

# THE UBIQUITOUS TECHNOLOGY MODEL: THE USE AMONG STUDENTS AT MALAYSIAN TECHNICAL UNIVERSITY NETWORKS (MTUN)

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## ABSTRACT

*Laptops, smartphones and tablets which also known as a ubiquitous technology or U-Tech have been widely used by many students in the university. However, little is known about the factors influencing its usage as not many comprehensive studies have been done related to it. A review of related literature demonstrates that factors, namely the Technology Competency (TC), Performance Expectancy (PE), Effort Expectancy (EE), Behavioural Intention (BI), Facilitating Conditions (FC) and Social Status (SS) influence technology usage. The focus of this study was to confirm whether these factors contribute towards the U-tech usage among students in the Malaysian Technical Universities Network (MTUN). This study was based on a quantitative research in which the Structural Equation Modeling using AMOS was employed. The research instrument was in the form of a questionnaire. The reliability of the instrument ranged from 0.851 to 0.912. The results attained from the analysis produced a new theory 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. Thus, it can be concluded that, 63% of the variance in u-tech usage described by the five factors. This study suggested that to increase the use of U-tech, the students need to be given more training and more workshops. The university administration should play an active role in disseminating any news that is related to the usefulness of U-Tech.*

**KEYWORDS:** *New theory; Structural equation modeling; Ubiquitous technology; Engineering and technical students*

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## **1.0 INTRODUCTION**

### **1.1 Ubiquitous Technology**

In this 21<sup>st</sup> century and coupled with the fast paced development of technology, students thrived more on mobility, where they expect to take their technology everywhere they go, and immediate gratification, where they aim to get feedback straight away (Margaryan et al., 2011). The students also expect constant connections in using technology simultaneously for both social and academic lives (Oblinger et al., 2005).

Therefore, these needs have led to the introduction of u-tech in education. In the context of this study, the focused ubiquitous technologies were laptops, smartphones and tablets, as these three technologies were identified to be mostly used for learning purposes among students.

U-Tech is a multipurpose and refined mobile communication which can be used to make calls, browse the Internet to find information or check e-mail, find location using a Global Positioning System (GPS), and take pictures and record video (Zhou et al., 2011). These features make life of students easier, as there is surerity that they get everything they need in one technology (Lance, 2012). U-Tech also permits learners to gain the latest information and knowledge faster, easier with the affordance of the Internet's 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 (Yahya et al., 2010). U-Tech is lightweight and portable, therefore users can take the technology anywhere they like (El-Gayar et al., 2011; Moran et al., 2010; Moran, 2006) and interactive due to the colourful interface, speed, response as well as it immediate feedback (Jobs, 2007; Corona et al., 2013).

The current economic challenges and globalisation are forcing employers in the engineering sector to seek for competent engineers. Consequently, the graduates have to prepare themselves with the skills desired by their future employers. According to Malaysia ICT Policy (2010), is important to produce a new breed of knowledge workers for the 21st century as well as to support learning, teaching, administrative and management processes within the education system with the usage of technology. For engineering and technical students, it is paramount for them not only to utilise the most reliable mobile technology for learning, but also to fully utilise the technology (Male et al., 2010; Megat Johari et al., 2002).

## **1.2 Malaysian Technical University Networks (MTUN)**

The Malaysian Action Plan Phase 2 has put focus to increase the number of future technical-skilled workers by strengthening the field of study based on the engineering as well as Technical and Vocational Education & Training (TEVT). In this context, the Malaysian Technical University Networks (MTUN) plays an important role in this agenda, through the mainstream approach in engineering and technical education. There are four MTUN namely Universiti Teknikal Malaysia Melaka (UTeM), Universiti Tun Hussein Onn Malaysia (UTHM), Universiti Malaysia Pahang (UMP) and Universiti Malaysia Perlis (UniMAP). These four universities focus and function towards the betterment of education in terms of technology, technical and engineering field. Their programmes are designed to be more student-focused and conducted through experiential learning with the affordance of new and latest technology, such as the ubiquitous technologies (Malaysian Technical University Networks (MTUN), Strategic Plan, 2013).

## **2.0 FACTORS INFLUENCING THE USE OF U-TECH**

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

### **2.1 Technology Competency**

In the context of engineering and technical education, Passow (2012) interpreted the technology competencies as the perception of skills, abilities, knowledge, attitudes and other characteristics that performed by students. Male et al., (2010) saw technology competency as the most important skill that should be required by the engineering graduates before they enter the workforce. This is because, the graduates are expected to have a high technology competency as they are expected to deal and involve with various of technical skills which require them to handle and utilise a wide array of technologies and machines (Male et al., 2010).

Goel (2006) conducted a study to assess engineering students' competency in using technology and how far the technology competency may significantly influence the students' technology use. The result revealed that the students had an excellent competency in using technology and this has significantly influenced them to use the

technology for learning purposes. However, from the study, Goel finds that most of the students used technology only for a lower cognitive thinking level, such as for specific subjects and as a general tool, and the technology is not being used to their fullest capability. The use of technology for a higher cognitive thinking at the level of analysis, synthesis, and evaluation is still lacking due to the limited opportunities and exposure given to the students.

## **2.2 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 & Jaafar, 2013). According to Avarez et al., (2011), the use of tablets was theorised to be influenced by the students' PE. In their study, they find that there was a significant direct effect of PE on tablets usage among students in higher institutions.

Research in the Malaysian context showed that the use of educational computer games (ECG) using laptops was regarded as a useful and promising tool due to its fun and engagement features (Ibrahim, 2010). He stated that the use of technology will remain vital when students' perceived PE as one of the salient factors 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 Shamsudin (2009) among students from the institution of higher education in Malaysia, revealed that PE acted as one of the salient factors that influenced the students' usage of new developed software in learning the Computer Graphics and Image Processing subjects.

## **2.3 Effort Expectancy**

Effort expectancy (EE) is a perception which a person believes that using a technology is free of physical and mental attempt (Dulle & Minishi-Majanja, 2011). Meanwhile, Agarwal and Prasad (1998) and Davis (1993) have identified perceived ease of use, which also known as effort expectancy as one of the factors that influence the use of technology.

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.

## **2.4 Social Status**

In this era of modernisation and technology advancement, students' modes of life, especially in learning environment have profoundly been altered (De Silva et al., 2009). In this study, it indicated a change in students' choices and preference in employing technology and how they perceived that social status factor might influence them in using it. Social status (SS) to the degree to which an individual perceives the importance of others believe he or she should use the technology (Venkatesh et al., 2003). According to Venkatesh et al., (2012), the importance of the SS was more significant in a mandated environment and appeared to be significant only in the early stages with its effect eroding over time. Therefore, in some cases, SS can directly and indirectly influences the technology uptake.

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 conducted by them at Harvard University showed that students chose their technology devices based on what their lecturers, family and peers were using and largely driven from a desire to emulate those they admired. 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. Osman et al., (2012) 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.

## **2.5 Facilitating Conditions**

Facilitating conditions (FC) refer 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 (Alryalat et al., 2013). A study by Alryalat et al., (2013), Smith (2012), Abrahams (2004), El-Gayar et al., (2011) and Reed (2010) reported that FC, in terms of administrative support can influence the success of technology usage among students. Administrators in the universities, such as lecturers,

may act as a change agent to help increase the usage of technology and play a key role in supporting students to utilise technology.

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 (Reed, 2010). According to Lee et al., (2013) and Kukulska-Hulme (2010), 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 used. Moreover, the support given is also to ensure that users are satisfied in using technology.

## **2.6 Behavioural Intention**

Behavioural intention (BI) was identified as a mediating factor that influences PE to technology usage. A study conducted by Lee, Kim and Choi (2012) showed that PE has significantly affected on the students' behavioural intention, which in turn have a positive effect to usage. In terms of EE, BI was identified as a mediator that mediates the technology usage among students. A study by El-Gayar et al., (2011) showed a prominent influence of EE on students' behavioural intention towards tablets usage. A study 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 students' BI to use e-placement tests continuously. Therefore, this showed that BI acts as a mediating factor that influence the students' perceived SS towards technology usage.

## **3.0 PROBLEM STATEMENT**

Studies in identifying the factors that contribute towards technology usage among students in Malaysia were conducted by many researchers (Amirnudin & Sulaiman, 2013; Tan, 2013; Hussin et al., 2012; Yusof et al., 2012; Mohd Suki & Mohd Suki, 2011; Abdullah, 2011; Shamsuddin, 2009; Abas et al., 2009). Findings showed that the technology usage were mostly being influenced by perceived ease of use, usefulness, motivation and environment. 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 MTUN itself, research that uncovers the factors related to usage of technology only focused on the use of LMS and software and not on the ubiquitous technologies such as laptops, smartphones and tablets. Khalid (2012) reported that unattractive and dull are the main factor that hinder the usage of LMS which has negatively affected the students' intention in using it continuously. Ibrahim (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. A review of related literature demonstrates that factors such as technology competency, performance expectancy, effort expectancy, behavioural intention, facilitating conditions and social status influence technology uptake the usage. Thus, the focus of this study was to examine and confirm either the determined predictors contribute towards the u-tech usage among students in the Malaysian Technical Universities Network (MTUN).

#### **4.0 METHODOLOGY**

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 students 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 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 usage, Section C was on the technology competency and Section D was on factors that influence the technology usage. However, for the purpose of this paper, the researcher had discussed only on the analysis done on Section D. A five-point likert scale used to be as follows, (1) Strongly Disagree (SD), (2) Disagree (D), (3) Somehow Agree (HA), (4) Agree (A), (5) Strongly Agree (SA).

A total of 493 questionnaires had been distributed and 420 responses were returned. 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. From the analysis, the range of the instruments' reliability was between 0.819 and 0.901. Overall the reliability of the instrument was good.

### 4.1 Structural Equation Theorying (SEM)

According to Hair, Black, Babin, Anderson and Tatham (2010), SEM is an extension of various multivariate methods encompasses a Confirmatory Factor Analysis (CFA), measurement theory and structural theory. 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 in the analysis. According to Awang (2013), by including the items in the analysis. The 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 theory (Awang, 2013).

### 4.2 Data Preparation in Structural Equation Theoryling

#### 4.2.1 Confirmatory Factor Analysis

The Confirmatory Factor Analysis (CF) was the first step in data preparation prior to SEM analysis. The CFA was meant to define the individual constructs and was employed for three major purposes, namely to test for, (1) theory fit, (2) convergent validity and (3) construct reliability (Awang, 2013; Loehlin, 2004; Rencher & Christensen, 2012; Hair et al., 2010). For the test of theory fit, two criteria were referred, (1) the fit indices and (2) the individual factor loadings of each item in a construct. Table 1 shows the set of criteria for fit indices and their recommended value.

Table 1. Set of criteria for fit indices

Fit Indices	Recommended value
CMIN/DF	< 5.0
Relative $\chi^2$	< 5.0
CFI	> .90
RMSEA	< 0.80
Factor loadings	> 0.5
	Positive
	< 1.0

Once the three analyses were conducted, it was expected that the number of items for each construct will be reduced. From the CFA analysis the confirmed items for Section D: Factors Influencing the U-Tech Usage showed that PE factor had four items (PE1, PE2, PE4 and PE5), four confirmed items (EE1, EE2, EE3, EE4) for EE, four confirmed items (SS1, SS2, SS3, SS4) for SS, four confirmed items (FC1, FC2, FC3, FC4) for FC and four confirmed items (BI1, BI2, BI3, BI4) for BI. As the



confirmed items (PE1, PE2, PE4 and PE5) for PE were not in sequel, therefore the items have been renumbered to PE1, PE2, PE3 and PE4.

#### *4.2.2 Measurement Theory Test*

Next the analysis of measurement theory was conducted and prior to this analysis, test for normality and for outliers were conducted. The analysis of measurement theory strived to test for theory fit and discriminant validity. For theory fit, two criteria were referred, (1) the fit indices and (2) the individual factor loadings of each item in a construct. The set of criteria for fit indices that used were similar in the CFA.

##### *4.2.2.1 Test for theory fit*

The complete measurement theory for this study with its seven constructs and it fits well according to the criteria set. The input covariance matrix was generated from 35 indicators measured in the measurement theory and it contains 465 sample moments. There were 60 regression weights, 21 covariances, 37 variances and a total of 81 distinct parameters to be estimated. Hence, this measurement theory had 384 (465-81) degrees of freedom and the chi-square goodness-of-fit statistic,  $X^2 (N=388, df=384) = 930.665, p0 .000$  which was  $<0.05$ .

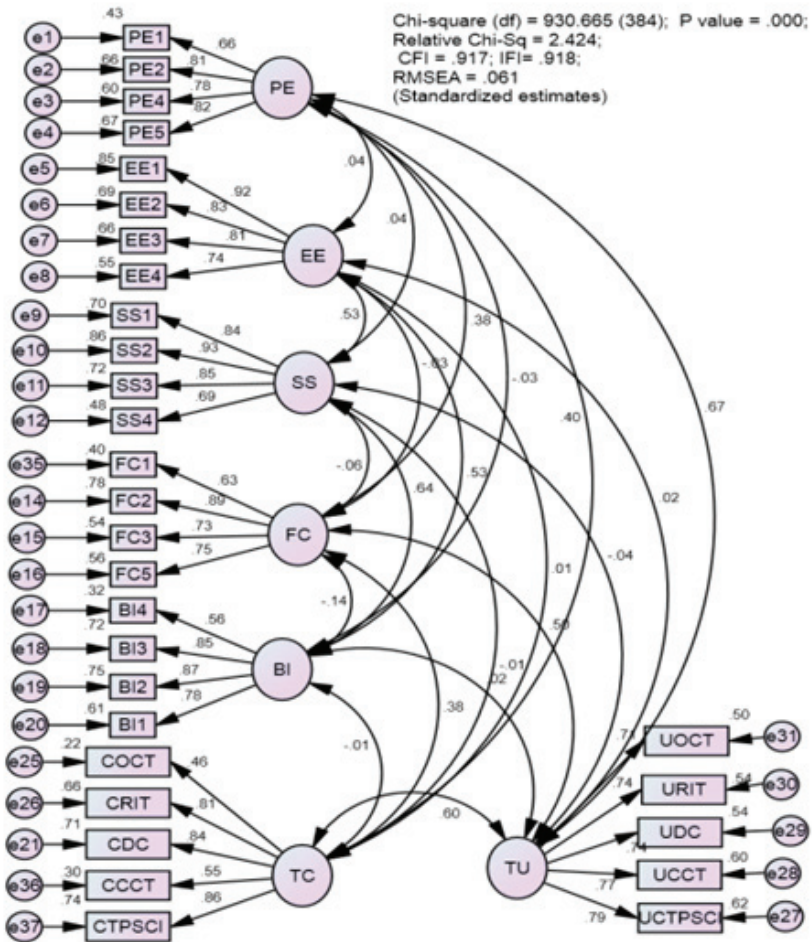


Figure 1. The measurement theory

4.2.2.2 Results for Discriminant Validity

Based on the calculation, the AVE for PE and EE were 0.59 and 0.68 and their  $r^2$  was 0.16. Meanwhile, the AVE for SS and FC were 0.69 and 0.57 and their  $r^2$  was 0.36. The AVE for BI and TC were 0.60 and 0.53 and their  $r^2$  was 0.10. Finally, from the calculation, the AVE for TC and technology usage were 0.53 and 0.56 and their  $r^2$  was 0.36. Therefore, it can be concluded that all the constructs showed sufficient discriminant validity.

## 5.0 FINDINGS

### 5.1 The Predictive Theory

As the main objective of this study was to develop a predictive theory on the usage of u-tech among students in MTUN, the  $R^2$  for each constructs (variables) and every  $\beta$  value for each structural path were referred. The structural path for the predictive theory was considered significant by determined its (C.R  $\geq \pm 1.96$ ,  $\beta$  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 ( $\beta=0.051$ ,  $p=0.337$ ). Meanwhile, the structural path for PE to BI ( $\beta=-0.037$ ,  $p=0.505$ ) and FC to BI ( $\beta=-0.110$ ,  $p=0.060$ ) were identified as insignificant too. However, the structural paths for EE to BI was significant ( $\beta=0.267$ ,  $p=0.000$ ). Meanwhile, the structural paths for TC to TU ( $\beta=.306$ ,  $p=.000$ ), BI to TU ( $\beta=0.156$ ,  $p=0.013$ ), PE to TU ( $\beta=0.485$ ,  $p=0.000$ ) and FC to TU ( $\beta=0.216$ ,  $p=0.000$ ) were all significant, but, the structural path for EE to TU ( $\beta=-0.014$ ,  $p=0.796$ ) was not significant.

From the analysis, the structural path for SS to TU ( $\beta=-0.126$ ,  $p=0.038$ ) and SS to BI ( $\beta=0.494$ ,  $p=0.000$ ) were both significant. However, the  $\beta$  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 predictive theory in this study found it to account for an impressive 48% of the variance in BI and about 63% in u-tech usage among students in MTUN. Therefore, from these results, it can be explicated that this predictive theory was able to explain 63% of the u-tech usage among the students in MTUN.

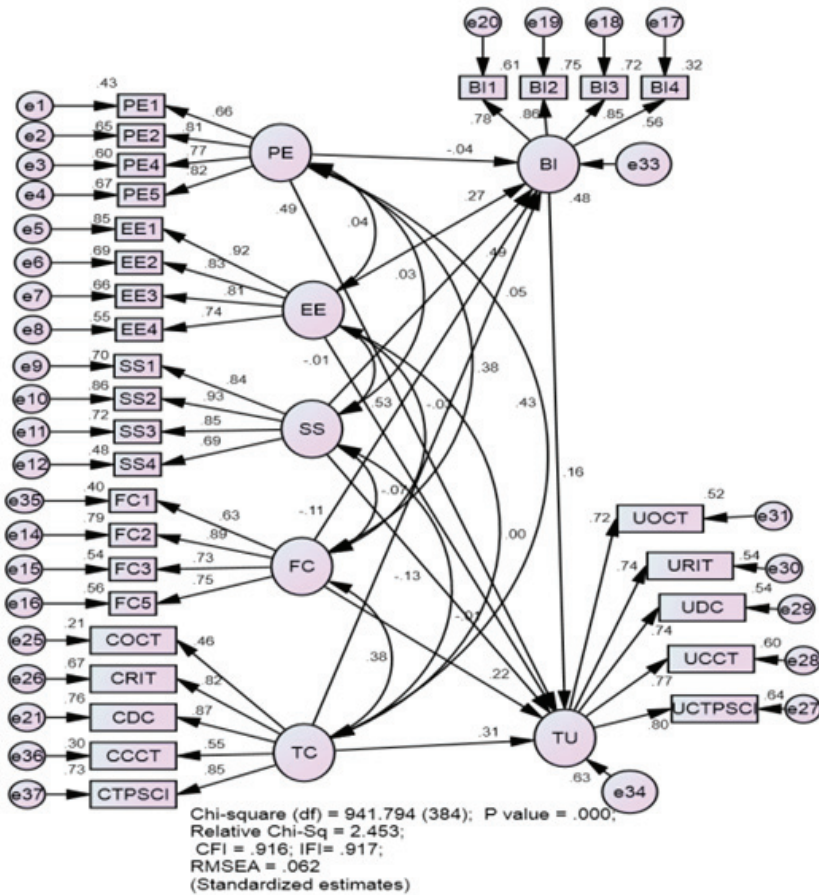


Figure 2. The theory

## 6.0 IMPLICATIONS AND RECOMMENDATIONS

### 6.1 Theoretical Implications

Generally, Unified Theory of Acceptance and Use of Technology (UTAUT) had provided a constructive framework for understanding and predicting variables influencing u-tech use. This study supported the findings that UTAUT could provide an appropriate theoretical framework to explain u-tech usage among students in higher learning in Malaysia, particularly at MTUN. More importantly, this study has not only tested the UTAUT itself, but was expanded by adding one variable, a technology competency which was adapted from TAM theory. With the proposed predictive theory and the results gained in this study, has provided a full understanding on u-tech usage of MTUN students' and its relation between the students' technology

competency and perceptions on performance expectancy, effort expectancy, behavioural intention, facilitating conditions and social status. Therefore, the outcome of this study may contribute in bridging the gap that existed in searching for the theory that predicts the use of u-tech among students in Malaysia.

## **6.2 Practical Implications**

The findings of this research may provide productive directions for MTUN administrations as well as the MOE, to start an effective planning for subsequent policy and investment on the technology initiatives for learning. In brief, the findings of this study have provided practical implications to further infuse technology, especially u-tech, as a 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 the u-tech as learning tools among the students in MTUN.

## **6.3 Recommendations for Future Research**

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 depends 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.

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