Towards an understanding of the factors affecting m-learning acceptance: Roles of technological characteristics and compatibility

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A B S T R A C T

To date, prior studies have placed considerably less emphasis on the determinants of learners' acceptance of mobile learning (m-learning). Hence, this study's purpose was to combine the extended technology acceptance model (TAM) with the innovation diffusion theory (IDT) to examine whether technological characteristics (including navigation and convenience) and compatibility as the antecedents to learners' beliefs affected their intention to use m-learning. Sample data for this study were collected from Taiwanese mobile phone users; a total of 750 questionnaires were distributed, and 486 usable questionnaires were analyzed in this study, with a usable response rate of 64.80%. Collected data were analyzed using structural equation modeling. This study showed that technological characteristics (including navigation and convenience) and compatibility had significant effects on perceived usefulness (PU), perceived ease of use (PEOU), and perceived enjoyment (PE) of m-learning; besides, PU, PEOU, PE, and compatibility, respectively, exhibited significantly strong impacts on intention to use m-learning, and PEOU indirectly affected intention to use m-learning via PU and PE. The results of this study show that learners can judge m-learning by how well it meets their perceived compatibility of m-learning, and they will regard m-learning as a useful, easy to use, and enjoyable tool if they can explore it themselves through the content and interface screens over the mobile-based learning environments at any time in any location, and these situations will further facilitate their intention to use m-learning. In conclusion, the views of the extended TAM with the IDT provide clear expositions of learners' beliefs, which affect their intention to use m-learning.

1. Introduction

Recently, mobile devices and ubiquitous computing technologies have created unprecedented opportunities for conducting learning. Hence, mobile learning (m-learning) has increasingly attracted the interest of educators, researchers, and companies that publish learning materials and develop a seamless ubiquitous learning environment that supports learning without constraints of learning time and space (Cavus & Uzunboylu, 2009; Chen & Huang, 2012). M-learning is defined as a form of e-learning that specifically uses mobile devices to integrate with ubiquitous computing technologies to deliver learning contents and supports (Brown, 2005; Hwang & Chang, 2011; Muyinda, 2007), and it inherits many advantages from e-learning. However, m-learning can further extend the flexibility of e-learning regardless of learners' location using handheld mobile devices through wireless technologies (Hwang & Chang, 2011; Motiwalla, 2007). To date, mobile/wireless technologies and applications have been rapidly and widely developed for m-learning, but researchers have placed considerably less emphasis on the determinants of learners' acceptance of m-learning, which is an important topic for learners if they are to use m-learning to help them continuously enhance competencies and effectively solve problems.

Noteworthily, although m-learning is a relatively new tool, which is more likely to be embraced by innovators or early adopters (Alvarez, Alarcon, & Nussbaum, 2011; Martin et al., 2011), the technological characteristics of this new information system (IS)/information technology (IT) is not out of consideration, because users tend to seek the technological benefits of using the new IS/IT

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as compared with the traditional IS/IT to determine their attitude toward the new IS/IT (Childers, Carr, Peck, & Carson, 2001). However, the empirical evidence on the role of technological characteristics in explaining learners' acceptance of m-learning is less well documented. Hence, this study conducted a survey to examine whether technological characteristics as the antecedents to learners' beliefs affected their intention to use m-learning. To date, the technology acceptance model (TAM) is one of the most widely applied models in a variety of domains including related IS/IT acceptance studies (Lindsay, Jackson, & Cooke, 2011; Maditinos, Chatzoudes, & Sarigiannidis, 2013; Wu, 2011), and thus it can be used as the base for this study's research model. Furthermore, to enhance the TAM's explanatory power, it should first include the intrinsic motivational perspective to extend its function (Davis, Bagozzi, & Warshaw, 1992; Lee, Cheung, & Chen, 2005; Teo, Lim, & Lai, 1999; Van der Heijden, 2004), and it may further be integrated with the innovation diffusion theory (IDT) to address the compatibility (Chen, Gillenson, & Sherrell, 2002; Ryu, Kim, & Lee, 2009; Tan & Chou, 2008; Tung & Chang, 2008; Wu & Wang, 2005). Thus, a hybrid model is developed for exploring learners' intention to use m-learning. Based on the aforementioned statement, this study's purpose was to combine the extended TAM with the IDT to examine whether technological characteristics and compatibility as the antecedents to learners' beliefs affected their intention to use m-learning.

2. Literature review

2.1. The outline of m-learning

M-learning is defined as a form of e-learning that specifically uses mobile devices [e.g., personal digital assistants (PDAs), cell phones, smart phones, notebooks (NBs), or tablet personal computers (PCs)] to deliver learning contents and supports (Brown, 2005; Hwang & Chang, 2011; Muyinda, 2007). Essentially, m-learning is based on the use of mobile devices anywhere at any time (Chen & Huang, 2012; Motiwalla, 2007), and the prevalent use of portable technologies makes it easier for learners to learn when and where they intend to access the learning materials (Evans, 2008). In this study, m-learning refers to IT for learning, which employs the mobile devices to integrate with ubiquitous computing technologies to support learners' learning activities (Alvarez et al., 2011; Martin et al., 2011). In addition, it allows learners to have access to learning contents (e.g., learning materials, tests, dictionaries) and conduct personalized curriculum sequencing according to their learning needs (Chan, Leung, Wu, & Chan, 2003; Chen & Hsu, 2008; Hwang & Chang, 2011; Lundin & Magnusson, 2003).

Essentially, m-learning may play an extremely important role in the field of education where it can make significant contributions to learners' learning performance (Fang, Huang, & Lu, 2007). To date, Taiwan already has a very excellent mobile telecommunication infrastructure, which is under continuous development due to the strong commitment of the government (Chuang & Tsao, 2013; Fang et al., 2007). With the use of innovative information and communication technologies, the mobile technology finds its way into the field of education in Taiwan as well, and educational institutions are picking up mobile learning services based on the highly developed telecommunication infrastructure (Fang et al., 2007; Hwang & Chang, 2011). Besides, with the development of new mobile devices, m-learning has emerged as a prosperous trend in Taiwan (Chuang & Tsao, 2013). Of these devices, the mobile phone is the most widely used device, because Taiwan has approximately 29.5 million mobile phone subscribers in 2012, with a market penetration rate of approximately 127.6% (Commerce Industrial Services

Portal, Ministry of Economic Affairs, R.O.C., 2013). Hence, the mobile phone has the promising potential to provide learning materials to Taiwan's learners (Chuang & Tsao, 2013). However, although m-learning is a relatively new tool, which is more likely to be embraced by learners in Taiwan, mobile device applications may present some limitations such as the reduced screen size of mobile devices and the requirement of being easy of using at any time in any proper equipped location, and these may add to the problems faced by learners (Chen & Huang, 2012; Hwang & Chang, 2011).

2.2. Theory of reasoned action

TRA originates from the field of social psychology, and it has been one of the most widely applied models in explaining individuals' behavior (Cheung & Vogel, 2013; Hong et al., 2013; Lee, Qu, & Kim, 2007). To date, TRA has received substantial empirical supports by several prior studies, and it has been applied to a wide range of users' IS/IT acceptance (Cheung & Vogel, 2013; Hong et al., 2013). From a theoretical viewpoint, TRA posits that an individual's behavior is determined by the individual's intention to engage in a given behavior, which in turn can be influenced by the individual's attitude toward the behavior and subjective norm surrounding the performance of the behavior (Ajzen & Fishbein, 1980; Cheung & Vogel, 2013; Fishbein & Ajzen, 1975). Hence, the concept of TRA is that individuals are usually rational and will consider the implications of their actions before they decide whether to perform a given behavior (Ajzen & Fishbein, 1980; Hong et al., 2013). Essentially, TRA makes a major contribution to the prior attitude studies by proposing the behavioral intention as the most key determinant of an individual's behavior (Cheung & Vogel, 2013; Hong et al., 2013).

2.3. Extended TAM

Many theoretical models have been used to explain users' IS/IT acceptance. Among them, TAM, proposed by Davis (1989) and Davis, Bagozzi, and Warshaw (1989), is one of the most widely accepted and applied models in a variety of domains including related IS and IT acceptance studies (Lindsay et al., 2011; Maditinos et al., 2013; Wu, 2011). TAM is adapted from the well-known TRA (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), which is a model used extensively for explaining technology acceptance and utilization among users. In general, TAM proposes that two particular beliefs, perceived usefulness (PU) and perceived ease of use (PEOU), are the primary drivers for explaining user acceptance of specific type of system (Davis et al., 1989). PU is defined as "the degree to which a person believes that using a particular system would enhance his/her job performance," and PEOU is defined as "the degree to which a person believes that using a particular system would be free of physical and mental effort" (Davis, 1989, p. 320). The external variables of the TAM can affect PU and PEOU, and both PU and PEOU affect a person's attitude toward using the system, and the attitude toward using the system determines behavioral intention, which in turn leads to actual system use (Davis, 1989; Davis et al., 1989). Essentially, previous studies have shown TAM to be justified both pragmatically and theoretically (Hossain & de Silva, 2009), because it has reliable instruments with excellent measurement properties (Chen, Fan, & Farn, 2007; Pavlou, 2003).

While TAM has been verified as a valuable model in explaining users' acceptance of technology in various contexts, cultures, and usage dimensions (Chen et al., 2007; Chen & Tan, 2004; Ha & Stoel, 2009; Hernández, Jiménez, & Martín, 2008; Hossain & de Silva, 2009; Lee, Li, Yen, & Huang, 2010; Pavlou, 2003; Polančič, Heričko, & Rozman, 2010), it provides little assistance in capturing the hedonic feature of a hedonic-oriented IS/IT in the nonworking place (Kim, Choi, & Han, 2009; Van der Heijden, 2004).