2012 International Conference on Management and Education Innovation
IPEDR vol.37 (2012) © (2012) IACSIT Press, Singapore

Technology Acceptance Model for Web-based Repository of Health Education Materials

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Abstract. Web-based system acceptance model (Web-SAM) was designed to test the acceptance ofa newly developed Multimedia Repository System (MRS). . An empirical study was conducted in Universiti Sains Malaysia to predict health sciences (HS) lecturers' intention to use of MRS. One major finding of this study was that *usefulness*, *compatibility*, and years of *computer experience* were direct determinants of lecturers' *intention to use*. *Technical support* has a significant direct effect on *compatibility* and *compatibility* has a significant direct effect on *usefulness*. Web-SAM explained 59% of the variance in *intention to use*. Findings from this study have provided supplementary insights for developers in implementing Web-based information systems for health education.

Keywords: Country-Specific Development; Web-Based System Evaluation; Technology Acceptance Model, Health Education

1. Introduction

Ever since World Wide Web (WWW) technology has been introduced, many researchers have investigated various WWW contexts in an effort to predict acceptance of this technology. These include the use of Web sites and the Internet [1,2] and intention to use e-services [3] and online courses [4,5]. Studies on Web-based systems have primarily involved students or employees, with some involving customers. For example, Ngai et al. [5] surveyed the adoption of WebCT by students in Hong Kong. Similarly, Liao et al. [3] studied students' satisfaction in using e-services in Taiwan. Another Taiwanese study conducted by Wu and Wang [6] focused on the acceptance of mobile commerce by customers, and in South Korea, Kim et al. [7] investigated the adoption of groupware by company staff. Very few articles in the literature have reported on the acceptance of Web-based systems in institutions of higher learning.

A cross-sectional study conducted in 2006 in the health sciences community in Malaysia found that community members have vast collections of digital educational materials that could be shared among health professionals, students, and the public [8,9]. The collections exist in various formats such as lecture notes or slides, rare case photos, and video recordings of clinical procedures, surgical operations, and lectures. Generally, these rich knowledge materials have been kept individually or shared with a limited number of colleagues. There was no appropriate system that would enable members of the community to share knowledge materials and to be recognized for their creations and contributions. To solve this problem, a Multimedia Repository System (MRS) was developed to help the health sciences community share and disseminate health-related knowledge while protecting their intellectual property rights [10].

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MRS is a Web-based application that was designed based on the Health Education Assets Library (HEAL) and Instructional Management Systems (IMS) standards [11]. MRS was developed from scratch using a prototyping system development methodology and implemented using open-source technologies, including Apache Web Server, PHP scripting, and the MySQL database management system. The application is accessible at http://www.mrs.kk.usm.my. This study was carried out to predict intention to use of MRS by using a modified technology acceptance model.

2. Theoretical framework

The theoretical framework of this study was based on the Technology Acceptance Model (TAM), Innovation and Diffusion Theory (IDT), and other extended models which are modifications of these two models. The objective of the TAM is to provide an explanation for the determinants of computer acceptance across a broad range of end-user computing technologies and user populations [12]. TAM consists of perceived ease of use (PEU), perceived usefulness (PU), attitude toward usage (ATU), behavioral intention to use (BI), and actual system use (AU). Davis [12]defined perceived usefulness as the degree to which a person believes that using a particular system will enhance his or her job performance and perceived ease of use as the degree to which a person believes that using a particular system will involve minimal effort. The amount of effort that is required to use an innovation will have an effect on the adopter's sense of self-efficacy with regard to using the innovation. If the individual finds that he or she can comprehend fairly easily how to use an innovation, he or she is more likely to feel confident about using the innovation effectively [13].

The IDT model includes five significant innovation characteristics or attributes, (i) relative advantage, (ii) complexity, (iii) compatibility, (iv) trialability, and (v) observability, to explain users' adoption and decision-making processes [14]. Relative advantage and complexity are parallel to two of the constructs in Davis' TAM, usefulness and ease of use. Relative advantage is defined as the degree to which an innovation is perceived as better than the idea it supersedes. Complexity is the degree to which an innovation is perceived as difficult to understand and use. It is the conceptual opposite of ease of use [15]. Compatibility (COM) is the degree to which an innovation fits with a potential adopter's existing values, beliefs, and experiences. It is one of the significant IDT attributes in IT innovation research, and researchers have often integrated it with TAM. For example, Tung and Chang [4], Wu and Wang [6], and Yi et al. [16] included compatibility in their extended models to predict the acceptance or innovativeness of the proposed technology. Trialability is the degree to which an innovation can be experimented with on a limited basis, and observability is the degree to which the results of an innovation are observable to others. Among the five attributes, the latter two are not as popular as the former three in innovation research and are often omitted in research models.

As discussed above, TAM and IDT are similar in some constructs and supplement one another. Some researchers have suggested that the TAM constructs are fundamentally a subset of the IDT perceived innovation characteristics and that integration of the two could provide an even stronger model than either alone [6]. Some researchers have modified and extended TAM and IDT by adding more constructs such as technical support (TS) and Web experience (WE).

Based on literature research, TS has been neglected as a factor by researchers and has seldom been included in models. Igbaria [17] was the first to include it, and Ngai et al. [5] used it in their study. Users should be able to contact the administrator or Webmaster whenever they need help. "Help", "FAQ", "Inquiries", and "Contact administrator or Webmaster" are essential help-desk functions for any Web-based system.

Figure 1 shows the Web-based System Acceptance Model (Web-SAM) that was proposed to explain the acceptance of MRS by HS lecturers and their intention to use MRS. This model incorporates some of the relevant constructs from TAM, IDT, and other research models which have extended and modified TAM and IDT. The model consists of seven variables and is designed to predict the intention to use MRS using six determinants: perceived ease of use, perceived usefulness, web experience, compatibility, technical support, and computer experience.

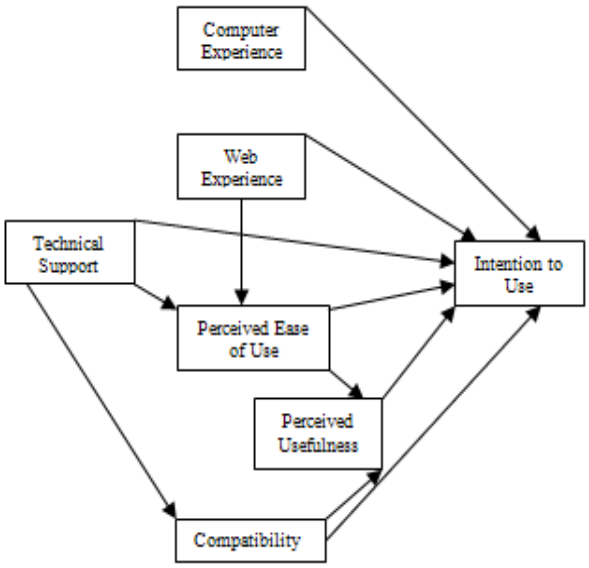

Fig. 1: Web-based System Acceptance Model (Web-SAM).

Based on the proposed Web-SAM model, eleven research hypotheses were postulated for testing:

H1: Perceived ease of use significantly increases intention to use.
H2: Perceived ease of use significantly increases perceived usefulness.
H3: Perceived usefulness significantly increases intention to use.
H4: Compatibility significantly increases intention to use.
H5: Compatibility significantly increases perceived usefulness.
H6: Technical support significantly increases intention to use.
H7: Technical support significantly increases compatibility.
H8: Technical support significantly increases perceived ease of use.
H9: Web experience significantly increases intention to use.
H10: Web experience significantly increases perceived ease of use.
H11: Computer experience significantly increases intention to use.

3. Methodology

On January 7, 2008, a workshop was conducted to perform an acceptance test of the MRS among the HS lecturers from the School of Health Sciences, Universiti Sains Malaysia. An invitation e-mail was sent to all 92 lecturers, and 38 lecturers who were interested in attending the workshop registered by e-mail. Among the 38 registered lecturers, 35 turned up, attended the workshop, and participated until the end. The training period was two-and-a-half hours. The workshop was divided into three main sessions: Introduction, Hands-On, and Evaluation. As an introduction, the participants were told briefly about MRS, given a comparison between MRS and other systems, e.g., Moodle, and told what MRS offers and how they can enhance their lectures with materials from MRS. In the hands-on session, the participants were taught how to use the system. Hard copies of hands-on lecture notes were distributed in advance to all the participants. After the hands-on session, the participants were given the English version of a self-administered questionnaire. The questionnaire was divided into two sections: demographic information and evaluation. The first section asks for background information on the participants such as age, gender, working experience as a lecturer, and computer experience. The second questionnaire contains 26 items measured by seven-point Likert scales. The Structural Equation Modeling technique as implemented in the AMOS 7 software [20] was used for the analysis.

4. Results

Hypotheses were tested using path analysis. The estimates of the regression coefficients, the standard errors (SE), and the 95% confidence intervals (CI) of the constructs in the model were presented in Table 1.

This table shows that PEU had (β=0.33) on IU; a beta coefficient of 0.33 predicted that when PEU increases by 1 unit, IU increasedby 0.33 units. The predictive power of PEU in the prediction of IU was not significantly different from zero at the 0.05 level (two-tailed test). It did not have a significant effect on usefulness either (β=0.05, p>0.05). Therefore, hypotheses 1 and 2 were not supported by the data.

Table 1: Results of path analysis of SEM testing of eleven hypotheses

Structural Path	Estimate (Beta Coef)	S.E.	C.R.	P-Value	95% CI of estimate	
					Lower	Upper
H1:PEU → IU	0.33	0.21	1.59	0.11	-0.08	0.75
H2:PEU →PU	0.05	0.13	0.36	0.71	-0.21	0.31
H3:PU → IU	0.68	0.25	2.70	**0.007**	0.18	1.18
H4:COM →IU	0.41	0.20	2.09	**0.037**	0.02	0.80
H5:COM →PU	0.43	0.10	4.54	**0.001**	0.25	0.62
H6:TS → IU	0.12	0.23	0.53	0.59	-0.33	0.57
H7:TS → COM	0.71	0.20	3.50	**0.001**	0.31	1.11
H8: TS → PEU	0.22	0.16	1.38	0.16	-0.09	0.53
H9: WE → IU	-0.02	0.10	-0.20	0.84	-0.21	0.17
H10: WE → PEU	0.15	0.08	1.94	0.05	-0.01	0.30
H11: CE→IU	0.15	0.06	2.46	**0.014**	0.03	0.27

The high beta values of both PU and COM indicated that a unit increase in PU or COM increased IU by 0.68 and 0.41 units respectively. It was found that both PU and COM had highly significant effects on IU, with p-values of <0.01 and <0.05 respectively. Therefore, hypotheses 3 and 4 were supported by the data. It was also found that COM had a strong significant effect on PU (β=0.433, p<0.05). Therefore, hypothesis 5 was also supported.

When the estimates of TS were examined, it was found that although TS had a very strong and significant effect on COM (β=0.71, p<0.001), it did not have highly significant effects both on IU (β=0.12, p>0.05) and PEU (β=0.22, p>0.05). Therefore, hypotheses 6 and 8 were not supported, while hypothesis 7 was supported.

Obviously, among all these constructs, WE was found to be the weakest predictor of IU, having a weak negative effect on IU (β= -0.02) with a p-value greater than 0.05. Therefore, hypothesis 9 was not supported. Its regression coefficient on PEU was 0.19, and its p-value was 0.05. Although the p-value was almost significant, the beta-coefficient value (0.194) was not of a satisfactory magnitude, and consequently hypothesis 10 was also rejected. According to the results, CE had a significant effect on IU, with a beta coefficient of 0.15 and a p-value of 0.01. Therefore, hypothesis 11 was supported. In summary, five hypotheses, H3, H4, H5, H7, and H11, were supported, while six hypotheses, H1, H2, H6, H8, H9, and H10, were not.

Figure 2 shows the empirical results of the Web-SAM model. It was estimated that 14% of PEU was explained by TS and WE. Twenty-seven percent of COM was explained by TS, and 39% of PU was explained by PEU, TS, and COM. All six constructs together explained 59% of the variation in IU.

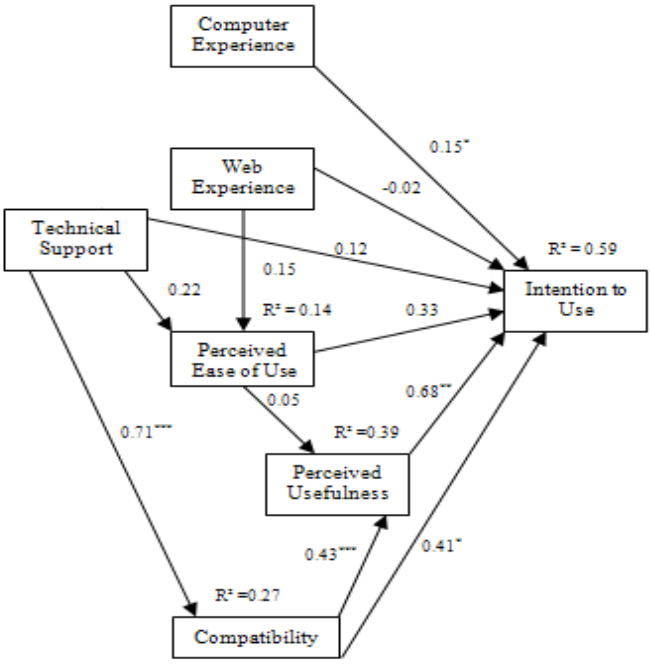

Fig. 2: Empirical results of Web-based System Acceptance Model (Web-SAM).

5. Discussion

Researchers have already identified various determinants affecting acceptance of Web-based systems, but very few studies have been performed in institutions of higher learning. Similarly to other studies conducted on the acceptance of IT- and ICT-related technologies [3,4,16,18,21], this study also found that PU is a significant predictor ($p<0.01$) of IU. It has a very strong direct effect on IU, as well as an indirect effect on IU through PEU and COM. It was estimated that the predictors of PU (i.e., TS and COM) explained 39 percent of its variance. This result indicated that lecturers who perceived that the system was useful might tend to be more willing to use the system in the future, but that the system must be compatible with their lecture preparation style and technical support must be provided whenever they need help in using the system by means of features such as a user guide, an FAQ, and a link to contact the system administrator. Any doubts and problems encountered should be solved with a mouse click using convenient features provided by the system.

Consistent with the results of this research, other studies investigating the acceptance and use of computer systems by knowledge workers in Saudi Arabia [22], current IT usage among Malaysian entrepreneurs [23], acceptance of groupware [7], and acceptance of Web-based learning systems [5] have also found that PU has a significant direct effect on actual usage.

Also in agreement with the findings from previous studies [6,16,23], the present study has shown that PEU is not a significant predictor of IU, although the direct effect was high ($\beta=0.33$). Contradicting with these findings, Tung and Chang [4] found that the IU of online course usage by nursing students was significantly affected by PEU. Jebeile and Reeve [1] also found that PEU had a significant effect on IU of the Web by Australian secondary-school teachers for teaching preparation, although it had no significant effect on intended use of the Web for teaching delivery.

Considering Davis's determinants, PU and PEU, the latter did not seem to be a consistent determinant of IU for certain technology acceptance. This study has shown that when other constructs were incorporated into the model, PU was found to be a consistent determinant of IU, whereas PEU was no longer a significant determinant of IU. Kim et al. [7] stated that PEU represents short-term belief and that its impact quickly diminishes after a short period of usage. Compared to the era when computer technologies were first introduced, nowadays computer users are becoming smarter, and the software packages available are also becoming more and more user-friendly.

In line with the findings from Wu [6], COM was found to have significant effects on both PU and IU, with high beta coefficients and significant p-values. TS, on the other hand, had a strong influence on COM.

This underscored the importance of system compatibility with potential users' personal preferences that might have strong influence on IU. The importance of this factor could mean that a person's choice is normally based on what is more compatible with him or her rather than on other aspects. Mao [18] claimed that when technology is harmonized with a person's work, he or she tends to have a more favorable impression and is more likely to use it.

It was found that only a very few studies have included TS in their models. Although this factor did not have a direct significant effect on IU, the findings of this study revealed an underlying effect of TS on IU through PU. The importance of TS was further indicated by its direct effect on PEU and COM. A groupware usage survey [7] found out that TS had significant direct effects on both PEU and PU. TS is essential for those who have less experience in Web technology and lack ofcomputer skills. Their expectations for round-the-clock availability of TS should be taken into consideration in system development.

Yi et al. [16] found that WE had significant direct effects on both PEU and PU. Inconsistently, the results of this study showed no significant effect of WE on PEU, with a marginally insignificant p value of 0.052. This discrepancy might perhaps be due to the small sample size in this study because the power of a test to detect an underlying disagreement between theory and data is controlled largely by the size of the sample [24].

It was noted that very few studies have included CE in their models and Al-Gahtani [22] found that CE negatively moderated the influence of effort expectancy on behavioral intentions to use the computer. The negative interaction of effort expectancy and experience on intention indicated that, as years of experience with computers increase, PEU becomes less important in predicting participants' behavioral intentions.

In this study, years of computer experience were found to have a significant effect on IU ($\beta = 0.15$, $p < 0.05$). This was explained by noting that users who have been using computers for many years feel more confident in using IT-related technologies, which might lead them to explore new technologies with less effort. This study looked only for effect of CE on IU, without considering interacting effects with other constructs. Interestingly, it was found that when CE was added to the model, the amount of variance explained in IU increased from 52% to 59%.

6. Conclusions

This study found that PU, COM, and years of computer experience were direct determinants of IU. The results for direct and indirect effects among the constructs revealed that TS has an indirect effect on IU through COM and PU. The materials in the system under study should be useful for lecturers in their lecture preparations in areas such as format and subject-matter information. The strong direct and indirect effect of COM on IU proved that system features should be compatible with lecturers' style of preparation. Moreover, facilitating users with reliable and efficient TS is another important fact for system developers to consider. Importantly, to facilitate efficient TS for system users, there should be a stand-by system administrator available to respond all feedback and queries.

The six constructs used in this study cumulatively explained 59% of the variance in IU. There might be some other determinants which were not included in this model and may have an effect on IU, such as organizational support [22] and an e-learning culture in the organization [5]. When lecturers actually use the system in practice, they may come across some other factors which would influence their IU and their actual usage, such as system quality (e.g., accessibility, integration, timeliness, etc.) and information quality [21].

The overall findings provided supplementary insights for developers implementing Web-based information systems. Further research on this topic should continue to test the recommended determinants from this study along with the additional determinants suggested above. Replicating this study through extension of the model on a bigger sample might give more robust results.

7. Acknowledgments

The authors would like to thank the entire MRS development team and the participants who willingly and actively attended the MRS evaluation workshop. We also thank Universiti Sains Malaysia for providing the short-term grant to make this study possible.

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