

AN ADOPTION MODEL FOR MOBILE LEARNING

Yong Liu

*Department for Information Management,
Institute for Advanced Management Systems Research,
Åbo Akademi University, Turku Centre for Computer Science
Joukahainengatan 3-5 B, Åbo, Finland. Yong.liu@abo.fi*

ABSTRACT

Resting on the use of mobile device which is increasingly popular worldwide, mobile learning in fact extends the reach of education to all social-economic levels independent of location and time, indicating a new opportunity for education industry development. Nonetheless, there is still a lack of a comprehensive understanding regarding the factors affecting the adoption of mobile learning. In this light, an adoption model of mobile learning was built in this paper based on the Unified Theory of Acceptance and Use of Technology (UTAUT), in which self-efficacy, mobility, attainment value, perceived enjoyment and self-management of learning are integrated in order to increase the predictive capability of model. This model hopefully provides a framework for future research, and will serve as a basis for our future survey and analysis of data.

KEYWORDS

Mobile learning; User adoption; Acceptance; TAM; UTAUT

1. INTRODUCTION

As an emerging paradigm in a long tradition of technology-mediated learning, mobile learning is defined as the acquisition of any knowledge and skill through the use of mobile technology, anywhere, anytime that results in an alteration in behavior (Geddes 2004). Currently, mobile learning is emerging as a promising market for education industry. On one hand, from a technology perspective the tipping point for mobile learning is coming closer as technology improves and standards emerge (Quinn 2008). On the other hand, the number of potential users of mobile learning is keeping increased, as a wide-scale proliferation of mobile devices in fact extends the reach of education industry to all social-economic levels covering all age groups from toddlers to seniors. In some markets, mobile learning has already experienced a rapid development. In UK, Cambridge Training and Development Ltd (CTAD) have already developed a series of learning materials and software, such as driving theory test practices questions, to be commercially available products accessible via mobile phone (Stead 2005). In China, millions of educational electronic handheld devices exclusively designed for mobile learning have already been sold and used by students since 2006 (SINO 2006). In US, Ambient Insights (2006) sized that the US market for mobile Learning products and services is around \$460.4 million in 2006, and the market will continue to prosper at a five-year compound annual growth rate (CAGR) of 27.3% and reach \$1.5 billion by 2011. In order to increase market competitiveness, mobile manufacturers, such as Nokia, have already started to embed mobile learning functionality and offer corresponding services in parts of their products.

On the other hand, mobile learning posits unprecedented opportunities for both education institutions and governments as well. In the context of education institutions, many higher education managers have seen mobile learning as a way of extending the reach and hence increasing revenues (Murphy 2006). As for government, mobile learning has been projected to extend learning opportunities to mass learners, in particular to those previously hard-to-reach via traditional education approaches. In light of a fact that many learners might never be able to afford a personal computer or enroll into formal education again, the application of mobile learning appears to be especially important. Funded by the European Commission, a pan-European project—m-learning for instance has been launched since 2001 for educationally disadvantaged young adults, such as dropouts and unemployed, to improve their literacy and numeracy skills.

With regard to learners, mobile learning has already proved its capability to help improve literacy and numeracy skills; encourage independent and collaborative learning experiences; identify areas where learners need assistance and support; mitigate resistance using ICTs; engage reluctant learners; enable learners to remain more focused for longer periods and promote self-esteem and self-confidence (Attewell 2005, pp. 13–15).

Whilst there is a growing interest from both academic and business communities, the issues regarding how to promote learner's adoption of mobile learning seem to be largely unsolved, and thereby posit to be a challenge for services providers. For instance, according to Corbeil and Valdes-Corbeil (2007), the availability of various mobile devices for students does not guarantee their use for educational purpose. Consequently, there appears to be an urgent requirement to understand the factors influencing user's behavioral intention in order to retain developing cost and make the services acceptable and to be used. And while the process of technology acceptance has been widely studied in an organizational context, there is hence a need to explore the potentiality of current acceptance theory in a social context alike. In this sense, this paper attempts to fill a gap in the literature by deepening the understanding related to technological acceptance issues within a social context while the user behavior with a new role—learner. The remainder of paper is structured as follows. In the next section, we review the literatures in the context of mobile services adoption and discuss the necessities to embed additional factors associated with the unique characteristics of mobile learning in order to explain learner's behavioral intention. This is followed by a description of the research model and related ingredients. Finally, conclusion and future work are briefly reported.

2. LITERATURE REVIEW

The commercialization of mobile services is reaching a critical stage in Europe (Carlsson et al. 2006). In contrast to a growing mobile phone penetration rate, average revenue per user (ARPU) in traditional mobile service, such as voice telephony and SMS, is declining (Knutsen et al. 2005). To counteract decreasing ARPU, advanced mobile data services are often portrayed as sources of remediation (Knutsen et al. 2005). However, there is yet little evidence to show a fast or broad proliferation in terms of advanced mobile services in Europe, including mobile learning services. In this light, Carlsson et al. (2006) pointed out that the basic challenge currently faced is to understand how and why people adopt or do not adopt mobile services.

In order to understand peoples' acceptance process towards mobile services, previous adoption models call for proper modifications and extensions on their original structure when using in a social context. As Carlsson et al. (2006) stated, Technology acceptance model (TAM) and UTAUT were developed to describe and explain organizational adoption of information technologies, “but that the mobile technology adoption is more individual, more personalized and focused on the services made available by the technology” (Carlsson et al. 2006). In addition to this, diffusion theory which is also widely used in IS field does not give a particularly exact guidance regarding the adoption of mobile services, as mobile services tends to be adopted by non-tech-savvy users once they considered services are useful, according to the empirical study of Carlsson et al. (2005). A long list and the variety of factors have been investigated by researchers in order to understand the essence of adoption behavior with regard to different mobile services. And, due to the wide variety of services within the spectrum of mobile services and their unlimited use contexts, the scope of combining existing variables and adding new ones by each study is as a result extensive (AlHinaï et al. 2007). In some research, the variables added posit stronger explanatory capabilities than the ones from original model structure in particular within the context of mobile services (e.g. Ha et al. 2008; Mallat et al. 2008). Hence, it is critical and essential to integrate mobile service-specific features into the traditional adoption models (Mallat et al. 2008).

Among all acceptance models, TAM emerges as one of most widely accepted and applied models. TAM was proposed by Davis in 1989, which focuses on two particular constructs of perceived usefulness and perceived ease of use as drivers of technology acceptance. In the past decade, a number of modifications and changes to the original TAM model have been made, in which UTAUT stands out as a most prominent one. The UTAUT model posits four core determinants of intention and usage, namely performance expectancy, effort expectancy, social influence and facilitating conditions (Venkatesh et al. 2003). As shown in Figure 1, UTAUT model also considers four moderators influencing the four direct determinants: gender, age, experience and voluntariness of use. UTAUT was developed based on conceptual and empirical similarities

across eight competing and prominent models in IS adoption research. After empirical examination, UTAUT has been found to outperform the eight individual models, and account for 70% of the variance in user intention (Venkatesh et al. 2003). In this sense, UTAUT is introduced as the basis of research model in addressing our research question.

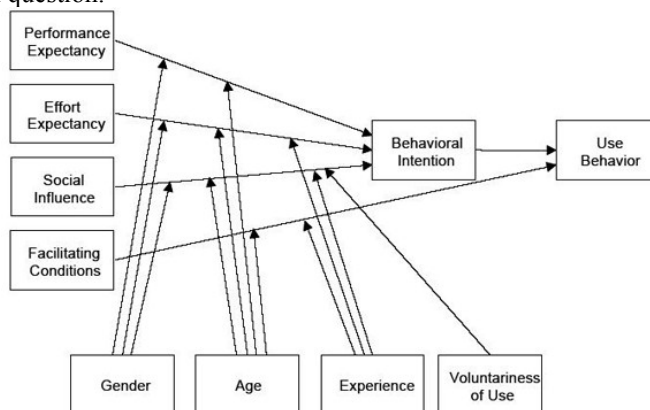


Figure 1. The UTAUT model
Source: Venkatesh et al (2003).

3. RESEARCH MODEL

As aforementioned, mobile learning emerges as a new mobile application generally used in a social context and the fundamental constructs of UTAUT hence do not fully reflect the unique influences of mobile learning context factors which may alter user adoption. With this, proper extension and modification of original model is necessary. As UTAUT is initiated in an organizational context to explore the technology acceptance of employees, it is essential to integrate the variables reflecting the unique characteristics of mobile learning which is used independent of time and place by learners. Hence, in addition to the four core constructs of UTAUT, five additional determinants associated with the unique characteristics of mobile learning are integrated into our research model, namely self-efficacy, mobility, attainment value, perceived enjoyment and self-management of learning, as shown in Figure 2. The basic understanding and rationalities for the structure of our research model are specified as follows:

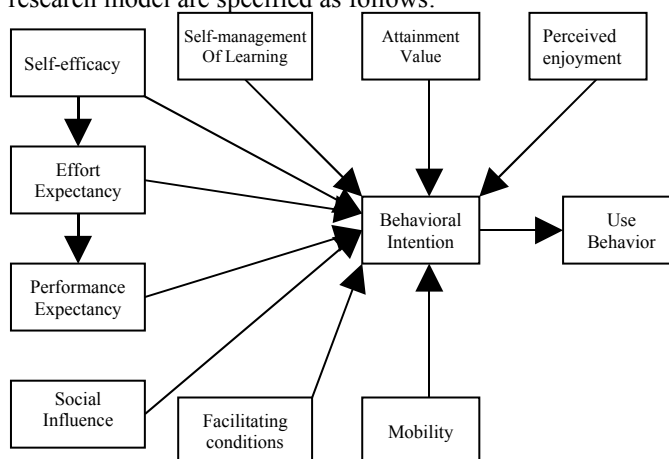


Figure 2. Research Model for mobile learning

3.1 Performance Expectancy

Performance expectancy has to do the degree to which an individual believes that using a particular system will help him or her to attain gains in job performance (Venkatesh et al. 2003). It pertains to perceived usefulness in TAM. In the context of technology-mediated education, a number of researches have already empirically support a positive relationship between performance expectancy and behavioral intention (e.g. Chiu and Wang 2008). Hence, in terms of mobile learning, it is reasonable to include performance expectancy into our model.

3.2 Effort Expectancy

Effort expectancy is conceived as the degree of ease associated with the use of the particular information system. Effort expectancy is closely related to perceived ease of use in TAM. To the extent that promoted effort expectancy leads to improved performance, effort expectancy should have a direct effect on performance expectancy and intention to use. Also, Chiu and Wang (2008) indicated that effort expectancy was positively associated with performance expectancy and behavioral intention in the e-learning context. Thus we propose the same relationships would be found in terms of mobile learning.

3.3 Self-Efficacy

Self-efficacy refers to ‘beliefs in one’s capabilities to organize and execute the courses of action required producing given attainments’ (Bandura 1997). Previous research on computer self-efficacy has confirmed the critical role that computer self-efficacy plays in understanding individual acceptance to IT (e.g. Agarwal et al. 2000). Within the context of mobile services, self-efficacy has also been found with a positive effect on intention to use and perceived ease to use (e.g. Wang et al. 2006). As one of mobile services, the acceptance of mobile learning is also likely to be affected by self-efficacy, which is integrated into our model.

3.4 Social Influence

The social influence is defined as the degree to which an individual perceives that important others believe he or she should use the new system. Social influence is also included in the TAM and TPB as a determinant of behavioral intention. Prior studies suggest social influence is a strong predictor of behavioral intention to use particular IS (e.g. Venkatesh and Davis 2000). As the decision of learner is also influenced by others, such as peer students or instructor (Miller et al. 2003), it is rational to include social influence into the research model.

3.5 Facilitating Conditions

Facilitating conditions refers to the availability of resources needed to engage in a behavior, such as time, or money. It is well understood that behavior can not occur if objective conditions in the environment prevent it (Triandis 1979). In the mobile service context, a positive relation has been found between facilitating conditions and behavioral intention (e.g. Cheong et al. 2004; Wu et al. 2007). As to mobile learning, the satisfaction and decision of learner is affected by the perception of support from learning material providers, functionality of personal devices. Hence, facilitating conditions appears to be an essential structure in the model.

3.6 Mobility

Mobility is the most significant feature of mobile services (Coursaris and Hassanein 2002), and is also the main advantage of mobile learning in comparison to traditional education approaches, such as computer-based learning. The studies from Kaigin and Basoglu (2006) and Mallat et al. (2008) provided clear evidences of importance of mobility in affecting user’s decision to adopt particular mobile services. Hence, it is necessary to involve mobility into the model.

3.7 Self-management of Learning

Self-management of learning refers to the extent to which an individual perceives he or she is self-disciplined and enables to engage in autonomous learning (Smith et al. 2003). Indeed, the need for self-direction, or self-management of learning, runs clearly across the distance education and resource-based flexible learning literature (Evans 2000; Smith et al. 2003). In terms of mobile learning, as McFarlane et al. (2007) pointed out, the increased learner autonomy and personalization posit a heightened requirement for appropriate self-direction learning capability, such as capabilities of locating and evaluating resources, critical thinking and reflecting on their own learning. As a result, self-management of learning is included into our model.

3.8 Attainment Value

Attainment value is personal importance of doing well with regard to self-schema and core personal values, such as achievement (Eccles et al. 1983). Wigfield and Eccles (1992) argued that tasks will have higher attainment value to the extent that they allow the individual to confirm salient aspects of learner's self-schema. Chiu and Wang (2008) indicate a positive relationship between attainment value and continuance intention from a perspective of web-based learning. Accordingly, the learner's decision regarding the use of mobile learning may be influenced as well by perceived attainment value, which is integrated into our model as well.

3.9 Perceived Enjoyment

Perceived enjoyment is the extent to which an activity is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated (Davis et al. 1992). Perceived enjoyment is closely related to perceived entertainment and intrinsic value. As the process of learning may also bring a sense of pressure, it is necessary to make learning activities more enjoyable so as to promote learner's acceptance of mobile learning. Hence, we tend to include perceived enjoyment into our research model as a critical structure.

4. CONCLUSION AND FUTURE WORK

UTAUT for mobile learning proposes a framework for understanding and predicting factors that may affect individual adoption. The key constructs of UTAUT are included in our research model, in which the variables reflecting the unique characteristics of mobile technologies and role of user (learner) are integrated for the purpose to establish a model with better explanatory power regarding mobile learning. The model is proposed in order to provide an insight on adoption theory in the context of mobile learning. It is clear that the model is likely to be a useful framework for future research design. Also, this model will serve as a basis for our future survey and analysis of data.

REFERENCES

- Agarwal, R. et al, 2000. Research report: The evolving relationship between general and specific computer self-efficacy – An empirical assessment. *Information Systems Research*, Vol 11, No 4, pp. 418–430.
- AlHinai, Y. S. et al, 2007. Adoption of Mobile Commerce Services by Individuals: A Meta-Analysis of the Literature. *International Conference on Mobile Business*. Toronto, Canada, pp. 62-62.
- Ambient Insight, 2006. Mobile Learning Content and Services Market Accelerating in the U.S. Available from: http://mobileanalystwatch.blogspot.com/2006/05/ambient-insight-mobile-learning_31.html, retrieved on February 5, 2008.
- Attewell, J., 2005. Mobile technologies and learning: A technology update and m-learning project summary. Technology Enhanced Learning Research Centre Paper, Learning and Skills Development Agency, UK.
- Bandura, A., 1997. *Self-Efficacy: The exercise of control*. New York: Freeman.

- Carlsson, C. et al, 2005. Asynchronous Adoption Patterns of Mobile Services. *Proceedings of the Thirty-Eighth Annual Hawaii International Conference on System Sciences*. Hawaii, USA, pp. 189a-189a.
- Carlsson, C. et al, 2006. Adoption of Mobile Devices/Services—Searching for Answers with the UTAUT. *Proceedings of the 39th Annual Hawaii International Conference on System Sciences (HICSS'06)*. Hawaii, USA, pp. 132a-132a.
- Chiu, C. M. and Wang, E. T. G., 2008, Understanding Web-based learning continuance intention: The role of subjective task value. *Information & Management*, Vol 45, No 3, pp. 194-201.
- Cheong, J. H. et al, 2004. Mobile Payment Adoption in Korea: Switching from Credit Card. *Paper presented at the ITS 15th Biennial Conference*. Berlin, Germany.
- Coursaris, C. and Hassanein, K., 2002. Understanding m-commerce a consumer centric model. *Quarterly journal of electronic commerce*, Vol. 3, No. 3, pp. 247-271.
- Davis, F. D., 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, Vol. 13, No 3, pp. 319–339.
- Davis, F. D. et al, 1992. Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology*. Vol. 22, pp. 1111-1132.
- Eccles, J. S. et al, 1983. Expectancies, values, and academic behaviors, in: *J.T. Spence (Ed.), Achievement and Achievement Motivation*, W.H. Freeman, San Francisco, CA, pp. 75–146.
- Evans, T., 2000. Flexible delivery and flexible learning: developing flexible learners? In *V. Jakupec & J. Garrick (Eds), Flexible learning, human resource and organizational development*. London: Routledge.
- Corbeil, J. R. and Valdes-Corbeil, M. E., 2007. Are you ready for mobile learning?, *Educause Quarterly*, Vol. 30, No 2, pp. 51-58.
- Geddes, S. J., 2004. Mobile learning in the 21st century: benefit for learners. *Knowledge Tree e-journal: An ejournal of flexible learning in VET*, Vol. 30 No.3, pp.214-28.
- Ha, I. et al, 2007. Determinants of Adoption of Mobile Games under Mobile Broadband Wireless Access Environment. *Information and Management*, Vol. 44, No 3, pp. 276-286.
- Kaigin, B. and Basoglu, N., 2006. Adoption Factors of Mobile Services. *2006 International Conference on Mobile Business*. Copenhagen, Denmark, pp. 41-41.
- Knutsen, L. et al, 2005. Acceptance and perceptions of advanced mobile services: alterations during a field study. In *Proceedings of International Conference on Mobile Business*. Sydney, Australia, pp. 326-332.
- Mallat, N. et al, 2008. An Empirical Investigation of Mobile Ticketing Service Adoption in Public Transportation. *Personal and Ubiquitous Computing*, Vol. 12, No 1, pp. 57 - 65.
- McFarlane, A. et al, 2007. Mobile learning: Research findings: Report to Becta. Available from: http://partners.becta.org.uk/upload-dir/downloads/page_documents/research/mobile_learning_july07.pdf, retrieved on: March 5, 2008.
- Miller, M. et al, 2003. Predictors of Engagement and Participation in an On-line Course. *Online Journal of Distance Learning Administration*, Vol. 6, No. 1.
- Murphy, A., 2006. Mobile learning in a global context: a training analysis. *Fifth International Conference on Networking and the International Conference on Systems (ICNICONSMCL'06)*. Morne, Mauritius, pp. 219-219.
- Quinn, C., 2008. What's the (m) point? Available from: <http://blog.learnlets.com/wp/?p=287>, retrieved on: March 10, 2008.
- SINO, 2006. Market Analysis Report on China educational electronic devices in 2006. Available from: http://www.cciddata.com/2006_11/smxj_ly.htm, retrieved on February 5, 2008.
- Smith, P. J. et al, 2003. Towards identifying factors underlying readiness for online learning: an exploratory study. *Distance Education*, Vol 24, No 1, pp. 57–67.
- Stead, G., 2005. Moving mobile into the mainstream. *mLearn 2005 Conference*. Cape Town, South Africa, 2005.
- Triandis, H.C. 1979. *Values, Attitudes, and Interpersonal Behaviors*, In: Nebraska symposium on motivation, 1979: Beliefs, attitudes and values, University of Nebraska Press, Lincoln, NE. pp. 159-295.
- Venkatesh, V. and Davis, F. D., 2000. A theoretical extension of the technology acceptance model: four longitudinal field studies. *Management Science*, Vol 45, No 2, pp. 186–204.
- Venkatesh, V. et al, 2003. User acceptance of information technology: toward a unified view. *MIS Quarterly*, Vol. 27, No 3, pp. 425–478.
- Wang, Y. S. et al, 2006. Predicting consumer intention to use mobile service, *Information Systems Journal*, Vol 16, No 2, pp. 157-179.
- Wigfield, A. and Eccles, J. S., 1992. The development of achievement task values: a theoretical analysis, *Developmental Review*, Vol 12, No, 3, pp. 265–310
- Wu, Y. L. et al, 2007. Using UTAUT to explore the behavior of 3G mobile communication users. *2007 IEEE International Conference on Industrial Engineering and Engineering Management*. Singapore, pp. 199-203.