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Antecedents and consequences of e-learning acceptance

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Abstract. *Based on the technology acceptance model (TAM), this study uses the framework of the extended TAM to examine the antecedents and consequences for employees' acceptance of the e-learning system within financial services organizations. The total of 328 useable responses collected from eight international or domestic financial services companies in Taiwan were tested against the model using structural equation modelling (SEM). The main research results are summarized as follows in terms of the antecedents of e-learning acceptance and its impact on employees' perceived performance. Four types of determinants are demonstrated: individual factors, system factors, social factors and network externality factor. Finally, this study proposes relevant suggestions for practitioners and future researchers.*

Keywords: technology acceptance model, extended TAM, e-learning acceptance, perceived performance, structural equation modelling

INTRODUCTION

With the rapid development of information communication technologies (ICT), internet technologies and Web-based applications have created unprecedented opportunities for conducting learning (Liaw *et al*., 2008; Liu *et al*., 2009), and this phenomenon has led to the exponential growth of electronic learning (e-learning) in recent years (Baylari & Montazer, 2009; Liu *et al*., 2009). Essentially, e-learning is a powerful tool which helps organizations deliver the learning content to their employees and to educate and train anyone, anytime and from anywhere (DeRouin *et al*., 2005; Baylari & Montazer, 2009). As e-learning is reported to be an approach of solving learning and performance problems and has become an increasingly critical issue for organizations (Ong *et al*., 2004), organizations should utilize the advantages of e-learning to provide their employees with the continually increasing demand for knowledge acquisition and absorption (Chatzoglou *et al*., 2009).

Obviously, the importance of e-learning has become widely recognized and accepted by organizations. However, as far as the understanding of e-learning acceptance by organizations

is concerned, it appears that numerous research efforts have focused on the antecedents for explaining users' acceptance of the e-learning system, with limited emphasis upon the consequences of users' acceptance of the e-learning system, which is an important topic for organizations if they are to use the system to solve learning and performance problems. The main aim of this study is to simultaneously examine the antecedents and consequences for employees' acceptance of the e-learning system within organizations. Accordingly, the primary reasons with corresponding objectives are threefold:

Firstly, many theoretical models have been used to explain users' acceptance/adoption of the information system (IS)/information technology (IT). Among these theoretical models, the technology acceptance model (TAM), proposed by Davis (1989) and Davis *et al*. (1989), is one of the most widely accepted and applied models in a variety of domains that include related IS and IT acceptance/adoption studies (Chau, 1996; Venkatesh, 2006). This is why the research model in this study is based on the TAM. The TAM is adapted from the well-known theory of reasoned action (TRA) (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980) which is a model that is used extensively for predicting and explaining technology acceptance and usage among users. Essentially, the TAM examines IS/IT acceptance and usage primarily from the instrumental perspective, focusing mainly on extrinsic motivators such as usefulness and ease of use (Agarwal & Karahanna, 2000; Lee *et al*., 2005). The two constructs of perceived usefulness (PU) and perceived ease of use (PEOU) have been extensively investigated by many studies using different samples and have been generally verified to be crucial determinants in affecting IS/IT acceptance and usage (King & He, 2006; Schepers & Wetzels, 2007). Nevertheless, some studies (e.g. Davis *et al*., 1992; Igbaria *et al*., 1995; Teo *et al*., 1999; Van der Heijden, 2004; Lee *et al*., 2005; Ha *et al*., 2007; Lee *et al*., 2007; Yang & Jolly, 2008) argue that incorporating extrinsic motivators (PU and PEOU) and the intrinsic motivator (perceived enjoyment; PE) into the TAM may provide better explanation and prediction of IS/IT acceptance and usage. Hence, the first objective of this study is to examine whether the drivers of users' behaviour towards acceptance and usage of the e-learning system are focused predominantly on three beliefs such as PU, PEOU and PE.

Secondly, to date, few studies have used the model including extrinsic and intrinsic motivators to predict users' acceptance and usage of the e-learning system within organizations. Although Lee *et al*. (2005) have proposed the incorporating perspectives of extrinsic and intrinsic motivators to predict students' acceptance of the internet-based learning medium (ILM) within an academic institution, there may be a need to search for more external variables to improve the ability to predict usage intention more accurately. Accordingly, the second objective of this study is to propose multiple groups of antecedents to, respectively, predict PU, PEOU and PE in explaining users' acceptance and usage of the e-learning system within organizations.

Thirdly, the empirical evidence on the consequences for users' acceptance and usage of the e-learning system is less well documented. Hence, the third objective of this study is to confirm whether users' actual usage (AU) of the e-learning system within organizations can effectively enhance their perceived performance (PP) or not.

This study therefore proposes a research model combining extrinsic motivators (PU and PEOU) with the intrinsic motivator (PE) to predict employees' acceptance and usage of the e-learning system within financial services organizations. Sample data collected from eight international or domestic financial services companies in Taiwan were tested against the model using structural equation modelling (SEM). The structure of this study is organized as follows: firstly, this study reviews the relevant literature to develop the research model and research hypotheses; next, this study presents the methodology and the results of empirical analyses; finally, this study proposes relevant suggestions for practitioners and future researchers.

THEORETICAL BACKGROUND

The outline of e-learning

Essentially, e-learning is defined as a tool that uses the computer network technology, primarily via electronic media, such as internet, intranets, extranets or many others, to deliver learning materials to users (Welsh *et al*., 2003; Engelbrecht, 2005), and utilizes Web-based communication, collaboration, knowledge transfer and training to support users' active learning without the time and space barriers (Kelly & Bauer, 2004; Lee *et al*., 2009). In general, e-learning can be classified as asynchronous e-learning, synchronous e-learning and blended e-learning. Firstly, asynchronous e-learning is a form of self-study, and it allows learners to follow their own time and schedule; however, it lacks real-time interaction between instructors and learners (Wu & Hiltz, 2004; Zhang, 2004; Huang *et al*., 2008; Lee, 2010). Thus, it has to provide learners with standardized materials to achieve platform-independent course exchange and reuse (Huang *et al*., 2008). By contrast, synchronous e-learning allows for real-time interaction and just-in-time response between instructors and learners; however, it requires instructors and learners to participate simultaneously at distributed locations (Zhang, 2004; Huang *et al*., 2008; Lee, 2010). Thus, it loses time flexibility (Zhang, 2004). Further, blended e-learning combines asynchronous e-learning (self-paced e-learning) with synchronous e-learning (live e-learning) to provide learners with access to both asynchronous and synchronous communication and information (Martyn, 2003; EL-Deghaidy & Nouby, 2008; Donnelly, 2010).

In order to support e-learning, various e-learning systems have been developed for organizations (Ngai *et al*., 2007), and various combinations of text, graphics, audio, video and many others can be integrated into these systems (Liu *et al*., 2009). According to the views of Ismail (2001), there are basically four types of e-learning systems: learning management system (LMS), learning content management system (LCMS), learning design system (LDS), and learning support system (LSS). Firstly, the LMS can process, store and disseminate learning materials and support administration and communication associated with teaching and learning (McGill & Klobas, 2009), and it allows users to control the pace of the training and to tailor learning according to their individual needs (Baylari & Montazer, 2009; Ely *et al*., 2009). Secondly, the LCMS is a collaborative authoring environment where content developers can

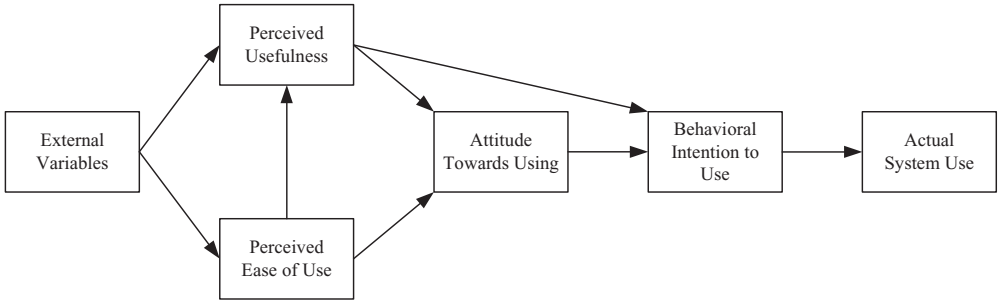

Figure 1. Technology acceptance model [adapted from Davis *et al*. (1989)].

create, maintain and deliver digital learning content from a central object repository (Ismail, 2001). Thirdly, the LDS can allow content producers to quickly analyse, design and develop instructional materials and learning programs (Ismail, 2001). Fourthly, the LSS is a Web-based tool to support teaching and learning activities; it can manage and support a group of learners and provide access to course-related information and materials as laid out by the instructors (Ismail, 2001). Synthetically speaking, e-learning systems provide e-learning platforms that use the internet as a delivery mechanism to allow users from all over the world to access a number of learning tools (e.g. discussion boards, chat rooms, course content management, etc.) for their e-learning courses (Ngai *et al*., 2007). Furthermore, through the e-learning systems, employees within organizations also have access to various online databases and tools that help them learn and find solutions for work-related problems (Wang *et al*., 2007).

TAM

The TAM adapted from the TRA proposes that two particular beliefs, PU and PEOU, are the primary drivers for explaining and predicting user acceptance of the IS (Davis *et al*., 1989). PU is defined as 'the degree to which a person believes that using a particular system would enhance his/her job performance', and PEOU is defined as 'the degree to which a person believes that using a particular system would be free of physical and mental effort' (Davis, 1989, p. 320). A key purpose of the TAM is to provide a basis for tracing the impact of external factors on internal beliefs, attitudes and intentions (Davis *et al*., 1989, p. 985). Hence, the external variables of the TAM can affect PU and PEOU; furthermore, PU and PEOU both affect a person's attitude towards using the system, and the attitude towards using the system determines behavioural intention, which in turn leads to actual system use (Davis *et al*., 1989). Figure 1 shows a common operationalization of the TAM.

Extended TAM

Davis *et al*. (1992) ascertained the importance of the role of PE in predicting computer acceptance and usage, and they found that PE and PU mediated the influence of PEOU on

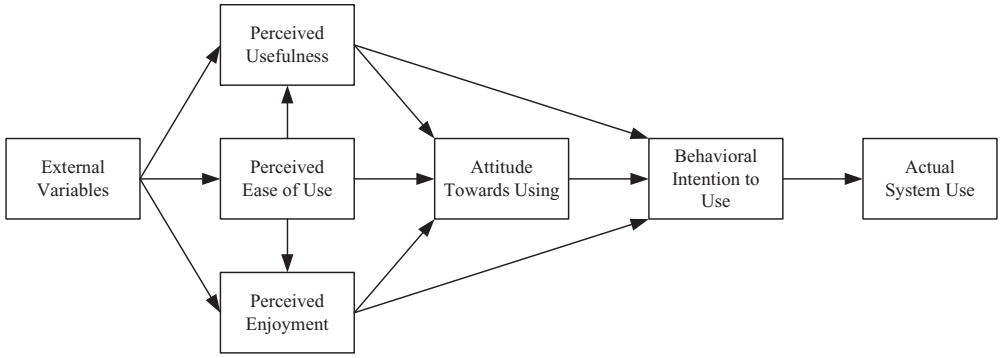

Figure 2. Extended technology acceptance model.

intention to use a computer in the workplace. PE refers to the degree to which the activity of using a particular system is perceived to be personally enjoyable in its own right, apart from the instrumental value of the specific type of system (Davis *et al*., 1992; Lee *et al*., 2005). Essentially, PU and PEOU reflect the extrinsic motivational aspect of specific type of system usage, and PE usually reflects the intrinsic motivational aspect of specific type of system usage (Davis *et al*., 1992). Subsequently, many studies (e.g. Igbaria *et al*., 1995; Teo *et al*., 1999; Van der Heijden, 2004; Lee *et al*., 2005; Ha *et al*., 2007; Lee *et al*., 2007; Yang & Jolly, 2008) integrate the intrinsic motivational perspective into the TAM, and explain IS/IT acceptance from both extrinsic and intrinsic motivational perspectives. That is, these studies extend the TAM by adding a PE construct, and the extended TAM posits that three particular beliefs, PU, PEOU and PE, are of primary relevance for IS/IT acceptance behaviours. Synthetically speaking, the external variables of the extended TAM can, respectively, affect PU, PEOU and PE (Davis *et al*., 1992; Ha *et al*., 2007; Lee *et al*., 2007); PU, PEOU and PE directly affect attitude towards using the IS/IT, and PU and PE mediate the influence of PEOU on attitude towards using the IS/IT (Davis *et al*., 1992; Lee *et al*., 2005; Ha *et al*., 2007; Lee *et al*., 2007; Yang & Jolly, 2008); PU, PE and attitude towards using the IS/IT directly determine intention to use the IS/IT, and PU and PE mediate the influence of PEOU on intention to use the IS/IT (Davis *et al*., 1992; Van der Heijden, 2004; Lee *et al*., 2005; Lee *et al*., 2007; Yang & Jolly, 2008); furthermore, intention to use the IS/IT directly leads to actual IS/IT usage (Davis, 1989; Davis *et al*., 1989). Figure 2 shows an operationalization of the extended TAM.

RESEARCH MODEL AND HYPOTHESES

Figure 3 depicts the research model used in this study, which is based on the extended TAM, and which presents the antecedents and consequences of the acceptance and usage of the

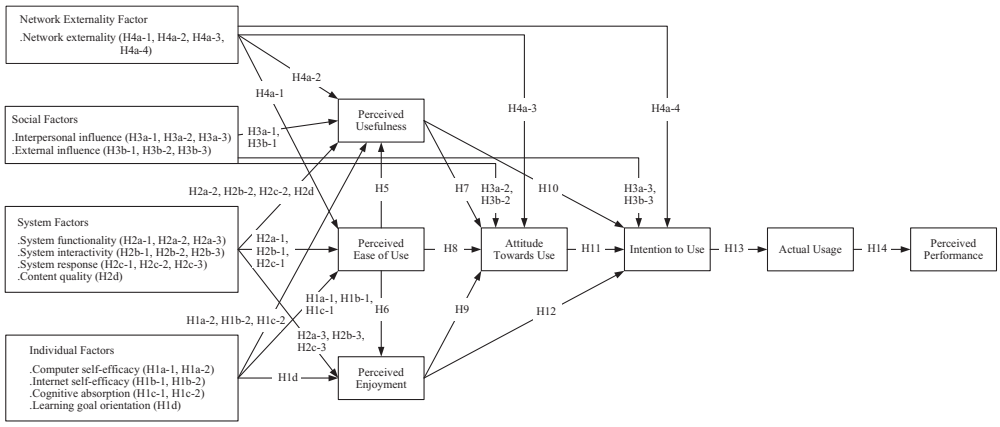

Figure 3. The research model.

e-learning system. In an e-learning context, the specific elements of the research model and related hypotheses are further detailed below.

Antecedents to user beliefs

Many studies have suggested that extending the TAM with external variables may provide a more complete picture of the IS/IT acceptance process (Hu *et al*., 2003; Kim *et al*., 2008). Several types of external variables are repeatedly mentioned as central to users' acceptance of the e-learning system, and which can be grouped into the following four types: the individual factors include computer self-efficacy (CSE) (e.g. Ong *et al*., 2004; Lee, 2006; Ong & Lai, 2006; Pituch & Lee, 2006; Roca *et al*., 2006), internet self-efficacy (ISE) (e.g. Pituch & Lee, 2006; Roca *et al*., 2006), cognitive absorption (CAB) (e.g. Saadé & Bahli, 2005; Roca *et al*., 2006) and learning goal orientation (LGO) (e.g. Chatzoglou *et al*., 2009); the system factors include system functionality (SF) (e.g. Pituch & Lee, 2006), system interactivity (SI) (e.g. Pituch & Lee, 2006), system response (SR) (e.g. Pituch & Lee, 2006) and content quality (CQ) (e.g. Lee, 2006; Lee *et al*., 2009); the social factors include interpersonal influence (INI) (e.g. Lee, 2006; Roca *et al*., 2006; Van Raaij & Schepers, 2008) and external influence (EXI) (e.g. Roca *et al*., 2006; Van Raaij & Schepers, 2008); and the network externality factor (e.g. Lee, 2006). In this study, four types of determinants as external variables to PU, PEOU and PE are, respectively, proposed and examined. The following subsections provide further discussion on the impacts of each type of external variables on PU, PEOU and PE.

Individual factors

Many studies indicate that individual factors have a significant effect on the way that users perceive the e-learning system and, subsequently, on their desire to accept it. The inferences of individual factors as antecedents of user beliefs in the e-learning context and related hypotheses are further detailed below.

Self-efficacy reflects one's beliefs about the ability to perform particular tasks successfully (Bandura, 1977). Thus, CSE refers to the self-assessment of individual ability to apply computer skills to complete particular tasks (Compeau & Higgins, 1995). In an e-learning context, CSE has been shown to influence PEOU in prior studies (e.g. Ong *et al*., 2004; Lee, 2006; Ong & Lai, 2006; Pituch & Lee, 2006; Roca *et al*., 2006), and researchers (e.g. Ong *et al*., 2004; Ong & Lai, 2006) have empirically examined that it can be an important factor affecting PU. Furthermore, ISE is defined as 'an individual's judgment of efficacy across multiple Internet application domains' (Hsu & Chiu, 2004, p. 370). Roca *et al*. (2006) proposed a decomposed TAM in the context of the e-learning system, and they demonstrated that ISE played an important role in affecting users' beliefs of PEOU. Furthermore, Kim *et al*. (2007) developed and tested an integrated conceptual model of the internet acceptance; they hypothesized that ISE would directly influence PU and PEOU, and they found that ISE significantly predicted PEOU. Virtually, self-efficacy is similar to the concept of competence (Roca & Gagné, 2008), and cognitive evaluation theory specifies that feelings of competence may not enhance intrinsic motivation (Fisher, 1978; Ryan & Deci, 2000). Thus, self-efficacy may not affect PE. Hence, this study hypothesizes:

H1a-1: CSE will positively affect PEOU of the e-learning system.
H1a-2: CSE will positively affect PU of the e-learning system.
H1b-1: ISE will positively affect PEOU of the e-learning system.
H1b-2: ISE will positively affect PU of the e-learning system.

CAB refers to a behaviour performed for itself to experience pleasure and satisfaction inherent in the activity (Vallerand, 1997; Saadé & Bahli, 2005); it represents one form of intrinsic motivation (Vallerand, 1997). In an e-learning context, CAB is defined as 'a state of deep involvement with the internet-based learning systems' (Saadé & Bahli, 2005, p. 318). Saadé & Bahli (2005) applied the TAM to explain the acceptance of internet-based learning systems, and they demonstrated that CAB had a positive impact on students' beliefs about PEOU and PU. Roca *et al*. (2006) also found that CAB could positively affect PEOU and PU. Hence, this study hypothesizes:

H1c-1: CAB will positively affect PEOU of the e-learning system.
H1c-2: CAB will positively affect PU of the e-learning system.

Goal orientation is a theory that attempts to explain the reasons for setting goals and motivations for achieving those goals (Code *et al*., 2006), and it has been described as the dynamic force that regulates behaviours in achievement situations (Sideridis, 2006). Furthermore, LGO is conceptualized as an achievement-oriented motivation via task learning process (Kanfer & Heggestad, 1997). Individuals with an LGO tend to approach a task to understand something new and to enhance their level of competence in a given activity (Button *et al*., 1996; Yi & Hwang, 2003); that is, they usually tend to choose challenging tasks that foster learning, and they can further be motivated by competence development (Dweck, 1986; Godshalk & Sosik, 2003). Hence, LGO has been recognized as being important in understanding individual characteristics in intrinsic motivation (Dweck & Leggett, 1988; Yi & Hwang,

2003; Chatzoglou *et al*., 2009). However, the effect of LGO has not received much attention with regard to e-learning acceptance (Chatzoglou *et al*., 2009). Thus, this is why this study focuses on the understanding of what role LGO plays with the PE (intrinsic motivation) for the acceptance of the e-learning system. In the related context of e-learning acceptance, individuals with high LGO are expected to relish the challenge of specific application with intrinsic motivation and develop self-confidence in using it; hence, they will enjoy exploring the features of Web-based training (Chatzoglou *et al*., 2009). Hence, this study hypothesizes:

H1d: LGO will positively affect PE of the e-learning system.

System factors

Since the TAM was proposed by Davis (1989) and Davis *et al*. (1989), system factors have been posited to affect user beliefs. Subsequent studies (e.g. Lee, 2006; Pituch & Lee, 2006; Roca *et al*., 2006) have validated the role of system factors in predicting user beliefs and acceptance in the e-learning context. The inferences of system factors as antecedents of user beliefs in the e-learning context and related hypotheses are further detailed below.

Pituch & Lee (2006) classified the system factors of e-learning acceptance for the distance education into SF, SI and SR. SF refers to the perceived ability of an e-learning system to provide flexible access to instructional and assessment media (Pituch & Lee, 2006). SI refers to the interactions between instructors and learners, and the collaboration in learning that results from these interactions (Palloff & Pratt, 1999; Pituch & Lee, 2006). SR is defined as the degree to which a learner perceives that the response from the e-learning system is fast, consistent and reasonable (Bailey & Pearson, 1983; Pituch & Lee, 2006). In Pituch & Lee's (2006) study, the AU of the e-learning system for distance education was analysed by the TAM, and they found that the three system factors could positively affect PEOU and PU. Roca *et al*. (2006) also classified the system factors of e-learning acceptance into system quality, information quality and service quality, but they did not examine the direct relationships between the three system factors and user beliefs. Furthermore, Shin (2007) indicated that users would think Wireless Broadband Internet more useful because of ubiquitous availability, and users would further think Wireless Broadband Internet more enjoying because of perceived quality of actual functionality, such as high-quality video and real-time voice with minimized delay, latency, jitter and packet loss, and new quality of services, such as context-aware application (i.e. location-based services, the user roaming seamlessly between networks, etc.). Hence, this study hypothesizes:

H2a-1: SF will positively affect PEOU of the e-learning system.
H2a-2: SF will positively affect PU of the e-learning system.
H2a-3: SF will positively affect PE of the e-learning system.
H2b-1: SI will positively affect PEOU of the e-learning system.
H2b-2: SI will positively affect PU of the e-learning system.
H2b-3: SI will positively affect PE of the e-learning system.

H2c-1: SR will positively affect PEOU of the e-learning system.
H2c-2: SR will positively affect PU of the e-learning system.
H2c-3: SR will positively affect PE of the e-learning system.

CQ includes both content richness and update regularity (Lee, 2006). Lee (2006) indicated that an e-learning system had greater appeal to students because of the richness of content provided by the internet. As compared to traditional learning methods, the updated content and new content of e-learning may lead students to feel that the e-learning system could be a useful means of gaining new knowledge and learning (Lee, 2006; Lee *et al*., 2009). Hence, this study hypothesizes:

H2d: CQ will positively affect PU of the e-learning system.

Social factors

In general, social factors (social influence) profoundly affect user behaviour (Triandis, 1980; Lee, 2006). According to the TRA, social factors were tested as subjective norms on behavioural intention (Fishbein & Ajzen, 1975; Lee, 2006; Van Raaij & Schepers, 2008). Subjective norm is defined as 'the person's perception that salient social referents think he/she should or should not perform the behaviour in question' (Fishbein & Ajzen, 1975, p. 302). The referent influence may be the INI (Taylor & Todd, 1995; Bhattacherjee, 2000) or the EXI (Bhattacherjee, 2000). INI refers to the influence of friends, family members, colleagues, superiors and experienced persons considered by individuals in performing a behaviour, and EXI refers to the influence of mass media reports, expert opinions and other non-personal information considered by individuals in performing a behaviour (Bhattacherjee, 2000). In an e-learning context, when individuals perceive that their important referents think they should use the e-learning system, they will further incorporate the referents' beliefs into their own beliefs; that is, they are influenced by the referents, and thus they believe the system must be useful in its purpose (Lee, 2006; Van Raaij & Schepers, 2008) and further intend to use it (Lee, 2006). Furthermore, Hsu & Lu (2004) showed that social influences would have a direct impact on the attitude and intention of IT adoption, and they further explained that users might feel obligated to participate because they might want to belong to a community. Besides, individuals' perception of enjoyment is usually in an autonomy-supportive context; they may not be influenced by relevant others such as family, friends or peers (Deci & Ryan, 2000; Ryan & Deci, 2000). Thus, social factors may not affect PE. Hence, this study hypothesizes:

H3a-1: INI will positively affect PU of the e-learning system.
H3a-2: INI will positively affect attitude towards using the e-learning system.
H3a-3: INI will positively affect intention to use the e-learning system.
H3b-1: EXI will positively affect PU of the e-learning system.
H3b-2: EXI will positively affect attitude towards using the e-learning system.
H3b-3: EXI will positively affect intention to use the e-learning system.

Network externality factor

Network externality (NE) refers to an increase in the value of a product as the number of users of that product increases (Farrell & Saloner, 1985; Katz & Shapiro, 1985), and it also means that the utility of the product for a user depends on the number of other users (Van den Ende *et al*., 2003). In general, the development of technology is along with consumers' perceptions of increasing numbers of others supporting that technology; this will continuously add value to the technology and further lead to increases in the number of other users' usage (Nault & Dexter, 1994; Wang & Seidmann, 1995; Lee, 2006). Hsu & Lu (2004) examined the effects of NE on the adoption of IT from the aspect of 'perceived critical mass', and they indicated that perceived critical mass dominated users' attitudes. In the context of e-learning, Lee (2006) indicated that if students perceived that increasing numbers of their classmates were using the e-learning system, they would also try out the system. Furthermore, Lee (2006) showed that perceived network externality, respectively, exerted a significant direct effect on PU, PEOU and behavioural intention. Besides, individuals can autonomously perceive the enjoyment of activity itself, and they may usually not be influenced by others (Deci & Ryan, 2000; Ryan & Deci, 2000). Thus, NE may usually not affect PE. Hence, this study hypothesizes:

H4a-1: NE will positively affect PEOU of the e-learning system.
H4a-2: NE will positively affect PU of the e-learning system.
H4a-3: NE will positively affect attitude towards using the e-learning system.
H4a-4: NE will positively affect intention to use the e-learning system.

User beliefs and technology acceptance

Based on the extended TAM (see Figure 2), the relationships between users' beliefs and their acceptance and usage of the e-learning system are further detailed below. PU directly affects attitude towards using the e-learning system (Stoel & Lee, 2003; Lee *et al*., 2005; Ngai *et al*., 2007; Liu *et al*., 2009); PEOU directly affects attitude towards using the e-learning system (Stoel & Lee, 2003; Ngai *et al*., 2007; Liu *et al*., 2009); and PE directly affects attitude towards using the e-learning system (Lee *et al*., 2005). Furthermore, PU mediates the influence of PEOU on attitude towards using the e-learning system (Stoel & Lee, 2003; Lee *et al*., 2005; Ngai *et al*., 2007; Liu *et al*., 2009), and PE mediates the influence of PEOU on attitude towards using the e-learning system (Lee *et al*., 2005). PU directly determines intention to use the e-learning system (Stoel & Lee, 2003; Ong *et al*., 2004; Lee *et al*., 2005; Saadé & Bahli, 2005; Lee, 2006; Ndubisi, 2006; Ong & Lai, 2006; Lee, 2008; Roca & Gagné, 2008; Chatzoglou *et al*., 2009; Lee *et al*., 2009; Liu *et al*., 2009); PE directly determines intention to use the e-learning system (Lee *et al*., 2005; Roca & Gagné, 2008; Chatzoglou *et al*., 2009; Lee *et al*., 2009); and attitude towards using the e-learning system directly determines intention to use the system (Stoel & Lee, 2003; Lee *et al*., 2005; Liu *et al*., 2009). Furthermore, PU mediates the influence of PEOU on intention to use the e-learning system (Stoel & Lee, 2003; Ong *et al*., 2004; Lee *et al*., 2005; Saadé & Bahli, 2005; Lee, 2006; Ndubisi, 2006; Ong & Lai, 2006; Lee, 2008; Roca

& Gagné, 2008; Chatzoglou *et al*., 2009; Lee *et al*., 2009; Liu *et al*., 2009), and PE mediates the influence of PEOU on intention to use the e-learning system (Lee *et al*., 2005). And then, intention to use the e-learning system directly leads to AU of the system (Stoel & Lee, 2003). Hence, this study hypothesizes:

H5: PEOU will positively affect PU of the e-learning system.
H6: PEOU will positively affect PE of the e-learning system.
H7: PU will positively affect attitude towards using the e-learning system.
H8: PEOU will positively affect attitude towards using the e-learning system.
H9: PE will positively affect attitude towards using the e-learning system.
H10: PU will positively affect intention to use the e-learning system.
H11: Attitude towards using the e-learning system will positively affect intention to use the system.
H12: PE will positively affect intention to use the e-learning system.
H13: Intention to use the e-learning system will positively affect AU of the system.

Actual usage and perceived performance

Empirical support for the relationship between actual system usage and PP can be found in some studies of IS/IT acceptance. Igbaria & Tan (1997) investigated the implications and consequences of IS acceptance by examining the relationship between IS acceptance and PP, and they showed that user satisfaction and system usage could positively affect perceived performance impacts. Furthermore, Ahearne *et al*. (2004) showed that it appeared that increasing the system usage would have a positive effect on performance. Besides, Shih (2004) showed that positive attitudes towards using the internet to seek information might increase performance in decision-making or problem solving during the information use stage, and this study further implied that enterprise intranet usage provided more relevant information to meet employee needs and allowed employees to enhance their task performance by using the internet. Hence, this study hypothesizes:

H14: AU of the e-learning system will positively affect PP.

METHODOLOGY

Measures

In this study, responses to the items in CSE, ISE, CAB, LGO, SF, SI, SR, CQ, INI, EXI, NE, PEOU, PU, PE, attitude towards use (ATU), intention to use (ITU) and PP were measured on a 7-point Likert scale from 1 (= 'strongly disagree') to 7 (= 'strongly agree') with 4 labelled as neutral. Next, responses to the items in AU were measured on a 7-point Likert scale from 1 (= 'never') to 7 (= 'more than once a day') with 4 labelled as neutral. To ensure content validity of the scales, the items must represent the concept about which generalizations are to be

made (Ong *et al*., 2004). Items chosen for the constructs in this study were adapted and revised from previous research. The final items are listed in Table 1 along with their sources.

Furthermore, in order to ensure the translation equivalence for the original meaning of questionnaire, the standard back-translation procedure for the questionnaire was followed (Sperber *et al*., 1994; Mullen, 1995). The original questionnaire was first developed in English, and then the original questionnaire was translated into Chinese by a bilingual Taiwanese MBA student, and another bilingual Taiwanese MBA student back translated the Chinese version of the questionnaire into English. Lastly, in order to ensure the cross-cultural uniformity in translation (Parameswaran & Yaprak, 1987; Sperber *et al*., 1994), two other bilingual Taiwanese doctoral students provided independent checks on the back-translation.

Pre-test

The questionnaire was pre-tested on 38 senior employees from one domestic financial services company in Taiwan. This selected company had implemented the e-learning system at least 1 year ago, and the participants from this selected financial services company were using the e-learning system in their learning. Likert scales were used for measuring each independent and dependent variable in the research model. Based on feedback, the participants were asked to identify any ambiguities in the meanings, and the questionnaire was revised based on their comments. The instrument's reliability was evaluated, and the Cronbach's α values ranged from 0.8 to 0.98, indicating a satisfactory level of reliability exceeding that commonly required for exploratory research (Nunnally, 1978; Hair *et al*., 1998). The final items are listed in Table 1 along with their sources. The subjects who had participated in the pre-test were excluded from the final data collection and subsequent study.

Sample and data collection

In order to facilitate e-learning, various e-learning systems have been developed to help organizations deliver the learning content to their employees and to educate and train anyone, anytime and from anywhere (DeRouin *et al*., 2005; Ngai *et al*., 2007; Baylari & Montazer, 2009). Basically, four types of e-learning systems that include LMS, LCMS, LDS and LSS have been developed for organizations (Ismail, 2001). In this study, the focus is on so-called LMS. Furthermore, the e-learning examined in this study is the LMS with a blend of asynchronous and synchronous technologies.

This study gathered sample data from eight well-known international or domestic financial services companies in Taiwan. The eight companies included two life insurance companies, two banks, two securities companies, one financial holding company and one finance company (this company is a provider of leasing, installment, factoring, corporate direct loan and offshore financing services). All selected financial services companies had implemented the same LMS developed by one Taiwan-based digital learning platform/system provider at least 1 year ago, and the participants from these selected financial services companies were using the LMS in their learning. The names of these companies are withheld due to the non-disclosure agreement with their executives.

Table 1. Construct measurement and sources

Construct	Item	Measure	Source
Computer self-efficacy (CSE)	CSE1	I could complete my learning activities using the e-learning system if I had never used a system like it before.	Compeau & Higgins (1995)
	CSE2	I could complete my learning activities using the e-learning system if I had only the system manuals for reference.	Ong *et al*. (2004)
	CSE3	I could complete my learning activities using the e-learning system if I had seen someone else using it before trying it myself.	
Internet self-efficacy (ISE)	ISE1	I feel confident in the e-learning system finding information and downloading files.	Hsu & Chiu (2004)
	ISE2	I feel confident in the e-learning system attaching files to emails.	Roca *et al*. (2006)
	ISE3	I feel confident in the e-learning system exchanging messages with other users in discussion forums.	
	ISE4	I feel confident in the e-learning system posting messages on a bulletin board.	
Cognitive absorption (CAB)	CAB1	Most times when I get on to the e-learning system, I end up spending more time than I had planned.	Agarwal & Karahanna (2000)
	CAB2	While using the e-learning system, I am absorbed in what I am doing.	Roca *et al*. (2006)
	CAB3	I enjoy using the e-learning system.	
Learning goal orientation (LGO)	LGO1	I look for opportunities to develop my work ability.	Brett & VandeWalle (1999)
	LGO2	I learn to develop my work ability.	Yi & Hwang (2003)
	LGO3	I enjoy challenging environment.	
	LGO4	I prefer to work in situations.	
	LGO5	I prefer to develop competence through expanding my work ability.	
	LGO6	I prefer to develop competence through mastering challenging situations.	
System functionality (SF)	SF1	The e-learning system allows learner control over his or her learning activity.	Pituch & Lee, (2006)
	SF2	The e-learning system offers multimedia (audio, video, and text) types of course content.	
	SF3	The e-learning system provides a means for taking tests and turning in assignments.	
	SF4	The e-learning system can present course material in a well-organized and readable format.	
System interactivity (SI)	SI1	The e-learning system enables interactive communication between instructor and learners.	Pituch & Lee (2006)
	SI2	The e-learning system enables interactive communication among learners.	
	SI3	The communicational tools in the e-learning system are effective (email, bulletin board, chat room, etc.).	
System response (SR)	SR1	When you are using the e-learning system, system response is fast.	Bailey & Pearson (1983)
	SR2	In general, the response time of the e-learning system is consistent.	Pituch & Lee (2006)
	SR3	In general, the response time of the e-learning system is reasonable.	
Content quality (CQ)	CQ1	I search and share the related course content from the e-learning system to help my learning.	Arbaugh (2000)
	CQ2	Content on the e-learning system is updated on a regular basis.	Lee (2006)
	CQ3	The e-learning system often provides the updated information.	
Interpersonal influence (INI)	INI1	My supervisor thinks that I should use the e-learning system.	Bhattacherjee (2000)
	INI2	My colleagues think that I should use the e-learning system.	Roca *et al*. (2006)
	INI3	My friends think that I should use the e-learning system.	

Table 1. Cont.

Construct	Item	Measure	Source
External influence (EXI)	EXI1	I read/see news reports that using the e-learning system is a good way of learning.	Bhattacherjee (2000)
	EXI2	Expert opinions depict a positive sentiment for using the e-learning system.	Roca *et al*. (2006)
	EXI3	Mass media reports convince me to use the e-learning system.	
Network externality (NE)	NE1	Most employees in my office use the e-learning system frequently.	Hsu & Lu (2004)
	NE2	Most employees in my department use the e-learning system frequently.	Chun & Hahn (2007)
	NE3	Most employees in my company use the e-learning system frequently.	
Perceived ease of use (PEOU)	PEOU1	Interacting with the e-learning system does not require a lot of my mental effort.	Davis (1989)
	PEOU2	I find the e-learning system to be easy to use.	Ngai *et al*. (2007)
	PEOU3	My interaction with the e-learning system is clear and understandable.	
	PEOU4	I find it easy to get the e-learning system to do what I want it to do.	
Perceived usefulness (PU)	PU1	Using the e-learning system improves my learning performance.	Davis (1989)
	PU2	Using the e-learning system enhances my learning effectiveness.	Ngai *et al*. (2007)
	PU3	Using the e-learning system gives me greater control over learning.	
	PU4	I find the e-learning system to be useful in my learning.	
Perceived enjoyment (PE)	PE1	I find using the e-learning system to be enjoyable.	Davis *et al*. (1992)
	PE2	The actual process of using the e-learning system is pleasant.	Lee *et al*. (2005)
	PE3	I have fun using the e-learning system.	
Attitude towards use (ATU)	ATU1	Using the e-learning system is a good idea.	Ajzen & Fishbein (1980)
	ATU2	The e-learning system provides an attractive learning environment.	Ngai *et al*. (2007)
	ATU3	Overall, I like using the e-learning system.	
Intention to use (ITU)	ITU1	I will use the e-learning system on a regular basis in the future.	Mathieson (1991)
	ITU2	I will frequently use the e-learning system in the future.	Bhattacherjee (2001).
	ITU3	I will strongly recommend others to use the e-learning system.	Roca *et al*. (2006)
Actual usage (AU)	AU1	I have accessed the program information pages on the e-learning system.	Van Raaij & Schepers (2008)
	AU2	I have accessed the news pages on the e-learning system.	
	AU3	I have accessed the study units on the e-learning system.	
Perceived performance (PP)	PP1	I successfully use the e-learning system to enhance my job effectiveness.	Goodhue & Thompson (1995)
	PP2	I successfully use the e-learning system to perform my job.	Shih (2004)
	PP3	I am satisfied with the effect of using the e-learning system on my job performance.	

This study authorized all selected financial services companies' human resources departments to randomly distribute the questionnaires. A total of 480 questionnaires were distributed, and 351 (73.13%) questionnaires were received. Twenty-three of these received questionnaires were discarded due to large portions of missing values. Finally, 328 (68.33%) questionnaires were analysed in this study. Besides, in this study, 206 useable responses were received in the early mailing wave and 122 in the late wave. The mean differences between the two groups with respect to gender, age, educational level, work experience and whether the employee was in a supervisory position were tested using an unpaired *t*-test. No significant differences were observed at the 0.05 level, indicating no systematic differences between the two groups.

Besides, this study could not use the comparable statistics (e.g. gender, age, educational level, work experience and whether the employee was in a supervisory position, etc.) from non-respondents to test the non-response bias, because all selected financial services companies withheld the data of their non-responding employees. Hence, a non-response follow-up survey was conducted to assess the reasons for non-response. This study authorized all selected financial services companies' human resources departments to randomly inquire why non-responding employees might choose not to respond to the survey. This study received 37 (28.68%) follow-up responses from 129 original non-respondents. In analyzing the reasons given for non-response, the reasons for non-response can be rank-ordered as follows: insufficient time to fill out the questionnaire (48.65%), length of the questionnaire (21.62%), inability to recall receiving the questionnaire (18.92%), unwillingness to express personal viewpoints (8.11%) and the sensitivity of questions in the questionnaire (2.70%).

E-learning in Taiwan

Since 2003, the Taiwan government has made great efforts to promote the 'E-learning Industry Promotion and Development Plan' and has placed more resources in strategic implementations (National Science & Technology Program Office for E-learning, 2008). This reveals that the Taiwan government has realized the potential benefits of e-learning in the future. With direct assistance and funding from the Taiwan government, great progress has been made in the introduction of e-learning in the enterprise sector; in 2007, the introduction rate was highest in the financial services sector with 74.3%. On the whole, the service industry's introduction rate reached 56.2%, and the manufacturing industry's introduction rate also reached 46.7% (National Science & Technology Program Office for E-learning, 2008). However, while the diffusion of e-learning in Taiwan is rapidly progressing, motivated executives within organizations may pay more attention to their employees' usage of e-learning, which may lead to biases against the employees' acceptance of e-learning. Hence, one should realize this context that may threaten the validity of claims made by this study.

Data analysis

The data analysis process of this study followed a two-step approach for SEM method recommended by Anderson & Gerbing (1988). In the first step, confirmatory factor analysis (CFA) was used to develop the measurement model. In the second step, to explore the causal relationships among all constructs, the structural model for the research model depicted in Figure 3 was tested using SEM. A software program called Analysis of Moment Structures (AMOS), part of the Statistical Package for the Social Sciences (SPSS) software (Arbuckle, 2003), was used for the CFA and SEM. These procedures are detailed in the next section.

RESULTS

Descriptive characteristics of the respondents

To make the results generalizable, a sample of 328 useable responses was obtained from a variety of respondents with different backgrounds. Descriptive characteristics of the respondents are summarized below. Among the 328 respondents, 155 respondents (47.26%) were males, and 173 respondents (52.74%) were females. The distribution of age was approximately normal: under 20 (0.0%), 21–30 (28.05%), 31–40 (42.07%), 41–50 (24.39%), 51–60 (5.49%) and over 61 (0.0%). Educational levels were generally high. Respondents who had completed high school accounted for 3.05%, respondents who had completed college numbered 15.55%, respondents who had completed university numbered 51.22%, while respondents who had completed graduate school comprised 30.18% of the survey sample. The respondents identified themselves as top-level managers (2.13%), middle-level managers (7.93%), first-level managers (26.22%), professional employees (39.33%) and general employees (24.39%). Additionally, the respondents had an average of 8.02 years of work experience (SD = 3.89) in their field.

Measurement model

In this study, to assess the measurement model, three analyses were conducted. Firstly, squared multiple correlation (SMC) for each item, composite reliability and average variance extracted (AVE) for each construct were used in this study to test the construct reliability (Nunnally, 1978; Hair *et al*., 1998; Byrne, 2001; Holmes-Smith, 2001). The results of CFA show that the SMC values for all of the items are greater than 0.5, which indicates a good reliability level (Holmes-Smith, 2001). The values of composite reliability and AVE for all of the constructs exceed the minimum acceptable values of 0.7 and 0.5 (Nunnally, 1978; Hair *et al*., 1998; Holmes-Smith, 2001), indicating a good reliability level and subsequently yielding very consistent results. Hence, the results of CFA demonstrate an acceptable level of reliability for all of the constructs. The reports are listed in Table 2. Furthermore, the reliability coefficients of all constructs assessed by the Cronbach's α coefficient exceed the 0.7 cut-off value as recommended by Nunnally, (1978) and Hair *et al*. (1998). The results of reliability test are shown in Table 2.

Secondly, according to Anderson & Gerbing's (1988) rule, the results of CFA show that the *t*-value of every item exceeds the 1.96 value ($p < 0.05$), so the evidence of convergent validity is obtained as the items represent their constructs significantly. That is, the measurement model yields a good convergent validity. The reports are listed in Table 2. Furthermore, to test for discriminant validity, the procedure described by Fornell & Larcker (1981) was used in this study. The results of CFA show that the AVE of each construct is greater than the squared correlation for each pair of constructs, indicating that each construct is distinct (see Tables 2 and 3).

Thirdly, the most common rules used in performing the CFA for measurement model and testing the structural model include stipulating that the goodness-of-fit index (GFI) should be

Table 2. Results of confirmatory factor analysis, validity analysis, and reliability test

Construct item	Estimate	*t*-value	Standardized path coefficients	SMC	Composite reliability	AVE	Cronbach's α
CSE					0.89	0.74	0.86
CSE1	1	–*	0.84	0.70			
CSE2	0.96	13.04	0.81	0.66			
CSE3	0.96	12.88	0.81	0.65			
ISE					0.94	0.80	0.90
ISE1	1	–*	0.77	0.60			
ISE2	1.05	13.99	0.85	0.72			
ISE3	1.09	14.59	0.87	0.76			
ISE4	1.06	12.58	0.81	0.65			
CAB					0.84	0.64	0.83
CAB1	1	–*	0.71	0.51			
CAB2	1.27	18.30	0.87	0.75			
CAB3	1.16	18.17	0.78	0.60			
LGO					0.92	0.65	0.94
LGO1	1	–*	0.77	0.60			
LGO2	0.99	12.92	0.79	0.63			
LGO3	1.18	14.22	0.83	0.69			
LGO4	1.22	15.56	0.87	0.75			
LGO5	1.28	17.20	0.91	0.82			
LGO6	1.29	15.98	0.88	0.77			
SF					0.92	0.74	0.92
SF1	1	–*	0.77	0.59			
SF2	1.18	16.78	0.91	0.83			
SF3	1.12	16.79	0.91	0.83			
SF4	1.04	14.43	0.84	0.71			
SI					0.90	0.75	0.90
SI1	1	–*	0.85	0.72			
SI2	0.99	19.24	0.88	0.77			
SI3	0.98	18.61	0.87	0.75			
SR					0.93	0.82	0.86
SR1	1	–*	0.76	0.58			
SR2	0.98	20.97	0.78	0.61			
SR3	1.17	21.91	0.91	0.83			
CQ					0.91	0.77	0.91
CQ1	1	–*	0.69	0.53			
CQ2	1.33	14.28	0.97	0.89			
CQ3	1.28	14.35	0.94	0.84			
INI					0.87	0.68	0.85
INI1	1	–*	0.78	0.60			
INI2	1.15	20.46	0.75	0.57			
INI3	1.07	21.84	0.92	0.84			
EXI					0.95	0.86	0.96
EXI1	1	–*	0.90	0.81			
EXI2	0.99	13.46	0.94	0.89			
EXI3	1.10	17.38	0.98	0.95			

Table 2. Cont.

Construct item	Estimate	*t*-value	Standardized path coefficients	SMC	Composite reliability	AVE	Cronbach's α
NE					0.89	0.73	0.91
NE1	1	–*	0.87	0.75			
NE2	1.08	25.14	0.94	0.88			
NE3	0.96	19.64	0.85	0.72			
PEOU					0.86	0.62	0.84
PEOU1	1	–*	0.83	0.81			
PEOU2	0.98	21.34	0.73	0.66			
PEOU3	1.04	23.86	0.88	0.82			
PEOU4	0.91	16.10	0.69	0.59			
PU					0.92	0.75	0.93
PU1	1	–*	0.82	0.67			
PU2	1.10	20.68	0.91	0.83			
PU3	1.08	21.98	0.94	0.88			
PU4	1.02	17.86	0.86	0.74			
PE					0.80	0.58	0.81
PE1	1	–*	0.83	0.67			
PE2	1.21	11.35	0.71	0.56			
PE3	1.07	15.66	0.91	0.84			
ATU					0.92	0.80	0.92
ATU1	1	–*	0.88	0.77			
ATU2	1.11	24.58	0.91	0.83			
ATU3	1.12	22.05	0.88	0.77			
ITU					0.94	0.83	0.97
ITU1	1	–*	0.94	0.88			
ITU2	1.06	24.55	0.96	0.92			
ITU3	1.03	24.10	0.96	0.92			
AU					0.86	0.67	0.92
AU1	1	–*	0.92	0.84			
AU2	1.01	20.09	0.94	0.88			
AU3	0.90	15.30	0.83	0.69			
PP					0.92	0.79	0.95
PP1	1	–*	0.90	0.80			
PP2	1.05	22.91	0.95	0.91			
PP3	1.02	20.11	0.93	0.86			

*The loading was fixed.

SMC, squared multiple correlation; AVE, average variance extracted; CSE, computer self-efficacy; ISE, internet self-efficacy; CAB, cognitive absorption; LGO, learning goal orientation; SF, system functionality; SI, system interactivity; SR, system response; CQ, content quality; INI, interpersonal influence; EXI, external influence; NE, network externality; PEOU, perceived ease of use; PU, perceived usefulness; PE, perceived enjoyment; ATU, attitude towards use; ITU, intention to use; AU, actual usage; PP, perceived performance.

greater than 0.9, the adjusted goodness-of-fit index (AGFI) should be greater than 0.9, the normalized fit index (NFI) should be greater than 0.9, the comparative fit index (CFI) should be greater than 0.9, the root mean square error of approximation (RMSEA) should be less than 0.08, and the χ^2/df should be less than 3 (Bentler & Bonett, 1980; Bagozzi & Yi, 1988; Hair

Table 3. Discriminant validity for the measurement model

	Variance																	
Construct	CSE	ISE	CAB	LGO	SF	SI	SR	CQ	INI	EXI	NE	PEOU	PU	PE	ATU	ITU	AU	PP
CSE	*0.74*																	
ISE	0.38	*0.80*																
CAB	0.02	0.02	*0.64*															
LGO	0.05	0.01	0.04	*0.65*														
SF	0.01	0.02	0.02	0.34	*0.74*													
SI	0.04	0.05	0.01	0.14	0.27	*0.75*												
SR	0.09	0.05	0.02	0.07	0.04	0.05	*0.82*											
CQ	0.02	0.07	0.01	0.01	0.02	0.02	0.01	*0.77*										
INI	0.05	0.02	0.01	0.07	0.01	0.01	0.02	0.01	*0.68*									
EXI	0.04	0.02	0.06	0.01	0.06	0.02	0.01	0.03	0.01	*0.86*								
NE	0.01	0.01	0.01	0.21	0.33	0.46	0.06	0.01	0.02	0.06	*0.73*							
PEOU	0.22	0.19	0.18	0.02	0.27	0.38	0.01	0.01	0.03	0.02	0.40	*0.62*						
PU	0.02	0.01	0.20	0.02	0.34	0.46	0.01	0.16	0.14	0.18	0.03	0.44	*0.75*					
PE	0.03	0.01	0.06	0.19	0.25	0.45	0.14	0.01	0.03	0.01	0.02	0.34	0.45	*0.58*				
ATU	0.01	0.02	0.06	0.12	0.27	0.44	0.01	0.02	0.05	0.05	0.44	0.45	0.50	0.38	*0.80*			
ITU	0.04	0.01	0.04	0.14	0.26	0.29	0.01	0.04	0.02	0.06	0.28	0.36	0.36	0.33	0.36	*0.83*		
AU	0.02	0.02	0.03	0.08	0.16	0.19	0.01	0.01	0.01	0.09	0.22	0.19	0.21	0.15	0.25	0.40	*0.67*	
PP	0.01	0.02	0.03	0.18	0.27	0.31	0.04	0.01	0.01	0.03	0.26	0.35	0.40	0.38	0.36	0.44	0.36	*0.79*

Note: The italic values along the diagonal line are the AVE values for the constructs, and the other values are the squared correlations for each pair of constructs.

AVE, average variance extracted; CSE, computer self-efficacy; ISE, internet self-efficacy; CAB, cognitive absorption; LGO, learning goal orientation; SF, system functionality; SI, system interactivity; SR, system response; CQ, content quality; INI, interpersonal influence; EXI, external influence; NE, network externality; PEOU, perceived ease of use; PU, perceived usefulness; PE, perceived enjoyment; ATU, attitude towards use; ITU, intention to use; AU, actual usage; PP, perceived performance.

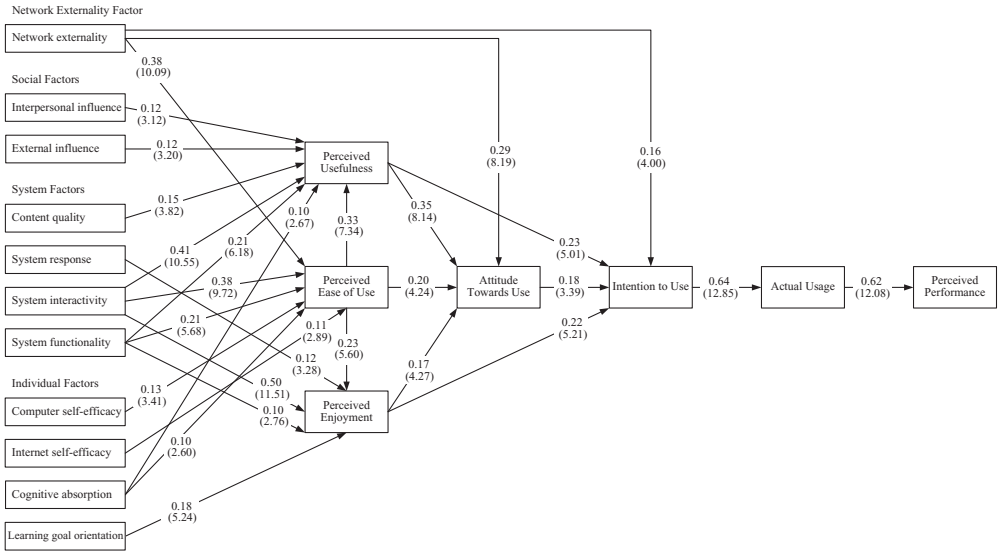

Figure 4. Results of structural modelling analysis.
Note: Standardized path coefficients are reported (*t*-values in parentheses).

et al., 1998; Byrne, 2001). The overall fit indices of measurement model are $\chi^2 = 2763.80$, df = 1616, $\chi^2/df = 1.71$, $p < 0.001$, GFI = 0.93, AGFI = 0.91, NFI = 0.96, CFI = 0.97, and RMSEA = 0.042. The results of CFA show that the indices are over their respective common acceptance levels. Thus, the proposed model generally fits the sample data well.

Structural model

The following step is to test the structural model for the research model depicted in Figure 3. The overall fit indices for the structural model are stated as follows: $\chi^2 = 3481.63$, df = 1731, $\chi^2/df = 2.01$, $p < 0.001$, GFI = 0.92, AGFI = 0.90, NFI = 0.95, CFI = 0.96, and RMSEA = 0.054. Based on the rules of prior studies (e.g. Bentler & Bonett, 1980; Bagozzi & Yi, 1988; Hair *et al*., 1998; Byrne, 2001), the fit indices for this structural model are quite acceptable, and these values indicate that the model fits the data reasonably well. The results of structural modelling analysis are shown in Figure 4.

Hypothesis testing

Properties of the causal paths, including standardized path coefficients (β) and *t*-values, are shown in Figure 4. This study now explains each segment in the light of each empirical finding with the corresponding hypothesis testing result.

Antecedents to user beliefs

As for individual factors, the effect of CSE on PEOU is significant ($\beta = 0.13$, $p < 0.05$), but the effect of CSE on PU is insignificant ($\beta = 0.02$, $p > 0.05$). Hence, H1a-1 is supported, but H1a-2 is rejected. The effect of ISE on PEOU is significant ($\beta = 0.11$, $p < 0.05$), but the effect of ISE on PU is insignificant ($\beta = 0.004$, $p > 0.05$). Hence, H1b-1 is supported, but H1b-2 is rejected. The effects of CAB on PEOU and PU are significant ($\beta = 0.10$ and 0.10, respectively; $p < 0.05$). Hence, H1c-1 and H1c-2 are supported. The effect of LGO on PE is significant ($\beta = 0.18$, $p < 0.05$). Hence, H1d is supported.

With regard to system factors, the effects of SF on PEOU, PU and PE are significant ($\beta = 0.21$, 0.21 and 0.10, respectively; $p < 0.05$). Hence, H2a-1, H2a-2 and H2a-3 are supported. The effects of SI on PEOU, PU and PE are significant ($\beta = 0.38$, 0.41 and 0.50, respectively; $p < 0.05$). Hence, H2b-1, H2b-2 and H2b-3 are supported. The effect of SR on PE is significant ($\beta = 0.12$, $p < 0.05$), but the effects of SR on PEOU and PU are insignificant ($\beta = 0.03$ and 0.05, respectively; $p > 0.05$). Hence, H2c-3 is supported, but H2c-1 and H2c-2 are rejected. The effect of CQ on PU is significant ($\beta = 0.15$, $p < 0.05$). Hence, H2d is supported.

As far as social factors are concerned, the effects of INI and EXI on PU are significant ($\beta = 0.12$ and 0.12, respectively; $p < 0.05$). Hence, H3a-1 and H3b-1 are supported. The effects of INI and EXI on ATU are insignificant ($\beta = 0.04$ and 0.01, respectively; $p > 0.05$). Hence, H3a-2 and H3b-2 are rejected. The effects of INI and EXI on ITU are insignificant ($\beta = 0.01$ and 0.02, respectively; $p > 0.05$). Hence, H3a-3 and H3b-3 are rejected.

As to network externality factor, the effects of NE on PEOU, ATU and ITU are significant ($\beta = 0.38$, 0.29 and 0.16, respectively; $p < 0.05$), but the effect of NE on PU is insignificant ($\beta = 0.003$, $p > 0.05$). Hence, H4a-1, H4a-3 and H4a-4 are supported, but H4a-2 is rejected.

Synthetically analyzing the results of antecedents to user beliefs, firstly, three types of factors, individual factor (e.g. CAB), system factors (e.g. SF, SI, CQ) and social factors (e.g. INI, EXI), positively make the direct impacts on users' PU in affecting their acceptance of the e-learning system. Secondly, three types of factors, individual factors (e.g. CSE, ISE, CAB), system factors (e.g. SF, SI) and network externality factor (e.g. NE), positively make the direct impacts on users' PEOU in affecting their acceptance of the e-learning system. Thirdly, two types of factors, individual factor (e.g. LGO) and system factors (e.g. SF, SI, SR), positively make the direct impacts on users' PE in affecting their acceptance of the e-learning system. Besides, NE positively directly affects users' attitude and intention to use the e-learning system.

User beliefs and technology acceptance

The effects of PEOU on PU and PE are significant ($\beta = 0.33$ and 0.23, respectively; $p < 0.05$). Hence, H5 and H6 are supported. The effects of PU, PEOU and PE on ATU are significant ($\beta = 0.35$, 0.20 and 0.17, respectively; $p < 0.05$). Hence, H7, H8 and H9 are supported. The effects of PU, ATU and PE on ITU are significant ($\beta = 0.23$, 0.18 and 0.22, respectively; $p < 0.05$). Hence, H10, H11 and H12 are supported. The effect of ITU on AU is significant ($\beta = 0.64$,

$p < 0.05$). Hence, H13 is supported. Obviously, users' PEOU, PU and PE, respectively, exhibit positively strong impacts on their attitude and intention to use the e-learning system, and then, users' intention to use the e-learning system directly leads to their AU of the system.

Actual usage and perceived performance

In regard to the relationship between AU and PP, the effect of AU on PP is positively significant ($\beta = 0.62$, $p < 0.05$). Hence, H14 is supported. That is, users' AU of the e-learning system can enhance their PP.

DISCUSSION AND IMPLICATIONS

The objectives of this study are to enhance the understanding of the antecedents of e-learning acceptance and its impact on employees' PP, and thus offer useful and practical implications for the organizations wishing to successfully implement the e-learning system and realize performance gains. This study now discusses each segment in the light of the empirical results with corresponding implications.

Antecedents to user beliefs

In this study, four types of determinants, individual factors, system factors, social factors and network externality factor, as external variables of the extended TAM have been examined. The results and implications for each type of determinants are discussed below.

Firstly, this study showed that individual factors had significant effects on user beliefs of the e-learning system. CSE and ISE were found to positively affect PEOU. The results just support prior research (e.g. Ong *et al*., 2004; Lee, 2006; Ong & Lai, 2006; Roca *et al*., 2006). Obviously, individuals' confidence in their computer-related and internet-related knowledge and abilities may play important roles in affecting their judgment of the ease or difficulty of the acceptance and usage of the e-learning system (Lee, 2006; Roca *et al*., 2006). CAB was found to positively affect PU and PEOU, respectively. As advocated by prior research, when individuals' attentions are focused on the e-learning system, the level of cognitive burden is reduced; that is, enjoyable learning activities may be less taxing (Saadé & Bahli, 2005; Shang *et al*., 2005; Roca *et al*., 2006). Hence, when individuals experience the total engagement with the e-learning system and enjoy the pleasure aspects of the interaction with the e-learning system as long as possible, they can perceive the e-learning system as more useful and easy-to-use (Saadé & Bahli, 2005; Roca *et al*., 2006). LGO was found to positively affect PE. This result reveals that learning goal-oriented employees can perceive the e-learning system as more enjoyable, and they may further show a strong desire for e-learning acceptance and usage. The main reason why such employees can increase their interest in learning via the e-learning system is because the executives focus on employees' learning goals to design a training program that will satisfy employees' learning needs (Chatzoglou *et al*., 2009). This

result implicates that executives should outline the employees' learning goals to design a suitable and enjoyable learning program via the e-learning system.

Secondly, this study provided better support for the effects of system factors on user beliefs of the e-learning system. SF and SI were found to positively affect PEOU, PU and PE, respectively, SR was found to positively affect PE, and CQ was found to positively affect PU. The results are consistent with prior research (e.g. Lee, 2006; Pituch & Lee, 2006). The results reveal three implications. Firstly, the functionality and interactivity of the e-learning system can be beneficial for learners to cultivate the interest in learning; hence, learners can not only perceive that the e-learning system is easier to use and more useful, but also show greater intention to use the e-learning system for additional learning. The results implicate that system designers should be cautious about the compatibility between system features and users' requirements to enhance users' adoption of the e-learning system (Pituch & Lee, 2006). Secondly, learners who are sensitive about the system quality may usually think the e-learning system more enjoying because of the functionality, interactivity and response time, such as up-to-date, personalized services and timely (Pituch & Lee, 2006; Shin, 2007). However, if there is more interactivity and functionality than the learners can take, the e-learning system may be unable to keep learners' attention on learning for a long time. Hence, system designers should be cautious about the level of the interactivity and functionality to allow for the constraints of users' neural bandwidth and skills (Hoffman & Novak, 1996; Chang & Wang, 2008). Thirdly, when learners perceive that instructors or course managers would spend more time managing the content and sharing information on the e-learning system, they may feel the content on the system is more abundant and updated regularly, and they will further find the content on the e-learning system is more useful. Besides, based on the view of Lee (2006), this study focuses on the impact of CQ on PU in the e-learning context, and the construct of CQ is formed with content richness and update regularity. However, it is particularly noteworthy that incorporation of enjoyment into teaching content presents the greatest challenge to instructors who do not have sufficient computer skills (Lee *et al*., 2009).

Thirdly, social factors were found to significantly affect user beliefs of the e-learning system. INI and EXI were found to positively affect employees' attitude towards using the e-learning system and intention to use the system only indirectly via PU. The results reveal that employees internalize the opinions of their important referents. However, The results further implicate that such internalization is a gradual process, the longer an individual works with a system, the less salient subjective norm becomes, thus internalization can take place regardless of whether system adoption is mandatory or voluntary (Van Raaij & Schepers, 2008). That is to say, the opinions of users' important referents will gradually become part of their belief structure (Venkatesh & Davis, 2000; Van Raaij & Schepers, 2008).

Fourthly, NE was found to positively affect PEOU, ATU and ITU, respectively. The results are consistent with prior research (e.g. Hsu & Lu, 2004; Lee, 2006). The results reveal that users' perception of the e-learning system adoption by other users can create bandwagon effects (Lee, 2006). Bandwagon effect denotes that decision-makers tend to be influenced by the behaviour or expected behaviour of similar decision-makers (Van den Ende *et al*., 2003, p. 275). Further speaking, decision-makers adopt innovations, not because of any rational

efficiency assessment of the practice, but because of external pressure caused by the similar decision-makers that have already adopted or are considering adopting the innovations (Tolbert & Zucker, 1983; Frohlich & Westbrook, 2002). Thus, the perception of critical mass will be rapidly strengthened as more users participate in such network activities (Hsu & Lu, 2004). The results implicate that executives should be aware of the benefits for the phenomenon of NE and further utilize such phenomenon to entice more employees within organizations to try out the e-learning system.

User beliefs and technology acceptance

In this study, PEOU, PU and PE were found to, respectively, exhibit positively strong impacts on employees' attitude and intention to use the e-learning system. Simultaneously, PEOU was found to affect employees' attitude and intention to use the e-learning system indirectly through PU and PE. Furthermore, employees' attitude towards using the e-learning system was found to have a positive impact on their intention to use the system, and their intention to use the e-learning system positively affected AU of the system. Obviously, employees use the e-learning system mainly because they perceive the e-learning system to be more useful to their job tasks and secondarily because the e-learning system is enjoyable and easy-to-use. Briefly, extrinsic and intrinsic motivators play important roles in affecting employees' attitude and intention to use the e-learning system. The results implicate that system designers should reflect intrinsic as well as extrinsic motivation issues in user interface design to increase the users' involvement (Chang & Wang, 2008), thus instructors should use such system features to make learners' learning through the e-learning system easy, useful and enjoyable (Lee *et al*., 2005; Lee *et al*., 2009).

Actual usage and perceived performance

In this study, employees' AU of the e-learning system was found to have a significantly positive impact on their PP. The result is consistent with the implication that the increased system utilization will lead to positive task performance impacts (Goodhue & Thompson, 1995; Igbaria & Tan, 1997; Ahearne *et al*., 2004). However, it is particularly noteworthy that how to achieve and maintain a particular level of the system usage to optimize employees' PP (Ahearne *et al*., 2004). Obviously, if organizations can provide more relevant training content and learning materials to meet employees' requirements, the low complexity, high usefulness and high enjoyment of the e-learning system may assist employees in saving time and acquiring benefits from learning activities, further enhance their acceptance and usage of the e-learning system and subsequently boost their PP.

CONCLUSIONS

Research conclusions

According to established theories and empirical studies, this study proposes the research model that based on the extended TAM to demonstrate the antecedents for the acceptance of

the e-learning system and its impact on employees' PP. The main research results are summarized as follows. Synthetically speaking, PU, PEOU, PE and network externality factor are the direct predictors of employees' acceptance of the e-learning system. Individual factors and system factors affect employees' acceptance of the e-learning system indirectly via PU, PEOU and PE, social factors affect employees' acceptance of the e-learning system indirectly via PU, and network externality factor also affects employees' acceptance of the e-learning system indirectly via PEOU. Further, employees' acceptance of the e-learning system provides a detailed account of the key forces underpinning decision-making with regard to the system usage, and this situation can lead to the enhancement of their PP.

Research contributions

Based on the extended TAM, this study further uses the research model and empirical results to help practitioners and researchers better understand why employees tend to use the e-learning system, predict how employees will respond to the e-learning system, and realize what relationship between employees' AU of the e-learning system and their PP. Hence, a better understanding and implementation of the e-learning system will effectively assist organizations in creating business values and enhancing competitive advantages.

The main contributions of this study are threefold. Firstly, previous studies have focused on extrinsic motivators such as PEOU and PU (Agarwal & Karahanna, 2000; Lee *et al*., 2005). This study is one of the few attempts to adopt the extrinsic and intrinsic motivational perspectives to explain employees' acceptance and usage of the e-learning system. This study incorporates the intrinsic motivator (PE) along with conventional extrinsic motivators (PEOU and PU) into its analysis of e-learning acceptance and usage for a more robust analysis. Secondly, four types of determinants, individual factors, system factors, social factors and network externality factor, make the great impacts on user beliefs in affecting e-learning acceptance and usage. Collectively they have greater explanatory power than any single group of determinants in describing the principal antecedents of user beliefs in affecting e-learning acceptance and usage. Thirdly, to date, there is a dearth of knowledge regarding the impact of e-learning acceptance and usage on individual PP. Hence, this study examines and validates the positively direct impact of employees' usage of the e-learning system on their PP. Briefly, this study proposes a well-rounded theoretical model (see Figure 3) that may act as an integrated base for the research of e-learning acceptance and usage, and this study's results for e-learning acceptance and usage within organizations are justified both pragmatically and theoretically.

Suggestions for practice

Executives within organizations should use this study's results to enhance their understanding of what makes employees use the e-learning system for better performance. In this study, the main suggestions for practice are fivefold.

Firstly, some employees lack confidence in their ability to apply computer or internet skills, thus the e-learning system should include mechanisms for reduction of their anxiety. This study suggests that executives and system designers should try to make learning through the e-learning system easy. They may choose user-friendly software (Quinn, 1995) and further create a low stress atmosphere without time pressure to reduce employees' anxiety for computers or the internet.

Secondly, in order to cultivate learning-oriented employees, this study suggests that executives should create an environment that is beneficial for their employees to cultivate employees' enjoyment in learning. Further speaking, executives and instructors may design employee-centered programs taking the employees' knowledge level and style into account to increase employees' interest in learning via the e-learning system (Chatzoglou *et al*., 2009). Besides, executives and instructors may also make good use of creative games and heuristic methods to enhance employees' interest in learning via the e-learning system.

Thirdly, this study suggests that executives, instructors and system designers should try to make employees' learning through the e-learning system useful and enjoyable. Instructors may make full use of the rich multimedia capability to facilitate employees understanding, memory and absorption of the course content (Lee *et al*., 2005; Lee, 2006). However, system designers should simultaneously take the bandwidth of the infrastructure that delivers the interactivity into account to ensure that access is not slowed down by the increased interactivity (Chang & Wang, 2008). Furthermore, instructors may make use of online chat rooms and discussion boards to interact with learners to make them feel connected to others within a virtual learning environment (Lee *et al*., 2005).

Fourthly, this study suggests that executives should realize and notice the effects of social influences and NE. Essentially, the two phenomena mentioned above are just the typical drivers of bandwagon effects among users. In general, if employees perceive that their important internal or external referents think they should use the e-learning system, they will believe that the system must be useful in its purpose, thus this phenomenon is the so-called social influence effect. Executives may utilize the effects of social influences, such as interpersonal communication, expert opinions, news reports and mass media reports, to create the positive feedback loop for employees' perception of usefulness of the e-learning system, and to further facilitate employees' attitude towards using the system and intention to use the system. Hence, internalization will take place regardless of whether users' acceptance of the e-learning system is mandatory or voluntary (Van Raaij & Schepers, 2008). Moreover, when some employees use the e-learning system intensely, their interactions with other employees will cause more to join in. Such phenomenon is the so-called network externality effect. In order to develop the bandwagon effects, executives may accelerate the effects of network externalities to achieve the perception of critical mass (Hsu & Lu, 2004). That is, executives may strive to attract opinion leaders to affect others to use the e-learning system and facilitate interpersonal interactions between instructors and employees to create more learning organizations in which business value can be created by enhancing the employees' interest in e-learning via the e-learning system.

Fifthly, it is important to achieve and maintain a particular level of the system usage to optimize prime task performance (Ahearne *et al*., 2004). Hence, this study suggests that executives should keep track of employees' usage of the e-learning system, update the system to provide valuable training content and learning materials, and incorporate changes to the system that may be in use. Besides, to achieve the administrative goals, this study suggests that executives should regard the employees as the internal customers, whose needs and beliefs must be grasped, managed and eventually satisfied, thus the enhancements of employees' PP are to be realized.

Limitations and suggestions for further research

There are five main limitations and suggestions for future research in this study. This study thinks these following suggestions will be worth future efforts in this field, and these will provide more insights in the field of management. Firstly, because this study was limited to the financial sector only, given this study's limited scope, caution must be exercised in generalizing from this study's sample to firms in other sectors. Secondly, this study's results were obtained within the context of one type of the e-learning system (i.e. the LMS). Future research should need further validation across other systems. Thirdly, caution must be taken in generalizing the results due to the fact that respondents in this study could be from different cultural background (i.e. national culture, organizational culture, etc.) with different cultural beliefs influencing their perceptions, attitudes and intentions. Future research may include the interactions of national and organizational culture as hypotheses to the research model. Fourthly, respondents might usually display different anxious feelings or playful reactions for the same e-learning system, depending on where they used the system. Future research in e-learning acceptance and usage may examine the different set of mechanisms involve between work and home usage settings. Fifthly, this study was a cross-sectional analysis and might not draw a complete picture of the course of e-learning acceptance and usage over time. It is important to understand how the influences of related elements will change over time with increasing experience using the e-learning system. Future research should use longitudinal analysis or offer in-depth multiple-case studies of the evolution of e-learning acceptance and usage over time.

REFERENCES

Agarwal, R. & Karahanna, E. (2000) Time flies when you're having fun: cognitive absorption and beliefs about information technology usage. *MIS Quarterly*, **24**, 665–694.

Ahearne, M., Srinivasan, N. & Weinstein, L. (2004) Effect of technology on sales performance: progressing from technology acceptance to technology usage and consequence. *Journal of Personal Selling & Sales Management*, **24**, 297–310.

Ajzen, I. & Fishbein, M. (1980) *Understanding Attitudes and Predicting Social Behavior*. Prentice-Hall, Englewood Cliffs, NJ, USA.

Anderson, J.C. & Gerbing, D.W. (1988) Structural equation modeling in practice: a review and recommended two-step approach. *Psychological Bulletin*, **103**, 411–423.

Arbaugh, J.B. (2000) Virtual classroom characteristics and student satisfaction with internet-based MBA. *Journal of Management Education*, **24**, 32–54.

Arbuckle, J.L. (2003) *Amos 5.0: Update to the Amos User's Guide*. Smallwaters Corporation, Chicago, IL, USA.

Bagozzi, R.P. & Yi, Y. (1988) On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, **16**, 74–94.

Bailey, J.E. & Pearson, S.W. (1983) Development of a tool for measuring and analyzing computer user satisfaction. *Management Science*, **29**, 530–545.

Bandura, A. (1977) Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review*, **84**, 191–215.

Baylari, A. & Montazer, G.A. (2009) Design a personalized e-learning system based on item response theory and artificial neural network approach. *Expert Systems with Applications*, **36**, 8013–8021.

Bentler, P.M. & Bonett, D.G. (1980) Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, **88**, 588–606.

Bhattacherjee, A. (2000) Acceptance of Internet applications services: the case of electronic brokerages. *IEEE Transactions on Systems, Man, and Cybernetics-Part A: Systems and Humans*, **30**, 411–420.

Bhattacherjee, A. (2001) An empirical analysis of the antecedents of electronic commerce service continuance. *Decision Support Systems*, **32**, 201–214.

Brett, J.F. & VandeWalle, D. (1999) Goal orientation and goal content as predictors of performance in a training program. *Journal of Applied Psychology*, **84**, 863–873.

Button, S.B., Mathieu, J.E. & Zajac, D.M. (1996) Goal orientation in organizational research: a conceptual and empirical foundation. *Organizational Behavior and Human Decision Processes*, **67**, 26–48.

Byrne, B.M. (2001) *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming*. Lawrence Erlbaum Associates Publishers, Mahwah, NJ, USA.

Chang, H.H. & Wang, I.C. (2008) An investigation of user communication behavior in computer mediated environments. *Computers in Human Behavior*, **24**, 2336–2356.

Chatzoglou, P.D., Sarigiannidis, L., Vraimaki, E. & Diamantidis, A. (2009) Investigating Greek employees' intention to use web-based training. *Computers & Education*, **53**, 877–889.

Chau, P.Y.K. (1996) An empirical assessment of a modified technology acceptance model. *Journal of Management Information Systems*, **13**, 185–204.

Chun, S.Y. & Hahn, M. (2007) Network externality and future usage of Internet services. *Internet Research*, **17**, 156–168.

Code, J.R., MacAllister, K., Gress, C.L.Z. & Nesbit, J.C. (2006) Self-regulated learning, motivation and goal theory: implications for instructional design and e-learning. *Proceedings of the Sixth IEEE International Conference on Advanced Learning Technologies (ICALT'06)*, pp. 872–874, Kerkrade, The Netherlands.

Compeau, D.R. & Higgins, C.A. (1995) Computer self-efficacy: development of a measure and initial test. *MIS Quarterly*, **19**, 189–211.

Davis, F.D. (1989) Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, **13**, 319–340.

Davis, F.D., Bagozzi, R.P. & Warshaw, P.R. (1989) User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, **35**, 982–1003.

Davis, F.D., Bagozzi, R.P. & Warshaw, P.R. (1992) Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology*, **22**, 1111–1132.

Deci, E.L. & Ryan, R.M. (2000) The 'what' and the 'why' of goal pursuits: human needs and the self-determination of behavior. *Psychological Inquiry*, **11**, 227–268.

DeRouin, R.E., Fritzsche, B.A. & Salas, E. (2005) E-learning in organizations. *Journal of Management*, **31**, 920–940.

Donnelly, R. (2010) Harmonizing technology with interaction in blended problem-based learning. *Computers & Education*, **54**, 350–359.

Dweck, C.S. (1986) Motivational processes affecting learning. *American Psychologist*, **41**, 1040–1048.

Dweck, C.S. & Leggett, E.L. (1988) A social cognitive approach to motivation and personality. *Psychological Review*, **95**, 256–273.

EL-Deghaidy, H. & Nouby, A. (2008) Effectiveness of a blended e-learning cooperative approach in an Egyptian teacher education programme. *Computers & Education*, **51**, 988–1006.

Ely, K., Sitzmann, T. & Falkiewicz, C. (2009) The influence of goal orientation dimensions on time to train in a self-paced training environment. *Learning and Individual Differences*, **19**, 146–150.

Engelbrecht, E. (2005) Adapting to changing expectations: postgraduate students' experience of an e-learning tax program. *Computers & Education*, **45**, 217–229.

Farrell, J. & Saloner, G. (1985) Standardization, compatibility, and innovation. *RAND Journal of Economics*, **16**, 70–83.

Fishbein, M. & Ajzen, I. (1975) *Belief, Attitude, Intentions and Behavior: An Introduction to Theory and Research*. Addison-Wesley, Reading, MA, USA.

Fisher, C.D. (1978) The effects of personal control, competence, and extrinsic reward systems on intrinsic motivation. *Organizational Behavior and Human Performance*, **21**, 273–288.

Fornell, C. & Larcker, D.F. (1981) Evaluating structural equation models with unobservable and measurement error. *Journal of Marketing Research*, **18**, 39–50.

Frohlich, M.T. & Westbrook, R. (2002) Demand chain management in manufacturing and services: web-based integration, drivers and performance. *Journal of Operations Management*, **20**, 729–745.

Godshalk, V.M. & Sosik, J.J. (2003) Aiming for career success: the role of learning goal orientation in mentoring relationships. *Journal of Vocational Behavior*, **63**, 417–437.

Goodhue, D.L. & Thompson, R.L. (1995) Task-technology fit and individual performance. *MIS Quarterly*, **19**, 213–236.

Ha, I., Yoon, Y. & Choi, M. (2007) Determinants of adoption of mobile games under mobile broadband wireless access environment. *Information & Management*, **44**, 276–286.

Hair, J.F., Anderson, R.E., Tatham, R.L. & Black, W.C. (1998) *Multivariate Data Analysis with Readings*, 5th edn. Prentice-Hall, Englewood Cliffs, NJ, USA.

Hoffman, D.L. & Novak, T.P. (1996) Marketing in hypermedia computer-mediated environments: conceptual foundations. *Journal of Marketing*, **60**, 50–69.

Holmes-Smith, P. (2001) *Introduction to Structural Equation Modeling Using LISREL*. ACSPRI-Winter Training Program, Perth, Western Australia.

Hsu, M.-H. & Chiu, C.-M. (2004) Internet self-efficacy and electronic service acceptance. *Decision Support Systems*, **38**, 369–381.

Hsu, C.-L. & Lu, H.-P. (2004) Why do people play on-line games? An extended TAM with social influences and flow experience. *Information & Management*, **41**, 853–868.

Hu, P.J.-H., Clark, T.H.K. & Ma, W.W. (2003) Examining technology acceptance by school teachers: a longitudinal study. *Information & Management*, **41**, 227–241.

Huang, Y.-M., Kuo, Y.-H., Lin, Y.-T. & Cheng, S.-C. (2008) Toward interactive mobile synchronous learning environment with context-awareness service. *Computers & Education*, **51**, 1205–1226.

Igbaria, M. & Tan, M. (1997) The consequences of information technology acceptance on subsequent individual performance. *Information & Management*, **32**, 113–121.

Igbaria, M., Iivari, J. & Maragahh, H. (1995) Why do individuals use computer technology? A Finnish case study. *Information & Management*, **29**, 227–238.

Ismail, J. (2001) The design of an e-learning system: beyond the hype. *The Internet and Higher Education*, **4**, 329–336.

Kanfer, R. & Heggestad, E.D. (1997) Motivational traits and skills: a person centered approach to work motivation. In: *Research in Organizational Behaviour*, Vol. 19, Straw, B.M. & Cummings, L.L. (eds), pp. 1–56. JAI Press, Greenwich, CT, USA.

Katz, M.L. & Shapiro, C. (1985) Network externalities, competition, and compatibility. *The American Economic Review*, **75**, 424–440.

Kelly, T. & Bauer, D. (2004) Managing intellectual capital via e-learning at Cisco. In: *Handbook on Knowledge Management 2: Knowledge Directions*, Holsapple, C. (ed.), pp. 511–532. Springer, Berlin, Germany.

Kim, T.G., Lee, J.H. & Law, R. (2008) An empirical examination of the acceptance behaviour of hotel front office systems: an extended technology acceptance model. *Tourism Management*, **29**, 500–513.

Kim, B.G., Park, S.C. & Lee, K.J. (2007) A structural equation modeling of the Internet acceptance in Korea. *Electronic Commerce Research and Applications*, **6**, 425–432.

King, W.R. & He, J. (2006) A meta-analysis of the technology acceptance model. *Information & Management*, **43**, 740–755.

Lee, Y.-C. (2006) An empirical investigation into factors influencing the adoption of an e-learning system. *Online Information Review*, **30**, 517–541.

Lee, Y.-C. (2008) The role of perceived resources in online learning adoption. *Computers & Education*, **50**, 1423–1438.

Lee, M.-C. (2010) Explaining and predicting users' continuance intention toward e-learning: an extension of the expectation–confirmation model. *Computers & Education*, **54**, 506–516.

Lee, H.-Y., Ahn, H. & Han, I. (2007) VCR: virtual community recommender using the technology acceptance model and the user's needs type. *Expert Systems with Applications*, **33**, 984–995.

Lee, M.K.O., Cheung, C.M.K. & Chen, Z. (2005) Acceptance of Internet-based learning medium: the role of extrinsic and intrinsic motivation. *Information & Management*, **42**, 1095–1104.

Lee, B.-C., Yoon, J.-O. & Lee, I. (2009) Learners' acceptance of e-learning in South Korea: theories and results. *Computers & Education*, **53**, 1320–1329.

Liaw, S.-S., Chen, G.-D. & Huang, H.-M. (2008) Users' attitudes toward Web-based collaborative learning systems for knowledge management. *Computers & Education*, **50**, 950–961.

Liu, S.-H., Liao, H.-L. & Pratt, J.A. (2009) Impact of media richness and flow on e-learning technology acceptance. *Computers & Education*, **52**, 599–607.

Martyn, M. (2003) The hybrid online model: good practice. *EDUCAUSE Quarterly*, **26**, 18–23.

Mathieson, K. (1991) Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior. *Information Systems Research*, **2**, 173–191.

McGill, T.J. & Klobas, J.E. (2009) A task–technology fit view of learning management system impact. *Computers & Education*, **52**, 496–508.

Mullen, M.R. (1995) Diagnosing measurement equivalence in cross-national research. *Journal of International Business Studies*, **26**, 573–596.

National Science & Technology Program Office for E-learning (2008) *2008 E-Learning in Taiwan: The Vision and Achievements*. Industrial Development Bureau, Ministry of Economic Affairs, Taipei, Taiwan.

Nault, B. & Dexter, A. (1994) Adoption, transfers, and incentives in a franchise network with positive externalities. *Marketing Science*, **13**, 412–423.

Ndubisi, N.O. (2006) Factors of online learning adoption: a comparative juxtaposition of the theory of planned behaviour and the technology acceptance model. *International Journal on E-Learning*, **5**, 571–591.

Ngai, E.W.T., Poon, J.K.L. & Chan, Y.H.C. (2007) Empirical examination of the adoption of WebCT using TAM. *Computers & Education*, **48**, 250–267.

Nunnally, J.C. (1978) *Psychometric Theory*, 2nd edn. McGraw-Hill, New York, NY, USA.

Ong, C.-S. & Lai, J.-Y. (2006) Gender differences in perceptions and relationships among dominants of e-learning acceptance. *Computers in Human Behavior*, **22**, 816–829.

Ong, C.-S., Lai, J.-Y. & Wang, Y.-S. (2004) Factors affecting engineers' acceptance of asynchronous e-learning systems in high-tech companies. *Information & Management*, **41**, 795–804.

Palloff, R.M. & Pratt, K. (1999) *Building Learning Communities in Cyberspace: Effective Strategies for the Online Classroom*. Jossey-Bass Publishers, San Francisco, CA, USA.

Parameswaran, R. & Yaprak, A. (1987) A cross-national comparison of consumer research measures. *Journal of International Business Studies*, **18**, 35–49.

Pituch, K.A. & Lee, Y.-K. (2006) The influence of system characteristics on e-learning use. *Computers & Education*, **47**, 222–244.

Quinn, B. (1995) Reducing stressful aspects of information technology in public services. *Public and Access Services Quarterly*, **1**, 1–34.

Roca, J.C., Chiu, C.-M. & Martínez, F.J. (2006) Understanding e-learning continuance intention: an extension of the technology acceptance model. *International Journal of Human-Computer Studies*, **64**, 683–696.

Roca, J.C. & Gagné, M. (2008) Understanding e-learning continuance intention in the workplace: a self-determination theory perspective. *Computers in Human Behavior*, **24**, 1585–1604.

Ryan, R.M. & Deci, E.L. (2000) Intrinsic and extrinsic motivations: classic definitions and new directions. *Contemporary Educational Psychology*, **25**, 54–67.

Saadé, R. & Bahli, B. (2005) The impact of cognitive absorption on perceived usefulness and perceived ease of use in on-line learning: an extension of the technology acceptance model. *Information & Management*, **42**, 317–327.

Schepers, J. & Wetzels, M. (2007) A meta-analysis of the technology acceptance model: investigating subjective norm and moderation effects. *Information & Management*, **44**, 90–103.

Shang, R.-A., Chen, Y.-C. & Shen, L. (2005) Extrinsic versus intrinsic motivations for consumers to shop on-line. *Information & Management*, **42**, 401–413.

Shih, H.-P. (2004) Extended technology acceptance model of Internet utilization behavior. *Information & Management*, **41**, 719–729.

Shin, D.-H. (2007) User acceptance of mobile Internet: implication for convergence technologies. *Interacting with Computers*, **19**, 472–483.

Sideridis, G.D. (2006) Goal orientations and strong oughts: adaptive or maladaptive forms of motivation for students with and without suspected learning disabilities? *Learning and Individual Differences*, **16**, 61–77.

Sperber, A.D., Devellis, R.F. & Boehlecke, B. (1994) Cross-cultural translation: methodology and validation. *Journal of Cross-Cultural Psychology*, **25**, 501–524.

Stoel, L. & Lee, K.H. (2003) Modeling the effect of experience on student acceptance of Web-based courseware. *Internet Research*, **13**, 364–374.

Taylor, S. & Todd, P.A. (1995) Assessing IT usage: the role of prior experience. *MIS Quarterly*, **19**, 561–570.

Teo, T.S.H., Lim, V.K.G. & Lai, R.Y.C. (1999) Intrinsic and extrinsic motivation in Internet usage. *Omega*, **27**, 25–37.

Tolbert, P.S. & Zucker, L.G. (1983) Institutional sources of change in the formal structure of organizations: the diffusion of civil service reform 1880–1935. *Administration Science Quarterly*, **28**, 22–39.

Triandis, H.C. (1980) Values, attitudes, and interpersonal behavior. In: *Nebraska Symposium on Motivation 1979*, Howe, H.E. & Page, M. (eds), pp. 195–259. University of Nebraska Press, Lincoln, NE, USA.

Vallerand, J.R. (1997) Towards a hierarchical model of intrinsic and extrinsic motivation. *Advances in Experimental Social Psychology*, **29**, 271–374.

Van den Ende, J., Wijnberg, N., Vogels, R. & Kerstens, M. (2003) Organizing innovative projects to interact with market dynamics: a coevolutionary approach. *European Management Journal*, **21**, 273–284.

Van der Heijden, H. (2004) User acceptance of hedonic information systems. *MIS Quarterly*, **28**, 695–704.

Van Raaij, E.M. & Schepers, J.J.L. (2008) The acceptance and use of a virtual learning environment in China. *Computers & Education*, **50**, 838–852.

Venkatesh, V. (2006) Where to go from here? Thoughts on future directions for research on individual-level technology adoption with a focus on decision making. *Decision Sciences*, **37**, 497–518.

Venkatesh, V. & Davis, F.D. (2000) A theoretical extension of the technology acceptance model: four longitudinal field studies. *Management Science*, **46**, 186–204.

Wang, E. & Seidmann, G. (1995) Electronic data interchange: competitive externalities and strategic implementation policies. *Management Science*, **41**, 401–418.

Wang, Y.-S., Wang, H.-Y. & Shee, D.Y. (2007) Measuring e-learning systems success in an organizational context: scale development and validation. *Computers in Human Behavior*, **23**, 1792–1808.

Welsh, E.T., Wanberg, C.R., Brown, K.G. & Simmering, M.J. (2003) E-learning: emerging uses, empirical results and future directions. *International Journal of Training and Development*, **7**, 245–258.

Wu, D. & Hiltz, S.R. (2004) Predicting learning from asynchronous online discussions. *Journal of Asynchronous Learning Networks*, **8**, 139–152.

Yang, K. & Jolly, L.D. (2008) Age cohort analysis in adoption of mobile data services: gen Xers versus baby boomers. *Journal of Consumer Marketing*, **25**, 272–280.

Yi, M.Y. & Hwang, Y. (2003) Predicting the use of web-based information systems: self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model. *International Journal of Human-Computer Studies*, **59**, 431–449.

Zhang, D. (2004) Virtual mentor and the lab system – toward building an interactive, personalized, and intelligent e-learning environment. *Journal of Computer Information Systems*, **44**, 35–43.

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