The Effects of Learners' Personality Traits on M-Learning

Saif Dewan
University of Canberra, Saif.Dewan@canberra.edu.au

Kevin Ho
University of Guam

Recommended Citation

Dewan, Saif and Ho, Kevin, "The Effects of Learners' Personality Traits on M-Learning" (2013). *ACIS 2013 Proceedings*. 95.

https://aisel.aisnet.org/acis2013/95

Information Systems: Transforming the Future

24th Australasian Conference on Information Systems, 4-6 December 2013, Melbourne

Proudly sponsored by

The Effects of Learners' Personality Traits on M-Learning

Saifullah M Dewan
Faculty of Business, Government and Law
University of Canberra
Canberra, Australia
Email: saif.dewan@canberra.edu.au

Kevin K.W. Ho
School of Business and Public Administration
University of Guam
Mangilao, Guam 96923
Email: kevinkho@uguam.uog.edu

Abstract

Mobile learning (m-learning) is becoming increasingly significant for educators and businesses. Prior research often examines the effectiveness of m-learning; however, it overlooks that learners with different characteristics may respond to m-learning differently. This research examines how learners with different personalities react to m-learning messages. Specifically, it uses the Myers-Briggs Type Indicator (MBTI), which is one of the most widely-used personality instruments, and uses four dichotomies, namely introversion–extroversion, sensing–intuition, thinking–feeling and judgment–perception, to describe learner personalities. We conducted a 10-week study with 217 students. We used MBTI to categorize these 217 participating learners into sixteen personality groups, and sent short text messages to their mobile devices. These messages stimulated them to access lecture materials and to participate in online class discussions. We observed how learners with different personalities responded to text messages, and confirmed that learners of different personalities showed different levels of responses to m-learning messages.

Keywords

Mobile learning (m-learning), text messaging, learner's personality

INTRODUCTION

Mobile learning is a kind of learning that occurs when the learner is not at a fixed location, or learning that takes place when the learner takes advantage of the opportunities offered by mobile technologies (Liu et al. 2010). The proliferation of mobile phones and other mobile devices has evolved m-learning from a research endeavour to an everyday activity, where personal mobile devices enable people to learn anytime and anywhere. M-learning has been adopted by many educators and businesses (Johnson et al. 2013). According to a recent report by Ambient Insight, m-learning revenue in the Asia (including Australia) alone soared to US$2.6 billion in 2012. It is expected to reach US$6.8 billion by 2017 (Adkins 2013).

M-learning enables educators and businesses to efficiently keep in touch with learners (Johnson et al. 2013; Richardson and Corbitt 2010). It is believed to place educators and businesses at the forefront of pedagogical excellence of practice in response to the increasingly mobile and modern-day learners' requirements to access information anytime and anywhere. The m-learning process can be interactive and stimulating; for instance, learners and instructors can upload questions and opinions to a mobile site and share their learning experiences. Learners can receive immediate feedback and guidance from the instructor who is simultaneously online. Incorporating mobile devices in the learning process results in a paradigm shift in the way individuals learn: from the classroom to the pocket.

Education literature suggests that learners' personality traits influence learning outcomes (Chamorro-Premuzic and Furnham 2003; DiTiberio 1996). This literature is limited to the context of face-to-face education or web-based learning, in which the instructors can exert direct influences to, or have more interactions with, learners. In the context of m-learning, the instructors can only use a mobile device with a small screen to interact with the learners, hence, the effect of individuals' personalities on the learning outcomes in m-learning may be different from that in the face-to-face education or in the web-based learning. Therefore, this study investigates how learners' personalities influence their learning outcomes in the context of m-learning.

Since its early inception, Myers-Briggs Type Indicator has been used to study how personality traits relate to learning aptitudes and outcomes in the face-to-face education and in the web-based learning. For instance, Harrington and Loffredo (2010) found that introverted learners preferred web-based learning, while extroverted

learners preferred face-to-face classes. Dewar and Whittington (2000) found that feeling-type learners preferred face-to-face instructions, while thinking-type learners preferred a web-based learning environment. Nonetheless, there is scant research to examine how MBTI types affect m-learning. The current research adopts MBTI because MBTI focuses on how individuals process information to make decisions, which is the primary facet of learning. It is also one of the most widely-used personality instruments. Our interest is in how m-learning, in the form of short text messages, can stimulate individuals to access lecture materials and participate in class discussions.

The objective of this research is two-folded. First, we examine the use of m-learning messages to fully exploit its ability to stimulate students to access course materials. Second, we examine the effects of m-learning messages on stimulating learners to access course materials. In particular, we examine how learners' personalities influence their learning preferences and address the following question: What is the effect of an individual's personality on affecting his/her responses to m-learning?

The remainder of this paper is structured as follows: the next section reviews literature on face-to-face learning and web-based learning, and literature on learners' personalities and MBTI personality types. Section 3 develops the hypotheses of the study. Sections 4 and 5 describe the methodology and its findings. Section 6 discusses the theoretical and practical implications of the study, its limitations, and future research, which is followed by a conclusion in the last section.

LITERATURE REVIEW

From Web-based Learning toward M-Learning

Prior research in information systems field has examined the use of technology in learning; however, it has mostly focused on web-based learning (Islam 2012; Piccoli et al. 2001; Shen et al. 2008; Wan et al. 2008; Xu and Wang 2006). Web-based learning refers to the use of the Internet to deliver information and instruction to learners (Chiu et al. 2007; Wan et al. 2008; Welsh et al. 2003), and it is a major subcomponent of the broader term 'e-learning' or 'distance learning' (Chiu et al. 2007). Web-based learning delivers learning content anytime and anywhere, and provides learners with a customised, interactive and just-in-time learning experience (Narciss et al. 2007; Piccoli et al. 2001; Shen et al. 2008; Woo and Reeves 2007; Xu and Wang 2006). Even though prior research has examined the effectiveness of web-based learning (Arbaugh and Benbunan-Fich 2007; Narciss et al. 2007; Shepherd and Martz 2007; Woo and Reeves 2007), there is scant empirical work and theoretical framework on m-learning.

M-learning refers to the acquisition of any knowledge and skills using mobile technology, anywhere and anytime (Liu et al. 2010). Researchers suggest that, instead of simply adapting the existing e-learning techniques to mobile devices, m-learning should be used to exploit the new possibilities offered by mobile devices in an innovative and efficient way (Horvath et al. 2009). Kim et al. (2007) found that m-learning (in the form of text messages) is more likely to add to, and blend with, web-based and face-to-face learning, rather than replacing it, but they did not examine how individuals with different personalities react to those text messages.

In addition, some studies reveal the effectiveness of m-learning (again, in the form of text messages) in gaining learners' attention. Text messaging services are more reliable than e-mail in reaching the recipient for time-critical administrative communication (e.g., delayed start of a lecture) (Naismith 2007). Naismith (2007) advised that effective administrative messages should be relevant, simple, time-critical and trustworthy, and found that notices of relevant learning activities are the most popular type of message among students. Traxler and Riordan (2003) used a text messaging system to provide learning support (such as alerts and reminders), to distribute feedback on assignments and to provide revision tips to students. These studies showed that students are generally supportive of m-learning, as long as no cost is incurred. Research also suggests that students are generally more supportive of texting for administration purposes than for course content. The use of m-learning increases interactivity and learning opportunities among students and the instructor (Markett et al. 2006). Thornton and Houser (2004) showed m-learning benefits when pedagogical text messages are sent via short-text message services (SMS) to students' mobile phones, as opposed to e-mailing or posting an announcement on a website. Overall, these studies highlight the strength of m-learning (but they do not examine how individuals with different personalities interact with m-learning).

Learners' Personality and Learning Outcomes

Prior research on individuals' personalities and learning outcomes reveals that individuals with different personality types have different academic priorities that will affect learning outcomes (Clark and Schroth 2010; Kanuka and Nocente 2003). Furnham and Medhurst (1995) examined how the personality relates to different learning activities such as comprehension of subject matter, essay writing, oral expression, work habits and the degree of participation. They found that an individual's personality exerts a stronger effect on his or her learning

activities, than on his or her academic results. Caspi et al. (2006) found significant correlations between personality traits and class participation.

In web-based learning, personality explains some of the variability in students' course enrolment. For instance, researchers suggest that web-based courses appeal more to introverted learners (Clark and Schroth 2010), who show more positive attitudes to, and greater success in, web-based learning environments, compared to face-to-face learning (Clark and Schroth 2010). Learners who have an internal locus of control are more successful in web-based learning programs than learners who have an external locus of control (Kanuka and Nocente 2003).

MBTI Personality Types

Personality research, based on Carl Jung's (1921) theory, is conducted on the premise that the mental functions related to information gathering and decision making are central to one's personality (McElroy et al. 2007). Consequently, learners can be typed according to how they perceive and form judgments (McElroy et al. 2007). In this paper, learners' personality types refer to how individuals prefer to receive information and what methods they use to process that information (Barkhi 2002). The preferences indicate the types of environments which suit the people, let them feel comfortable and work well (Barkhi 2002).

The MBTI is the primary instrument used to capture Jung's theory of conscious psychological type (Wheeler et al. 2004). Among various personality instruments, MBTI is one of the most dominant to study personality in learning (Chamorro-Premuzic and Furnham 2003). MBTI is a popularly accepted and mature personality model that has evolved over the last 70 years. In our study, we used the MBTI to examine the relationship between personality and m-learning activities. MBTI classifies people, based on their self-reporting behaviour, preferences and value judgments into four dichotomies: introversion–extroversion, sensing–intuition, thinking–feeling and judgment–perception (Myers et al. 2003). Myers et al. (2003) explain each of the four dimensions:

(1) Introversion–Extroversion (I–E): This dichotomy explains whether individuals are introverted or extroverted, and indicates how individuals gather energy. Introverts are oriented more towards the inner world of concepts and ideas. They gather energy from their own internal world of thoughts, ideas and viewpoints. Extroverts are oriented primarily to the outer world of people and things. They find themselves energised by people and activities in the world external to themselves.

(2) Sensing–Intuition (S–N): This dichotomy explains how individuals choose to gather information or perceive the world. Sensing-type individuals prefer to rely most heavily on the five senses to observe facts or events. Intuition-type individuals prefer to perceive the world as possibilities, meanings and relationships. They rely more on hunches or insights rather than on the five senses.

(3) Thinking-Feeling (T-F): This dichotomy explains how individuals prefer to make decisions. Thinking-type individuals make decisions based more on logic and objective facts. Feeling-type individuals make decisions based more on personal and social values, subjective beliefs, and how actions affect other people when making decisions.

(4) Judging-Perceiving (J-P): This dichotomy explains how individuals prefer to deal with the world, and how they organize their lives. Judging-type individuals use either thinking or feeling, usually seek closure, and are more orderly and planned in their behaviour. Perceiving-type individuals use either sensing or feeling, and are usually more open, and adaptable in lifestyle.

In a review of MBTI literature on education and learning styles, DiTiberio (1996) reported that introverts like lectures and do well in computer-assisted learning, whereas extroverts prefer a collaborative learning environment. Intuition-type learners generally perform better than sensing-type learners on standardised tests of verbal and mathematical reasoning. Sensing- and judging-type learners persist and learn in classrooms at levels equal to intuition-type learners, outperforming them in clinical situations. Harrington and Loffredo (2010) found that introverts preferred web-based learning, while extroverts preferred face-to-face classes. Lucas (2007) observed differences in individuals along the thinking–feeling dimension in web-based courses and found that the feeling-type learners were more satisfied than the thinking-type learners in learner-to-learner and learner-to-content interactions.

HYPOTHESES DEVELOPMENT

In this study, we develop hypotheses on how each of the four MBTI personality dimensions influences a learner's reactions to m-learning messages, based on our extrapolations from Myers et al. (2003) and Myers and Myers (1995) to the context of this study. We first examine the extrovert-introvert dimension, which describes where individuals focus their attention and get their energy. Extroverts (E) like to spend time in the outer world of people and things; they feel comfortable in groups and like working in them. Their minds are outwardly directed, and they follow the events in their immediate environments. They are goal-oriented and stimulus hungry. Conversely, introverts (I) attend to their inner world of ideas, feel comfortable being alone, and like to do things

on their own. They are frequently unaware of the objective environment, and their interest and attention are engrossed by the inner events. Consequently, introverted learners prefer reflective observation, and the hustle-and-bustle interrupts their concentration. Since extroverts like social interactions and respond to external stimulus, we anticipate that extroverts are more likely than introverts to respond to m-learning messages that invite them to access course materials. Therefore, we hypothesize that:

H1: Compared with introverts, extroverts are more likely to have a positive attitude toward m-learning.

Sensing-intuition explains how individuals process information. Sensing-types (S) pay attention to facts and physical reality; start with facts and then form a big picture. They are very much aware of the events that occur in their external environment. Intuition-types (N) are interested in new things, like to see the big picture, and then uncover the facts. They are imaginative, independent of their physical surroundings, and quite indifferent to what other people do. As sensing types pay attention to facts and realities, we anticipate that sensing learners are more likely to pay attention to m-learning messages, and are more likely to respond to m-learning messages that invite them to participate in learning than intuitive learners. Hence, we hypothesize that:

H2: Compared with intuitive-type learners, sensing-type learners are more likely to have a positive attitude toward m-learning.

Feeling-thinking explains how individuals make human-related decisions. Thinking-types (T) use objective principles and impersonal facts to make decisions. They are more interested in subject matter than in human relationships, and value logic over sentiment. Feeling-types (F) give more scores to personal concerns. They are more interested in people than in things, and value sentiment above logic. They like harmony, are people-oriented, and respond more easily to people's values. As thinking types use objective principles and impersonal facts to make decisions, we anticipate that thinking-type learners are more likely to respond to m-learning messages that invite them to participate in learning than feeling-type learners and hypothesize that:

H3: Compared with feeling-type learners, thinking-type learners are more likely to have a positive attitude toward m-learning.

Judging-perceiving explains how individuals organize their lives. Judging-types (J) prefer a more structured and decided lifestyle. Judging-types are purposeful and more decisive than curious. They are self-regimented, and like to live according to schedules, standards, and customs. They like it when the instructor presents a plan, and they tend to follow it as given. Conversely, perceiving-types (P) prefer a more flexible and adaptable lifestyle. They are adaptive, tolerant, and more curious than decisive. They live at the present, and can better adjust to the accidental and the unexpected. They are empirical (ready for anything), enjoy new experiences, like to start something new, until the newness wears off. They want their natural curiosity to remain alive, and prefer the flexibility to wait and see without constraints. Presumably, judging-type learners prefer to follow an instructor's defined work plan to complete the learning materials. Conversely, perceiving-type learners like to set up their own plans. Hence, we anticipate that judging-type learners are more likely to respond to m-learning messages that invite them to access course materials than perceiving-type learners and hypothesize that:

H4: Compared with perceiving-type learners, judging-type learners are more likely to have a positive attitude toward m-learning.

Technology acceptance studies have established that behavioural intention to use an information system is influenced by attitudes towards using the system (Davis et al. 1989). An attitude towards behaviour describes the positive or negative feeling towards that behaviour. It is the degree to which an individual is interested in a specific system that has a direct effect on his or her intention to use that system (Davis et al. 1989). Individuals form an intention to conduct behaviour towards which they have a positive attitude (Davis et al. 1989). Using the same logic, learners would want to perform an m-learning behaviour that is in accordance with their attitude. Hence, we anticipate that learners who have a positive attitude toward m-learning will have a higher intention to use m-learning than those who have a negative attitude and hypothesize that:

H5: A positive attitude toward m-learning will lead to a strong intention to use it.

Technology acceptance studies have established that the actual usage of an information system is influenced by the behavioural intention to use that system (Venkatesh et al. 2003). Individuals are likely to use a system when influenced by a strong intention (Venkatesh et al. 2003). The extent to which a system will be used over a fixed unit of time is influenced by an intention (Davis et al. 1989). Hence, we anticipate that behavioural intention will have a significant positive influence on the actual access of course materials and hypothesize that:

H6: A strong intention to access course materials will lead to actual access of course materials.

Figure 1 depicts our research model. We conducted an experiment to test the above hypotheses. An m-learning system was developed that was capable of sending SMS to participants. We recruited 217 participants and collected their click data during a ten-week period.
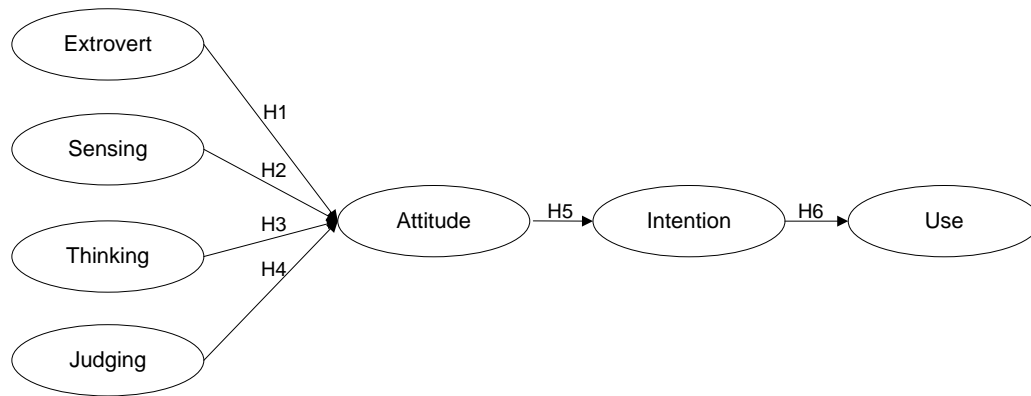
Figure 1: Research Model

METHODOLOGY

Participants

Our target participants were university students from an introductory course on management information systems. We believe that these university students are authenticated participants because they were learners. Generally, they accessed their lecture materials on WebCT—a teaching and learning management platform adopted by the university. The experiment spanned a 10-week period. We recruited 217 participants (139 males and 78 females; average age = 18.25 years) from a public university in Australia to participate in this study, which was equivalent to 71% of the students who enrolled in the captioned courses. Among 217 participants, 182 of them were Year 1 undergraduate students, 23 were Year 2 students, and 12 were Year 3 students. All of them were active mobile phone users. On average, they spent more than 100 minutes per week on mobile phone communication, and sent more than eight SMSs per week. Also, they had more than five years of Internet experience, and spent more than three hours on Internet browsing every day. During the experiment period, we sent 4,340 SMS recommendations to the 217 participants. Each participant received 20 SMS learning reminders (on average, two SMS reminders a week) to invite them to access the WebCT course materials.

Experimental Procedures

For the purposes of the study, an m-learning system was developed, which sent SMSs to registered learners. Flyers were distributed in the classroom to recruit undergraduate students in the Introduction of Management Information Systems course to participate in the study. The respondents would come to a room to fill in a paper registration form. During registration, they also completed an MBTI test, which took approximately 45 minutes to complete. There were many types of MBTI tests. For this study, the copyrightable MBTI self-scorable Form M was used, which measured four dimensions of participants' personalities: extrovert–introvert, sensing–intuition, thinking–feeling and judging–perceiving.

Throughout the semester, the participants received SMS reminders to access teaching materials, to prepare quizzes and to work on assignment submission deadlines. The reminders were sent twice a week, on Monday, Wednesday and/or Friday. Examples of the content of the text messages were as follows: 'Content, on XXX topic, is available on WebCT. It is important. Please read', or 'Your lecturer has posted messages in the discussion forum. Enjoy'. The participants' logon and page access on WebCT were tracked. At the end of every two weeks, the participants logged onto the website to complete a questionnaire. In the questionnaire, the participants reported their attitude towards, and intention to use, the m-learning system. There were three statements to answer relating to attitude: 'Using mobile SMS to facilitate my learning was a pleasant experience', 'Using mobile SMS to support my learning was a good experience', and 'Overall, I liked mobile SMS'. There were also two statements on usage intention: 'I predict I would continue using mobile SMS learning', and 'I plan to continue using mobile SMS learning'. The entire study spanned a period of around 10 weeks.

FINDINGS

In an MBTI test, a participant completed 93 questions on basic patterns of human functionality, preferred feeling and acting (i.e., personality) as equally legitimate dichotomous responses. These 93 questions were summed to form four scores, corresponding to the four dichotomies: extroversion–introversion, sensing–intuition, thinking–feeling and judgment–perception. For each score, we performed median splitting to divide the sample into two groups, and we used a binary variable (four binary variables for all four dichotomies) to categorise participants. We analysed the four dichotomies one by one. For the first dichotomy, the introversion (0) to extroversion (21) scores ranged from 0 to 21. The mean of the introversion–extroversion scores for the participants was 11.3. We

used a median split to divide our participants into two groups: introverted learners and extroverted learners. There were 102 introverted learners and 115 extroverted learners. As some learners had equal scores, the two group sizes were not even. We used a binary variable to code this dichotomy. The 102 introverted learners were given a value of '0' and the 115 extroverted learners were given a value of '1'. For the second dichotomy, the intuition (0) to sensing (26) scores also ranged from 0 to 26. The mean of the sensing–intuition scores for the participants was 12.6. There were 126 intuitive-type learners (coded as '0') and 91 sensing-type learners (coded as "1"). For the third dichotomy, the feeling (0) to thinking (24) scores also ranged from 0 to 24. The mean of the thinking–feeling scores for the participants was 12.8. There were 109 feeling-type learners (coded as "0") and 108 thinking-type learners (coded as "1"). For the last dichotomy, the perceiving (0) to judging (22) scores also ranged from 0 to 22. The mean of the judging–perceiving scores for the participants was 11.1. There were 113 perceiving-type learners (coded as "0") and 104 judging-type learners (coded as "1").

To analyse the effects of MBTI constructs on the m-learning adoption, we used partial least square (PLS) to test our model. Figure 2 depicts the standardised path coefficients and the explained construct variances. The total variance explained by learners' attitudes towards m-learning was 72.8%. Surprisingly, being an extrovert did not have a significant effect on a learner's attitude towards m-learning materials ($\beta = 0.005$, $p > 0.10$); thus, H1 was not supported. This means that there is insufficient evidence to claim that extroverts have a more positive attitude than introverts towards m-learning. Although this finding does not support our hypothesis, it is consistent with Dewar and Whittington's (2000) study, where it was found that web-based learning appealed to both extroverts and introverts. The results also lean towards some other previous studies, where researchers found that introverts were more inclined to use e-learning materials than extroverts (Clark and Schroth 2010). As hypothesised, being a sensing-type had a significant effect on learners' attitudes towards m-learning ($\beta = 0.08$, $p < 0.01$), thus supporting H2. The results show that sensing-type learners have a more positive attitude towards m-learning than intuitive-type learners.
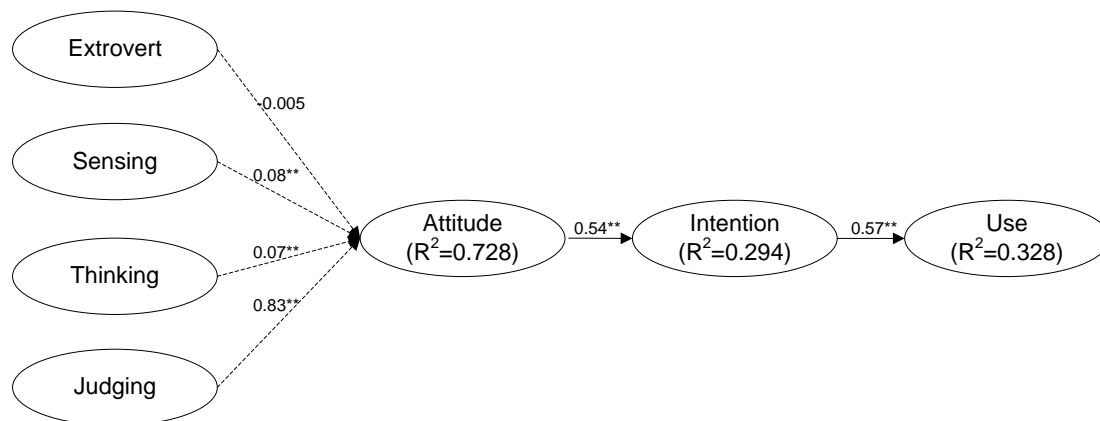
Notes: **$p < 0.01$, *$p < 0.05$. Dotted line indicates insignificant influence.

Figure 2: Structural Model

Being a thinking-type had a significant effect on learners' attitudes towards m-learning ($\beta = 0.07$, $p < 0.01$), thus supporting H3. The results show that thinking-type learners have a more positive attitude towards m-learning than feeling-type learners. Being a judging-type had a significant effect on learners' attitudes towards m-learning ($\beta = 0.83$, $p < 0.01$), thus supporting H4. The results showed that judging-type learners had a more positive attitude towards m-learning than perceiving-type learners.

The total variance explained by the intention to use m-learning was 29.4%. As hypothesised, a positive attitude towards m-learning had a significant effect on learners' intentions to access m-learning materials ($\beta = 0.54$, $p < 0.01$), thus supporting H5. The results support prior technology acceptance literature that suggested that attitude was a strong determinant of the intention to use a service (Davis et al., 1989). The total variance explained by actual access to m-learning materials was 32.8%. Learners' strong intentions to access m-learning materials ($\beta = 0.57$, $p < 0.01$) led to actual access of m-learning materials, thus supporting H6. The results support prior technology acceptance literature that suggested that intention was a strong determinant of the actual use of a service (Venkatesh et al. 2003).

DISCUSSION

Theoretical Contributions

This research contributes to the existing literature in several ways. First, the study contributes to the 'coupling' (Orton and Weick 1990) literature by adding a perspective on how m-learning messages can be used in an effective manner for education. Roschelle (2003) called for more research to unlock the value of mobile devices for learning. He suggested that a clear understanding was needed of how wireless networks meet the requirements and desires of learners. This study generally helps in understanding coupling between m-learning messages and learning.

Second, this study responds to the call for more research on mobile learning in education (Ngai and Gunasekaran 2007). It contributes to a better understanding of text messaging learning to pedagogically use text messaging in order to stimulate different learning activities. Text messaging services, which is a text-based and lean (low in information richness) medium, is more suitable to augment rather than substitute face-to-face communication due to its mobility, flexibility, immediacy, high social presence (due to its informal nature) and pervasiveness (Rau et al. 2008). This study sheds light on the clearer identification of the separate roles of text messaging-based learning and web-based learning, and the ties that bind these together to enhance learning experiences.

Third, this study provides information to researchers and technology designers on the effectiveness of an m-learning function: personalisation. Personalisation has been widely adopted in e-commerce (Tam and Ho 2006). This study is a first step towards examining the use of personalisation in learning. Our findings confirm that personalised learning should take users' characteristics, that is, personalities, into consideration. We examined whether users' MBTI personality types influence their learning preferences.

Fourth, this study responds to the call for more research on understanding learners' engagement in web-based environments to consider additional intervening variables (Arbaugh and Benbunan-Fich 2007). It highlights the role of personality in web-based learners' engagement with m-learning.

Fifth, this study contributes to the technology-mediated learning literature by expanding the breadth of traditional stimulus-response perspectives on learning by adding personality in an m-learning context. Without knowledge of the learners' psychology that lies behind learning in innovative learning environments, learning outcomes cannot be achieved. In the context of this study, learners' psychology refers to learners' personalities or MBTI types. The study deepens our understanding of the m-learning phenomenon and informs the design of effective SMS-based learning environments by shedding light on learners' personalities.

Practical Implications

This research will provide several vital outcomes for businesses, educators and technology designers. First, our findings will help lecturers understand the teaching opportunities associated with mobile text messaging. It also provides an opportunity for businesses to disseminate teaching messages to their employees. Competition within the business world is keen, and employee training is a key attraction and retention strategy. From 2001 to 2005, the number of employees in Australia that completed training courses increased from 4.8 million (42%) to 5.3 million (48%) (ABS 2009). This statistic indicates how crucial staff training is to businesses. At the same time, more and more employees work at home. According to the ABS, 2.3 million employees (24% of 9.4 million) worked some hours at home in 2006, while 8% of employees only worked at home and 36% spent time travelling for work (ABS 2009). The number of home workers and travelling workers is increasing, but how can businesses encourage these employers to log on an information system to receive training and further education? In this environment, mobile training is an increasingly important business development strategy. This study provides a first step to understanding how to use mobile devices—even a very simple function such as text messaging—to stimulate people to learn. Our findings provide instructors with ideas on how learners react to learning through mobile messaging.

Second, this study helps educators (e.g., in high schools, vocational training institutions and universities) to understand how to leverage the potential of the mobile communication channel. Nowadays, teaching is not easy. According to a report by the University of Melbourne, full-time university students spend more time in paid work, and fewer of them study on weekends. The report also finds that it is harder to motivate students to learn. This study explores a new pedagogical practice—shifting the teaching platform to mobile devices—which may lead to affective learning. M-learning delivers teaching content to an identifiable device; hence, it can be personalised. For instance, teaching materials, training schedules and quizzes can be tailored to individuals and even matched with their personality types. Learners can receive reminders via mobile messages. The study provides preliminary findings on the effects of personalised m-learning.

Last, this study provides information to technology designers on the usefulness of mobile messages for learning. Researchers have suggested the need to adopt a 'critical attitude to the economic plausibility' of an m-learning platform that will 'run all the best pedagogical applications' (Roschelle 2003, p. 270). This study is a step towards driving raw technologies, such as text messaging services, which have arrived in classrooms, towards a common, scalable and feasible pedagogical platform. Given that technology can both enable and hinder learning innovations, this study helps to determine whether text messaging is an appropriate teaching and learning application.

Limitations and Future Research

This study has several limitations. First, the field study only spanned a 10-week period. It is inconclusive whether the effects observed in this study would have a long-term effect. A longitudinal study, in future, could explore whether the ability of mobile messaging to stimulate learners to access various teaching content diminishes over time. Second, only full-time students were used in the study. Part-time students who are employed in businesses may have different learning preferences and expected outcomes compared to full-time students. As they juggle the roles of student and employee, their time may be less flexible and their personalities that affect learning may differ from those of full-time students. More effort should be invested into exploring the effects of various user characteristics or traits on users' learning preferences. It would also be useful to test the relationships found in this study in different m-learning contexts involving different participants, such as part-time students, full-time workers and visiting learners at museums, to determine whether the same findings are observed. Third, we only studied one feature of m-learning: SMS to stimulate learning. Future research can also examine the effects of different mobile devices and m-learning tools on stimulating learning activities.

CONCLUSION

M-learning will play a significant role in future education, as it has the potential to provide learners with interesting and relevant learning experiences. Although businesses and education institutes invest heavily in m-learning, there has been little research into its effectiveness.

This study examined the effects of mobile messaging on the stimulation of students' learning activities. Specifically, we examined how learners' personalities influence their reactions to mobile messaging. Based upon a field study of 217 participants, we confirmed that the personalities of learners did affect their attitude and behaviour towards m-learning.

Overall, the study contributes to theory by highlighting the effects of personality on m-learning behaviour, and it contributes to practice by highlighting the use of mobile messaging to stimulate learning.

REFERENCES

ABS. 2009. *Locations of Work*, Australia, Canberra, Australia: Australian Bureau of Statistics.

Adkins, S. 2010. "The US market for mobile learning products and services: 2010−2015 forecast and analysis." Retrieved 22 July, 2013, from http://www.ambientinsight.com/Resources/Documents/Ambient-Insight-2010-2015-US-Mobile-Learning-Market-Executive-Overview.pdf.

Adkins, S. 2013. "The Asia Market for Mobile Learning Products and Services: 2012-2017 Forecast and Analysis." Retrieved 22 July, 2013, from http://www.ambientinsight.com/Reports/MobileLearning.aspx#section2.

Alavi, M. and Leidner, D.E. 2001. "Technology-mediated Learning - A Call for Greater Depth and Breadth of Research," *Information Systems Research* (12:1), pp 1−10.

Arbaugh, J.B. and Benbunan-Fich, R. 2007. "The Importance of Participant Interaction in Online Environments," *Decision Support Systems* (43:3), pp 853−865.

Barkhi, R. 2002. "Cognitive Style may Mitigate the Impact of Communication Mode," *Information & Management* (39:8), pp 677−688.

Caspi, A., Chajut, E., Saporta, K., and Beyth-Marom, R. 2006. "The influence of personality on social participation in learning environments," *Learning and Individual Differences* (16:2), pp 129−144.

Chamorro-Premuzic, T., and Furnham, A. 2003. "Personality Traits and Academic Examination Performance," *European Journal of Personality*, (17:3), pp 237−250.

Chiu, C.M., Sun, S.Y., Sun, P.C., and Ju, T.L. 2007. "An Empirical Analysis of the Antecedents of Web-based Learning Continuance," *Computers & Education* (49:4), pp 1224−1245.

Clark, M., and Schroth, C.A. 2010. "Examining Relationships between Academic Motivation and Personality among College Students," *Learning and Individual Differences* (20:1), pp 19−24.

Davis, F.D., Bagozzi, R.P., and Warshaw, P.R. 1989. "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," *Management Science* (35:8), pp 982−1003.

Dewar, T., and Whittington, D. 2000. "Online Learners and their Learning Strategies," *Journal of Educational Computing Research* (23:4), pp 385−403.

DiTiberio, J.K. 1996. "Education, Learning Styles, and Cognitive Styles," in *MBTI Applications: A Decade of Research on the Myers-Briggs Type Indicator*, A.L. Hammer and N.J. Barger (eds.), Palo Alto, CA: Consulting Psychologists Press, pp. 123−166.

Furnham, A., and S. Medhurst (1995) "Personality Correlates of Academic Seminar Behaviour: A study of Four Instruments," Personality and Individual Differences (19) 2, pp. 197−208.

Harrington, R., and Loffredo, D.A. 2010. "MBTI Personality Type and Other Factors that Relate to Preference for Online versus Face-to-Face Instruction," *The Internet and Higher Education*, (13:1-2), pp 89−95.

Horvath, I., Peck, D., and Verlinden, J. 2009. "Demarcating Advanced Learning Approaches from Methodological and Technological Perspectives," *European Journal of Engineering Education* (34:6), pp 465−485.

Islam, A.K.M.N. 2012. "The Role of Perceived System Quality as Educators' Motivation to Continue E-learning System Use," *AIS Transactions on Human-Computer Interaction* (4:1), pp 25-43.

Johnson, L., Smith, R., Willis, H., Levine, A., and Haywood, K. 2011. "The 2011 Horizon Report", Austin, Texas: The New Media Consortium.

Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A., and Ludgate, H. 2013. "NMC Horizon Report: 2013 Higher Education Edition", Austin, Texas: The New Media Consortium.

Jung, C. 1921. *Psychological Types*, Princeton, NJ: Princeton University Press.

Kanuka, H., and Nocente, N. 2003. "Exploring the Effects of Personality Type on Perceived Satisfaction with Web-based Learning in Continuing Professional Development," *Distance Education* (24:2), pp 227−244.

Kim, H., Kim, G.J., Park, H.W., and Rice, R.E. 2007. "Configurations of Relationships in Different Media: FtF, Email, Instant Messenger, Mobile Phone, and SMS," *Journal of Computer Mediated Communication* (12:4), pp 1183−1207.

Kitsantas, A. and A. Chow (2007) "College Students' Perceived Threat and Preference for Seeking Help in Traditional, Distributed, and Distance Learning Environments," Computers & Education (48) 3, pp. 383−395.

Liu, Y., Li, H., and Carlsson, C. 2010. "Factors Driving the Adoption of M-learning: An Empirical Study," *Computers & Education* (55:3), pp 1211−1219.

Lucas, D.J.W. 2007. *Personality Type (MBTI) Relationship to Performance and Satisfaction in Web-Based Instruction (WBI)*, PhD Thesis, NC State University.

Markett, C., Sánchez, I.A., Weber, S., and Tangney, B. 2006. "Using Short Message Service to Encourage Interactivity in the Classroom," *Computers & Education* (46: 3), pp 280−293.

McElroy, J.C., Hendrickson, A.R., Townsend, A.M., and DeMarie, S.M. 2007. "Dispositional Factors in Internet Use: Personality versus Cognitive Style," *MIS Quarterly* (31:4), pp 809−820.

Myers, I.B., McCaulley, M.H., Quenk, N.L., and Hammer, A.L. 2003. *MBTI Manual: A Guide to the Development and Use of the Myers-Briggs Type Indicator*, 3rd ed., Mountain View, CA: Consulting Psychologists Press.

Myers, I.B. and Myers, P.B. 1995. *Gifts Differing: Understanding Personality Type*, Mountain View, CA: Davies-Black Publishing.

Naismith, L. 2007. "Using Text Messaging to Support Administrative Communication in Higher Education," *Active Learning in Higher Education* (8:2), pp 155−171.

Naismith, L., Lonsdale, P., Vavoula, G., and Sharples, M. 2004. "Literature review in mobile technologies and learning," Nesta FutureLab Report 11.

Narciss, S., Proske, A., and Koerndle, H. 2007. "Promoting Self-regulated Learning in Web-based Learning Environments," *Computers in Human Behavior* (23:3), pp 1126−1144.

Ngai, E.W.T., and Gunasekaran, A. 2007. "A Review for Mobile Commerce Research and Applications," *Decision Support Systems* (43:1), pp 3−15.

Orton, J. D. and K. E. Weick (1990) "Loosely Coupled Systems: A Reconceptualization," The Academy of Management Review (15) 2, pp. 203−223.

Piccoli, G., Ahmad, R., and Ives, B. 2001. "Web-based virtual learning environments: a research framework and a preliminary assessment of effectiveness in basic IT skills training," *MIS Quarterly* (25:4), pp 401−426.

Rau, P.L.P., Gao, Q., and Wu, L.M. 2008. "Using Mobile Communication Technology in High School Education: Motivation, Pressure, and Learning Performance," *Computers & Education* (50:1), pp 1−22.

Richardson, J. and Corbitt, B. 2010. "Using Trigger That Instant Messaging to Improve Stakeholder Communications," *Journal of Cases on Information Technology* (12:4), pp 1−17.

Roschelle, J. 2003. "Unlocking the Learning Value of Wireless Mobile Devices," *Journal of Computer Assisted Learning* (19:3), pp 260−272.

Shen, L., Callaghan, V., and Shen, R. 2008. "Affective E-Learning in Residential and Pervasive Computing Environments," *Information Systems Frontiers* (10:4), pp 461−472.

Shepherd, M.M., and Martz, Jr. W.M.B. 2006. "Media Richness Theory and the Distance Education Environment," *The Journal of Computer Information Systems* (47:1), pp 114−122.

Tam, K.Y., and Ho, S.Y. 2006. "Understanding the Impact of Web Personalization on User Information Processing, Behavior and Judgment," *MIS Quarterly* (30:4), pp 865−890.

Thornton, P., and Houser, C. 2004. "Using Mobile Phones in Education," in J. Roschelle, T.W. Chan, Kinshuk, and S. J. H. Yang (eds.) Proceedings of the 2nd IEEE International Workshop on Wireless and Mobile Technologies in Education: Taoyuan, Taiwan, March 2004.

Traxler, J., and Riordan, B. 2003. "Evaluating the Effectiveness of Retention Strategies using SMS, WAP and WWW Student Support," Proceedings of the 4th Annual LTSN-ICS Conference: Galway, Ireland, August 2003.

Venkatesh, V., Morris, M.G., Davis, G.B., and Davis, F.D. 2003. "User Acceptance of Information Technology: Toward a Unified View," *MIS Quarterly* (27:3), pp 425−478.

Wan, Z., Wang, Y., and Haggerty, N. 2008. "Why People Benefit from E-learning Differently: The Effects of Psychological Processes on E-learning Outcomes," *Information & Management* (45:8), pp 513−521.

Welsh, E.T., Wanberg, C.R., Brown, K.G., and Simmering, M.J. 2003. "E-learning: Emerging Uses, Empirical Results and Future Directions," *International Journal of Training and Development* (7:4), pp 245−258.

Wheeler, P.R., Hunton, J.E., and Bryant, S.M. 2004. "Accounting Information Systems Research Opportunities using Personality Type Theory and the Myers Briggs Type Indicator," *Journal of Information Systems* (18:1), pp 1−19.

Woo, Y., and Reeves, T.C. 2007. "Meaningful Interaction in Web-based Learning: A Social Constructivist Interpretation," *The Internet and Higher Education* (10:1), pp 15−25.

Xu, D., and Wang, H. 2006. "Intelligent Agent Supported Personalization for Virtual Learning Environments," *Decision Support Systems* (42:2), pp 825−843.

Yang, J.H., Fu, G.S, Lan, Y.J., and Huang, J.S. 2012. "Editorial: Advanced learning technologies," *Knowledge Management & E-Learning: An International Journal* (4:1), pp 1−6.

ACKNOWLEDGEMENTS

COPYRIGHT