

Chinese college students' attitude and intention of adopting mobile learning

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ABSTRACT

This study examined the relationship between Chinese college students' motivational needs, their attitude as well as the intention to use mobile devices for learning. The relationship between their attitude and intention of adopting mobile learning (m-learning) was also investigated. A total number of 337 Chinese college students participated in the study. Results revealed that the needs of affective, social integrative, and entertainment positively influence their attitude and intention to adopt m-learning. Additionally, entertainment needs and their attitude enhance their intention to use mobile devices for learning. This study extends the understanding of what motivates Chinese college students to adopt m-learning and also provides higher education professionals with a new vision about what influences students' attitude to use mobile devices for learning.

Keywords: *Mobile learning; M-learning; Smartphone; Chinese college students; Attitude and intention*

INTRODUCTION

Mobile learning (m-learning) has been defined from various perspectives. For example, Mcconatha, Praul, and Lynch (2008) defined m-learning as learning which is conducted through the use of smartphones. Alzaza and Yaakub (2011) described m-learning as the next generation of e-learning that applies mobile technology. Similarly, Homan and Wood (2003) stated that m-learning could influence the communication, interaction, and behaviors between students and their peers and instructors, as well as changing their perceptions of learning. M-learning is also identified as a way to enhance knowledge sharing among learners while interacting with each other, and it is learning that mediates across multiple contexts using portable mobile devices (Al-Emran and Shaalan, 2014; Matias and Wolf, 2013). In sum, m-learning aims to help learners perform their tasks by using small technological devices anytime, anywhere, as well as enhancing the collaboration between learners and motivating the interaction between them and their instructors (Al-Emran, Elsherif, & Shaalan, 2016).

With mobile devices connected to the Internet, learners can learn anytime, anywhere with flexibility and ubiquity (Du, Zhang, Shelton, & Hung, 2019; Taleb & Sohrabi, 2012). Therefore, m-learning is used in many higher education institutions to provide flexibility in learning within the classroom and at home (Sarrab, Al-Shihi, Al-Manthari, & Bourdoucen, 2018; Tsinakos & Ally, 2013). Using mobile devices to learn also provides learners, especially those who are work-based, or in traveler communities, the opportunity to carry their institutions in their own hands (Al-Emran, Elsherif, & Shaalan, 2016; Taleb & Sohrabi, 2012). Moreover, Wilkinson and Barter (2016) stated that mobile technologies "bridge the gap between formal and informal learning environments and transcend environmental limitations" (p. 15). For example, mobile devices can improve the feedback process between students and instructors that leads to a greater understanding of a wider learning process (Jeno, Adachi, Grytnes, Vandvik, & Deci, 2019; Johnson et al., 2011). Additionally, mobile devices

allow students to access education easily (Johnson et al., 2011). These researchers further indicated that m-learning would deliver more flexible education by allowing for the personalization and customization of the student learning experience (Jeno et al., 2019; Johnson et al., 2011).

The use of mobile technologies additionally increases the enrollment of college students as well as broadening student population, as learners of different age groups can access course materials anywhere and anytime flexibly (Lowenthal, 2010). Moreover, mobile devices with Internet access are convenient to carry and can be used as a learning tool to interact with other learners for the purpose of sharing information, completing a task or working collaboratively on a project (Wu, Wu, & Li, 2019). Learners could also use their mobile devices to access the most recent and related learning resources from the Internet and to engage in discussion with professionals in a specific field (Ally & Prieto-Blázquez, 2014). The learner is at the center of mobile learning, and technology allows the learner to learn in any context. Vavoula and Sharples (2009) therefore stated that mobile learning is:

“a social phenomenon, constructing spontaneous learning contexts and advancing through everyday life by negotiating knowledge and meanings through the interaction with settings, people and technology” (cited in Ally, 2019, p. 228).

However, several challenges are stated in terms of using mobile devices for learning, such as the small screens, limited processing power, and small keyboards (Yousafzai, Chang, Gani, & Noor, 2016). Other challenges include the limited memory size that may not hold the multimedia course resources (Kukulka-hulme, 2007; Sarrab, Elbasir, & Alnaeli, 2016), and learners may suffer from the risk of materials lost due to the portability of mobile devices (Shonola & Joy, 2014). Additionally, mobile learning may not be widely deployed due to the high costs of smartphones and the network, the low network transmission rate, and limited learning resources (Dashtestani, 2016; Li, 2010). In other words, the low processing power and the limited memory size of smartphones, an expensive network connection fee, the slow network transmission, and limited educational resources may hinder the development of mobile learning.

M-LEARNING IN CHINA

The m-learning penetration rate is high in China (GSMA, 2011; Pew Research Center, 2014; Wu, 2018). In addition to making communication easier and quicker, mobile phone users are taking the opportunity provided by mobile technology to learn. For instance, mobile technology has been employed in university course learning and many research studies have explored how to integrate m-learning into college curricula for learning enhancement (Wang, Chen & Khan, 2014; Wilkinson & Barter, 2016). Specifically, mobile technology has been widely used for English language learning in and out of the classroom in China (Huang, Yang, Chiang & Su, 2016; Wu, 2018).

As Confucian culture deeply influences both instructors and students, classes in China are teacher-centered and lecture-based (Biggs & Watkins 2001), and Chinese students sometimes fail to conduct self-directed learning when instructors are not present, especially in English related courses (Hurd & Xiao, 2006). English courses in China are usually identified as time-consuming and ineffective (Cai, 2010). Yu and Zhong (2008) investigated 1,615 college students from 12 universities and discovered that, the surveyed students were most dissatisfied with their improvement in English learning. To be specific, 11.3% of the participants reported that they made considerable progress, 23.6% of them considered that they made no progress, and 24.6% of the students thought they even regressed compared with their English proficiency in high school. Cai (2010) later on surveyed 1,246 students from 8 provinces among 16 colleges regarding their English learning experience. The results indicated that only 3.9% of the participants agreed that college education improved their English skills, 35.2% reported that some progress was made,

25.4% stated that not much was learned, and 35.1% of the college students reported that their English proficiency regressed from high school to college.

The shortage of experienced English teachers is another reason for the ineffectiveness of English college courses. Dai and Zhang's (2004) national study revealed that 32.4% of English college instructors did not have more than 5 years of teaching experience. Additionally, only 1.5% of 21,065 English teachers in 457 colleges in China have a doctoral degree, 60.1% hold a master's degree, which is below the average compared with other major subjects (Wang & Wang, 2011). As a result, the traditional "teacher-centered" and "textbook-reliant" approaches prevent students from conducting efficient self-directed learning for English (Li, 2014, p, 296). Furthermore, students are less likely to be motivated to learn if they learn passively, which would decrease their learning confidence while increasing their unwillingness to use English (Cai, 2010).

In addition to the focus on English learning, mobile learning has become prevalent in Chinese higher education because of the growing smartphone ownership and the availability of Internet connectivity. To be specific, mobile device ownership is high in China, especially among college students. One report stated that 69% of the 18 to 29 years old age group and 83% of college graduates owned a smartphone in 2013 (Pew Research Center, 2014). The number increased rapidly so that 94% of Chinese aged 18 to 34 owned a smartphone in 2016 (Pew Research Center, 2017). The increased deployment of wireless Internet connection in most colleges and universities has contributed to the growth of web-based mobile learning activities, which motivate mobile learning among college students (Hao, Dennen, & Mei, 2017).

As a result, using mobile devices to learn has become a prevalent trend among Chinese college students. Mobile technology, equipped with digital production features such as cameras, and video and audio recorders, provides students with access to interactive multimedia tools that enhance learning and engagement (Harley, et al., 2019; Tseng, Tang, & Morris, 2016). Those features motivate students to learn and to individualize their learning, offering them a greater sense of ownership and responsibility for their own learning (Blood, Ridenour, Simmons, Crouch & Johnson, 2011; Kang & Lin, 2019; Shadiev, Hwang, Huang, & Liu, 2017). Using mobile devices for learning also motivates students' enthusiasm. For example, students consider using apps through mobile devices to be easy and comfortable to communicate with their peers and instructors, and they feel more confident to discuss the learning content via their mobile devices (Zou & Li, 2015)

Most of the previous studies focused on the relationship among cognitive, affective and social factors and students' intention of adopting m-learning (Hashim, Tan, & Rashid, 2015) and explored the predictive factors and students' experience of using mobile (Mondi, Woods, & Rafi, 2008). However, these studies were limited in examining the relationship between the predictive factors and students' attitude and intent to adopt m-learning. Furthermore, the majority of studies explored using mobile devices in China focusing on English language learning. As a result, this study explores those factors (that is, the cognitive, affective, personal integrative, social integrative, and entertainment needs) that predict Chinese college students' attitude and intention to use m-learning for any subjects, as well as the relationship between their attitude and intention to use mobile devices for learning.

THEORETICAL FRAMEWORK

The framework for this study incorporated the Users and Gratification Theory model (UGT) developed by Katz, Blumler & Gurevitch (1973). The UGT is widely used in studies to understand an individual's motivation and behavior when actively looking for and using specific media (Lin, 1999; Stafford, Stafford, & Schkade, 2004). For example, UGT has been used to examine traditional media such as TV, radio, and newspaper, as well as innovative media such as cable

television, email, World Wide Web, or other technologies in the online learning context (Babrow 1987; Conway & Rubin 1991; Dimmick, Kline, & Stafford 2000; Elliott & Rosenberg, 1987; Guo, Tan, & Cheung, 2011; Guo, Zhang, & Stevens, 2009; Heeter & Greenberg 1985; Mondy, Woods, & Rafi, 2008; Papacharissi & Rubin 2000).

According to UGT (Katz et al., 1973), an individual's motivation to adopt educational media is usually categorized into cognitive needs, affective needs, personal integrative needs, social needs, and entertainment needs (Katz et al., 1973; Severin & Tankard, 1997). Cognitive needs refer to students' intention to gain information, knowledge, and understanding. Affective needs motivate students to seek emotional fulfilment, pleasant feelings and aesthetic experience. Personal integrative needs refer to students' pursuance of credibility, confidence, stability and status of self-regulated learners. Social integrative needs drive students to seek interaction and collaboration within the learning community. Finally, entertainment needs refer to students' search for entertainment through m-learning.

HYPOTHESES

With the development of mobile devices, the advantages and satisfaction of using mobile phones have been investigated (Leung & Wei, 2000). Researchers have also examined using mobile devices in the educational context. For example, Hashim et al., (2015) investigated adult learners' motivation to adopt m-learning, and Mondy et al., (2008) examined college students' motivations and decisions for e-learning through a combination of UGT and expectancy-value theory.

According to previous studies, cognitive needs refer to students' motivation to acquire information, knowledge, and understanding (Hashim, et al., 2015; Mondy et al., 2008). Previous researchers indicated that cognitive needs would encourage students to seek information and also positively influence students' attitude toward the use of m-learning (Hashim et al., 2015). Cognitive needs also positively affect their intention to utilize m-learning (Thongsri, Shen, Bao, & Alharbi, 2018). Thus, we hypothesize

H1: Cognitive needs have a positive influence on students' attitude towards adopting m-learning.

H2: Cognitive needs have a positive influence on students' intention to adopt m-learning.

Affective needs refer to students' emotional needs to use tools for learning in order to accomplish their learning achievements (Hashim et al., 2015). Previous studies suggested that students' affective needs have a significant and positive influence on their intention to use m-learning (Thongsri, Shen, Bao, & Alharbi, 2018). Moreover, mobile devices would support collaborative learning among students, which then leads to students' positive attitude towards m-learning (Thongsri et al., 2018). Therefore, we hypothesize

H3: Affective needs have a positive influence on students' attitude towards adopting m-learning.

H4: Affective needs have a positive influence on students' intention to adopt m-learning.

Personal integrative needs refer to students' need to seek credibility, confidence, stability and the status of self-regulated learners. These needs are often positively and significantly related to students' experience of using technology for e-learning (Mondy et al., 2008). Therefore, we hypothesize

H5: Personal needs have a positive influence on students' attitude towards adopting m-learning.

H6: Personal needs have a positive influence on students' intention to adopt m-learning.

Social integrative needs motivate students to seek interaction and collaboration within the learning community. Mobile devices enable communication and information sharing (Hao, Dennen, & Mei, 2017), which help to establish the social interaction among learners, and enhance their learning experience (Wang & Shen, 2012). Studies indicated social needs have a positive influence on students' experience of using technology to learn (Mondi, et al., 2008). Specifically, social needs would positively influence their intention to use mobile learning (Cheon et al., 2012). As a result, we hypothesize

H7: Social needs have a positive influence on students' attitude towards adopting m-learning.

H8: Social needs have a positive influence on students' intention to adopt m-learning.

Additionally, entertainment needs refer to students' searching for entertainment through the use of technology, and this type of need is a primary motivator for using mobile devices (iResearch Consulting Group, 2018). Researchers also defined the entertainment needs for m-learning as a state of mind that includes users' concentration, curiosity, enjoyment and interaction with mobile devices (Moon & Kim 2001; Wang et al., 2009). Therefore, entertainment is a significant motivating factor that potentially influences students' engagement with m-learning (Tan & McWilliam, 2008). Accordingly, we hypothesize

H9: Entertainment needs have a positive influence on students' attitude towards adopting m-learning.

H10: Entertainment needs have a positive influence on students' intention to adopt m-learning.

Finally, students' attitude has been identified as a significant factor which stimulates students' intention to adopt m-learning (Liu, Han, & Li, 2010; Hashim, Tan, & Rashid, 2015). As a result, we hypothesize

H11: Students' attitude towards adopting m-learning has a positive influence on their intention to adopt m-learning.

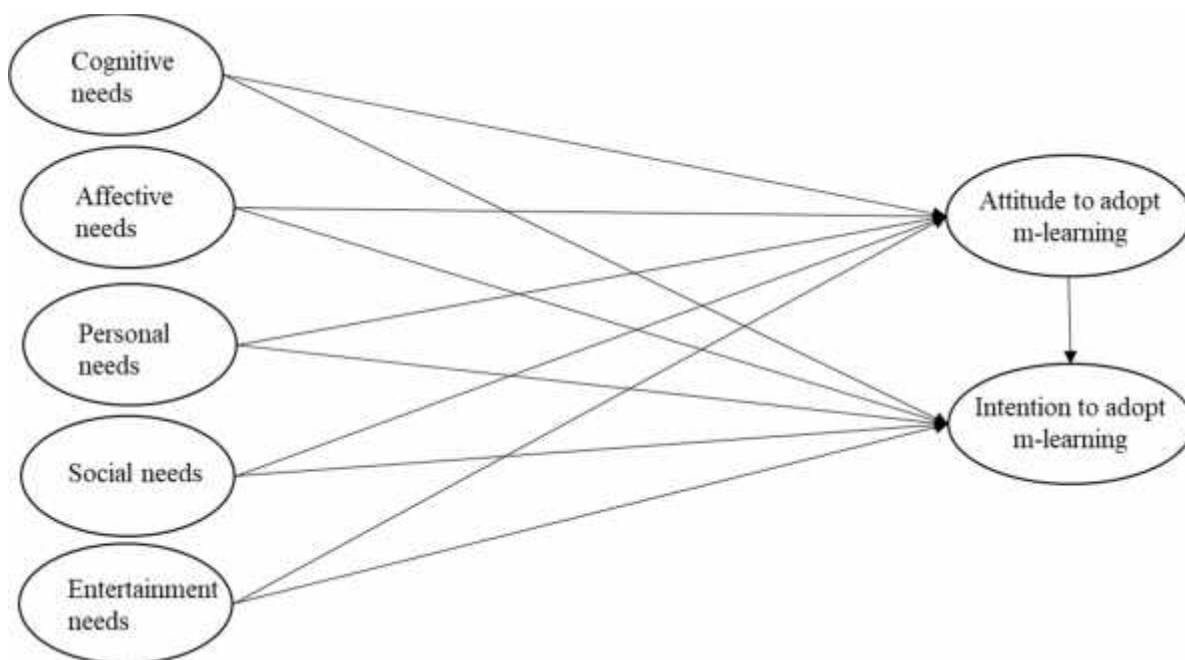


Figure 1: Hypothesized model

METHODS

This study was conducted to examine the relationship between college students' intention to adopt m-learning, attitude toward the adoption of m-learning, and their cognitive, affective, social, and entertainment needs.

Participants

A convenience sampling procedure was used to recruit participants. Students in one northeastern university which is an institution that attracts students nationwide in China were invited to participate in the study. An invitation email with the link to the survey was sent through the College of Foreign Languages and was available for two weeks. Since the invitations were sent out via a third party, researchers did not know how many invitations had been sent. All responding participants completed the survey items. Three hundred and thirty-seven college students participated in this study (65.5% female, 34% male, and 0.5% did not identify their sex). Participants were students from all majors across campus who enrolled in the required first-year introductory English courses. The average ages were 20.4 years ($SD = 2.6$). Most of the participants had used smart phones for 2 to 5 years (54.4%) or 6 to 9 years (40.5%). Referring to the smartphone daily uses, 57.1% of participants reported use of smartphones for 6 to 10 hours per day, followed by 24.4% use for 1 to 5 hours, 14.7% use for 10 to 15 hours, and 2.2% use for more than 16 hours per day. Additionally, English (79%), computer and digital media (8%), and accounting and finance (5%) were the top three subjects these participants usually learn through using mobile devices.

Procedure

Students clicked on the survey link provided in the invitation email. After clicking the link, they were able to read the consent form and decide whether they were willing to participate in the study. The survey was anonymous and took approximately 8 to 10 min to complete. Students were required

to complete every item during the survey, and were able to withdraw by closing the website at any time during the survey. The original items were in English and needed to be translated into Chinese. To guarantee the validity of the Chinese version of the measure, a standard translation and back-translation procedure was used (Hambleton & Patsula, 1998).

Measures

The instrument for measuring cognitive, affective, personal, social and entrainment needs was adopted and revised from the Uses and Gratification Expectancy scale (Mondi, Woods, & Rafi, 2008). This measurement focuses on understanding users' motivation to use e-learning as a medium of learning. A few modifications such as minor wording changes were made to the original items in order to make it fit into the context of the current study. All items were measured using a 5-point Likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. Detailed items and composited reliability are reported in Table 1.

Data Analysis

Preliminary analyses examining descriptive statistics and correlations among all study variables were conducted in SPSS (Version 23.0). Skewness statistics for primary study variables were within the acceptable range (absolute values < 2; Kline, 2010). Further, path analysis of the structural equation model was fitted in AMOS (Arbuckle, 2012) and used to examine the hypothesized model (Figure 1). Full information maximum likelihood estimation was used to address missing data. Model fit indices were used to evaluate the model fit. Model fit was considered acceptable with Comparative Fit Index (CFI) > 0.90, TLI > 0.90, and Root Mean Square Error of Approximation (RMSEA) < 0.08 (Little 2013). The ratio of Chi-square over degrees of freedom needs to be less than 3 (Meyers, Gamst, & Guarino, 2006).

RESULTS

As shown in Table 1 below, the measurement model revealed high item loadings for all constructs, ranging from .68 to .91, and all are significant at the level of $p < .001$. Both are critical criteria for convergent validity (Fornell & Larcker, 1981).

Table 1: Items, factor loadings, and composite reliability of study variables.

Construct	Items	Questions	Loadings	Composite Reliability
Cognitive need	CN1	I use mobile device to help me know many things	.80	.80
	CN2	I use internet on my mobile device to search for new information	.85	
	CN3	I carry out internet search through my mobile device to post and answer questions	.70	
	CN4	I use internet on my mobile device to explore topics of interest, beyond my normal content area	.84	
Affective need	AN1	I like to talk to others about mobile technologies	.73	.76

	AN2	I like showing my friends how to use mobile device in different ways	.80	
	AN3	Mobile based courseware layout, animation and illustrations are good to look at	.75	
	AN4	I enjoy learning using a mobile device	.77	
Personal need	PN1	Learning to use internet through mobile device is easy for me	.81	.85
	PN2	Using mobile device is easy for me	.83	
	PN3	Using the internet through mobile device allows me to be virtually anywhere at any time	.84	
	PN4	I can search and navigate through multimedia content on mobile device	.83	
Social need	SN1	Using mobile device gives me the feedback I need from others	.68	.81
	SN2	I use mobile device to interact with my friends	.72	
	SN3	Using mobile device prepares me to join the extended learning community in the world	.84	
	SN4	Using mobile device improves my ability to communicate with other people	.80	
	SN5	Using mobile device keeps me from feeling lonely	.76	
Entertainment need	EN1	The educational APPs make learning fun	.85	.91
	EN2	I like using educational APPs for learning	.90	
	EN3	I find educational APPs to be interesting	.90	
	EN4	It is fun to experiment with mobile educational APPs	.90	
Attitude to adapt m-learning	ATT1	I like the idea of using mobile device for learning	.91	.89
	ATT2	Using mobile device for learning is a wise idea	.91	
	ATT3	Using mobile device for learning gives me a pleasant experience	.91	
Intention to adapt m-learning	INT1	I intend to use mobile device for learning in the future	.92	.92
	INT2	I will use mobile device for learning in the future	.94	
	INT3	I will regularly use mobile device for learning in the future	.94	

Results of the fitted path analysis SEM are presented in Figure 2. This model was a good fit to the data, $\chi^2(10) = 29.52, p < .01$; $\chi^2/df = 2.95$; CFI = .99; TLI = .99; RMSEA = .06. As hypothesized, affective need ($B = .13, SE = .07, p < .05$), social need ($B = .17, SE = .07, p < .05$), and entertainment needs ($B = .65, SE = .04, p < .001$) predicted attitude to adopt m-learning. Cognitive and personal needs were not significantly associated with attitude to adopt m-learning after

considering the effects of affective, social and entertainment needs. Overall, 76.6% of variance in attitude to adopt m-learning was explained by the model.

Consistent with our hypothesis, entertainment needs ($B = .11$, $SE = .04$, $p < .01$) and attitude to adopt m-learning ($B = .76$, $SE = .04$, $p < .01$) predicted intention to adopt m-learning. However, cognitive, affective, personal and social needs were not significantly associated with intention to adopt m-learning after considering the effects of entertainment needs and attitude to adopt m-learning. In sum, 86.9% of variance in intention to adopt m-learning was explained.

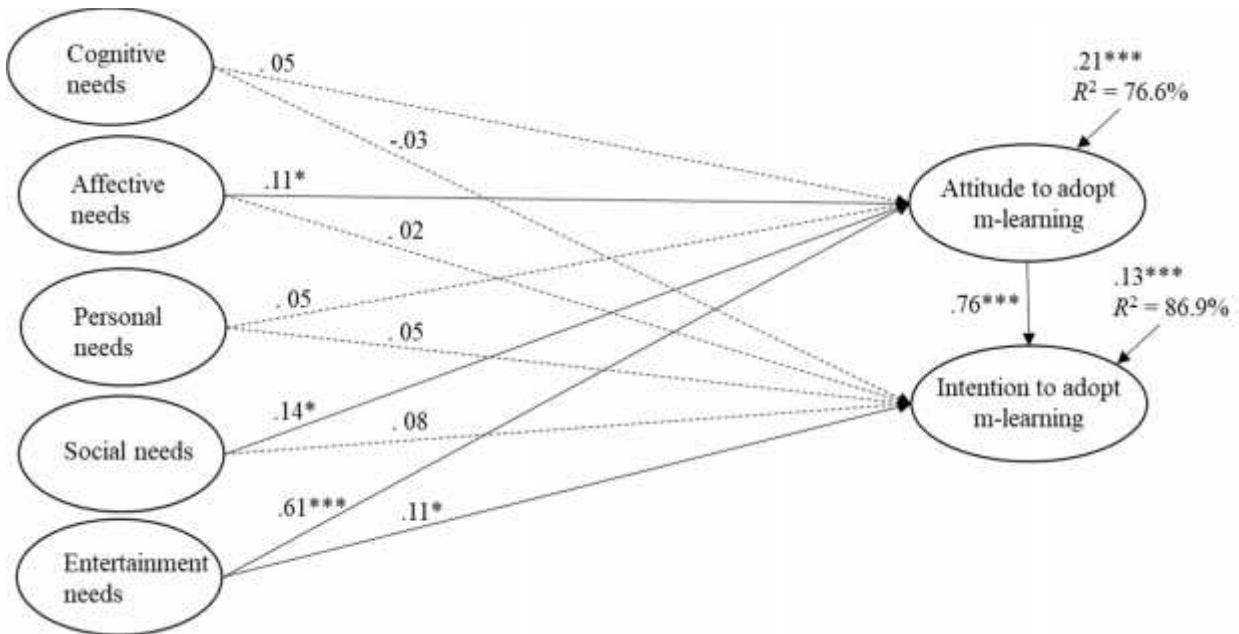


Figure 2: Cognitive, affective, personal, social and entertainment needs on attitude and intention to adopt m-learning.

Note: Statistically significant lines are solid, whereas non-significant lines are dotted. Standardized coefficients are provided. Significantly correlated exogenous variables were allowed to co-vary. Demographic variables (sex, age, education level) were considered but are not shown.

* $p < .05$, *** $p < .001$.

DISCUSSIONS AND CONCLUSIONS

This study examined how the cognitive, affective, personal integrative, social integrative, as well as entertainment needs predict Chinese college students' attitude and intention to use m-learning, and the relationship between their attitude and intention of adopting m-learning. Based on theoretical and empirical evidence, this study hypothesized that college students' intention to use m-learning is influenced by all these variables and the attitude to adopt m-learning.

Paralleling previous studies (Thongsri et al., 2018), this study has shown that students' affective needs had a significant and positive influence on their attitude toward using m-learning. In other words, students' emotional needs to use mobile devices would encourage them to use smartphones during their learning process in order to accomplish their learning achievements.

Similarly, this study revealed that social integrative needs positively affect students' attitude to use mobile devices for learning. This finding mirrors the conclusion of Mondri et al., (2008) that students' experience of using technology to learn often links to their social integrative needs, meaning that students intend to seek interaction and collaboration when using mobile devices for learning. Consistent with early research (Tan & McWilliam, 2008), this study noted that entertainment needs encourage students to use mobile devices during the learning process. Furthermore, only entertainment needs significantly predict students' intention to adopt m-learning. The findings for entertainment needs confirm previous conclusions that entertainment orientation remains as a primary motivator regarding using mobile devices (iResearch Consulting Group, 2018).

Different from previous findings that cognitive needs positively affect students' attitude and intention to adopt m-learning (Hashim et al., 2015; Thongsri, et al., 2018), the current study revealed that cognitive needs were not significantly associated with the attitude to use m-learning. In other words, students' motivation to seek information did not drive them to use mobile devices during the learning process. Similarly, findings show that personal needs have influence on neither students' attitude nor intention of using m-learning, which is the opposite of the previous finding (Mondri et al., 2008). To be specific, students' needs of seeking credibility, confidence, stability and the status of self-regulated learners were not a primary reason for them to use mobile devices for learning. Finally, students' attitude to use m-learning was significantly associated with their intention of adopting m-learning, which echoes previous scholars' statements (Liu et al., 2010; Hashim et al., 2015) that students' attitudes toward m-learning strongly influenced their decisions to use mobile devices for learning.

Several limitations exist in this study. First, data were collected from one university in a well-developed province in China where college students may be more exposed to m-learning. Therefore, results cannot be generalized to all Chinese college students. Future studies should be replicated in universities located in other provinces, especially those with less development. Additionally, most of the participants use mobile devices for English language learning while a very few of them study other subjects. Although students were recruited across campus, it is possible that they are recommended by other classmates to learn English through specific language learning Apps in the first-year introductory English courses, as Chinese college students often use mobile devices to learn English. As a result, future studies should recruit more students from courses provided by other colleges besides the College of Foreign Language in order to examine students' attitude and intention of using mobile devices regarding other subjects.

In conclusion, this study extends the understanding of what motivates Chinese college students to adopt m-learning. Findings provide higher education professionals with a new vision of what factors influence students' attitudes to use mobile devices for learning. As the results suggest, Chinese college students' attitude to adopt m-learning would be enhanced by affective, social integrative, and entertainment needs. Therefore, if students are able to personalize and customize the m-learning platform, they would be more likely to use mobile devices for learning. Additionally, collaborative applications should be integrated in the m-learning platform so that students would have opportunities to chat and do group work with other learners. In this way, students can be more encouraged to adopt m-learning. Finally, designers of the m-learning platform should consider including games for learning in order to meet students' entertainment needs.

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