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The Impact of College Students' Intrinsic and Extrinsic Motivation on Continuance Intention to Use English Mobile Learning Systems

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Abstract Mobile learning, with its features of ubiquitousness and flexibility, enables users to learn in any appropriate place and at any appropriate time. This emerging way of digital learning will be the future trend. Therefore, the technology acceptance model (TAM) proposed by Davis was extended with extrinsic motivation, perceived convenience, and intrinsic motivation, perceived playfulness, for examining the factors that affect continuance intention to use the English mobile learning system (EMLS) and the relationships among these factors. Participating in the study were 158 technical college students from the middle part of Taiwan who were studying English via EMLS using PDAs for 4 weeks. Data were collected by questionnaires and were analyzed by *SmartPLS* as an SEM analysis tool. The results revealed that perceived convenience, perceived playfulness, perceived ease of use, and perceived usefulness were antecedent factors that affected continuance intention to use the EMLS. Perceived usefulness had a greater impact on continuance intention than perceived playfulness. Overall, the extended TAM in the present study was effective at predicting and explaining the continuance intention to use the EMLS.

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Keywords Self-determination theory · Perceived convenience · Perceived playfulness · Mobile learning · Technology acceptance model

Introduction

Mobile learning is an emerging model or mode of e-learning whereby learners can complete learning tasks with support from mobile devices and a wireless network (Walton et al. 2005). As mobile devices with the transmission of wireless network are portable and movable, a meaningful learning experience can be demonstrated by the fact that students can interact with learning technology, learning content, peers, instructors and learning context in any appropriate place and at any appropriate time based on their personal situations. Therefore, many studies (Chen and Chung 2008; Shih et al. 2010; Walton et al. 2005) have confirmed that mobile learning is an effective learning method. With regard to English mobile learning, the study results by Thornton and Houser (2005) revealed that English vocabulary delivery to learners through mobile phones could effectively help learners acquire knowledge. Chen and Chung (2008) found that the integration of adaptive learning with mobile devices for English vocabulary could effectively improve learners' learning performances and interests. This implies that mobile learning can effectively enhance learners' English ability and their motivation to learn English.

Many studies have confirmed that the technology acceptance model (TAM) proposed by Davis (1989) can efficiently predict and explain users' intentions or behaviors in using information technology or systems (Moon and Kim 2001; Park et al. 2011; Shi 2007; Yoon and Kim 2007). Although perceived ease of use and perceived usefulness in the TAM are determinants for users' acceptance toward information

technology or systems, factors that affect users' acceptance toward information technology or systems depend on features of the technology or system, the target users and the environment (Moon and Kim 2001). Thus, many studies (Lee et al. 2007; Moon and Kim 2001; Yoon and Kim 2007) extended the TAM with external variables to explain and predict users' acceptance of e-learning and examined relationships between external variables and TAM variables.

Moon and Kim (2001) stated that the most pervious TAM studies focused on the effect of extrinsic motivations on the acceptance of technology, but few of them examined the effect of intrinsic motivations on the acceptance of technology. Therefore, they extended the TAM incorporating perceived playfulness. The study results revealed that perceived playfulness was an intrinsic motivation that affected attitudes toward using and intention to use technology. Perceived playfulness was also found to be a factor that affected intention to use technology (Roca and Gagné 2008). In addition, Yoon and Kim (2007) extended the TAM with perceived convenience and found that perceived convenience was an external variable that affected users' acceptance toward wireless local area network (WLAN). Hossain and Prybutok (2008) also found that perceived convenience affected intention to use radio frequency identification (RFID). Therefore, perceived convenience can predict the acceptance of mobile technology.

Although features of mobile learning include convenience, immediacy, and expediency (Peng et al. 2009), the small screen of the mobile device, audio-visual quality, data entry method and ability to concentrate on the small screen for an extended period of time can affect the ease of use and users' playfulness (Chinnery 2006; Churchill and Churchill 2008). Furthermore, the usefulness of the mobile learning content and the convenience of mobile learning can affect users' continuance intention. Thus, in the context of English mobile learning, it is crucial to conduct an empirical research to examine relationships of TAM variables (perceived ease of use, perceived usefulness and continuance intention) with perceived convenience and perceived playfulness.

Roca and Gagné (2008) noted that self-determination theory is beneficial for people to understand users' acceptance toward an e-learning system and the impact of extrinsic and intrinsic motivations on continuance intention to use the system. However, the study was conducted based on an information system rather than in the context of English mobile learning. Therefore, the purpose of the present study was to propose an extended TAM that included intrinsic motivation (perceived playfulness) and extrinsic motivation (perceived convenience) using an English mobile learning system (EMLS). After participants were selected for the English mobile learning activity, the data were collected by questionnaires, and structural equation modeling (SEM) was employed to analyze relationships among variables in the extended TAM and effects of each variable.

Literature Reviews

Technology Acceptance Model

The TAM was proposed by Davis based on the theory of reasoned action (TRA) and aimed to develop a model for explaining and predicting users' acceptance of an information system (Davis et al. 1989). The TAM suggested that perceived ease of use and perceived usefulness are related to users' acceptance of computer systems. Perceived usefulness is a belief that a user anticipates that a particular application system can enhance his work efficiency, whereas perceived ease of use is a belief that a user expects that little effort is required when using a particular system. In addition, the TAM assumed that (a) the actual use of the computer system is determined by a users' intention; (b) the users' intention is determined by attitude toward using technology and perceived usefulness; (c) the users' attitude toward using technology is determined by perceived usefulness and perceived ease of use; and (d) the perceived ease of use affects perceived usefulness, which also mediates the effect of perceived ease of use on intention (Davis et al. 1989). A study by Park et al. (2011), based on TAM, revealed that perceived usefulness and ease of use affected university students' attitudes toward and intentions to use mobile learning technology. In addition, perceived ease of use affected perceived usefulness of mobile learning technology. Furthermore, the TAM assumed that some external variables affect perceived usefulness and perceived ease of use and that perceived usefulness and perceived ease of use mediate the effects of external variables on intention to use technology or systems. Thus, the TAM provides a basis for relationships among external variables, beliefs, attitudes and intentions to use technology (Davis et al. 1989; Legris et al. 2003).

Many studies explained and predicted users' technology acceptance based on the TAM with external variables and examined relationships between external variables and variables in the TAM (Moon and Kim 2001; Roca and Gagné 2008; Yoon and Kim 2007). However, there were many studies that found external variables did not only affect the technology acceptance indirectly via perceived ease of use and perceived usefulness but also affected technology acceptance directly (Burton-Jones and Hubona 2006; Moon and Kim 2001; Shin 2007; Yoon and Kim 2007). Moreover, Legris et al. (2003) noted that external variables should be selected carefully when conducting a TAM study because external variables not only determine

the factors that affect perceived ease of use and perceived usefulness but can also be important factors in facilitating use behavior (Burton-Jones and Hubona 2006; Legris et al. 2003).

In short, the TAM, proposed by Davis, was employed as a basis in the present study. The researcher in the present study selected continuance intention to use an EMLS as an indicator of technology acceptance and chose external variables that affect users' acceptance toward the EMLS. In other words, the TAM with external variables perceived ease of use, perceived usefulness and continuance intention to use the EMLS were proposed in the present study to explain users' acceptance toward the EMLS and to examine relationships among these variables.

The Impact of Intrinsic and Extrinsic Motivation on Intention to Use the EMLS

Many recent studies have examined a user's acceptance toward technology based on the theory of motivation (Lee et al. 2007; Moon and Kim 2001; Roca and Gagné 2008; Shang et al. 2005). However, the TAM, as proposed by Davis, overemphasized the impact of extrinsic motivations, including perceived ease of use and perceived usefulness (Lee et al. 2007), on the acceptance of technology and neglected intrinsic motivations that affect the acceptance of technology. Thus, many studies have extended the impact of intrinsic motivations, including perceived playfulness, perceived enjoyment and cognitive absorption, on acceptance of technology based on the TAM, as proposed by Davis (Davis et al. 1992; Lee et al. 2007; Moon and Kim 2001; Roca and Gagné 2008). Most of these studies explained the impact of intrinsic and extrinsic motivations on intention to use technology based on the flow theory (Csikszentmihalyi 1975) and the self-determination theory (Ryan and Deci 2000). These study results revealed that the TAM extended with intrinsic motivations was important for explaining and predicting users' acceptance of technology, including the Web, online shopping, e-learning, and multimedia messaging services.

Among the variables of the TAM, perceived enjoyment and perceived playfulness are intrinsic motivations that affect users' intentions or behaviors (Lee et al. 2007; Moon and Kim 2001; Roca and Gagné 2008), while perceived ease of use and perceived usefulness are extrinsic motivations that affect users' intentions to use technology (Lee et al. 2007). From the perspective of self-determination, as the impact of perceived playfulness and perceived enjoyment on using behavior depends on users' perceptions about the system, perceived enjoyment and perceived playfulness are inherently autonomous motivations that belong to the intrinsic motivation category (Gagné and Deci 2005; Roca and Gagné 2008). Furthermore, as the impact of perceived ease of use and perceived usefulness on technology are related to users' feelings about whether perceived ease of use and perceived usefulness are helpful to the task or personal goals, perceived ease of use and perceived usefulness are identified regulations that belong to extrinsic motivation category.

With regard to the TAM in the context of using the Web, Moon and Kim (2001) found that the impact of perceived playfulness (intrinsic motivation) and perceived usefulness (extrinsic motivation) on intention to use technology could be affected by goals or types of tasks. For users with an entertainment purpose, perceived playfulness affected intention to use technology significantly more than perceived usefulness, whereas for users with a business purpose, perceived usefulness affected intention to use technology significantly more than perceived playfulness (Moon and Kim 2001). According to the theory of self-determination, Gagné and Deci (2005) posited that extrinsic motivation can efficiently predict users' persistence behavior toward effort-driven tasks, and intrinsic motivation can efficiently predict users' persistence behavior toward interest-driven tasks. Regarding intention to use an e-learning system, Roca and Gagné (2008) found that for the task or activity that is not interesting and that requires training and explicit effort, extrinsic motivation of identified regulation had a greater effect on users' efforts than intrinsic motivation. Therefore, the impact of intrinsic and extrinsic motivations on intention to use an e-learning system is related to a user's interests and goals and task types.

Perceived Convenience

Based on the study conducted by Yoon and Kim (2007), perceived convenience, in the present study, was defined as the level of convenience toward time, place, and execution that one feels during participation when using the EMLS. Time convenience refers to a level of convenience toward time that one feels when using the EMLS. Place convenience refers to a level of convenience toward place that one feels when using the EMLS. Execution convenience refers to a level of convenience toward execution that one feels when using the EMLS. From the perspective of self-determination, users who have a higher level of perceived convenience toward the technology or the system tend to complete a task more efficiently. Perceived convenience belongs to the identified regulation of external motivations when users agree that a technology or a system is helpful to the task completion.

Perceived Playfulness

Playfulness is one of the personal traits or state of mind (Moon and Kim 2001) based on an interaction between a

person and a situation (Webster and Martocchio 1992). The flow theory proposed by Csikszentmihalyi (1975) emphasized the flow of the state of mind, rather than a personal trait. Consequently, most studies that defined playfulness as a state of mind were based on the flow theory. Users who had a high level of flow were likely to interact more with the environment (Moon and Kim 2001). Therefore, activities and interactions that help users to concentrate, stimulate users' curiosity, and facilitate users' interests would lead to a higher level of playfulness. For the use of information technology or systems, perceived playfulness is a user's state of mind as it relates to concentration, curiosity, and enjoyment when he interacts with a system (Moon and Kim 2001).

There were many studies confirming that perceived playfulness was one of the factors that affected intention to use Web portals (Lin et al. 2005), online shopping (Ahn et al. 2007), and e-learning (Chiu and Wang 2008; Lee 2010; Lin 2011; Roca and Gagné 2008; Saade and Bahli 2005). However, among these studies, only Roca and Gagné (2008) examined the correlation between perceived playfulness and perceived usefulness. In addition, there was no study examining the relationship between perceived convenience and perceived playfulness. Therefore, correlations among perceived playfulness, perceived convenience, perceived usefulness, and intention to use an EMLS require further examination.

Research Model and Hypotheses

The TAM, proposed by Davis, was employed as a basis in the present study. The TAM for English mobile learning proposed included intrinsic and extrinsic motivations, as shown in Fig. 1. The present study examined relationships among perceived convenience, perceived playfulness, perceived ease of use, perceived usefulness and intention to use the EMLS based on the theory of self-determination and on the motivation theory that playfulness was defined as inherently autonomous motivation, whereas perceived ease of use, perceived usefulness, and perceived convenience were identified regulations that belonged to extrinsic motivations. The research model and hypotheses in the present study are shown in Fig. 1.

Correlations between Perceived Convenience and TAM Variables

Hossain and Prybutok (2008) posited that ease of use is an element for examining convenience, while Berry et al. (2002) noted that effort is an indicator for examining convenience. Hence, the easier the system, the less the mental effort required (Davis 1989), thus the system would be perceived by the user as more convenient. This implied that

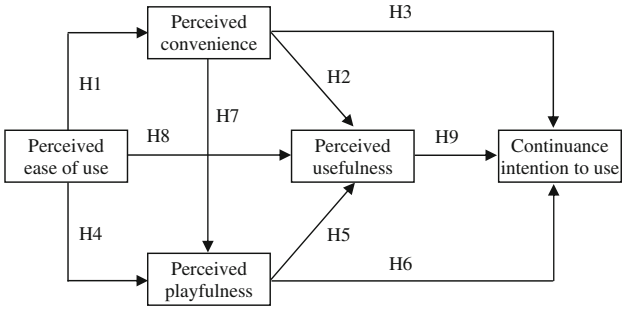

Fig. 1 The research model and hypotheses

there was a positive relationship between ease of use and convenience. Yoon and Kim (2007) found that perceived ease of use positively affected perceived convenience. Thus, with the EMLS, perceived ease of use is expected to affect perceived convenience. Hypothesis 1: Perceived ease of use positively affects perceived convenience.

Berry et al. (2002) noted that time is an indicator for assessing convenience. Davis (1989) also suggested that whether a system can help users efficiently complete tasks is an indicator for assessing perceived usefulness. Thus, it may be concluded that convenience and usefulness are related to time when assessing technology or systems, and it is also reasonable to infer that convenience and usefulness are positively related to each other. Moreover, Yoon and Kim (2007) found that perceived convenience positively affected perceived usefulness. Therefore, with respect to using the EMLS, perceived convenience is predicted to positively affect perceived usefulness. Hypothesis 2: Perceived convenience positively affects perceived usefulness.

Yoon and Kim (2007) noted that the development of technology tends to be convenience-orientated for both products and service, and perceived convenience plays an important role in determining what technology or system to use. Thus, it may be concluded that perceived convenience of technology products and services is positively related to intention to use technology. Furthermore, Gupta and Kim (2007) found that perceived convenience positively affected consumers' intention to use in online shopping, and Hossain and Prybutok (2008) also found that perceived convenience positively affected intention to use RFID technology. Therefore, when using the EMLS, perceived convenience is predicted to positively affect continuance intention. Hypothesis 3: Perceived convenience positively affects continuance intention to use the EMLS.

Correlations Between Perceived Playfulness and TAM Variables

The user's mental effort can be reduced when a service provided by an information system is easy to use (Davis

1989). Users feel in the flow when their cognitive system can focus on the interaction with the information system (Moon and Kim 2001). Thus, it may be concluded that there is a positive correlation between ease of use and playfulness. Studies related to using the Web and online retailing confirmed that perceived ease of use positively affected perceived playfulness (Ahn et al. 2007; Moon and Kim 2001). Therefore, when using the EMLS, perceived ease of use is predicted to positively affect perceived playfulness. Hypothesis 4: Perceived ease of use positively affects perceived playfulness.

Among studies regarding online shopping, Shang et al. (2005) found that cognitive absorption was an antecedent factor for affecting perceived usefulness, and Yeung and Jordan (2007) confirmed that enjoyment was a key construct for affecting perceived usefulness. Moreover, concentration and enjoyment were variables for assessing perceived playfulness (Moon and Kim 2001). Thus, it may be concluded that perceived playfulness is a preceding construct for perceived usefulness. In addition, a study regarding e-learning also confirmed that perceived playfulness positively affected perceived usefulness (Roca and Gagné 2008). Therefore, when using the EMLS, perceived playfulness is predicted to positively affect perceived usefulness. Hypothesis 5: Perceived playfulness positively affects perceived usefulness.

When a user feels playful when using a system by having his cognition interact with the system, continuance intention to use the system will be developed (Lin et al. 2005). Thus, it may be concluded that there is a positive relationship between perceived playfulness and intention. Furthermore, studies related to using the Web (Moon and Kim 2001), web portals (Lin et al. 2005), online shopping (Ahn et al. 2007), and e-learning (Roca and Gagné 2008) found that perceived playfulness was a determinant of intention. Therefore, perceived playfulness is predicted to have a positive relationship with intention to use the EMLS. Hypothesis 6: Perceived playfulness positively affects continuance intention to use the EMLS.

Correlations Between Perceived Convenience and Perceived Playfulness

If convenient levels of time, place, and execution can be enhanced, users' cognitive and affective efforts can be decreased because users are able to acquire the information they need or begin the task immediately. Hence, users can feel in the flow because they can complete tasks efficiently, and they possess more cognitive resources for interacting with the information system. In addition, Yoon and Kim (2007) found that perceived ease of use positively affected perceived convenience, while Chung and Tan (2004) suggested that ease of use and efficiency of an information system were antecedent factors that affected perceived playfulness. Ahn et al. (2007) also confirmed that convenience and immediate feedback were antecedent factors that positively affected playfulness. Thus, it may be concluded that there is a positive correlation between convenience and playfulness. Therefore, when using the EMLS, perceived convenience is predicted to positively affect perceived playfulness. Hypothesis 7: Perceived convenience positively affects perceived playfulness.

Correlations among TAM Variables

According to the TAM, as proposed by Davis et al. (1989), correlations among perceived ease of use, perceived usefulness, and intention to use include the following: (a) perceived ease of use positively affects perceived usefulness and (b) perceived usefulness positively affects intention. In addition, studies about using the Web (Moon and Kim 2001) and mobile services (Kuo and Yen 2009) also confirmed these correlations. Therefore, when using the EMLS, the following correlations among perceived ease of use, perceived usefulness and continuance intention to use the EMLS were expected. Hypothesis 8: Perceived ease of use positively affects perceived usefulness. Hypothesis 9: Perceived usefulness positively affects continuance intention to use the EMLS.

Research Method

Participants

Participants in the present study included 158 students from a technical college in the middle part of Taiwan who studied English using an e-book called *Mebook of Studio Classroom* (hence, EMLS) as the supplementary text volunteered to use the EMLS. Participants included 32 males and 126 females aged between 16 and 22 years. Their majors included applied foreign language and accounting and information management. Their experiences in learning English, in using a computer and in using the Internet were 8.6, 8.1, and 7.4 years, respectively. Approximately 86 % of the participants did not have any experience in using a PDA.

Instrument

Questionnaire

The data of latent variables were collected by a questionnaire using a 7-point Likert-type scale. The response options were from 1 (strongly disagree) to 7 (strongly agree). The five latent variables from the previous studies were modified based on the learning context as the

measureable variables in the present study. Each measurable variable was reviewed by two English teachers, five college students and two information technology experts to confirm that questions for each variable were clear and were properly translated. Perceived convenience was modified based on Yoon and Kim (2007), playfulness was modified based on Moon and Kim (2001), and perceived ease of use, perceived usefulness and continuance intention to use the EMLS were modified based on Davis (1989). Operational definitions for latent variables and measurable variables are shown in Table 1.

PDA and the EMLS

The English mobile learning in the present study required that students learn English using PDAs with an EMLS. The PDA installed with Windows mobile 6 was an HP iPAQ 112 and included Wi-Fi and Bluetooth. The EMLS was *Mebook* of *Studio Classroom*. *Mebook* was designed and developed by *Taiwan Soyong Corporation* as an e-book with the integration of text, sound, video and picture. It must be read through the reading software, *MeReader*. *Mebook* is a mobile e-book that integrates multi-media

Table 1 Operational definitions for latent variables and measurable variables

Latent variables	Operational definitions Measured variables
Perceived convenience	Perceived convenience is defined as a level of convenience toward time, place and execution that one feels when pursuing a task during using the EMLS
	CO1. I can learn English at any time via the EMLS
	CO2. I can learn English at any place via the EMLS
	CO3. The EMLS is convenient for me to engage in English learning
	CO4. I feel that the EMLS is convenient for me to learn English
Perceived playfulness	Perceived playfulness is defined as a level of concentration, curiosity, enjoyment and interest that one feels during using the EMLS
	PL1. When I learn English via the EMLS, time passes quickly
	PL2. When I learn English via the EMLS, I am not distracted by noise
	PL3. When I learn English via the EMLS, I often forget the work I need to do
	PL4. Learning English via the EMLS makes me feel good
	PL5. Learning English via the EMLS is enjoyable to me
	PL6. Learning English via the EMLS keeps me happy
	PL7. Learning English via the EMLS motivates my curiosity
	PL8. Learning English via the EMLS leads me to explore the mystery of English
	PL9. Learning English via the EMLS facilitates my creativity in learning English
Perceived ease of use	Perceived ease of use refers to a level of ease that one feels when using the EMLS
	EU1. Learning to operate the EMLS is easy for me
	EU2. I find it easy to manipulate the EMLS to do what I want it to do
	EU3. My interaction with the EMLS is clear and understandable
	EU4. I find the EMLS to be flexible to interact with
	EU5. It is easy for me to become skillful at using the EMLS
	EU6. I find the EMLS easy to use
Perceived usefulness	Perceived usefulness is a feeling that one holds toward the improvement in using EMLS
	UF1. Using the EMLS enables me to accomplish my learning English more quickly
	UF2. Using the EMLS improves my learning English performance
	UF3. Using the EMLS increases my learning English productivity
	UF4. Using the EMLS enhances my learning English effectiveness
	UF5. Using the EMLS makes it easier for me to learn English
	UF6. I find the EMLS useful for learning English
Continuance intention to use	Continuance intention to use refers to one's willingness to continue to learn English via mobile learning after using the EMLS
	IN1. In next few weeks, I would like to learn English via the EMLS
	IN2. In next few weeks, I predict that I will learn English via the EMLS
	IN3. In next few weeks, I plan to learn English via the EMLS

functions of texts, voices, images, pictures, etc., in a single system. Fitted with MeReader, a special display software, *Mebook* provides all directions for language-learning programs guiding the learner to read, listen, speak, and write (http://www.mebook.com.tw/).

Studio Classroom is a magazine that provided practical, interesting articles to help readers improve their English skills. It publishes a monthly issue that can be downloaded from its Website (http://www.studioclassroom.com/). The contents of Studio Classroom are various and broad as they include current issues related to politics, society, culture, economy, education, environment, technology, etc. Its learning types include vocabulary, reading, listening, speaking, and writing.

Studio Classroom was developed by using the Android for its operation system, and is the second most popular English-teaching magazine in Taiwan. The magazine and accompanying radio and TV programs have won numerous awards over the years, including Taiwan's famous Golden Bell and Golden Tripod Awards. Studio Classroom is distributed and broadcast in mainland China, the U.S., Canada, Europe, Australia, and Zealand.

Procedure

There were only 53 PDAs for the experiment, so 158 participants engaged in using the EMLS in three echelons. The procedures for each echelon are shown in Table 2.

Data Analysis

Partial least squares (PLS) are especially suitable for analyses with small or medium sample sizes (Lee et al. 2007). The sample size for the present study was 158 participants, which implied a medium sample size, so *SmartPLS 2.0* (Ringle et al. 2005) was employed in the present study as the statistical software for SEM. The PLS examined the significance of the path coefficient in the model analysis by conducting different re-sampling methods. *SmartPLS* performed a significance of path coefficient test by conducting bootstrapping sampling (Annear and Yates 2010) to provide *t* test value of the path coefficient in the model analysis.

Results

Measurement Model Analysis

The present study began with the measurement model for examining the reliability and validity of the latent variables based on the three perspectives suggested by Hulland (1999), which were (a) individual item reliability, (b) convergent validity and (c) discriminant validity.

Hulland (1999) noted that PLS examines the individual item reliability by evaluating factor loadings of measurable variables on latent variables and suggested that any measurable variables with factor loading <0.5 should be deleted because a low factor loading can result in low reliability. Table 3 presents an overall good reliability of the measurable variables in the present study because all the factor loadings of the latent variables ranged between 0.55 and 0.96.

Composite reliability (CR) and average variance extracted (AVE) are the two main indicators used to evaluate convergent validity (Lee et al. 2007). A CR of a latent variable is formed by reliabilities of all the measurable variables, which represents an internal consistency of a latent variable. Fornell and Larcker (1981) suggested that CR should be greater than 0.7. Table 3 shows a good internal consistency for each latent variable, as it ranges between 0.94 and 0.97. An AVE of a latent variable is to calculate the average variance explained power of measurable variables on latent variables. Fornell and Larcker (1981) suggested that an AVE should be >0.5. Table 3 shows that the AVE for each latent variable ranges between 0.64 and 0.90. Based on the analysis, the latent variables in the present study possessed a good convergent validity.

Table 2 Procedure

Phase	Place	Procedure	Time
Introduction and first time use	Classroom	A PDA is provided to each participant	10 min.
		Orientation for the research purpose and procedure	10 min.
		Orientation for the introduction of PDA and the EMLS	20 min.
		First time use: reading articles and listening practices	20 min.
Actual use	Any place	Participants engage in using the EMLS according to their own pace and learning needs	4 weeks
Questionnaire	Classroom	After the four weeks of using the EMLS, questionnaires are administered to participants	20 min.

Table 3 Reliability and validity analysis of latent variables

Latent variable	Measured variable	Average	Standard deviation	Loading	CR	AVE
Perceived convenience	CO1	5.58	1.19	0.87	0.94	0.81
	CO2	5.61	1.31	0.89		
	CO3	5.63	1.18	0.93		
	CO4	5.61	1.17	0.90		
Perceived playfulness	PL1	5.16	1.20	0.80	0.94	0.64
	PL2	4.58	1.25	0.64		
	PL3	4.47	1.29	0.55		
	PL4	5.14	1.18	0.91		
	PL5	5.12	1.19	0.91		
	PL6	5.14	1.19	0.87		
	PL7	5.05	1.22	0.84		
	PL8	4.97	1.17	0.81		
	PL9	4.85	1.23	0.82		
Perceived ease of use	EU1	5.50	1.18	0.84	0.95	0.75
	EU2	5.34	1.22	0.89		
	EU3	5.10	1.18	0.86		
	EU4	5.21	1.24	0.88		
	EU5	5.39	1.26	0.86		
	EU6	5.45	1.23	0.86		
Perceived usefulness	UF1	5.25	1.19	0.86	0.95	0.75
	UF2	5.05	1.15	0.88		
	UF3	5.12	1.25	0.89		
	UF4	5.16	1.26	0.90		
	UF5	5.08	1.23	0.83		
	UF6	5.23	1.32	0.84		
Continuance intention	IN1	5.09	1.40	0.95	0.97	0.90
	IN2	4.85	1.41	0.96		
	IN3	4.87	1.35	0.94		

Fornell and Larcker (1981) suggested that discriminating validity can be calculated by the square root of average variance extracted (SRAVE) of each latent variable and the correlation coefficient among latent variables. Discriminating validity exists when the SRAVE is greater than the correlation coefficient among the other latent variables. Table 4 shows that the SRAVE extracted were greater than the correlation coefficients among the other latent variables, indicating that adequate discriminating validity existed among latent variables in the present study.

Based on the analyses of the three indicators, the latent variables in the research model possessed good reliability and validity.

Structural Model Analysis

Structural model analysis is used mainly to examine path coefficients and R^2 among latent variables in the research model. Path coefficients measure the relative strength and sign of causal relationships among latent variables, whereas R^2 is the percentage of total variance explained of exogenous variable on endogenous variables and thus represents the predictability of the research model. Path coefficients and R^2 represent the matching level between the structural model and experimental data. Figure 2 is the summary of the structural model analysis in the present study. Table 5 shows the path coefficients, t values and p values among latent variables, and the results of the hypothesis test.

According to Table 5, the test results for Hypotheses 1, 2, 4, 5, 6, 7, 8, and 9 were significant. The significant results included (a) perceived ease of use positively affected perceived convenience; (b) perceived convenience positively affected perceived usefulness; (c) perceived ease of use positively affected perceived playfulness; d) perceived playfulness positively affected perceived usefulness; (e) perceived playfulness positively affected continuance intention; (f) perceived convenience positively affected perceived playfulness; (g) perceived ease of use positively affected perceived usefulness; and (h) perceived usefulness positively affected continuance intention. The coefficients for the eight hypotheses were 0.68, 0.26, 0.36, 0.42, 0.32, 0.42, 0.25, and 0.57, respectively. However, the test result for Hypothesis 3 was not significant, thus

Table 4 The SRAVE of each latent variable and the correlation coefficient among latent variables

Bold numbers on diagonal lines are the SRAVE of each latent variable; numbers on non-diagonal lines are correlation coefficient between latent variables

Latent variable	Perceived convenience	Perceived playfulness	Perceived ease of use	Perceived usefulness	Continuance intention to use
Perceived convenience	**0.90** **0.5701**				
Perceived playfulness	0.66	**0.80**			
Perceived ease of use	0.68	0.64	**0.87**		
Perceived usefulness	0.70	0.75	0.69	**0.87**	
Continuance intention	0.55	0.70	0.53	0.77	**0.95**

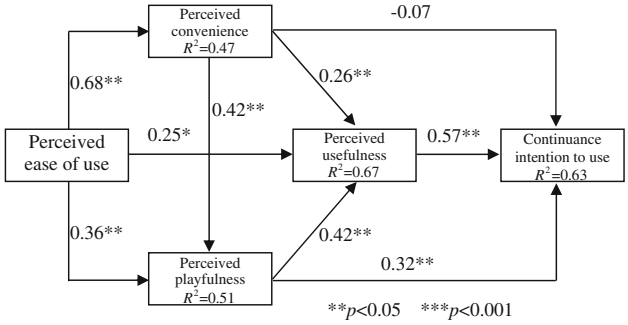

Fig. 2 Structural model analyzing result

indicating that perceived convenience and continuance intention did not have a direct causal relationship.

Hulland (1999) noted that PLS examines goodness-of-fit of the model based on R^2 of endogenous variables. As shown in Table 3, R^2 for the four endogenous variables in the present model, including continuance intention, perceived usefulness, perceived playfulness, and perceived convenience, were 0.63, 0.67, 0.51, and 0.47, respectively. In other words, perceived usefulness and perceived playfulness explained ~63 % of the total variance in continuance intention; perceived convenience, perceived playfulness, and perceived ease of use explained ~67 % of the total variance in perceived usefulness; perceived convenience and perceived ease of use explained ~51 % of the total variance in perceive playfulness; and perceived ease of use explained ~47 % of the total variance in perceived convenience. As the research model explained more than 50 % of the total variance in continuance intention, the research model held a good predictability and explanatory power for continuance intention of the EMLS.

Effect Analysis

Effects among latent variables, shown in Table 6, include direct effects and indirect effects (Kuo and Yen 2009). As shown in Table 6, perceived ease of use was the antecedent factor that affected perceived convenience; perceived convenience, and perceived ease of use were the antecedent factors that affected perceived playfulness; perceived convenience had a greater direct effect on perceived playfulness than did perceived ease of use. As perceived ease of use had a direct effect on perceived playfulness and had an indirect effect on perceived playfulness through perceived convenience, perceived ease of use had a greater overall effect on perceived playfulness than perceived convenience. Furthermore, the order (from great to small) for the direct effects of the latent variables that affected perceived usefulness was perceived playfulness, perceived convenience, and perceived ease of use. As perceived ease of use had a direct effect on perceived usefulness and had an indirect effect on perceived usefulness through perceived convenience and perceived playfulness, the order (from great to small) for the overall effects of the latent variables that perceived usefulness was as follows: perceived ease of use, perceived convenience

Table 5 Path coefficients and results of the hypotheses tests

Hypothesis	Path	Path coefficient	*t* value	*p* value	Result
1	Perceived ease of use → perceived convenience	0.68	15.18	<0.001	Accept
2	Perceived convenience → perceived usefulness	0.26	3.63	<0.001	Accept
3	Perceived convenience → continuance intention	−0.07	0.68	–	Reject
4	Perceived ease of use → perceived playfulness	0.36	4.67	<0.001	Accept
5	Perceived playfulness → perceived usefulness	0.42	6.54	<0.001	Accept
6	Perceived playfulness → continuance intention	0.32	2.70	<0.01	Accept
7	Perceived convenience → perceived playfulness	0.42	5.14	<0.001	Accept
8	Perceived ease of use → perceived usefulness	0.25	3.06	<0.01	Accept
9	Perceived usefulness → continuance intention	0.57	4.25	<0.001	Accept

Table 6 Effects among latent variables

	Perceived convenience			Perceived playfulness			Perceived usefulness			Continuance intention		
	D	I	O	D	I	O	D	I	O	D	I	O
Perceived convenience	–	–	–	0.42	–	0.42	0.26	0.17	0.43	−0.07	0.24	0.31
Perceived playfulness	–	–	–	–	–	–	0.42	–	0.42	0.32	0.24	0.56
Perceived ease of use	0.68	–	0.68	0.36	0.28	0.64	0.25	0.44	0.69	–	0.56	0.56
Perceived usefulness	–	–	–	–	–	–	–	–	–	0.58	–	0.58

D direct, *I* indirect, *O* overall

and perceived playfulness. Thus, perceived convenience, perceived playfulness, and perceived ease of use were the antecedent factors that affected perceived usefulness; perceived playfulness, and perceived usefulness were the main factors that affected continuance intention; and perceived usefulness had a greater direct effect on continuance intention than did perceived playfulness. Although perceived convenience and perceived ease of use did not affect continuance intention directly, these two factors affected continuance intention indirectly through perceived usefulness and perceived playfulness. Hence, the order (from great to small) for the overall effects of the latent variables that affected continuance intention was as follows: perceived usefulness, perceived ease of use, perceived playfulness, and perceived convenience. Therefore, perceived convenience, perceived playfulness, perceived ease of use, and perceived usefulness were the antecedent factors that affected continuance intention to use the EMLS.

Discussions

Research Hypotheses

For perceived convenience, the study results revealed that perceived ease of use positively affected perceived convenience, and perceived convenience positively affected perceived usefulness, which was consistent with findings from a previous study conducted by Yoon and Kim (2007). However, the study results found that perceived convenience did not affect continuance intention directly, which was inconsistent with findings from previous studies including Gupta and Kim (2007) and Hossain and Prybutok (2008). Accordingly, the participants who expressed low continuance intention to use were interviewed. Most of these participants expressed that, although the EMLS was convenient with respect to time and place, usefulness and efficiency of the EMLS were the main factors that affected their continuance intention. Thus, it may be concluded that the easier one perceived the use of the PDA when English learning, the less cognitive effort one put forth and the more convenient one perceived the use the EMLS. In addition, the more convenient one perceived the use of the EMLS, the more efficiently one completed the learning task, and the more positive attitude one held toward the use of the EMLS.

For the hypotheses related to perceived playfulness, the study results indicated that (a) perceived ease of use positively affected perceived playfulness, which was consistent with findings from previous studies, including Ahn et al. (2007) and Moon and Kim (2001), (b) perceived playfulness positively affected perceived usefulness, which was consistent with findings from a previous study conducted by Roca and Gagné (2008); (c) perceived playfulness positively affected continuance intention to use the EMLS, which was consistent with findings from previous studies (Ahn et al. 2007; Lin et al. 2005; Moon and Kim 2001; Roca and Gagné 2008; Wang et al. 2009) and (d) perceived convenience positively affected perceived playfulness, which was consistent with findings from a previous study conducted by Ahn et al. (2007). Thus, it may be concluded that (a) the easier one perceives the use of the PDA in English learning to be, the less cognitive effort one must exert, and accordingly, one will concentrate more on the interaction with the EMLS and be more motivated; (b) when a user is able to learn English at any time and in any place, which implies the system is of good quality, he will feel more comfortable using the system; and (c) when a user can concentrate on and explore the learning content happily, he will complete the English learning task efficiently and effectively, hold a relatively positive attitude toward using the EMLS and be willing to learn English continuously through mobile technology.

Furthermore, regarding the hypotheses related to relationships among TAM variables, the study results showed that (a) perceived ease of use positively affected perceived usefulness and that (b) perceived usefulness positively affected continuance intention. These study results were consistent with the study results regarding the TAM, proposed by Davis (1989). Although many previous study results showed that perceived ease of use positively affected intention (Wang et al. 2009; Yoon and Kim 2007), the proposed model in the present study showed that perceived ease of use did not directly affect continuance intention. Thus, it can be concluded that when the PDA and the EMLS are easy to use, users will be able to complete English learning tasks efficiently and will be willing to learn English through mobile devices.

Effects

Moon and Kim (2001) found that for users with a business purpose, perceived usefulness affected intention significantly more than perceived playfulness. In addition, Roca and Gagné (2008) noted that for a task or an activity with explicit efforts, extrinsic motivations of identified regulation had a greater effect on users' efforts than intrinsic motivation. However, in the present study, it was found that for participants with a learning purpose, perceived usefulness had a greater direct effect on users' continuance intention to use the EMLS than perceived playfulness, which was consistent with the finding from a previous study conducted by Moon and Kim (2001). Furthermore, participants in the present study who aimed at the enhancement of English language ability found that extrinsic motivations of identified regulation (perceived

usefulness) had a greater direct effect on users' continuance intention than inherently autonomous motivation (perceived playfulness), a finding that was consistent with the finding from a previous study conducted by Roca and Gagné (2008). Thus, it is may be noted that the purpose of using the EMLS is to enhance English language ability, and the extrinsic motivation of identified regulation (perceived usefulness) that helps one to complete learning goals has a greater direct effect on continuance intention to use the EMLS than inherently autonomous motivation (perceived playfulness), which motivates one's attention, curiosity, and interest.

Yoon and Kim (2007) noted that perceived convenience plays a crucial role in the adoption of the information technology system. However, the present study found that with respect to English mobile learning, perceived convenience did not affect continuance intention to use the EMLS directly but only affected continuance intention indirectly through perceived playfulness and perceived usefulness. Regarding the overall effect, the order (from great to small effects) of the factors that affected users' continuance intention to use the EMLS was perceived usefulness, perceived ease of use, perceived playfulness, and perceived convenience. Thus, it can be concluded that providing an EMLS that is useful, easy to use and playful attracts users to learn English through mobile learning continuously more so than providing an EMLS that is only convenient. In addition, the variables, including perceived usefulness, perceived ease of use, and perceived convenience, belonged to the extrinsic motivations of identified regulation. Therefore, effects of extrinsic motivations of identified regulation on continuance intention depend on users' perceptions toward these motivations.

Conclusions and Implications

The TAM proposed in the present study included intrinsic and extrinsic motivations and was extended with perceived convenience and perceived playfulness as external variables for examining factors that affected continuance intention to use the EMLS and the relationships among these factors. The study results revealed that extrinsic motivations of identified regulation (perceived usefulness) had a greater direct effect on users' continuance intention than inherently autonomous motivation (perceived playfulness). Overall, the present model was good in explaining users' continuance intention to use the EMLS.

Moon and Kim (2001) found that intention to use technology was affected by users' purpose of use. Therefore, the present study examined the factors that affected continuance intention to use mobile technology and relationships among these factors only for English learning. In addition, participants of the same approximate age engaged in the learning activity with a PDA and the particular EMLS for 4 weeks, and the researcher analyzed the data from them based on *SmartPLS*. Therefore, it is not appropriate to generalize the study results to other systems, subjects of participants of different ages. Although the study results are most likely not generalizable, they can be referenced with respect to the adoption and promotion of English mobile learning for other countries in the Asia–Pacific region.

Previous studies found that users' acceptance of technology or systems could vary due to age (Wang et al. 2009) and gender (Ong and Lai 2006). Accordingly, future studies can focus on other mobile devices, systems, and participants. A comparative study on acceptance of English mobile learning for different countries in the Asia–Pacific region may be conducted in the future. In addition, the data collected from participants can vary based on usage and on increased experiences (Venkatesh et al. 2003). Therefore, future studies can focus on longitudinal research, which is helpful to predict users' long-term beliefs and behaviors and to enhance the comprehension of causal relationships among variables. Moreover, attitude toward using and actual use of the EMLS were not included in the present model. Future studies can include these variables or other external variables that affect the acceptance of the EMLS to predict and explain users' acceptance of efficiently using the EMLS.

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