An Investigation of Mobile Learning Readiness and Design Considerations for Higher Education

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Abstract

This study employed the theory of planned behavior as a framework for identifying college students’ current perceptions and needs for mobile learning. The use of mobile devices continues to evolve, and many educators are eager to explore the potential of these devices to enhance student-centered learning by facilitating anytime/anywhere collaboration and communication. Self-reported data from 238 college students was analyzed with a structural equation modeling method. The results confirmed the theory that their attitude, behavioral control and subjective norm positively influenced their acceptance of m-learning, while they perceived that a social environment is not strong enough to implement m-learning. In addition, other findings revealed preferable instructional activities with mobile devices in higher education.

Introduction

In recent years, we have witnessed an explosion in the growth of mobile devices, such as smart phones (e.g., iPhone) and mobile tablets (e.g., iPad) which use 3G or wireless networks. These devices are altering how we live and how we learn (Abdullah & Siraj, 2010). Mobile learning (m-learning) enables people to access learning anytime and anywhere. These devices are also important for supporting just-in-time, customized, and life-long education. Since college classrooms are filled with students living in a mobile age, institutions in higher education have an opportunity to revitalize the process of teaching and learning via m-learning. However, m-learning is still in its infancy in higher education. Many universities provide a free App (an application for a mobile phone), but it contains mostly non-instructional contents such as news, event calendars or maps. Although m-learning has the potential to augment formal education with flexible access, immediate communication and supplemental learning materials, there are serious concerns about the readiness of college campuses to adopt m-learning (Al-Mushasha, 2010), and there is lack of research exploring the readiness of college environments for m-learning.

This study adapted the theory of planned behavior (TPB) to investigate the determinants of college students’ intention to use m-learning. The theory focuses on the formulation of an intention to behave in a particular way, and the sources of the intention are attitude, subjective norm, and behavioral control (Ajzen, 1991). Based on this approach, we proposed new antecedents of attitudinal constructs and draw out conceptual frameworks. Our research questions were: (a) What are the significant salient beliefs of college students that contribute to the levels of attitudinal constructs? (b) How strongly do their attitudinal constructs influence their intention to use m-learning? (c) How do college students want to use a mobile device in their course work? The answers to these questions will allow us to identify the readiness of college students for m-learning which will be a basis for designing effective m-learning environments in higher education.

Mobile learning

m-learning refers to any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of learning opportunities offered by mobile technologies (O’Mally et al., 2003). m-learning, in general, could enrich students’ learning experiences with enhanced mobility and connectivity. More specifically, there are five educational benefits based on previous literature: (a) portability, (b) interactivity, (c) context sensitivity, (d) connectivity, and (e) individuality (e.g., BenMoussa, 2003; Churchill & Churchill, 2008; Sharples, 2000). Previous research has proposed general considerations for m-learning (e.g., Gu, Gu & Laffey, 2011; Liu, Li & Carlsson, 2010; Shih & Mills, 2007). For
example, Gu et al. argued that m-learning contents for life-long education should address practical, real life needs; be micro in terms of length and time; and be simple and easy to understand. In addition, they discovered that audio is the preferred modality, and that usability requirements should be consistent with those required for web pages (i.e., minimizing scrolling). Liu, Li and Carlsson (2010) found that perceived usefulness and personal innovation significantly influence the intention to adopt m-learning. On the other hand, based on Keller’s ARCS model, Shih and Mills (2007) suggested five steps to increase learners’ motivation with mobile activities. Other studies investigated learners’ perceptions toward educational benefits of m-learning (e.g., Abdullah & Siraj, 2010; Al-Mushasha, 2010), and optimistic results were found.

Research Model and Hypothesis Development

Theory of Planned Behavior

The theory of planned behavior (TPB) was selected as a research model in this study. The TPB explains attitudinal factors of an individual’s intention to behave in particular way. In the TPB’s framework, intention is predicted by three determinants: (a) attitude, (b) subjective norm, and (c) perceived behavioral control (Ajzen, 1985, 1991). Many studies have applied this theory in different contexts (e.g., technology, health care, and political science) or with different antecedent variables of the attitudinal construct in order to predict behavior (e.g., Conner & Armitage, 1998; Davis, 1989; Taylor & Todd, 1995). Based on the TPB, we formulated our research model as shown in Figure 1. We used the behavioral intention as an ultimate perception in this study as the TPB proposed. The research model proposes that behavioral beliefs reinforce three attitudinal constructs, and, in turn, the constructs positively enhances behavioral intention. The antecedent variables of each attitudinal construct shown in the left column are proposed from various theories, and all hypotheses are described below.

Attitudinal Constructs and Behavioral Intention

First, attitude toward behavior refers to the degree to which a person has a favorable or unfavorable feeling about performing a particular behavior. Previous studies found that attitude is a strong predictor of intention (Davis, 1989; Taylor & Todd, 1995). Second, subject norm is about a social environment. In other words, an individual integrates others’ opinions into his/her belief and performs a similar behavior to others (Venkatesh & Davis, 2000). Last, regarding behavioral control, he/she perceives greater control, which triggers an intention to perform the behavior, when an individual perceives that he/she has more resources and confidence than expected obstacles (Ajzen, 1985; Hartwick & Barki, 1994; Lee & Kozar, 2005). Therefore, we hypothesized:

- H1: College students’ attitude toward m-learning positively influences their intentions to use m-learning.
- H2: College students’ subjective norm of m-learning positively influences their intentions to use m-learning.
- H3: College students’ perceived behavioral control of m-learning positively influences their intentions to use m-learning.
Attitudinal Beliefs toward Attitude

The antecedents of the first attitudinal construct (i.e., attitude) are attitudinal beliefs. In our research model, variables for attitudinal beliefs are derived from the technology acceptance model (TAM) which explains how people accept a new system. It argues that perceived ease of use and usefulness determine an individual's intention to use a system (Davis, 1989). Also, perceived usefulness is affected by perceived ease of use. Accordingly, we include the two perceptions in our belief constructs and hypotheses,
- H4: College students’ perceived ease of use of m-learning positively influences their perceived usefulness of m-learning.
- H5: College students’ perceived ease of use of m-learning positively influences their attitude toward m-learning.

Normative beliefs toward Subjective Norm

Subjective norm is determined by the accessible normative beliefs that accounts for social pressure from referent as an important determinant in an individual’s behavioral intention. Since individuals are dependent on context, and they are socially constructed beings (Shah, 1998), we propose that other people in their academic life (i.e., instructor and other students) can affect the subjective norm of m-learning for college students. Thus, we hypothesized:
- H6: Perceived instructors’ readiness of m-learning positively influences their subjective norm with m-learning.
• H7: perceived other students’ readiness of m-learning positively influences their subjective norm with m-learning.

Control beliefs toward Perceived Behavioral Control

Perceived behavioral control is compatible with the concept of self-efficacy. In other words, individual’s confidence in performing a specific task significantly influences behavior (Ajzen, 1991). Self-efficacy refers to individuals' beliefs about their ability and motivation to perform specific tasks (Bandura, 1986, 1997). In other words, individuals who believe they can master a certain skill or an activity tend to have higher intention to obtain the skill or perform the activity. Previous studies found that higher levels of self-efficacy will lead to higher levels of behavioral intention and the usage of information technology (Compeau & Higgins, 1995; Gist, Schwoerer, & Rosen, 1989). In addition, this study employed learning autonomy as the second antecedent. Learner’s autonomy toward m-learning is whether they can control the learning pace and style of interaction. Autonomy has proved to be a major contributor to system acceptance (Liaw, Huang, & Chen, 2007). Therefore, we hypothesized:

• H8: College students’ perceived self-efficacy of m-learning positively influences their behavioral control with m-learning.
• H9: College students’ perceived learning autonomy of m-learning positively influences their behavioral control with m-learning.

Method

To address the above research questions and investigate our hypotheses, we collected data from college students using a survey instrument adapted from previous studies. The survey data was analyzed to test the hypotheses with Partial Least Squares (PLS) Graph. The participants of this research were 238 undergraduate students at a large university in the southwestern United States (Male: 114, Female: 124). One hundred and eighty students had a smartphone (iPhone: 111, other smartphones: 69). The most frequent use of their phones was texting followed by accessing social networking services (i.e., Facebook or Twitter). All data about their mobile phone use will be presented at the conference. We developed the survey instrument containing 30 items (three items for 10 constructs). The survey measured participants’ perceptions with 7-point Likert scales ranging from totally disagree to totally agree. In addition, preferable learning activities with mobile devices were collected by six items with 7-point Likert scales as well.

Results

Confirmatory factor analysis was conducted to assess the measurement scales’ validity using PLS-Graph, version 3.0. Table 2 shows that the composite reliability for all constructs is greater than 0.80 and the average variance extracted (AVE) is greater than 0.50. Also, all item-loadings were greater than 0.70; therefore, the level is generally acceptable (Fornell & Larcker, 1981). In this study, AVE for each construct is greater than the correlation between that and all other constructs. The structural model analyzed the relationships between the various latent variables. Figure 2 presents the standardized path coefficients and the explained construct variances.
The results show that all hypotheses were supported. Hypotheses 1 to 3 were supported (H1, coefficient of 0.48, t-value of 7.33, p < 0.01; H2, coefficient of 0.16, t-value of 2.87, p < 0.01; H3, coefficient of 0.37, t-value of 5.11, p < 0.01). In other words, behavioral intention was positively influenced by attitude, subjective norm and perceived behavioral control. However, the effect of subjective norm was less than other constructs. All hypotheses regarding the relationships between three attitudinal constructs and antecedent variables for each construct were supported. First, both perceived ease of use (H4, coefficient of 0.21, t-value of 3.04, p < 0.01) and perceived usefulness (H5, coefficient of 0.69, t-value of 11.23, p < 0.01) made a significant effect on attitude. Second, the assumption of the positive relationship between the readiness of instructor and other students and subjective norm was met (H6, coefficient of 0.41, t-value of 6.38, p < 0.01; H7, coefficient of 0.41, t-value of 5.96, p < 0.01). Last, we found that both hypotheses 8 and 9 were supported. For example, perceived self-efficacy positively influenced perceived behavioral control (H8, coefficient of 0.62, t-value of 7.48, p < 0.01). Furthermore, learning autonomy favorably influenced perceived behavioral control (H9, coefficient of 0.23, t-value of 2.74, p < 0.01).

In addition, a dependent t-test revealed that the perceived readiness of students (M = 5.56) was significantly higher than the readiness of instructors (M = 4.67, t(237) = 12.60, p < .001). The results of another survey showed that accessing course information (e.g., schedulers, exam results,) (M = 6.07) was the most highest activity participants want to do with their mobile devices. The second one was communication with instructors (M = 5.77).

**Discussion and Conclusions**

In sum, this study allows us to empirically investigate the effects of college students’ perceptions toward m-leaning intention. First, the significant impact of perceived ease of use and usefulness on attitude confirm the
technology acceptance model (TAM). In other words, college students who feel that m-learning is easy to use and useful are more likely to use mobile devices for their course work. Since the coefficient value of perceived usefulness (0.69) was higher than the value of perceived ease of use (0.21), it can be said that the perception toward usefulness is a stronger contributor to attitude. We assume that they were already familiar with mobile devices, and the advantages of using the mobile devices for the courses highly influenced the attitude toward m-learning.

Second, the results showed that college students’ behavioral control was another important facilitator of their intention to use m-learning. Although both antecedents positively affect the behavioral control, their self-efficacy (i.e., confidence, Agarwal & Karahanna, 2000) had higher effect on the perceptions of control over m-learning. This finding implies that empowering students’ with confidence in using m-learning will lead to a greater likelihood of technology adoption.

Third, although a significant relationship between subjective norm and intention was found, the effect was somewhat lower than other two constructs. This finding is consistent with what Shiue (2007) found in which subjective environment weakly influenced the actual use of technology. Interestingly, college students’ thought that their instructors may not be ready to use mobile devices in their courses.

Last, the first and second highest favorable activities with mobile devices were accessing course information and instructors. In order to make the course syllabus or schedule available for mobile devices, course website or learning management system should be mobile friendly. Thus, institutional support is necessary to implement the mobile supports. Another support for faculty members is also required, such as professional development, online space with real examples, or learning communities.

This study has a number of limitations that circumscribe our interpretation and create opportunities for future research. Since the participants watched three video clips that showed some examples of m-learning, they might have favorable bias toward m-learning. Furthermore, they have not had a chance to utilize mobile learning for their course works except exchanging email, and the learning management system in the university does not have a mobile application (i.e., App). Thus their responses were not derived from a real situation. However, the results showed that the students are highly favorable toward using mobile devices for their learning. This study may be extended to college faculty members to compare their perceptions to student’s perceptions. Our findings show that emphasis on the three elements for college students’ perceptions could enhance their actual adoption of new technologies which change the way they learn. Detailed discussion from this study will be presented at the conference.

References


