TIM TAM: A Teaching Initiated Modification of the Technology Acceptance Model

Con Nikakis, Victoria University - Footscray Park, Footscray 3011, Australia; E-mail: con.nikakis@vu.edu.au
Linda Hill; E-mail: linda.hill@web.de

ABSTRACT

The Technology Acceptance Model (TAM) and its variants have proven to be a useful tool in explaining user uptake intentions. With the drive to use new eLearning environments, cost-benefit analyses have been given little attention with the consequent 'Has there been a commensurate improvement in learning?' question largely unanswered. Analysis of technology uptake issues relating to learners informs teachers and educational administrators of the most efficient use of new learning technologies. This paper proposes the need for an educational, context-sensitive variant of the TAM as a basis for grappling with the educational value question, whilst maintaining learning quality.

Keywords: Technology Acceptance Model, TAM, EduTAM, technology uptake, educational technology acceptance.

INTRODUCTION

Recent research undertaken within the Information Systems arena, has related to the modelling of technology uptake in the Technology Acceptance Model (TAM). TAM has shown promise in defining the underpinning behavioural reasons why users embrace new computer technology. Much of this research has culminated in the pulling together of TAM-related research within a seminal article presented in Information Systems' Management Information Systems Quarterly (MISQ): *"User Acceptance of Information Technology: Toward a Unified View"* (Venkatesh, Morris, Davis, & Davis, 2003). The purpose of this paper is to review the development of TAM-related research that culminated in the Venkatesh paper, to identify the key factors and issues most relevant in "porting" this research practice into ICT education technology research, and in particular, the factors important in the adoption of new eLearning programs.

NEW TECHNOLOGIES IN EDUCATION – THE NEED FOR COST BENEFIT?

During the past twenty to thirty years, there has been a development of technologies at the forefront of the communication revolution. These have centred on the development of sophisticated communication channels championed by the telephone, the PABX (Private Automatic Branch eXchange), the FAX (facsimile) and recently, the internet and mobile telephone (Yi-Shun, Hsin-Hui, & Pin, 2006). A communication revolution involving the merger of three global industries: the telephone, computer and entertainment industries (Sanayei & Sadeghi, 2004); (Crafts, 2005). A revolution manifested in sales pitches that focus on consumer experiences underpinned by access to content-rich information in a form that only broadband, multimedia can deliver ("Telstra - Product & Services: 3G Mobile Phones,").

Whilst similar cutting-edge technologies aren't widely used in education, educators have shown that they aren't backward in taking on-board new technologies. The advocates of automated teaching methods used enabling technologies such as teaching machines and early computers in innovative ways, but mainly as adjuncts to traditional "face-to-face" methods (Niemiec & Walberg, 1989). In all these cases, the mooted replacement of the traditional teacher didn't eventuate.

The communication revolution encompassing cheap, highly accessible, multimedia technologies has resurrected the idea of replacing the teacher, with "learning from home" (Jared, 2005); (van Schaik, Barker, & Moukadem, 2005). Much is now possible with these technologies with interaction, instant response, extensive research capacity and simulation, available to the teacher. These technologies are no longer content delivery vehicles, but increasingly a way of providing student-centred, self-paced, eLearning programs (Turker, Gorgun, & Conlan, 2006). Government and education administrations see the rapid rise in these eLearning programs as a way of cutting delivery costs (particularly labour costs) without decreasing quality. Consequently, education administrations are funding these types of programs (Solomon, 2005).

But with the increased expenditure, 'Has there been a commensurate improvement in learning?' A TAM analysis could be part of the attempt to answer this question.

Beastall suggests that current spending on these technologies hasn't seen the improvement in learning to the extent it might have (Beastall, 2006), with Harris and Weller advocating the need to evaluate these programs using cost benefit analyses (Harris, 2003);(Weller, 2004). Cost benefit analyses should have significant currency amongst local educational administrations who must ensure their scarce funds are being used to achieve the richer eLearning environments promised (Solomon, 2005). However, analyses able to determine the degree of success of eLearning programs are often not included within the cost benefit assessments educational administrations undertake. The subsequent scepticism this can generate will drive the need for the eLearning dollar to be stretched further. The extent of student acceptance of these programs is therefore fundamental to their ultimate success (Flynn, Concannon, & Bheachain, 2005).

Thus, research into the decisive factors involved in the uptake of eLearning technologies, will have significant value for education administrations in their eLearning investment decision-making (Ndubisi & Chukwunonso, 2004).

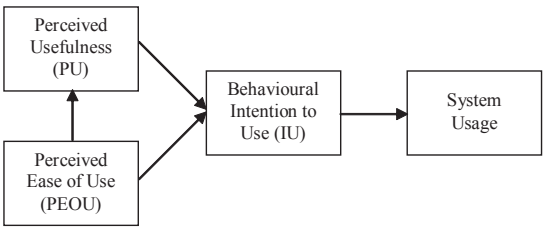
Much can be made of the experience the business world has had in technology uptake research issues. Perceptions of information technology have taken on new meaning in the business world where it's crucial the "right" choices be made to lead to the successful adoption of information technology and the monetary benefits such adoptions bring.

In ICT education, the success factors aren't as clearly defined in pure "dollar" terms, but technology uptake modelling is just as relevant (Chang, 2002). The benefits aren't immediately realized but are longer term and less tangible, leading to monetary and non-monetary benefits (Conlon, 2000). To this end, understanding the determining factors that drive a successful acceptance of an information technology education program should be an imperative. Deriving the factors thus becomes crucial to designing relevant educative programs (Ellis, 2001) for modern, apparently technologically literate students, who appears to have little time or patience in utilising courseware that they see as irrelevant.

TAM AND TAM-LIKE MODELS

In the information systems research field, the TAM (F. D. Davis, 1989) has been used to explain the key behavioural factors involved in the uptake of computer technology. This model was adapted from behavioural science's Theory of

Figure 1. Technology acceptance model



Source: (Money & Turner, 2004)

Reasoned Action (TRA) (Fishbein & Ajzen, 1975), with the underlying principal being that individuals adopt a specific behaviour if they perceive it leading to positive outcomes.

The TAM adaptation identifies Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) as the principal behavioural constructs influencing users' Intention to Use (IU) (F. D. Davis, 1989).

The model has had wide acceptance as a reasonable predictor of information technology uptake. Studies since, (Taylor & Todd, 1995); (Szajna, 1996); (Gefen & Straub, 1997) and (Doll, Hendrickson, & Deng, 1998), confirm it as a useful instrument for investigating and forecasting user information technology acceptance. Many of these studies support the moderate explanatory limitations of the two factors (PU and PEOU), with the model accounting for 40%-50% of the variance in computer technology usage (Ifinedo, 2006).

Recent efforts have been undertaken to improve TAM by including factors that account for a greater part of the variance (Venkatesh & Davis, 2000); (Venkatesh & Morris, 2000); (Gefen & Straub, 1997); (McFarland, 2001); (Wright & Granger, 2001). One positive advance is the inclusion of characteristics of the Theory of Planned Behaviour (TPB). (Ajzen, 1991); (Pavlou & Fygenson, 2006) particularly in predicting the adoption of computer-related technologies for specific computing environments. Examples include the take-up of e-commerce within small business communities, and the evolution of TAM to include Wireless Internet via Mobile Device (WIMD) specific factors (J. Lu, Chun-Sheng, Chang, & Yao, 2003) with the latter study describing extra social factors such as individual differences, technology complexity, facilitation and trust.

The explanatory power of these modified models is further enhanced by structural equation modelling (Alshare, Miller, & Wenger, 2005) that combines TAM and TPB factors.

The original generality and simplicity of applications attributed to TAM have been supplanted by targeted technology-specific variations with superior explanatory power (Venkatesh et al., 2003). TAM and modified TAM models are also beginning to be described in educational contexts, particularly in relation to tertiary student attitudes to technology uptake (Drennan, Kennedy, & Pisarki, 2005), (Wolski & Jackson, 1999b).

TAM IN AN EDUCATION CONTEXT

It isn't unusual in the research world to take activities from one set of research endeavours and migrate these to another, throwing new light on research within the latter (Day & Jorgensen, 1995). Migrating the ideas espoused by Venkatesh and others into an educational technology uptake setting would seems valuable. In an educational context, TAM could be used to describe the effectiveness of new technologies introduced into classrooms (Welsh, Wanberg, Brown, & Simmering, 2003) or to evaluate the effectiveness of new teaching programs (Cheung & Huang, 2005) with a technology focus. eLearning programs would seem to be suitable (Liaw, 2001). Educational administrations might be able to use a TAM evaluation of pilot eLearning programs to determine the effectiveness of these programs before committing to full roll-outs (Ifinedo, 2006).

So, is the use of TAM in an educational context possible? If so, how? To answer these questions, it would be useful to review the literature for successful use of TAM in educative environments and determine whether there is a need for modification, adaptation, or complete rejection of the approach. The modification of TAM as described by Venkatesh that used meta-analysis in the formulation of the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), is a useful starting point. In this meta-analysis, there were two key issues in developing the UTAUT: the degree of robustness or the explanatory power of the model, and the degree of applicability in specific contexts (Venkatesh et al., 2003). This seminal work reflected thoughts of others (Rose & Straub, 1998) and (Szajna, 1994) in relation to these issues. So, to what extent have these two issues been raised within the information systems field of research?

Robustness of the Davis general TAM model had been tested many times (F. Davis, 1986), Straub's study verified the effectiveness of TAM in information technology but sought to recommend the development of a cultural dimension (Straub, Keil, & Brenner, 1997), McFarland's testing of TAM in relation to technology used for mail surveys (McFarland & Hamilton, 2006). Horton et al. considered the application of the technology acceptance model in explaining intranet usage in two organizations: a bank and engineering firm (Horton, Buck, Waterson, & Clegg, 2001). Lu & Gustafson verified PEOU and PU as factors when they determined there was an intermediatory exploring stage in the technology uptake process (H. P. Lu & Gustafson, 1994). Finally, Wober & Gretzel verified the TAM in their survey conducted among tourism operators (Wober & Gretzel, 2000).

The degree of applicability into specific contexts has necessitated modifications to TAM. Wu and Chen extended TAM with the antecedent variable of trust and elements of the Theory of Planned Behavior (TPB), to better understand behavioural intention in using on-line tax products (Wu & Chen, 2005), Whetton & Walker compared TPB (Ajzen, 1991), TAM and Diffusion of Innovation Theory (Rogers, 1995) in the uptake of health informatics systems and moderated TAM with a Diffusion Innovation effect (Whetton & Walker, 2002). Gurajan reinforced Whetton et al. when they identified health-care informatics literature describing the inappropriateness of TAM, and that specific adaptations were necessary for health-care (Gururajan, Toleman, & Soar, 2004). Finally, Venkatesh & Ramesh illustrated the Microsoft Usability Guidelines (MUG) (Agarwal & Venkatesh, 2002) outperform TAM in a wireless usability study (Venkatesh & Ramesh, 2006).

It is clear that TAM modelling is a useful instrument with significant robustness, in determining technology acceptance in many general applications. On the other hand, for greater applicability, TAM applied to specific environments has been shown to need either modification or adaptation. In the attempt to use a generalised TAM within specific contexts some of its explanatory power and usefulness can be lost. How does a generalised TAM lose its usefulness in an educational context?

THE CASE FOR AN EDUTAM?

There have been studies in the application of TAM or TAM-like models within educational settings. Wolski is concerned about TAM failing to include normative factors relevant in an education setting (Wolski & Jackson, 1999a). Drennan et al. conducted a study of first year management students with results that suggest student satisfaction is influenced by positive perceptions toward technology, and an autonomous learning mode – a significant adaptation of TAM (Drennan et al., 2005).

Cheung & Huang propose a partial use of TAM with modification – the addition of IT Diffusion Model factors - in their study of how the internet is used in university learning from a student's perspective (Cheung & Huang, 2005). Selim evaluates the use of the World Wide Web as a teaching and research tool amongst students and proposes a Course Webs Acceptance Model (CWAM) adaptation of TAM (Selim, 2003) which essentially validates TAM with a course website usage variation. Similarly, McFarland adds an age factor to TAM to better explain eLearning program uptake (McFarland, 2001). Legris et al. suggest that TAM is useful if human and social processes are included (Legris, Ingham, & Collerette, 2003). They describe a simple student environment which TAM is good at explaining but suggest more complex environments should include supplementary Innovation Model factors.

The limited literature suggests there are aspects of TAM that are useful in analysing educational technology acceptance and more broadly, technology-orientated educational programs such as eLearning programs. So, while TAM has wider usage and usefulness in the business community, to be a greater predictor of program success in an educational setting would require modifications with factors that aren't included in a generalised TAM.

In the technology world, the need to understand technology acceptance has been driven by the savings that can be made by an effective technology implementation.

In an educational setting, a similar impetus should also be clear but is undervalued (Finkelstein & Scholz, 2000). This maybe because of the lack of solid research undertaken over recent years into the concepts of technology acceptance in education. The little research that has been completed indicates that TAM and TAM-like models are showing some robustness in their explanatory power as predictors of technology acceptance and the consequent success of technology-based education programs. In particular, with proposed eLearning programs it would be consistent to apply TAM methodologies to evaluate degrees of success. What is also clear is that using a broad, general model is not sufficient. The application of TAM in specific educational settings necessitates the substantial modification of the model, usually by adding humanistic factors described by other models (Wright & Granger, 2001); (Wolski & Jackson, 1999a), (Ma, Andersson, & Streith, 2005).

CONCLUSION

What is needed now? Firstly, work can be undertaken in testing a generalised TAM within different educational environments to confirm the need for setting education specific modifications. Secondly, use can be made of a meta-analysis similar to Venkatesh's with applications of TAM that are education specific (Venkatesh et al., 2003). Thirdly, the education specific criteria so gleaned could then be used to propose an education specific modified TAM (Pan, Gunter, Sivo, & Cornell, 2005), that is, an EduTAM. Finally, an EduTAM should be verified and tested by applying it to existing education programs and maybe new and emerging learning environments, such as podcasting and mobile technology-based learning. In relation to the original proposition (looking for factors that modify TAM for the specific eLearning context), it is clear that TAM, in a modified form, could be a significant tool for predicting the success of new technology-based environments, such as the latest eLearning programs, within an educational setting. For an eLearning strategy this would mean that an EduTAM could be used to identify the important criteria. These criteria can then be used to set up specific educational administrative practices that bring technology uptake issues into the forefront of planning considerations, and to create strategies that are "student-centric" in relation to eLearning program acceptance. Finally these strategies could be used to address EduTAM issues within eLearning training programs delivered to teachers.

Hence, education administrations would be able to predict with greater confidence that funded eLearning programs would deliver commensurate improvements in learning.

REFERENCES

Agarwal, R., & Venkatesh, V. (2002). Assessing a Firm's Web Presence: A Heuristic Evaluation Procedure for the Measurement of Usability. *Information Systems Research, 13*(2), 168-186.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior & Human Decision Processes, 50*(2), 179.

Alshare, K., Miller, D., & Wenger, J. (2005). An Exploratory Survey of Student Perspectives Regarding Search Engines. *Delta Pi Epsilon Journal, 47*(2), 75-82.

Beastall, L. (2006). Enchanting a Disenchanted Child: Revolutionising the Means of Education Using Information and Communication Technology and e-Learning. *British Journal of Sociology of Education, 27*(1), 97-110.

Chang, C.-K. (2002). *Record Desktop Activity as Streaming Videos for Asynchronous, Video-Based Collaborative Learning*. Taiwan.

Cheung, W., & Huang, W. (2005). Proposing a Framework to Assess Internet Usage in University Education: An Empirical Investigation from a Student's Perspective. *British Journal of Educational Technology, 36*(2), 237-253.

Conlon, T. (2000). Visions of Change: Information Technology, Education and Postmodernism. *British Journal of Educational Technology, 31*(2), 109-116.

Crafts, N. (2005). The 'Death of Distance.' *World Economics, 6*(3), 1-14.

Davis, F. (1986). *Technology Acceptance Model for Empirically Testing New End-User Information Systems: Theory and Results.* Unpublished Doctoral Dissertation, Massachussetts Institute of Technology, Boston, MA.

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly, 13*(3), 318-340.

Day, D., & Jorgensen, C. (1995). The transfer of research information within and by multicultural teams, *Information Processing & Management* (Vol. 31, pp. 89-100).

Doll, W. J., Hendrickson, A., & Deng, X. (1998, Fall). Using Davis's Perceived Usefulness and Ease-of-Use Instruments for Desision Making: A Confirmatory and Multigroup Invariance Analysis. *Decision Sciences, 29,* 839-869.

Drennan, J., Kennedy, J., & Pisarki, A. (2005). Factors Affecting Student Attitudes toward Flexible Online Learning in Management Education. *Journal of Educational Research, 98*(6), 331-331.

Ellis, A. (2001). Student-Centred Collaborative Learning via Face-to-Face and Asynchronous Online Communication: What's the Difference?

Finkelstein, M. J., & Scholz, B. W. (2000). *Dollars, Distance, and Online Education: The New Economics of College Teaching and Learning.*: Oryx Press, 4041 North Central at Indian School Rd., Phoenix, AZ 85012-3397 http://www.oryxpress.com.

Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley Publishing Company.

Flynn, A., Concannon, F., & Bheachain, C. N. (2005). Undergraduate Students' Perceptions of Technology-Supported Learning: The Case of an Accounting Class. *International Journal on E-Learning, 4*(4), 427-444.

Gefen, D., & Straub, D. (1997). Gender Difference in the Perception and Use of E-Mail: An Extension to the Technology Acceptance Model. *MIS Quarterly, 21*(4, December), 389-400.

Gururajan, R., Toleman, M., & Soar, J. A. A. A. (2004). *Necessity for a New Technology Acceptance Model to Predict Adoption of Wireless Technology in Healthcare*. Paper presented at the National Health Informatics Conference (12th : 2004 : Brisbane (Qld)).

Harris, P. (2003). ROI of E-Learning: Closing in. *T+D, 57*(2), 30-36.

Horton, R. P., Buck, T., Waterson, P. E., & Clegg, C. W. (2001). Explaining intranet use with the technology acceptance model. *Journal of Information Technology (Routledge, Ltd.), 16*(4), 237.

Ifinedo, P. (2006). Acceptance and Continuance Intention of Web-BAsed Learning Technologies (WLT) Use Among University Students in a Baltic Country. *The Electronic Journal on Information Systems in Developing Countries, 23*(6), 1-20.

Jared, L. (2005). Breaking down the Confines: An E-Learning Resource for All, at Home and at School. *Educational Media International, 42*(2), 135-141.

Legris, P., Ingham, J., & Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management, 40*(3), 191-204.

Liaw, S.-s. (2001). Developing a User Acceptance Model for Web-based Learning. *Educational Technology, 41*(6), 50-54.

Lu, H. P., & Gustafson, D. H. (1994). An Empirical-Study of Perceived Usefulness and Perceived Ease of Use on Computerized Support System Use over Time. *International Journal of Information Management, 14*(5), 317-329.

Lu, J., Chun-Sheng, Y., Chang, L., & Yao, J. E. (2003). Technology acceptance model for wireless Internet. *Internet Research, 13*(3), 206-222.

Ma, W. W.-k., Andersson, R., & Streith, K.-O. (2005). Examining User Acceptance of Computer Technology: An Empirical Study of Student Teachers. *Journal of Computer Assisted Learning, 21*(6), 387-395.

McFarland, D. J. (2001). The Role of Age and Efficacy on Technology Acceptance: Implications for E-Learning.

McFarland, D. J., & Hamilton, D. (2006). Adding contextual specificity to the technology acceptance model. *Computers in Human Behavior, 22*(3), 427-447.

Money, W., & Turner, A. (2004, 5-8 Jan. 2004). *Application of the technology acceptance model to a knowledge management system.* Paper presented at the 37th Annual Hawaii International Conference, Hawaii.

Ndubisi, N. O., & Chukwunonso, N. C. (2004). On-line learning adoption intention : comparing the predictive power of two competing models.

Niemiec, R. P., & Walberg, H. J. (1989). From Teaching Machines to Microcomputers: Some Milestones in the History of Computer-Based Instruction. *Journal of Research on Computing in Education, 21*(3), 263-276.

Pan, C.-C. S., Gunter, G., Sivo, S., & Cornell, R. (2005). End-User Acceptance of a Learning Management System in Two Hybrid Large-Sized Introductory Undergraduate Courses: A Case Study. *Journal of Educational Technology Systems, 33*(4), 355-365.

Pavlou, P. A., & Fygenson, M. (2006). Understanding and Predicting Electronic Commerce Adoption: An Extension of the Theory of Planned Behaviour. *MIS Quarterly, 30*(1), 115-143.

Rogers, E., M. (1995). *Diffusion of Innovations* (Fourth Edition ed.). New York: The Free Press.

Rose, G., & Straub, D. (1998). Predicting General IT Use: Applying TAM to the Arabic World. *Journal of Global Information Management, 6,* 39-46.

Sanayei, A., & Sadeghi, M. (2004). Globalization & Knowledge Economy. *Journal of International Marketing & Marketing Research, 29*(3), 153-163.

Selim, H. M. (2003). An Empirical Investigation of Student Acceptance of Course Websites. *Computers & Education, 40*(4), 343-360.

Solomon, G. (2005). Shaping E-Learning Policy: Virtual Education Is Growing Swiftly, and along with It, Debates Surrounding Teacher Quality and Jurisdiction, Funding, Accreditation, Assessment, Unions, and More. *Technology & Learning, 25*(10), 26-26.

Straub, D., Keil, M., & Brenner, W. (1997). Testing the technology acceptance model across cultures: A three country study. *Information & Management, 33*(1), 1-11.

Szajna, B. (1994). Software Evaluation and Choice: Predictive Validation of the Technology Acceptance Instrument. *MIS Quarterly, 17*(3), 319-324.

Szajna, B. (1996). Empirical Evaluation of the Revised Technology Acceptance Model. *Management Science, 42*((1)), 85-92.

Taylor, S., & Todd, P. (1995). Assessing IT usage: The Role of Prior Experience. *MIS Quarterly, 19*(4), 561-570.

Telstra - Product & Services: 3G Mobile Phones [Electronic Version], 1. Retrieved 12/04/2006 from http://www.telstra.com.au/video/index.htm?tR=4ts.

Turker, A., Gorgun, I., & Conlan, O. (2006). The Challenge of Content Creation to Facilitate Personalized E-Learning Experiences. *International Journal on E-Learning, 5*(1), 11-17.

van Schaik, P., Barker, P., & Moukadem, I. (2005). Using a Digital Campus to Support Electronic Learning in Lebanon. *Innovations in Education & Teaching International, 42*(2), 157-166.

Venkatesh, V., & Davis, F. D. (2000). A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Management Science, 46*(2), 186.

Venkatesh, V., & Morris, M. G. (2000). Why Don't Men Ever Stop to Ask for Directions? Gender, Social Influence and their Role in Technology Acceptance and Usage Behaviour. *MIS Quarterly, 24*(1), 115.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly, 27*(3), 425-478.

Venkatesh, V., & Ramesh, V. (2006). Web and Wireless Site Usability: Understanding Differences and Modeling Use. *MIS Quarterly, 30*(1), 181-205.

Weller, M. (2004). Learning Objects and the E-Learning Cost Dilemma. *Open Learning, 19*(3), 293-302.

Welsh, E. T., Wanberg, C. R., Brown, K. G., & Simmering, M. J. (2003). E-Learning: Emerging Uses, Empirical Results and Future Directions. *International Journal of Training and Development, 7*(4), 245-258.

Whetton, S., & Walker, J. A. A. (2002). *The Diffusion of Innovation: Barriers to the Uptake of Health Informatics*. Paper presented at the National Health Informatics Conference (10th : 2002 : Melbourne (Vic.)).

Wober, K., & Gretzel, U. (2000). Tourism Manager's Adoption of Marketing Decision Support Systems. *Journal of Travel Research, 39*(2), 172.

Wolski, S., & Jackson, S. (1999a). Technological Diffusion within Educational Institutions: Applying the Technology Acceptance Model.

Wolski, S., & Jackson, S. (1999b). *Technological Diffusion within Educational Institutions: Applying the Technology Acceptance Model*. U.S.
Arizona.

Wright, K. M., & Granger, M. J. (2001). Using the Web as a Strategic Resource: An Applied Classroom Exercise.

Wu, I.-L., & Chen, J.-L. (2005). An extension of Trust and TAM model with TPB in the initial adoption of on-line tax: An empirical study. *International Journal of Human-Computer Studies, 62*(6), 784-808.

Yi-Shun, W., Hsin-Hui, L., & Pin, L. (2006). Predicting consumer intention to use mobile service. *Information Systems Journal, 16*(2), 157-179.