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HYPOTHESIS FORMULATION FOR M-LEARNING ENVIRONMENT

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ABSTRACT

This paper proposes a conceptual framework for mobile learning applications that provides systematic support for mobile learning experience design. It is based on a combination of a game metaphor and several studies of mobile learning contexts. Accounts of four mobile learning projects are used to explore the relationship between the framework and mobile learning design requirements in practice. By applying the framework to previous successful mobile learning implementations, we are better able to understand their key qualities. Similarly, the framework provides forward engineering support for the successful design of future mobile learning systems of relationship.

INTRODUCTION

As mobile technologies have become pervasive, many researchers have questioned whether they can enhance learning experiences. It could be argued that mobile learning (M-learning) is an approach to electronic learning (E-learning) that simply utilizes mobile devices, yet it can also be viewed as a quite different learning experience. Indeed, M-learning can only be delivered with an awareness of the special limitations and benefits of mobile devices, so one cannot simply apply known design requirements from E-learning into the M-learning context. This paper explores what factors and design requirements are crucial to the M-learning environment, and suggests how M-learning applications can be designed with an understanding of these factors and requirements.

In our approach, we develop an M-learning framework for integrating relevant design requirements, grounded in best practices from the literature. This framework is both used as an analysis tool to help understand the critical success factors in previous mobile learning applications, and as a design tool for developing new systems. The following section reviews the literature, identifying several structural factors and contexts for M-learning design. From this we introduce a framework for developing M-learning applications, which is described in section three. Sections four to seven analyse four different M-learning environments with the framework, showing how their different techniques and technologies can all be encompassed within the general structure of the framework.

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RELATED STUDY

In 1996 M-Learning became "state of the art for the use of technology in education." Shortly thereafter, in 2001, there were at least 30 mobile learning initiatives underway. These initiatives not only increased M-Learning‟s visibility, but also saw it maintain continued hype cycle momentum. E-Learning took 4 years to move along the hype cycle continuum from technology trigger to decreased visibility. In contrast, M-Learning continues to gain visibility almost 40 years after its birth – an exponential difference that caused Geoff Stead to comment in 2005 that "interest in M-Learning has intensified over the past five years".

The slow movement of M-Learning along the hype cycle to its peak has been caused in part by both scholars‟ and practitioners‟ continued interest in M-Learning implementations and their excitement surrounding: learning object delivery, developing technologies, a growing audience, profitability, the growing, body of instructional design methodologies targeted specifically at learning through electronic transmission channels. In summary, during its infancy, through its growth, and on to its becoming a practical means of educating mobile learners, M-Learning has been a catalyst for:

1. A new use for small information appliances, making them much more than calendars, communication devices, or MP3 music players.
2. „Attendance‟ at courses at a distance by mobile students; the devices are able to play asynchronous lectures as MP3 and AVI files on iPods, PDAs, cell phones, and smartphones.
3. The advent of learning objects that need not be formatted for peculiar devices. Students are able to synchronously send instant messages via cell phones, smartphones and other small information appliances to instructors during virtual office hours. They are able to further collaborate via laptop and other wireless devices.
4. The development of a hardware platform specifically designed for digital course content delivery, e.g. the Dynabook proposal and prototype.

With M-Learning devices ubiquitous and the electronic course content library vast, a remaining concern is the means for hosting and delivery of course content. Commonly available post-secondary institution content-hosting platforms such as Blackboard, WebCT, Angel, Moodle, and Intra-Learn, etc., are all capable of hosting M-Learning multimedia content (audio, video, text, etc.) with minimal setup. When systems administrators are reluctant to or cannot modify their virtual learning environments, at least one free, online solution exists – Apple Computers‟ free hosting system called „iTunes University (iTunes U)‟. The platform was rolled out in May 2007 and pilot studies of iTunes began in 2004.The iTunes U interface is similar to that of the

popular iTunes store which was introduced in 2003. The iTunes store affords users the opportunity to download rich multimedia content, store it on their computers, and synchronize it to their iPod or other compatible media player for mobile playback.

The iTunes store was originally designed to provide users with access to audio files. It has since grown to be a repository for a wide variety of multimedia content to include audio books, videos, courseware, etc. This content is stored in a variety of means, to include „podcasts". In the case of courseware, podcasts provide the ability to automatically download only those course sessions that have not previously been accessed. This eases the burden of sifting through an entire semester of content to discover those lectures not previously listened to. After downloading content, students can use it while untethered, „attending" one, some, or all sessions of the course irrespective of time and place. iTunes U is an innovative, user-friendly service that lets students gain access to audio and video course materials anytime, anywhere. By 2008, more than half of the nation"s 500 top schools subscribed to the iTunes U service.

Driven by a multimedia-thirsty population, manufacturers have produced inexpensive and novel multimedia players to satisfy the demand of not only learners but the general population. As the multimedia infrastructure and information appliance environment continues to provide an environment ripe for M-Learning, could it be the case that M-Learning will become an effective supplement to, or even a replacement for FTF? In at least one instance M-Learning was found to an effective supplement to FTF. A 2006 European study included 1,000 participants: 1) traveler families across Scotland, 2) truck drivers and trainers in a large pharmaceutical company, 3) inner-city refugees, and 4) recent immigrants in Stockholm. The study was conducted in order to get a true sample of a widely diverse set of M-Learning participants in over twenty M-Learning trials across Europe, mostly in the United Kingdom.

The mixture of audio-only E-Learning delivered in an M-Learning environment combined with FTF activities such as group activities suggests that the study found a „blended" environment to be most favorable. Other studies suggest that rather than acting as an adjunct to an E-Learning environment comprising only audio, M-Learning is as equally effective as FTF; no significant difference in learning were found.

Electronic course content creation, delivery, and access have matured since Dynabook. Objects can be developed, delivered, and consumed: 1) wirelessly, 2) by heterogeneous media, 3) on small information appliances – a first generation 80GB iPod multimedia player suitable for multimedia learning object playback measures 5.7" x 3.5" x 1.8" (L x W x H) and weighs 12 gms 90 by devices with computing power rivaling that of Dynabook era supercomputers. When Kay, et al. proposed Dynabook, the Seymour Cray CDC 7600 was widely hailed as the best

sustained performance computing system. Its performance pales in comparison to today"s smartphones which run at more than twice its speed. Since 2000, interest in M-Learning has intensified. An acute awareness of the need to satisfy a growing number of mobile learners has developed, and the portable technologies envisioned by Kay, et al. have become a reality. M-Learning has moved "from being a theory, explored by academic and technology enthusiasts into a real and valuable contribution to learning."

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This study adopted UTAUT hypotheses because the model favored a belief that familiar, easy-to-use technologies would drive increased use behavior which would consequently equate to increased performance. Not adopted in the study were UTAUT hypotheses regarding age although Venkatesh, et al. find through their research that age plays an important part in Use Behavior. The investigator felt à priori that the age of participants in the sophomore Introduction to Information Systems course would be too similar for hypotheses regarding age of participants to have significant effect. Venkatesh, et al. conduct their research in work settings in the private sector. These settings provided study participants whose ages varied widely. Because Mode of Delivery (MOD) was added as an MV, additional hypotheses were defined that captured the effect of MOD on Behavioral Intention and Performance.

UTAUT Included/Excluded Variables

As a result of their investigations into the eight underlying models of UTAUT, Venkatesh, et al. state that "even constructs appear to be significant direct determinants of intention or usage in one or more of the individual underlying UTAUT models":

1. Anxiety
2. Attitude toward using technology
3. Effort Expectancy
4. Facilitating Conditions
5. Performance Expectancy
6. Self efficacy
7. Social Influence

In order to evaluate the UTAUT model in an M-Learning environment, the study adapted six hypotheses introduced by Venkatesh, et al. Additional hypotheses were incorporated into the study in order to examine the effects of Mode of Delivery on the modified UTAUT model. A list of hypothesis developed for this study is given below:

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Study Hypotheses

Hypothesis	Description
HIA	The effect of Performance Expectancy on Behavioral Intention will be moderated by Gender such that the effect will be stronger for men.
H1B	The effect of Performance Expectancy on Behavioral Intention will be moderated by Mode of Delivery.
H2A	The effect of Effort Expectancy on Behavioral Intention will be moderated by Gender and Experience such that the effect will be stronger for women and particularly at early stages of exposure to the M-Learning MOD.
H2B	The effect of Effort Expectancy on Behavioral Intention will be moderated by Mode of Delivery.
H3A	The effect of Social Influence on Behavioral Intention will be moderated by Gender, Experience, and Voluntariness such that the effect will be stronger for women particularly in mandatory settings in the early stages of Experience with the M-Learning MOD.
H3B	The effect of Social Influence on Behavioral Intention will be moderated by Mode of Delivery.
H4A	The effect of Facilitating Conditions will not have a significant influence on Behavioral Intention.
H4B	The effect of Facilitating Conditions on M-Learning System Use Behavior will be moderated by Experience with the M-Learning MOD such that the effect will be stronger for students with increasing Experience.
H4C	The effect of Facilitating Conditions on M-Learning MOD Use Behavior will be moderated by Mode of Delivery.
H5	The effect of Behavioral Intention on M-Learning MOD Use Behavior will be moderated by Gender.
H6A	Mode of Delivery will have an influence on Quiz 1 Performance.
H6B	Mode of delivery will have an influence on Quiz 2 Performance.
H6C	The effect of Use Behavior between Time 2 and Time 3 on Quiz 2 Performance will be moderated by Mode of Delivery.
H6D	The effect of Use Behavior between T1 and T3 on Average Performance over Quiz 1 and Quiz 2 will be moderated by Mode of Delivery.
H6E	The effect of Use Behavior on the difference between Performance on Quiz 1 and Quiz 2 will be moderated by Mode of Delivery.

CONCLUSION

The overall plan assessed hypotheses H1A – H6E using multiple regression, given that there were multiple predictor variables and à priori assumptions about the relative weight of each of these. The rationale for the approach was that it was hypothesized that the Mode of Delivery Predictor Variable would likely account for the greatest number of variability in Performance; while the Predictor Variables Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Behavioral Intention, and Use Behavior would account for the 2nd greatest amount of variability in Performance. It was hypothesized that Mediator Variables Gender, Age, Experience, and Voluntariness of Use would account for the least amount of variability in Performance. All interaction effects and corresponding main effects were tested within the context of a hierarchical multiple regression.

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