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Utilising Utaut Model in Defining Influencing Factors of Ubiquitous Technology (U-Tech) Usage

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Abtract: As according to the Unified Theory of Acceptance and Utilisation of Technology (UTAUT), Performance Expectancy (PE), Effort Expectancy (EE), Behavioural Intention (BI), Facilitating Conditions (FC) and Social Status (SS) have been identified as factors that influence the utilisation of technology. Thus, the focus of this study was to confirm whetherthe determined factors such as above contribute towards ubiquitous technology (u-tech) such as laptops, smartphones and tablets. The study also aims to develop a new model on the factors that influence the utilisation of u-tech as learning tools among students in the institutions of higher learning in Malaysia. This study was based on a quantitative research in which the structural equation modelling using AMOS was employed. The results attained from the analysis produced a reliable model towards u-tech usage. The significant paths found were TC influences u-tech usage ($\beta = 0.35$, $p = 0.000$) PE influences u-tech usage ($\beta = 0.41$, $p = 0.000$) and FC influences u-tech usage ($\beta = 0.23$, $p = 0.000$). Meanwhile, the structural paths for EE ($\beta = 0.26$, $p = 0.000$) and SS ($\beta = 0.52$, $p = 0.000$) towards u-tech usage were mediated by BI. Therefore, it can be concluded that, 63% of the variance in u-tech usage described by the five factors.

Key words: New model, UTAUT, structural equation modelling, ubiquitous technology, FC influences

INTRODUCTION

Ubiquitous Technology (U-Tech): In the 21st century and coupled by the fast paced development of technology, students have thrived more on mobility where they expect to take their technology everywhere they go and respond to an immediate gratification as well as get feedback straight away (Margaryan *et al*., 2011). The students also expect constant connections in using technology concurrently either for social and academic lives. The student's visions for an ideal learning are by foreseen using the latest and advanced technology during class as a way to look up information just in time on the internet (Kilbane and Milman, 2013) and want their learning environment to look more like the 'world' in which they live now where to use technology anywhere and anytime (Beetham and Sharpe, 2013).

Therefore, these needs have led to the introduction of ubiquitous technology or u-tech in education. Today, the most popular u-tech that have been used by many including students are laptops (Awwad *et al*., 2013) smartphones (Backer, 2010) and tablet computers or tablets (Zain *et al*., 2013). Apart from that, Personal Digital Assistants PDA (Shariffudin *et al*., 2012) MP3s (Tan, 2013) and smart boards (Singh and Mohamed, 2012; Al-Qirim, 2011) are others example of u-tech been used by students in learning. In the context of this study, the focused u-tech were laptops, smartphones and tablets as these three technologies were identified to be mostly used for learning purposes among students.

U-tech is known as a multipurpose and refined mobile communication which can be used to make call, browse the internet to find information or check e-Mail find location using a Global Positioning System (GPS) and take

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pictures and record video (Zhou *et al*., 2011). These features make life of students easier as there is surety that they get everything they need in one technology (Passow, 2012). U-tech also permits learners to gain the latest information and knowledge faster, easier with the affordance of the internet ability (Hwang *et al*., 2011).

U-tech is viewed as a versatile device, combining the mobility and connectivity of many elements such as powerful processors which enable users to organize a number of computing tasks simultaneously (Sedek *et al*., 2012). It is lightweight and portable, therefore users can take the technology anywhere they like (ElGayar *et al*., 2011) and interactive due to the colourful interface, speed, response as well as it immediate feedback (Corona *et al*., 2013).

Factors influencing ubiquitous technology usage: The review of past literature and the present study determines many factors that influence the usage of technology. However, in the context of this study, the determined factors include only technology competency, performance expectancy, effort expectancy, behavioural intention, facilitating conditions and social status.

Unified Theory of Acceptance and Use of Technology (UTAUT): Understanding student's use of technology, especially in using new technology is one of the most mature streams of research in the 21st century. There have been several theories, primarily developed from theories in psychology and sociology (Venkatesh *et al*., 2012) employed to explain technology utilisation. A review and synthesis of eight theories of technology utilisation resulted in the Unified Theory of Acceptance and Use of Technology (UTAUT) which was developed by Venkatesh *et al*. (2012).

With reference to Venkatesh *et al*. (2012) UTAUT intends to explicate user intentions in using technology. This theory holds four key constructs (performance expectancy, effort expectancy, social influence and facilitating conditions) as determinants towards behavioural intention and use. Venkatesh *et al*. (2012) added that variables namely gender, age, experience and voluntariness of use are posited to moderate the impact of the four key factors on behavioural intention and use. According to UTAUT theory is very comprehensive as it integrates elements across eight theories of technology use, namely, the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Theory of Planned Behaviour (TPB),

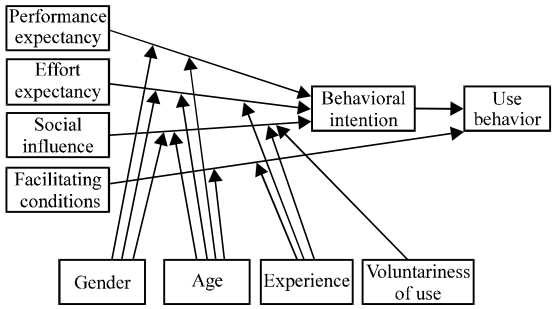

Fig. 1: Unified theory of acceptance and use of technology

Combined TAM and TPB (C-TAM-TPB) and diffusion of innovation or Innovation Diffusion Theory (IDT). The next theory is the Social Cognitive Theory (SCT), followed by that was the Motivational Model (MM) and finally was the Model of PC Use (MPCU). Therefore, UTAUT is now believed to be one of the most comprehensive and trustworthy theory can be used in determining the factors that influence the use of the new technology such as u-tech.

As per Venkatesh *et al*. (2012) subsequent validation of UTAUT in a longitudinal study found it to account for 70% of the variance in behavioural intention to use technology and about 50% of variance in actual technology use. The UTAUT theory is shown in Fig. 1.

Performance expectancy: Performance Expectancy (PE) refers to the degree to which learners believe that using the technology will help them to achieve gains in learning (Tan, 2013). Many researchers postulate that performance expectancy is the strongest factor of the four factors in the Unified Theory of Acceptance and Use of Technology (UTAUT) (Lakhal *et al*., 2013; Wong *et al*., 2013; Thowfeek amd Jaafar, 2013). Research in the Malaysian context showed that the use of Educational Computer Games (ECG) using laptops were regarded as useful and promising tool due to its fun and engagement features (Ayub *et al*., 2010). He stated that the use of technology will remain vital when student's perceived PE as one of the salient factor that directly influence their usage of technology. In his study, students found that the ECGs were useful and able to enhance their performance. Meanwhile, another study conducted by among students from the institution of higher education in Malaysia, revealed that PE acted as one of the salient factors that influenced the student's usage of new developed software in learning the computer graphics and image processing subjects.

Effort expectancy: Effort Expectancy (EE) is a perception which a person believes that using a technology is free of physical and mental attempt (Dulle and Majanja, 2011). In the study conducted by Loo and Choy (2013) showed that engineering students saw tablets as an excellent tool, as tablets were easy to use. The students agreed that while using the tablets, they did not have to put much effort in understanding and handling them. Due to these benefits had encouraged the students not to use tablets only in their engineering and technical subjects but also expanded their usage pattern as a tool for research purposes, for example to capture categorical data especially for data analyzing as well as for filling out forms that focused on categorical information.

Social status: In this era of modernisation and technology advancement, student's modes of life especially in Social Status (SS) refer to the degree to which an individual perceives the importance of others believe he or she should use the technology (Venkatesh *et al*., 2012). In the context of learning, Tapscott and Williams (2012) agreed that modern technology such as smartphones act as a status symbol among students in higher learning. A study showed that students chose their technology devices largely driven from a desire to emulate those they admired such as from lecturers, family and peers. Here, the use of u-tech was a way to aspire to the status of others or oneself with a particular group as well as a way to impress others. They also reported that students enjoyed showing their technology devices off because it made them feel important and trendy. They also agreed with this 'feel' and respect they gained from lecturers and friends directly influenced their usage of technology.

Facilitating conditions: Facilitating Conditions (FC) refers to as the degree to which an individual believes that an organizational and technical infrastructure exists to support the usage of the u-tech as a learning tool. A study by Smith (2012) and ElGayar *et al*. (2011) reported that FC, in terms of administrator support can influence the success of technology usage among students. The next party is the technical support provided by the organization. Technology or technical support refers to someone who has the access to personnel guidance and help. According to Lee *et al*. (2013), technical support includes the ICT facilities vendor, internal helpdesk and their availability in helping and assisting users to solve any problems related to the technology usage. The support given is also to ensure that users are satisfied in using technology.

Behavioural intention: Behavioural Intention (BI) was identified as a mediating factor that influences PE to technology usage. A study in Malaysia conducted by Tan (2013) in examining the core factors effecting students usage of e-Placement tests using technology confirmed that SS as one of the core factors that had a positive influence on behavioural intention which in turn lead to an effective use of technology. The researcher found that the influence of lecturers, family and friends was important in influencing student's BI to use e-placement tests continuously. Therefore, this showed that BI acts as a mediating factor that influence the student's percieved SS towards technology usage.

Statement of problem: Studies in identifying the factors that contribute towards technology usage among students in Malaysia were conducted by many researchers (Amirnudin and Sulaiman, 2013; Tan, 2013; Hussin *et al*., 2012; Yusof *et al*., 2012; Suki and Suki, 2013). Although, a lot of studies have been conducted in the recent years on the usage of technology for learning in Malaysia, little is known about the factors that contribute towards the usage of u-tech as not many comprehensive studies have been done related to it. In Malaysia itself, research that uncover the factors related to usage of new technology only focused on the use of LMS and software and not on the ubiquitous technologies such as laptops, smartphones and tablets. Khalid and Sulaiman (2012) reported that unattractive and dull are the main factor that hinder the usage of LMS which has negatively affected the student's intention in using it continuously. Ayub *et al*. (2010) found that the developed software in learning calculus provided to the students are perceived as difficult to use as the students have to put more effort in using and understanding the software.

MATERIALS AND METHODS

The type of research that was carried out in this study was a survey research and the accessible population were included the selected third-year undergraduates from four MTUN. In order to reconfirm the minimum recommended sample for this study, a Raosoft® software was employed. For sampling purpose, the proportional stratified sampling was used and finally the questionnaires were distributed randomly to the identified sample in each faculty to each university. The questionnaire was divided into four sections. Section A, collected the student's demographic information, Section B was on technology utilisation,

Section C was on the technology competency and Section D was on factors that influence the technology utilisation. However, for the purpose of this study, the researcher had discussed only on the analysis done on Section B. A five-point likert scale used were as follows, Never (N), Rarely (once a day a week) (R), Sometimes (2-3 days a week) (ST), Often (4-5 days a week) (OFT), Very Often (>5 days a week) (VO).

The questionnaire was validated by four panels of experts who have a vast experience in educational technology and teaching and learning. About 493 questionnaires had been distributed and 420 responses were returned. The 420 responses were stored and directly imported to the SPSS Version 20.0. Prior to data analysis, the questionnaires were carefully screened by checking for missing data. 20 responses were found to contain errors and incomplete values, therefore, the 400 responses were used as the actual data for this study. The obtained quantitative data were analyzed by using the SPSS Version 20.0. The reliability test was conducted in order to find the consistency of scores or answers provided by an instrument. From the analysis, the range of the instrument's reliability was between 0.819-0.901. Overall the reliability of the instrument was good.

Structural Equation Modeling (SEM): According to Hair *et al.* (2010), SEM is an extension of various multivariate methods encompasses a Confirmatory Factor Analysis (CFA), measurement model and structural model. There are three characteristics that distinguish SEM from the other analyses. The first characteristic is the ability to estimate the multiple and interrelated dependence influences simultaneously (Hair *et al*., 2010). The second feature of SEM is its ability to include items into the analysis. According to Awang (2013), by including the items in the analysis researcher will be able to define the individual constructs and test for convergent validity and construct reliability simultaneously. The last characteristic of SEM is its potential to define a model (Awang, 2013).

The model: As the main objective of this study was to develop a model on the usage of u-tech, the R^2 for each constructs (variables) and every β value for each structural path were referred (Table 1).

The structural path for the predictive model was considered significant by determined its (C.R>±1.96, β and p<0.05) for each and every structural path. From the analysis, the identified significant structural path for TC to BI was identified as insignificant (β = 0.051, p = 0.337). Meanwhile, the structural path for PE to BI (β = -0.037, p = 0.505) and FC to BI (β = -0.110, p = 0.060) were identified as insignificant too. However, the structural paths for EE to BI was significant (β = 0.267, p = 0.000).

Table 1: Regression weights: full mediation

Estimate	SE	CR	p-values
BI<---TC 0.051	0.059	0.960	0.337
BI<---PE -0.037	0.056	-0.667	0.505
BI<---EE 0.267	0.083	4.642	0.000
BI<---FC -0.110	0.053	-2.057	0.060
BI<---SS 0.494	0.081	7.731	0.000
TU<---TC 0.306	0.053	5.786	0.000
TU<---BI 0.156	0.057	2.482	0.013
TU<---PE 0.485	0.054	8.290	0.000
TU<---EE -0.014	0.068	-0.258	0.796
TU<---FC 0.216	0.045	4.258	0.000
TU<---SS -0.126	0.069	-2.078	0.038

SE = Standard Error of regression weight; CR = Critical Ratio for regression weight; P = level of significance

Meanwhile, the structural paths for TC to TU (β = 0.306, p = 0.000), BI to TU (β = 0.156, p = 0.013) PE to TU (β = 0.485, p = 0.000) and FC to TU (β = 0.216, p = 0.000) were all significant but the structural path for EE to TU (β = -0.014, p = 0.796) was not significant.

RESULTS AND DISCUSSION

From the analysis, the structural path for SS to TU (β = -0.126, p = 0.038) and SS to BI (β = 0.494, p = 0.000) were both significant. However, the β value for SS to BI's path was bigger and therefore, it can be concluded that the path for SS to BI was more significant compared to the path for SS to TU. Subsequent validation of the model found it to account for an impressive 48% of the variance in BI and about 63% in u-tech. Therefore, from these results, it can be explicated that this predictive model was able to explain 63% of u-tech usage.

From the model, Performance Expectancy (PE) was identified as the most salient factor influencing the use of u-tech among undergraduates in MTUN. Performance expectancy is the degree to which MTUN student's perceived that using u-tech would help them achieve desired goals in learning as well as improve their communication and collaboration, research and information seeking, critical thinking, problem solving and other important skills that are greatly needed in 21st century (Fig. 2).

The second factor that was identified as important was Technology Competency (TC). In this study, technology competency refers to the skills and the ability to use u-tech and to improve learning, productivity and performance. Technology competency represents behaviours which can be measured in order to assess the degree to which a student has achieved technology competence according to the relevant categories. In this study, the MTUN undergraduates were seen to be more likely to use u-tech when they saw themselves as competent users. The lack of technological competency

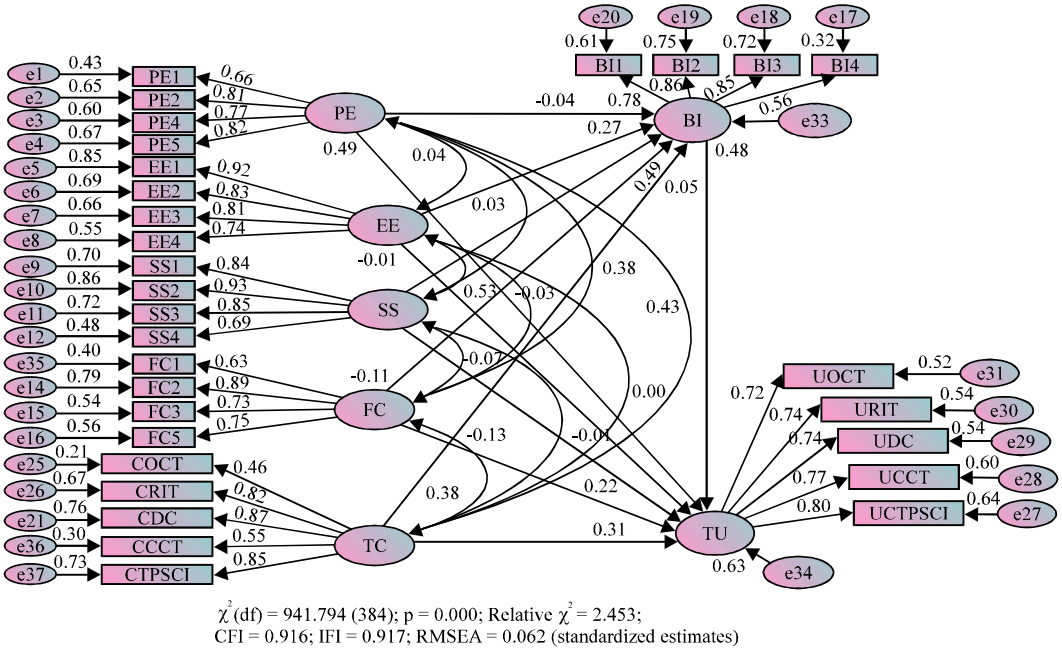

Fig. 2: The model

could probably be one of the main reasons for the undergraduate's refusal to use the new technology for learning. The third important factor influencing u-tech usage was Facilitating Conditions (FC). In this study, facilitating conditions refers to the degree to which MTUN undergraduates believed that their universities provided technical support, training, free Internet access and rewards in supporting u-tech usage. Results from this study revealed that MTUN undergraduates agreed that administrator support could influence the success of their usage of new technology and provision of a technical support in helping them to solve problems related to technology use as well as to ensure that they were satisfied when using new technology.

CONCLUSION

For the mediating effect, results showed that behavioural intention mediated the relationship between Effort Expectancy (EE) and Social Status (SS) towards u-tech usage among MTUN undergraduates. Although, social status was previously identified as being able to influence u-tech usage directly, this relationship can also be mediated by the behavioural intention and the relationship between social status and u-tech usage mediated by behavioural intention was more significant.

RECOMMENDATIONS

More studies could be conducted to compare the level of technology usage and its impacts on student's achievements such as grades or standardized tests. Furthermore, it is suggested to conduct a scientific study with a pre-test/post-test design in determining the effectiveness of technology usage for learning purposes. Finally, the current research involved only among the engineering and technical students in utilising u-tech namely laptops, smartphones and tablets. The results of this study verified that the technology competency, performance expectancy, effort expectancy, facilitating conditions and social status act as factors in influencing the utilisation of u-tech. However, students from different fields may vary in their u-tech usage for learning depending on their subject specific-needs, environment and others. It is recommended to conduct future studies that can examine other factors which may lead to the effective use of u-tech among students in different fields in higher learning in Malaysia. Consequently, the outcome may generate noteworthy findings to the body of knowledge concerning subject specific and programmes variation in the usage of u-tech

IMPLICATIONS

Theoretical and practical implications: The findings of this study have provided practical implications to further infuse technology, especially u-tech as a teaching and learning tool. The investigated factors are manifested in different manners, depending on the individual, supporting environment and so forth. Consequently, it suggests productive directions for students, university administrators, curriculum planners, policy makers and

other pertinent authorities to allow, adapt and alter not only the learning but also the teaching environment to provide a superior education system for the 21st century learners. Hence, this study may act as a catalyst to establish a deliberate vision mutually among the stakeholders and to successfully diffuse and utilise u-tech as learning tools among the students in Malaysia.

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