilla Moses² and Phaik Kin Cheah³

Abstract—The purpose of this study is to establish the determinants of attitude towards using Information and Communication Technology (ICT) for self-paced learning. Based on the Technology Acceptance Model (TAM) theory, a questionnaire was constructed for this investigation. The raw data were filtered using SPSS and followed by Confirmatory Factor Analysis procedure. Hence, a total of 380 valid data was successfully screened out and used for this investigation. The findings from this study confirms that perceived usefulness and perceived ease of use are the determinants of attitude towards using ICT for self-paced learning among undergraduates. Both of the behavioural variables in TAM; perceived usefulness and perceived ease of use are still the significant contributors of the model as suggested in past studies. Therefore, the behavioural variables investigated in this study were significant and have an influencing element in decision-making for students' ICT usage for their self-paced learning. Future studies could be carried out to examine TAM using different sets of samples and context to confirm the validity of the model. Apart from that, TAM model could also be expanded to include additional external variables that could influence the use of ICT for self-paced learning such as motivation.

Index Terms— Self-Paced Learning, Perceived Usefulness, Perceived Ease of Use, Attitude towards Using ICT, Undergraduates.

I. INTRODUCTION

In the past, knowledge has been taught and accessed by students through textbook, face-to-face interactions, and workbook in the classroom. With the integration of Information and Communication Technology (ICT) in learning process, the students are more active in their learning [1]. The dramatic and pivotal advancement of technology has a tremendous impact on today's society that the younger generations are depending greatly on technology that the technology have become part and parcel of today's modern society. Technological advancement of 21st century ideally allows students to use ICT in their learning process whenever they have the opportunity without much resistance from the educators as educators are aware of the benefits that ICT brings. According to benefits of ICT towards education presented by Syed Noor-Al-Amin [2], the

quality and accessibility of education can be enhanced, learning motivation among the students can be accelerated, and ICT has an impact on the scholastic performances of students. Technology is one of the vital element that leads to a more successful learning outcome among students in the past two decades [3]. Today's generation of students are born into the age of ICT-enabled society. With the advancement of ICT in teaching and learning, it is often used by the students to support self-paced learning and it offers countless interesting alternate methods to improve education for students of all level especially for those in higher education institutions. According to Bautista [4], the self-paced learning prototype optimizes students' performances and becomes a potent tool in optimizing classroom instruction. Apart from that, self-paced learning was also proven to have a better recall performance [5]. Therefore, there is a need to understand the determinants of students' attitude towards using ICT for self-paced learning.

II. LITERATURE REVIEW

In recent Technology Acceptance Model (TAM) studies conducted, it was revealed that students' attitude towards using ICT is among the strongest predictor that is influential in technology usage [6], [7], [8], [9], [10], [11], [12]. In another study conducted among teachers in Malaysia, attitude towards use was also found to be a main factor that contributes towards laptop use [13]. Thus, there is a need to understand the determinants of attitude towards using ICT as the attitude variable plays a significant role in determining ICT utilization.

In the review of literature, past studies suggested that technology user should have a positive attitude before utilizing ICT for self-paced learning. The TAM model was found to be the most suitable model to be utilized in predicting the determinants of attitude as the model was developed by Davis et al. [12] after they adapted Ajzen and Fishbein's Theory of Reasoned Action (TRA) and developed it into Technology Acceptance Model (TAM) to predict the technology acceptance among users [14]. According to Tang and Hsiao [15], the robust yet parsimonious theory of TAM is suitable to describe a particular information system or technology. Moreover, TAM proposed that an individual's attitude towards adapting a new

Tan Jian Heng is with the Faculty of Arts and Social Science, University Tunku Abdul Rahman, Malaysia. (e-mail: jianheng93@gmail.com).

technology is determined by two antecedents, namely, perceived usefulness and perceived ease of use [12], [18]. Therefore, the TAM variables, namely perceived ease of use (PEOU) and perceived usefulness (PU) were hypothesized to be the determinants of attitude towards using ICT (A) in this study. Therefore, the three formulated hypotheses are:

- H1: PEOU has a significant influence on PU.
- H2: PEOU has a significant influence on A.
- H3: PU has a significant influence on A.

III. METHODOLOGY

This quantitative study was conducted among Science undergraduates in a private university in Malaysia.

A. Participants

The 380 respondents for this study were recruited from four different faculties. Using the cluster-sampling method, the respondents were divided into several groups and a simple random sampling was used to select the groups used for this study based on two criteria. A total of 157 (41.3%) male and 223 (58.7%) female undergraduates participated in survey. Their ages ranged from 19 to 24 years old. The mean age of the participants is 20.14 with a standard deviation of 1.20. The respondents for the four faculties had an equal number of participation. Table I shows the distribution of participants according to faculty.

TABLE I: DISTRIBUTIONS OF RESPONDENTS BY FACULTY

Faculty	Frequency	Percentage (%)
Faculty of Science	95	25.0
Faculty of Medical and Health Science	95	25.0
Faculty of Engineering and Technology	95	25.0
Faculty of Engineering and Sciences	95	25.0
Total	380	100

B. Validity and Reliability

Two experts from the education research field verified the validity of the questionnaire. The reliability test showed an acceptable and high Cronbach's alpha value for PEOU (0.846), PU (.876) and A (.841). The researcher used a scale of one to five with one indicating strongly disagree and five indicating strongly agree for each of the items. Table II shows the construct and the items used for each of the constructs.

Constructs	Item
Perceived Ease of Use	PEOU1 Learning to use ICT for self-paced learning is easy for me.
	PEOU2 I find it easy to obtain materials using ICT for my self-paced learning.
	PEOU3 My interaction with ICT is clear for self-paced learning.
	PEOU4 My interaction with ICT is understandable for self-paced learning.
	PEOU5 It is easy for me to become skilful at using ICT for self-paced learning.
	PEOU6 Overall, I find that ICT is easy to use for my self-paced learning.
Perceived Usefulness	PU1 I find ICT useful in my self-paced learning process.
	PU2 The use of ICT enables me to increase productivity in self-paced learning.
	PU3 Using ICT improves my study performances.
	PU4 ICT gives me a greater control over my self-paced learning.
	PU5 I find ICT a useful tool for my self-paced learning in my course of study.
	PU6 Using ICT enhances the effectiveness of my self-paced learning process.
	PU7 Overall, I find ICT to be advantageous for my self-paced learning.
Attitude towards Using ICT	A1 ICT is an important source to maintain my interest in achieving my learning goals through self-paced learning.
	A2 ICT is an important tool to maintain my interest in achieving my learning goals through self-paced learning.
	A3 I feel that using ICT for my self-paced learning is a good idea.
	A4 I have a generally favourable attitude towards using ICT for my self-paced learning.
	A5 I feel that using ICT makes self-paced learning more interesting.
	A6 I feel better using ICT for self-paced learning as it provides better access.

IV. RESULTS

The study adopted a two-step approach of modelling and analyzing the structural model namely Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) using AMOS. Maximum likelihood estimation was used as the estimation procedure as it will maximize the likelihood of making the observations given the parameters. Prior to modelling the structural model and executing SEM, every construct in this study went through CFA procedure to

eliminate low factor loading items before conducting SEM. After carrying out CFA, one of the item (PEOU6) from perceived ease of use was deleted to achieve goodness –of-fit index. In order to test model fit in this study, degree of freedom (χ^2/df), GFI, TLI, CFI and RMSEA were computed. All the values had a value of the recommended guidelines of the acceptable fit (Table III). Thus, the research model indicates a good fit ($\chi^2/df < 3$, GFI, TLI, CFI $> .9$, and RMSEA $< .08$). The results are shown in Figure 1. Perceived ease of use had a significant direct effect on perceived usefulness (.700; $p < 0.001$), supporting hypothesis H1. Moreover, hypothesis H2 was also supported in this investigation. Based on the findings, there was a significant influence of perceived ease of use on science undergraduates’ attitude towards using ICT (0.370, $p < 0.001$). Apart from this, attitude towards using ICT was also found to be influenced by perceived usefulness (.530; $p < 0.001$), supporting hypothesis H3. Table IV depicts a summary of the three hypotheses testing results obtained in this investigation.

TABLE III: MODEL FIT OF THE RESEARCH MODEL

Name of Category	Name of Index	Level of Acceptance	Research Model
Absolute Fit Index	RMSEA	RMSEA < 0.08	.059
	GFI	GFI > 0.90	.922
Incremental Fit Index	CFI	CFI > 0.90	.946
	TLI	TLI > 0.90	.935
Parsimonious Fit Index	χ^2/df	$\chi^2/df < 3.0$	2.327

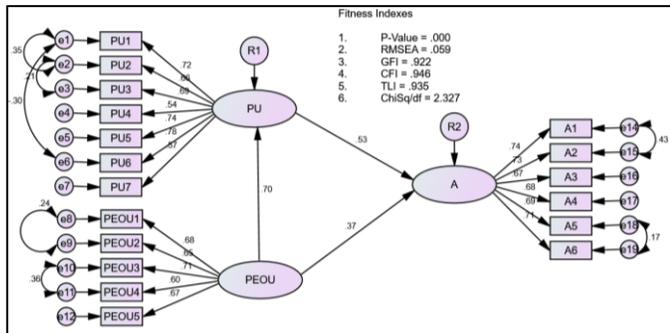


Fig.1: Model Testing Results

TABLE IV: HYPOTHESIS TESTING RESULTS

Hypothesis	Path	Path Coefficient	Results
H1	PEOU → PU	0.700	Supported
H2	PEOU → A	0.370	Supported
H3	PU → A	0.530	Supported

In summary, 69.8% of the variance in perceived usefulness was explained by perceived ease of use, whereas, combination of perceived usefulness and perceived ease of use explained more than half of the variance, 69.9% of attitude towards using ICT for self-paced learning. Nonetheless, perceived ease of use directly influenced attitude towards using ICT and indirectly via perceived usefulness.

V. DISCUSSION

In this investigation, perceived usefulness and perceived ease of use were found to be significant determinants of attitude towards using ICT for self-paced learning among the science undergraduates. It was proven in this study that perceived usefulness is a mediator between perceived ease of use and attitude towards using ICT. On the other hand, perceived ease of use directly and indirectly influenced the participants attitude towards using ICT.

In this investigation, all three formulated hypotheses were supported. The findings showed that perceived ease of use influenced perceived usefulness. This finding is similar to the results of past studies conducted [6], [16], [17], [18] and it is parallel with TAM theory as well [12]. The participants possibly use ICT for self-paced learning when they perceive they use ICT easily or with little effort. The opposite will happen if the students perceive ICT a complex tool to use. Thus, the students will less likely maximize their ICT use in their self-paced learning process. This result validates the point that perceived ease of use and perceived usefulness are strongly related to each other when it comes to understanding acceptance behavior of students towards ICT.

Apart from that, this study also revealed that attitude towards using ICT was influenced by perceived ease of use. This result was parallel to studies conducted by John [19], Alharbi and Drew [20], Al-Mushasha [21], Wong and Teo [22], and Albirini [23]. In regards with maximizing ICT usage for self-paced learning, the finding shows a favorable and positive attitude of students as it can be seen that there is an influence of perceived ease of use on attitude towards using ICT. This finding suggest that there is a greater probability that the students will maximize their current ICT use for self-paced learning when they identify with the ease of ICT use in their self-paced learning process, thus, resulting in a positive outlook attitude towards utilizing ICT. It means that the students’ attitude depends on the evaluation of whether it is difficult to use ICT for self-paced learning.

Moreover, respondents in this study understood the significance of ICT usefulness when it applies to their self-paced learning process, thus resulting in a positive attitude to use it directly. This is correspondence to the findings done by Zogheib and RAbaa’i [24], Alharbi and Drew [20], Al-Mushasha [21], Lai, Wang, and Lei [25], Moses et al., [18], Wong and Teo [22], and Albirini [23]. The result demonstrated that students’ use of ICT for self-paced learning could be maximized if they perceive ICT to be useful to them to support their educational needs. Almost certainly, students welcomed the use of ICT as a part of their self-paced learning process.

VI. CONCLUSION

The influence of the perceived usefulness and perceived ease of use constructs on generating a positive attitude towards using ICT can be explained when the science undergraduates perceive using ICT as an easy and useful technological tool that could enhance their self-paced learning experiences. Future studies using TAM model needs to be conducted in this area

and a greater knowledge pool can be generated also by expanding TAM model with other possible external factors that could be a determinant for attitude towards using ICT such as motivation.

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Tan Jian Heng was born in Melaka, Malaysia. He is currently pursuing Master in Philosophy in Faculty of Arts and Social Science, Universiti Tunku Abdul Rahman under the supervision of his main supervisor; Dr. Priscilla Moses and co-supervisor; Dr. Cheah Phaik Kin and at the same time working on the main supervisor's project. He completed his Bachelor of Arts (HONS) in English Language in 2016 with merit. In his degree research, he have investigated on Mobile-assisted Language Learning (MALL) and he was inspired to continue his study in the educational technology research field.



Assistant Professor Dr. Priscilla Moses holds a Bachelor of Education (Hons) Information Technology and a Doctor of Philosophy (Educational Technology) from Universiti Putra Malaysia. Her research interests are in ICT integration in education, technology acceptance, ICT in teaching and learning, and e-learning.



Assistant Professor Dr. Cheah Phaik Kin holds a PhD, Master of Arts (Communication) from Universiti Sains Malaysia and Bachelor of Arts (Hons) English Language from University Putra Malaysia. Her areas of interest and research are in teacher training, e-learning, volunteerism, community engagement, police science and the criminal justice system.