

# Examining the Behavior Changes in Belief and Attitude among Smart Phone Users for Mobile Learning

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**Abstract**— Prior empirical studies have articulated that IT adoption and usage were determined by user beliefs and attitudes toward IT. We adopted Technology Acceptance Model's constructs to conduct a case study across two stages; Introduction and hand-on to examine the changes in users' beliefs and behavioral intention to use smart phone for learning. The sample was conveniently selected of those who enrolled in Digital Systems course resulting in a sample of 60 potential users of smart phones. This study called for the respondents to progress through two stages of participation with smart phones. The results show that the hand-on session was effective in improving users' beliefs and intentions to use smart phones for learning.

**Index Terms**—Beliefs, perception, smart phone, technology acceptance model.

## I. INTRODUCTION

Mobile communication devices beginning as wireless cell phones used by business executive people in the 1970's and 80's, then they have evolved into a daily use communication device for every level of end users from children to older people to business people on the go. With the increased use of more advanced mobile communication devices with the portability and connectivity features, education is now being transformed by the use of wireless mobile technologies for mobile learning [1].

This scenario has made user perception and acceptance an increasingly critical issue, as the end users are crucial for the effective use of the information technologies [2]. Although user acceptance has received fairly extensive attention in prior research, the majority of these studies have validated the user acceptance other than education by using specific information systems in Management Information Science (MIS) field. Many previous studies have extensively addressed mobile learning from technical perspectives [3-5], very limited research literature that examines learner beliefs and perceptions of mobile communication devices as new educational technologies for learning purpose.

Many previous studies have used intention-based theories such as Theory of Reasoned Action (TRA) [6], Theory of Planned Behavior (TPB) [7], and Technology Acceptance

Model (TAM) [8] to predict and understand user adoption and usage of IT innovations. The results revealed that user adoption and usage of IT innovation are determined by his/her beliefs and attitudes [8] and proved that user beliefs and attitudes tend to change over time as users learn more and develop more realistic understanding and expectations about the use and consequences of IT innovation [9].

According to Bhattacharjee and Premkumar [10], first time perception behavior is differentiated from second and subsequent perception as users have gained first-hand experience that can change their subsequent perceptions. Adoption is an ongoing process that can be studied and supported as the potential adopters of an innovation have to learn about an innovation and must be persuaded to try it out before making a decision whether to adopt or reject the innovation [11]. Prior research has also found that user's beliefs and attitudes formed through initial exposure may change significantly over time as his/her use experience increases [9].

In this study, we draw upon TAM's constructs to examine the formation and the changes in the users' beliefs and intention to use smart phone for learning across two stages. The research question of interest in this study is do users' beliefs and intentions to use change, and how do they change over time?

## II. METHOD

The measurement scales of perceived usefulness (PU), perceived ease of use (PEU), attitude (AT) and behavioral intention (BI) were measured using pre-validated scales adapted from prior IT usage literature [8]. Items wording were adapted appropriately and based on seven-point semantic differential bi-polar scales (Strongly disagree to strongly agree).

The sample was conveniently selected of those who enrolled in Digital Systems course resulting in a sample of 60 potential users of smart phones. In this study, one commercially available smart phone, HTC Touch Pro 2 was selected. It uses a 528 MHz Qualcomm CPU with 288 MBs of RAM and 512 MBs of Flash. It comes with 5-row full QWERTY keyboard and a large 3.6" touch screen display.

This study called for the respondents to progress through two stages of participation with smart phones. Stage one was conducted as a brief in-class introduction describing the benefits of smart phones for mobile learning. Following the introduction session, respondents completed the first survey for pre-usage smart phone perceptions and intentions. Stage

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two was conducted right after stage one by providing users the opportunity to explore the learning contents with smart phone. At the end of stage two, respondents were asked to complete the second survey which assessed their perception of smart phone usage right after the hand-on session.

### III. RESULTS

Table I presents the means and standard deviations of the main constructs in the study for smart phone users. In general, the mean scores from two stages indicate that, the smart phone users have more positive beliefs and behavioral intention to use smart phone for learning. Scores on behavioral intention at each stage show that overall users will continue using smart phone for learning.

TABLE I: DESCRIPTIVE STATISTICS

Variable	Stage 1		Stage 2	
	Mean	Std. Dev.	Mean	Std. Dev.
PEU	4.30	.876	5.31	1.040
PU	4.54	.768	5.35	1.040
AT	4.65	1.104	5.71	.956
BI	4.46	.887	5.41	1.149

In order to compare whether subjects' beliefs and behavioral intentions change and how do they change over time, we aggregated item responses for perceived ease of use, perceived usefulness, attitude and behavioral intention at times stage one (P1) and stage two (P2) and compared the mean aggregated scores pair-wise via a series of t-tests.

The examination of the means suggested that the average perceived ease of use (PEU), perceived usefulness (PU), attitude (AT) and behavioral intention (BI) were higher immediately after the hand-on session. Table II shows subjects' mean ease of use perceptions increased from 4.30 at time P1 to 5.31 at time P2 ( $t = 7.092, p < .001$ ), usefulness means increased from 4.54 to 5.35 during that time ( $t = 5.843, p < .001$ ) and attitude means increased from 4.65 to 5.71 during that time ( $t = 6.185, p < .001$ ). Besides that, subjects' mean behavioral intention to use smart phone for learning also increased from 4.46 to 5.41 ( $t = 6.424, p < .001$ ).

In summary, the pair-wise t-test revealed significant differences in the PEU score,  $t(60) = 7.092, p < .001$ ; PU score,  $t(60) = 5.843, p < .001$ ; AT score,  $t(60) = 6.185$  and BI score,  $t(60) = 6.424, p < .001$  before and after the hand-on session. These results indicate that the means for PEU, PU, AT and BI immediately after the hand-on ( $M_{PEU} = 5.31, M_{PU} = 5.35, M_{AT} = 5.71$  and  $M_{BI} = 5.41$  respectively) were significantly higher than the means before the hand-on ( $M_{PEU} = 4.30, M_{PU} = 4.54, M_{AT} = 4.65$  and  $M_{BI} = 4.46$  respectively). These changes supported our expectation that users' perceptions regarding smart phone usage do indeed change with time. It is in line with some of the preliminary empirical studies conducted by Szajna and Scamell [12] and

Venkatesh and Morris [13] that users' beliefs and attitudes do change over time.

TABLE II: COMPARISON OF MEANS FOR ALL USERS FOR TIME STAGE ONE (P1) TO STAGE TWO (P2)

Test (Study)	P2		P1		Diff (P2-P1)		t-stat.	p-value
	Mean	S.D.	Mean	S.D.	Mean	S.D.		
P2BI ≠ P1BI	5.41	1.15	4.46	.89	.96	1.15	6.42	.000
P2AT ≠ P1AT	5.71	.96	4.65	1.10	1.06	1.33	6.19	.000
P2PU ≠ P1PU	5.35	1.04	4.54	.77	.81	1.07	5.84	.000
P2PEU ≠ P1PEU	5.31	1.04	4.30	.88	1.01	1.11	7.09	.000

### IV. DISCUSSIONS

After In general, the findings indicated that the users' beliefs and perceptions about the smart phone for learning have increased significantly from initial exposure stage to hand-on session. Thus, hand-on session played an important role that influenced the formation and gradual change of users' beliefs and intentions to use smart phone for learning.

This finding supports many previous studies that user beliefs and attitudes are dynamic and change over time [14]. For learners who are comfortable with a new technology, they will have stronger beliefs in their ability to master the technology [15]. Stronger expectation to succeed will influence their subsequent behaviors. Attitudes toward the new technology are shaped during the initiation stage [16]. Potential adopters must first learn about the innovation and be persuaded to try it out before deciding to adopt or reject the innovation [17]. In other words, initial persuasion and training are important ways of conveying to the users the knowledge and skills needed to form initial beliefs and attitudes.

The study yielded interesting results that would help educators to promote the use of smart phone for learning. The initial exposure through introduction and hand-on sessions are powerful mechanism to enhance users' adoption and use of smart phone. Whenever it is feasible, educators may create effective persuasive strategies (introduction and demonstration) to help users form positive attitudes towards smart phone for learning. It is also important that users' perceptions and attitudes are monitored and managed over time so that appropriate measures can be taken to cope with any changes resulting from increased direct-use experience.

### V. CONCLUSIONS

This study indicated that initial exposure and hand-on played important roles that influenced the formation and gradual change of users' beliefs and intentions to use smart phone. Thus, when it is feasible, educators should create effective persuasive strategies and hand-on session at the

early stage to help users to form positive beliefs and attitudes towards smart phone. In addition the users' beliefs and attitudes are to be monitored and managed over time so that appropriate measures can be taken to cope with any changes resulting from increased direct-use experience.

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#### REFERENCES

- [1] M. Kassop, "Ten ways online education matches, or surpasses, face-to-face learning," *The Technology Source*, 2003.
- [2] P. H. Cheney and G. W. Dickson, "Organizational characteristics and information systems: An exploratory investigation," *Academy of Management Journal*, vol. 25, pp. 170-184, 1982.
- [3] C. Y. Chang, J. P. Sheu, and T. W. Chan, "Concept and design of ad hoc and mobile classrooms," *Journal of Computer Assisted Learning*, vol. 19, pp. 336-346, 2003.
- [4] Y. S. Chen, T. C. Kao, and J. P. Sheu, "A mobile learning system for scaffolding bird watching learning," *Journal of Computer Assisted Learning*, vol. 19, pp. 347-359, 2003.
- [5] T. C. Liu, H. Y. Wang, J. K. Liang, T. W. Chan, H. W. Ko, and J. C. Yang, "Wireless and mobile technologies to enhance teaching and learning," *Journal of Computer Assisted Learning*, vol. 19, pp. 371-382, 2003.
- [6] M. Fishbein and I. Ajzen, *Belief, Attitude, Intention and Behaviour: An Introduction to Theory and Research*. Reading MA: Addison-Wesley, 1975.
- [7] I. Ajzen, "The theory of planned behavior," *Organizational Behavior and Human Decision Processes*, vol. 50, pp. 179-211, 1991.
- [8] F. D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS Quarterly*, vol. 13, pp. 318-340, 1989.
- [9] V. Venkatesh and F. D. Davis, "A theoretical extension of the technology acceptance model: Four longitudinal field studies," *Management Science*, vol. 46, pp. 186-204, 2000.
- [10] A. Bhattacharjee and G. Premkumar, "Understanding changes in belief and attitude toward information technology usage: A theoretical model and longitudinal test," *MIS Quarterly*, vol. 28, pp. 229-254, 2004.
- [11] E. M. Rogers, *Diffusion of Innovations*, 4th ed. New York: The Free Press, 1995.
- [12] B. Szajna and R. W. Scamell, "The effects of information system user expectations on their performance and perceptions," *MIS Quarterly*, vol. 17, pp. 493-516, 1993.
- [13] V. Venkatesh and M. G. Morris, "Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior," *MIS Quarterly*, vol. 24, pp. 115-139, 2000.
- [14] E. Karahanna, D. W. Straub, and N. L. Chervany, "Information technology adoption across time: A cross-sectional comparison of pre-adoption and post-adoption beliefs," *MIS Quarterly*, vol. 23, pp. 183-213, 1999.
- [15] A. Bandura, *Social Learning Theory*. Englewood Cliffs, NJ: Prentice-Hall, 1977.
- [16] J. B. Bennett, W. E. Lehman, and J. K. Forst, "Change, transfer climate, and customer orientation: A contextual model and analysis of

change-driven training," *Group and Organization Management*, vol. 24, pp. 188-200, 1999.

- [17] I. Ajzen and M. Fishbein, *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs, NJ: Prentice-Hall, 1980.



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