Behaviour & Information Technology, 2014
Vol. 33, No. 1, 51–64, http://dx.doi.org/10.1080/0144929X.2012.702284

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Effects of individuals' locus of control and computer self-efficacy on their e-learning acceptance in high-tech companies

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(*Received 27 April 2011; final version received 24 May 2012*)

High-tech companies encounter intense competition in today's global economy. With rapid changes in working environments, high-tech employees must learn quickly and effectively to solve difficult problems and increase their productivity. Many large high-tech companies have recently implemented electronic learning (e-learning) for employee training. However, e-learning systems are expensive and often underutilised. Therefore, understanding the factors associated with acceptance to e-learning are of priority concern. By integrating locus of control, computer self-efficacy and technology acceptance model (TAM) into one model, this study examines the feasibility of the extended TAM to explain employee acceptance of e-learning systems. Data were collected from 223 employees at five high-tech companies located in the Hsinchu Science Park, Taiwan. Analytical results indicate that locus of control had significant direct effects on perceived usefulness and perceived ease of use. Computer self-efficacy had significant direct effects on perceived ease of use and behavioural intention to use. Overall, analytical results provide strong support for using the extended TAM to explain user acceptance of e-learning systems. The research and practical implications of findings are discussed.

Keywords: electronic learning (e-learning); individual difference; personality; locus of control; computer self-efficacy; technology acceptance model

1. Introduction

E-learning systems are new information technologies encompassing a broad set of applications and processes for computer-based learning, online learning, virtual classrooms and digital collaboration. According to a report by Ambient Insight, the global market for self-paced e-learning products and services exceeded US$32.1 billion in 2010. The five-year compound annual growth rate (CAGR) is 9.2%. Therefore, further growth in the global market for e-learning is expected in the near future (Ambient Insight 2011). In Taiwan, the e-learning market reached US$512.4 million in 2009 and is expected to reach US$1007.4 million in 2014. The five-year CAGR is 14.6% (Project of Industrial Development and Promotion of Digital Archives and E-learning 2010). Understanding the factors affecting user acceptance of e-learning is essential, given the great potential growth of investment in the e-learning industry.

High-tech industries are different from traditional industries. Traditional firms generally face a relatively stable and low uncertainty environment. The tasks of traditional organisational staffs are generally simple and routine (Hodson 1985, Harpaz and Meshoulam 2004). In contrast, high-tech firms exist in an environment characterised by rapid change, ambiguity, dynamic and hypercompetition (Miles and Snow 1984, Collins and Clark 2003). They have to face shorter product life cycle and may experience sudden and dramatic losses in market position (Christian *et al.* 1999, Qian and Li 2003). Hence, most high-tech firms have implemented e-learning systems to effectively train and equip workers with practical and valuable knowledge in order to sustain competitive advantage in the global competitive environment.

Despite the rapid growth and the large impact of e-learning in recent years, studies suggest that acceptance of e-learning is much lower than expected (Zhang and Zhou 2003, Ong *et al.* 2004, Padilla-Meléndez *et al.* 2008). Although few studies have measured e-learning adoption rate, substantial indirect evidence supports this argument. For instance, Xenos *et al.* (2002) documented dropout rates of 28–35% from e-learning courses. Moreover, a study of 4148 corporate e-learners in the United States, Canada and the United Kingdom performed by Corporate University Xchange showed drop-out rate of about 70%, which is significantly higher than the 15% drop-out rate for classroom training (Corporate University Xchange

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2001). This research implies that learners may have a very low rate of acceptance of e-learning. Therefore, why learners adopt e-learning systems is an important research issue.

To understand the factors affecting user acceptance of e-learning systems, this study adopted the technology acceptance model (TAM) based on the theory of reasoned action (TRA). The TAM has been validated by many empirical studies of e-learning acceptance and is the most commonly applied theory in e-learning research (King and He 2006, Šumak *et al*. 2011). Numerous TAM studies have verified two core cognitive beliefs (perceived usefulness and perceived ease of use) can affect users' attitude and behavioural intention towards varieties of IT (Legris *et al*. 2003, Padilla-Meléndez *et al*. 2008, Šumak *et al*. 2011). However, researchers argue that, without appropriate external factors, the fundamental constructs of TAM only provide general information about user opinions of a system but do not yield the specific and valuable information to better understand what factors affect perceived usefulness and perceived ease of use in TAM (Mathieson 1991, Moon and Kim 2001, Legris *et al*. 2003). Hence, this study aims to make an important contribution by integrating appropriate external variables into TAM to better understand individuals' e-learning acceptance.

Many studies have extended TAM by adding various external factors. This study divided the extension constructs used in prior research into three main categories after an extensive literature review. The first category is those used to quantify individual differences, including cognitive style, personality, demographic and situational variables such as experience (Pituch and Lee 2006), locus of control (Drennan *et al*. 2005), computer anxiety (van Raaij and Schepers 2008), personal innovativeness in the domain of IT (PIIT, van Raaij and Schepers 2008, Liu *et al*. 2010), computer self-efficacy (Padilla-Meléndez *et al*. 2008, Sanchez and Hueros 2010, Lee *et al*. 2011), self-efficacy (Pituch and Lee 2006, Wang and Wang 2009) and perceived playfulness (Roca and Gagne 2008). The second category is those used to quantify organisational-based differences such as management support (Wagner and Flannery 2004, Lee *et al*. 2011), organisational support (Lee *et al*. 2011), technical support (Ngai *et al*. 2007, Sanchez and Hueros 2010) and facilitating conditions (Karaali *et al*. 2011). The third category is those used to quantify system-based differences such as system quality, information quality, service quality and information support (Wagner and Flannery 2004, Roca *et al*. 2006, Chen 2010). All the three categories have been reasonably theoretical and empirical supported. However, even when system providers develop high quality information or useful services for e-learning, and even when managers motivate employees to use e-learning, some users still believe that e-learning is unnecessary and/or ineffective. Due to the individual differences may have great impacts on individuals' acceptance of e-learning, thereby the influence of individual differences on users' e-learning acceptance had stimulated our intensive research interesting.

Mixed empirical results obtained from prior e-learning research also demonstrate that individual differences affecting user adoption of e-learning are still not well understood (Wang 2002, Karahanna *et al*. 2002). For example, Arbaugh (2000) found no significant difference between the e-learning satisfaction of males and females. Yet, Blum (1999) argues that males have a higher level of e-learning courses satisfaction than females. Nonetheless, Sanders and Morrison-Shetlar (2001) found that females have a more positive attitude towards using an e-learning course than males. A possible reason for the mixed empirical evidence may result from these studies had proposed just a direct effect between individual differences and attitude/behaviour (Wang 2002). Thus, a valuable contribution of this article is to shed further light on how individual differences influence user acceptance of e-learning.

Despite the recognised individual differences in e-learning, prior research suggests that personality, which is an individual difference, has an important effect on user acceptance of IT (Zmud 1979, Marakas *et al*. 2000, Walczuch *et al*. 2007). Therefore, this study extended TAM by applying personality variables to explain and predict user acceptance of e-learning.

This study selected locus of control and computer self-efficacy as external variables to integrate TAM from various personality variables. Locus of control is presumed to be an innate trait and thus is a relatively steady characteristic, whereas computer self-efficacy reflects a malleable trait that affects responses to stimuli within computer usage situation (Rotter 1990, Jashapara and Tai 2006, Makri-Botsari and Paraskeva 2010). The study used the two variables for three reasons.

First, e-learners can choose their learning process and contents anyplace and anytime according individual preference due to e-learning offers a self-paced and learner-centred environment. Therefore, an important e-learning characteristic is increased learner control over the learning environment (Johnson *et al*. 2009). Thus, individuals with more perceived control towards environment are more likely to attract to use e-learning (Seyal *et al*. 2002, Lee 2010). The two control-related personalities (locus of control and computer self-efficacy) should be considered important, given the centrality of learner perceived control

within e-learning. Computer self-efficacy is derived from self-efficacy. Self-efficacy is closely associated with the construct of perceived control, which has emerged from research on locus of control (Rotter 1966, Bandura 1997, Zimmerman 2000). Prior research had indicated that locus of control and computer self-efficacy both represent the confidence of individuals in controlling their behaviours and outcomes within the technology environment (Zmud 1979, Compeau and Higgins 1995, Marakas *et al*. 2000). However, less research has integrated the two control-related personality traits into one model to understand their effect on user acceptance of e-learning. Therefore, we propose that locus of control and computer self-efficacy should be explored and understood in studies of user acceptance of e-learning.

Second, individuals with internal locus of control tend to search for more information, solve more difficult problems and make a greater effort in learning tasks compared to individuals with external locus of control in the learning context (Kovenklioglu and Greenhaus 1978, Spector 1982, Kirkpatrick *et al*. 2008). Much research has tested locus of control for associations with learning-related variables. For instance, locus of control has been examined for associations with learning behaviours and academic performance in a traditional classroom context (Bar-Tal and Yaakov 1977, Findley and Cooper 1983, Jones 2008, Kirkpatrick *et al*. 2008). Other studies have tested locus of control for associations with dropout rate, completion rate and academic performance in distance learning and cyber education learning context (Dille and Mezack 1991, Parker 1999, Levy 2007). This study tested locus of control for associations with user acceptance of e-learning since locus of control is considered an important factor for explaining and predicting learning-related variables.

Additionally, internals perceive they can control their environment. They are likely to make efforts to influence their environment to achieve their expected outcome (Aspinwall and Taylor 1992, Skinner 1996, Johnson *et al*. 2009). With respect to technology environment, the above suggests that internals are highly motivated in mastering technology environment because they have greater confidence in influencing outcomes and are likely to use technology in support of their work. In contrast, externals may be more likely to focus on the shortcomings and difficulties of using new technology. They have less confidence within technology environments and may make less effort and spend less time using new technology (Zmud 1979, Bellman 1998, Marakas *et al*. 2000, Hoffman *et al*. 2003, Ziefle *et al*. 2006, AbuShanab *et al*. 2010). Based on the above theoretical reasoning, internals may have more positive attitude and higher level of acceptance of new technology than externals.

Researchers have examined the locus of control associated with computer attitude, internet attitude, computer anxiety and computer literacy within the technology environment (Coovert and Goldstein 1980, Morrow *et al*. 1986, Kay 1990, Potosky and Bobko 2001). Researchers have also examined relationships between locus of control and other variables in different IT/IS applications to study its effects on adoption of home technologies (Bellman 1998), mobile phone (Ziefle *et al*. 2006), internet banking (AbuShanab *et al*. 2010), information system project (Korzaan and Morris 2009) and online learning course (Drennan *et al*. 2005).

Few studies have included locus of control within TAM to explain user adoption of e-learning systems in organisational settings, although research shows that locus of control has been evaluated for effects on computing environment. Therefore, this study attempts to fill the research gap by integrating locus of control with TAM to improve understanding its effects on user acceptance of e-learning.

Third, compared to individuals with low computer self-efficacy, those with high computer self-efficacy tend to use IT more frequently and are more likely to perceive IT use as effort-free (Compeau and Higgins 1995, Lee 2006). Computer self-efficacy has also been examined for effects on perceived e-learner satisfaction, perceived ease of use, attitude and behavioural intention within the e-learning context (Ong and Lai 2006, Roca *et al*. 2006, Waheed 2010). Therefore, this study also tested computer self-efficacy for effects on user adoption of e-learning. For the three reasons above, the extended TAM model integrates locus of control and computer self-efficacy to explain user acceptance of e-learning.

It is very important to investigate what factors can affect user acceptance of e-learning in the context of companies, giving the growth of investment of e-learning systems in most high-tech companies. Šumak *et al*. (2011) performed a systematic literature review of 42 independent studies, most of which had been published in major journals, of e-learning technology acceptance. However, they found that the subjects in most studies of e-learning acceptance are students in an academic environment. Only 9 of 42 studies have analysed the factors affecting e-learning systems in the context of companies. Therefore, this study can make an important contribution by filling this research gap in e-learning acceptance research by including employees as subjects.

In sum, the main purpose of this study is to integrate locus of control and computer self-efficacy into TAM to develop an extended TAM model to explain and predict user acceptance of e-learning systems in the organisational context. Thus, this study

begins by examining the relationships between locus of control, perceived ease of use and perceived usefulness. Next, computer self-efficacy is linked to perceived ease of use and behavioural intention to use. The hypothesised relationships are then empirically examined. The main goal is to understand how locus of control and computer self-efficacy affect perceived ease of use, perceived usefulness and behavioural intention to use e-learning systems.

2. Theoretical development

Figure 1 presents the theoretical model underpinning this study. The model suggests that computer self-efficacy influences perceived ease of use and behavioural intention to use. Locus of control influences perceived usefulness and perceived ease of use. This study tests the relationships among individual differences (computer self-efficacy and locus of control), TAM belief constructs (perceived usefulness and perceived ease of use) and behavioural intention to use e-learning systems.

2.1. Locus of control

To better understand what factors affect user acceptance of e-learning, this study we adopt TAM as our theoretical base. Technology acceptance model is the most widely used theory in studying IT usage. Technology acceptance model can explain the relationships among external variables, perceived usefulness, perceived ease of use and behavioural intention to use IT. Numerous studies have applied TAM to different technological features and different subjects, and used it with different external variables (Davis 1989, Davis *et al*. 1992, Legris *et al*. 2003, Hsu and Lu 2004). More specifically, many prior studies have used TAM to understand users' acceptance of e-learning systems

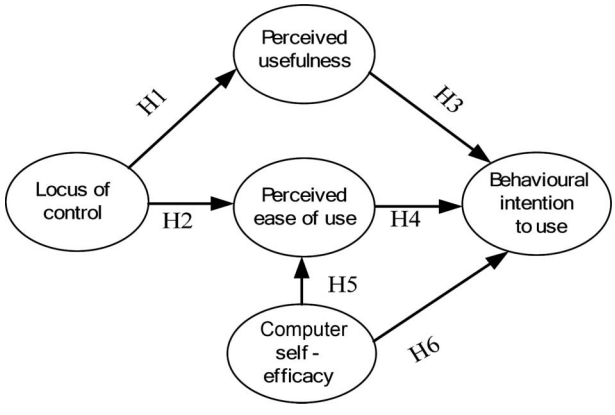

Figure 1. The research model.

(Zhang *et al*. 2008, Cho *et al*. 2009, Tao *et al*. 2009, Lin 2011).

In organisational research, locus of control has been defined to the degree to which one perceives events as under his/her control (internal locus) or under the control of powerful others (external locus) (Rotter 1966, 1990). Individuals with strong internal locus of control are called internals. Conversely, individuals with strong external locus of control are called externals (Spector 1982). Increasing evidence from organisational research shows that locus of control impacts the attitudinal, motivational and behavioural variables in organisational settings (Spector 1982, Rotter 1990, Potosky and Bobko 2001).

According to previous research, internals perform better than externals in learning and problem-solving situations, seek new information more actively when that information has personal relevance, use information more effectively, and make a greater effort to learn (Phares 1976, Spector 1982, Dille and Mezack 1991). These findings indicate that internals and externals likely have different learning attitude and behaviours.

Moreover, internal locus of control has been identified as a positive predictor of academic achievement in a traditional classroom context (Spector 1982, Kalechstein and Nowicki 1997, Kirkpatrick *et al*. 2008). In the distance-learning context, prior studies found that internals took more time and made greater efforts in television broadcasting courses than externals (Dille and Mezack 1991, Pugliese 1994). Locus of control has been used to predict dropout rate and academic performance in the online education context (Dille and Mezack 1991, Parker 1999, Levy 2007). These implies that locus of control could be an important indicator to predict e-learning-related outcomes in the context of e-learning.

In the context of technology, internals are highly motivated towards technology environmental mastery because they perceive they can control and influence on outcomes. They adopt riskier and innovative strategies in accepting new technology and are likely to utilise the technology to solve their working problems and to support their work. Conversely, externals may be more likely to focus on the difficulties of using new technology. They may have less confidence to overcome obstacles when they use new technology (Bellman 1998, Hoffman *et al*. 2003, Drennan *et al*. 2005, AbuShanab *et al*. 2010). This can lead to less effort and time placed into using new technology. Based on above arguments, internals may have more positive attitude and higher level of acceptance of new technology than externals.

Prior studies have examined the influence of locus of control in different applications of information and communication technologies (Bellman 1998, Drennan

et al. 2005, Korzaan and Morris 2009, AbuShanab *et al*. 2010). These findings also indicate that locus of control could influence user adoption of e-learning systems.

Internals are more likely to seek and collect new information than externals when the information was personally relevant. Internals are also willing to try new approaches and take risks than externals (Phares 1976, Spector 1982). Thus, internals may use e-learning systems to seek and collect work-related information and learn useful skills to enhance their performance, thereby increasing the perceived usefulness of e-learning systems. In an empirical research, Drennan *et al*. (2005) have shown that students with more internal locus of control perceived an online learning course more useful than students with more external locus of control. According to theoretical reasoning and empirical evidence, this study proposes the following hypotheses.

H1: Internal locus of control positively affects perceived usefulness of e-learning.

Additionally, based on our literature review, less research has empirically examined the direct effect of locus of control on perceived ease of use. Even so, since individuals with strong internal locus of control believe that they can control their own situations, they will believe that using IT is easy based on more proactive approach (Hwang 2005). Prior studies have demonstrated that internals have a more favourable attitude towards computers than externals (Coovert and Goldstein 1980, Potosky and Bobko 2001). Research also found internals exhibit lower computer anxiety due to their greater computing confidence (Charlton 2005). Thus, we can reasonably propose that individuals with strong internal locus of control are more likely to perceive an e-learning system as easy-to-use.

H2: Internal locus of control positively affects perceived ease of use of e-learning.

2.2. Perceived usefulness

Increasing evidence shows that user-perceived usefulness influences behavioural intention to use IT (Davis 1989, Venkatesh and Morris 2000, Saade and Bahli 2005, Green and Pearson 2011, Jonas and Norman 2011). Perceived usefulness, a critical internal belief in the TAM, is the degree to which users believe that using a particular system will increase their job performance within an organisational context (Davis 1989).

As high-tech organisations face fierce global competition, employees are under considerable work pressure and hence they might search valuable information to improve their skills and performance. Thus, we can propose that when individuals perceive e-learning as useful, they will likely have a high degree of intention to use e-learning. Prior studies have shown that perceived usefulness has a positive effect on behavioural intention to use e-learning (Hu *et al*. 2003, Ong *et al*. 2004, Lee *et al*. 2005, Ong and Lai 2006, Karaali *et al*. 2011). Therefore, the following hypothesis is proposed.

H3: Perceived usefulness positively affects behavioural intention to use e-learning.

2.3. Perceived ease of use

Perceived ease of use is the degree to which a user believes that using a particular system will be effort-free (Davis 1989). High-tech employees usually have heavy workloads and hence they have low motivation to use an unfriendly system. Thus, when users perceive an e-learning system as easy to use, their intention to use e-learning system increases. Prior studies have shown that perceived ease of use has a positive effect on behavioural intention to use e-learning (Hu *et al*. 2003, Lee *et al*. 2003, Ong *et al*. 2004, Lee *et al*. 2005, Ong and Lai 2006, Lee 2010). Therefore, the following hypothesis is proposed.

H4: Perceived ease of use positively affects behavioural intention to use e-learning.

2.4. Computer self-efficacy

In an IT usage context, computer self-efficacy refers to individuals' judgment of their capability to use a computer in diverse situations (Compeau and Higgins 1995), but does not refer to simple skills such as copying or restoring data. Rather, it is one's assessment of his/her capability to accomplish complex tasks (e.g. using Microsoft Excel software to analyse financial data) (Compeau and Higgins 1995).

Computer self-efficacy can influence an individual's perception of ease of use of IT (Venkatesh and Davis 1996, Hayashi *et al*. 2004, Roca *et al*. 2006). Such an effect is supported by self-efficacy theory (Bandura *et al*. 1977, Bandura 1986). Self-efficacy is the confidence of an individual to undertake a specific behaviour (e.g. using a computer) (Barling and Beattie 1983). In an e-learning context, individuals with high computer self-efficacy feel they are capable of performing well when using e-learning systems. They are more willing to try e-learning systems and to keep figuring out how they work. They do not become deterred easily by facing hard problems and will persist with

their efforts to overcome difficult obstacles. Therefore, they will perceive using e-learning systems as effort-free. In contrast, individuals with low computer self-efficacy will be frustrated more easily by hard obstacles and are more likely to give up trying e-learning systems (Compeau and Higgins 1995). From an empirical standpoint, researchers have found that computer self-efficacy is an important determinant of the perception of ease of use in e-learning context (Gong *et al*. 2004, Ong *et al*. 2004, Ong and Lai 2006, Terzis and Economides 2011). These above findings suggest that computer self-efficacy positively affects perceived ease of use of e-learning. Therefore, the following hypothesis is proposed.

H5: Computer self-efficacy positively affects perceived ease of use of e-learning.

Although TAM has been widely used in varieties of IT contexts, however, Bagozzi (2007) argued that it is unreasonable to expect that the simplicity of TAM would fully explain decisions and behaviour across varieties of IT (Bagozzi 2007). This study used social cognitive theory (SCT) as a secondary theoretical basis to better understand how e-learning systems are used, as it is a widely accepted, empirically validated model of individual behaviour (Bandura 1977, Bandura 1986).

The SCT premises that individuals can regulate their thoughts, motivation and actions (Bandura 1986, McCormick and Martinko 2004). The computer self-efficacy construct is grounded in SCT. The SCT asserts that self-efficacy strongly influences an individual's decision to attempt a task, the level of effort involved, and the degree of persistence exhibited in completing the task (Bandura 1986). Therefore, computer self-efficacy can influence individual's computer usage behaviour.

An individual with strong computer self-efficacy may have a high perception of their ability to use a computer. They will perceive they are good at using a new system. Furthermore, individuals with higher computer self-efficacy are more likely to use computer to accomplish challenging tasks and they enjoy the feeling of possessing high computer competence. The perception of high computer competence may enhance a user's intrinsic motivation (Deci 1975, Deng *et al*. 2004). Using e-learning provides a good chance for individuals with high computer self-efficacy to demonstrate their computer mastery in the e-learning context. Thus, high computer self-efficacy may have a higher intention to use e-learning systems simply because they find using the e-learning systems intrinsically rewarding. Based upon above arguments, this study proposes computer self-efficacy has a direct effect on behaviour intention to use e-learning. The discussed effects have been empirically examined by previous studies (Hu *et al*. 2003, Padilla-Melendez *et al*. 2008, Tung and Chang 2008). Thus, we integrated the two streams of research based on SCT and TAM. The following hypothesis is proposed.

H6: Computer self-efficacy positively affects behavioural intention to use e-learning.

3. Methodology

3.1. Measures

All research variables were measured using multi-item scales. To ensure the content validity of the scales, the items selected must represent the concept in order to generalise in other context (Bohmstedt 1970). Items selected for the constructs of the research mainly adapted from prior studies to ensure content validity.

The scales for computer self-efficacy were measured by five items adapted from Compeau and Higgins (1995) study. Locus of control was measured with a five-item subset of abbreviated version (Valecha and Ostrom 1974) of Rotter's (1966) general measure of locus of control was administrated. Items measuring perceived usefulness, perceived ease of use and behavioural intention to use e-learning were taken from previously studies on TAM and modified the wording to fit the e-learning context (Davis 1989, Ong *et al*. 2004). All above items were scored on a Likert scale form 1 to 5, with a 1 rating indicating strong disagreement and a 5 rating indicating strong agreement. The appendix lists the items used in this study.

3.2. Subjects

A questionnaire was designed and sent to high-tech companies chosen for the study. Data for this study were collected mainly from five high-tech companies in the Hsin chu Science-based Industrial Park in Taiwan. These include Taiwan Semiconductor Manufacturing (TSMC), United Microelectronics Corporation (UMC), Vanguard International Semi-conductor Corporation (VIS), AU Optronics Corporation (AUO) and Epistar Corporation.

Each company had implemented e-learning and each respondent had experience to use it. The respondents completed self-reported questionnaires. A total of 350 surveys were distributed and a total of 241 responses (68.9%) were received. Due to missing data and outliers, we obtained an effective response rate of $n = 223$ (63.7%).

The individual respondents averaged 32 years in age and had seven years of experience in computer. The sample consisted of 52% males and 48% females. Seventy-three per cent had completed one college or university degree. They work in a wide range of

functional areas including technical fields, such as operations and production, R&D and engineering (34.5%), marketing and sales (28.3%), accounting and finance (11.5%), personnel and general management (8.8%) and others (16.8%).

4. Data analysis and results

4.1. Analysis of measurement validity

The proposed research model was evaluated using structural equation modelling (SEM). The hypothesised measurement model was tested using confirmatory factor analysis (CFA). The original model included 19 items representing five latent constructs: locus of control, computer self-efficacy, perceived usefulness, perceived ease of use and behavioural intention to use. LISREL 8.54 software was used to compute the CFA. An initial CFA showed that two items (CSE1 and LOC5) had low factor loadings on their corresponding constructs. These items were dropped from the analysis and then the CFA was re-run. The various goodness-of-fit statistics is shown in Table 1, seven model fit indices, along with their recommended values for the common model fit, indicated an acceptable model fit. Thus, the measurement model fit was adequate to access the result for the structural model.

Table 1. Goodness-of-fit measures of measurement model.

Goodness-of-fit measure	Recommended value	Model statistic
Chi-square/degree of freedom	≦3.00	1.44
Goodness-of-fit index (GFI)	≧0.90	0.93
Adjusted goodness-of-fit index (AGFI)	≧0.80	0.90
Normalised fit index (NFI)	≧0.90	0.90
Non-normalised fit index (NNFI)	≧0.90	0.96
Comparative fit index (CFI)	≧0.90	0.97
Root mean square residual (RMSR)	≦0.10	0.045

Moreover, we evaluated the properties of the instrument in terms of composite reliability, convergent validity and discriminant validity. Reliability of the instrument was evaluated using the composite reliabilities test. All the values of the measures included in the model ranged from 0.72 to 0.86 (see Table 2). All were greater than the benchmark of 0.6 recommended by Bagozzi and Yi (1988). This showed that all measures had adequate reliability.

To evaluate discriminant validity, Fornell and Lacker (1981) have recommended a stronger test of discriminant validity: the AVE for each construct should exceed the squared correlation between that any other construct. As shown in Table 2, the factor correlation matrix indicated that the largest squared correlation between any pair of constructs was 0.21 (behavioural intention to use and perceived usefulness), while the smallest AVE was 0.53. Thus, the test of discriminant validity was met.

This study assessed convergent validity by two ways. First, we examined the value of AVE (Fornell and Lacker 1981). Table 2 indicated the adequate convergent validity, since all measures each had an AVE of more than 0.5. A second way to evaluate convergent validity is to examine each indicator's factor loading (Hair *et al*. 1998). As shown in Table 3, all of the factor loadings of the items in the research model were greater than 0.60. The results also indicated that all constructs in the model had adequate convergent validity. To summary above findings, the composite reliability, convergent validity, and discriminant validity all suggested the adequacy of the measurements used in the study.

4.2. Test of the structural model and hypotheses

The hypothesised relationships were tested using the path analysis of Lisrel 8.54. The procedure provides estimates of parameters and tests of fit for linear structural equation model. Goodness-of-fit indices for this model were chi-square/degree of freedom = 2.63,

Table 2. Scales properties and correlations.

Variables	The composite reliability (>0.6)	AVE (>0.5)	Factor correlations				
			LOC	CSE	PEOU	PU	BI
Locus of control (LOC)	0.82	0.53	1				
Computer self-efficacy (CSE)	0.86	0.61	0.24*	1			
Perceived ease of use (PEOU)	0.83	0.54	0.26*	0.22*	1		
Perceived usefulness (PU)	0.81	0.59	0.31*	0.02	0.23*	1	
Behavioural intention to use (BI)	0.72	0.56	0.27*	0.31*	0.29*	0.46*	1

Note: *$p < 0.01$.

GFI = 0.99, AGFI = 0.93, NFI = 0.95, NNFI = 0.90, CFI = 0.97 and RMSR = 0.044. All seven common goodness-of-fit indexed as shown in Table 4 exceeded their respective acceptable levels. Analytical results indicated that the model exhibited a good fit with the data.

Figure 2 presents the significant structural relationship among the research variables, standardised path coefficients, *P*-values and variance explained in the model. As expected, internal locus of control had a statistically significant positive effect on perceived usefulness ($\beta = 0.31$, $P < 0.05$). Individuals who reported higher level of internal locus of control were more likely to report high levels of perceived usefulness. Internal locus of control also had a statistically significant positive effect on perceived ease of use ($\beta = 0.22$, $P < 0.05$). Analytical results supported hypotheses H1 and H2.

Perceived usefulness had a greatest effect on behavioural intention to use ($\beta = 0.43$, $P < 0.05$). Thus, hypothesis H3 also was supported. Consistent with past studies of TAM (e.g. Kwon *et al*. 2007, Zhang and Xu 2010), perceived ease of use had a statistically significant positive effect on behavioural intention to use ($\beta = 0.13$, $P < 0.05$). The result supported hypothesis H4.

Finally, computer self-efficacy demonstrated a significant positive effect on perceived ease of use ($\beta = 0.17$, $P < 0.05$) and behavioural intention to use ($\beta = 0.27$, P < 0.05). Therefore, hypotheses H5 and H6 were supported.

Due to R^2 indicates the amount of variance explained by the model, the study calculated the R^2 values of perceived usefulness, perceived ease of use and behavioural intention to use. The results are presented in Figure 2.

Overall, the whole model was able to account for 32% of variance in the construct of behavioural intention to use. Ten percent of the variance in perceived usefulness was explained by computer self-efficacy and internal locus of control. On the other hand, 10% of the variance in perceived ease of use was explained by computer self-efficacy and internal locus of control.

Table 3. Factor loading of items.

	Factor				
	LOC	CSE	PU	PEOU	BI
Locus of control (LOC)					
LOC1	0.72				
LOC2	0.75				
LOC3	0.64				
LOC4	0.81				
Computer self-efficacy(CSE)					
CSE2		0.77			
CSE3		0.81			
CSE4		0.79			
CSE5		0.74			
Perceived usefulness (PU)					
PU1			0.76		
PU2			0.85		
PU3			0.68		
Perceived ease of use(PEOU)					
PEOU1				0.72	
PEOU2				0.80	
PEOU3				0.71	
PEOU4				0.71	
Behavioural intention to use(BI)					
BI1					0.77
BI2					0.73

Table 4. Goodness-of-fit measures of research model.

Goodness-of-fit measure	Recommended value	Model statistic
Chi-square/degree of freedom	≦3.00	2.63
Goodness-of-fit index (GFI)	≧0.90	0.99
Adjusted goodness-of-fit index (AGFI)	≧0.80	0.93
Normalised fit index (NFI)	≧0.90	0.95
Non-normalised fit index (NNFI)	≧0.90	0.90
Comparative fit index (CFI)	≧0.90	0.97
Root mean square residual (RMSR)	≦0.10	0.044

5. Discussion

The primary objective of this study was to understand how locus of control influences individual acceptance of e-learning systems. Analytical results demonstrate that locus of control was a significant determinant of perceived usefulness. This result is consistent with Drennan *et al*., (2005) findings. Internals may have found e-learning systems more useful than externals because it provided useful learning materials and learning options to improve employees' knowledge.

As expected, locus of control had a significant effect on perceived ease of use. Individuals who reported having strong internal locus of control were more likely to have high level of perceived ease of use. As externals may perceive e-learning systems are difficult to use, corporations may need to invest more resources to educate externals on how to use e-learning systems.

This study examined how computer self-efficacy influences individual's acceptance of e-learning systems. Analytical results indicate that computer self-efficacy affected perceived ease of use and behavioural

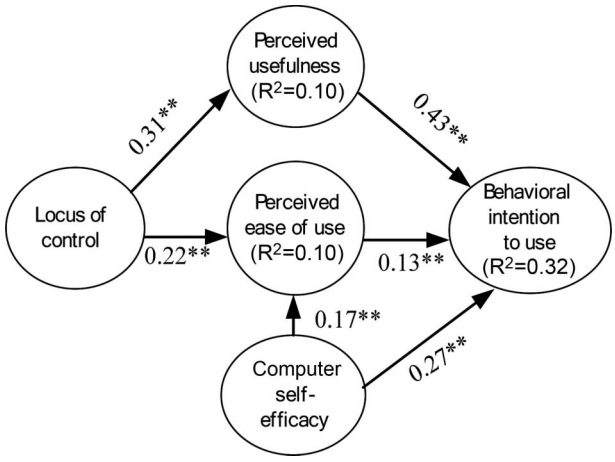

Figure 2. Model testing result: $^{**}P < 0.05$.

intention to use e-learning systems. These findings are in line with previous study (Ong and Lai 2006). Users who have high computer self-efficacy are likely to have higher perceived ease of use and behavioural intention to use e-learning systems than those with low computer self-efficacy.

Based on its direct effect on behavioural intention to use an e-learning system, perceived usefulness was associated with behavioural intention to use e-learning. These findings are in accord with the results of the previous studies (Hu *et al*. 2003, Karaali *et al*. 2011). When individuals feel e-learning systems will improve their work performance, they will have a high level of intention to use e-learning system. Therefore, content providers must provide valuable work-related information to increase user acceptance of e-learning.

Consistent with prior research, perceived ease of use directly affected behavioural intention to use e-learning systems (Ong *et al*. 2004, Lee 2010). Therefore, systems designers must design e-learning systems that are user-friendly to attract users.

6. Practical implications

From the practical perspective, this research may have implications for implementing e-learning systems. Understanding how personality factors affect adoption of e-learning systems may help system designers to improve e-learning systems and help managers to motivate employees to use e-learning. This study examined locus of control affects user perceptions of the usefulness and ease of use of e-learning systems. The findings suggest that, even when learner control and flexibility are high, e-learning systems may attract internals more than externals. The results have two practical implications.

One implication is that, although personality variables affect user acceptance of e-learning systems, employees are often treated as a homogenous group rather than as individual learners. To improve this condition, high-tech companies should provide personalised e-learning systems based on employee locus of control beliefs. For example, for employees with high internal locus of control, e-learning systems may increase the richness of materials and learning options. Because these employees are highly motivated learners who actively seek the most useful learning materials, their perceived usefulness of e-learning systems tends to be high. Conversely, since employees with an external locus of control tend to have negative attitudes towards computers and have more difficulty working with unfamiliar e-learning systems compared to those with an internal locus of control, system designers must provide a user-friendly interface and must provide clear instructions for using e-learning systems. Besides, managers may need to make efforts to motivate employees with an external locus of control to use e-learning systems. A second implication is that high-tech employees must increase their learning efficacy to remain competitive. Managers may consider actively recruiting individuals who have a strong internal locus of control, who have a positive attitude about e-learning systems, and who perceive e-learning systems as useful and easy to use.

Furthermore, the results also shown that improving employees' computer self-efficacy can enhance e-learning system acceptance. In practice, managers can foster computer self-efficacy through various methods, including selecting an experienced trainer, increasing computer training and building learning confidence in using computers. Locus of control and computer self-efficacy both affect user adoption of e-learning. By considering these differences among employees, managers and system designers can increase the benefit gained from investment in e-learning.

7. Conclusions

This study indicates that locus of control and computer self-efficacy can affect users' e-learning adoption. Using the extended TAM model can remind administrators and systems designers to pay attention to some kinds of individual differences that can affect user adoption of e-learning systems. Besides, the extended TAM model also helps researchers better understand and develop e-learning theories. Therefore, this study makes several contributions to researchers and practitioner as follows.

First, this study extended original TAM by integrating locus of control and computer self-efficacy, perceived ease of use, perceived usefulness and behavioural intention to use into one model, providing insights into the relationships among these variables.

This study succeeded in demonstrating that locus of control influences perceived ease of use and perceived usefulness and computer self-efficacy influences perceived ease of use and behavioural intention to use e-learning.

Second, this study helps researchers better understand how personality variables influence user adoption of e-learning system. As we mention before, the effect of personality on IT acceptance have shown mixed results, therefore, the study fill the research gap by integrating two personalities with TAM to better understand their effects on user acceptance of e-learning.

Third, analytical results indicate that locus of control directly affects perceived ease of use and perceived usefulness. These suggest that when managers and system designers design e-learning training programs and e-learning content they need to consider employees' locus of control.

Fourth, as shown in previous research, computer self-efficacy is an antecedent of perceived ease of use and behavioural intention to use e-learning system. Managers who enhance employee computer self-efficacy can improve their perceived ease of use and behavioural intention to use e-learning.

Fifth, analytical results indicate that perceived usefulness has a positive effect on behavioural intention to use e-learning system. As high-tech employees typically have strong motivation to improve their performance and solve difficult problems, e-learning systems must provide useful content and task-related knowledge to attract learners to use e-learning systems.

Finally, analytical results also indicate perceived ease of use has a positive effect on behavioural intention to use e-learning systems. Therefore, developing user-friendly e-learning systems also can increase the user acceptance of e-learning.

8. Limitations and future studies

Research findings must be considered in light of limitations. First, there are various individual differences may affect user acceptance of e-learning systems, such as age, gender, computer experience, computer anxiety, subjective norms, PIIT, etc. but in our study we just focused on two control-related personality factors. We intend to study the effects of other potential factors in future research. Second, as this study used a snapshot approach, a longitudinal approach should be considered in future research. Third, self-reported measures may suffer from common method variance, which can exaggerate the observed relationships between constructs. However, according to previous research, when strong correlations exist among constructs, a study may have common method bias (James *et al*. 1979, Thatcher and Perrewe 2002). An examination of the correlations matrix (Table 2) demonstrates that correlation coefficients varied across constructs at low to middle levels (range 0.02–0.46). Therefore, common method variance may not be a significant flaw in this study. Fourth, this study attempted to predict and explain behavioural intention to use e-learning systems rather than actual usage. Although, previous research has found that behavioural intention to use IT directly influences actual usage (Moon and Kim 2001), this relationship should be further investigated in future research to enhance the practical value of analytical results. Fifth, this study used the scales for computer self-efficacy adapted from Compeau and Higgins, (1995) study, however, the wording of the scales was not modified to fit the e-learning context. It needs to be modified for future research. Finally, due to the distance between initial acceptance of a technology and its ongoing use not having been very clear in previous TAM studies, the result regarding the factors affecting individual acceptance of e-learning should have its limitation on prediction of users future e-learning usage.

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Appendix

Instrument of the research

Locus of control (LOC)

(1) When I make plans, I am almost certain that I can make them work.
(2) It is impossible for me to believe that chance or luck plays an important role in my life.
(3) In my case, getting what I want has little or nothing to do with luck.
(4) What happens to me is my own doing.
(5) Getting people to do the right thing depends upon ability; luck has little or nothing to do with it.

Computer self-efficacy (CSE)

I could complete a job using a software package...

(1) If there was no one around to tell me what to do as I go.
(2) If I had never used similar package like it before.
(3) If someone else had helped me get started.
(4) If you had seen someone else using it before trying before trying it myself.
(5) If I had just the built-in-help facility for assistance.

Perceived usefulness (PU)

(1) Using the e-learning system improves my job performance.
(2) Using the e-learning system increases my productivity.
(3) Using the e-learning system enhances my effectiveness in my job.

Perceived ease of use (PEOU)

(1) Usage of the e-learning system is clear and understandable.
(2) I do not have to spend much time to learn how to use the e-learning system.
(3) Learning to operate e-learning system is easy for me.
(4) It's easy for me to use various functions of e-learning system.

Behavioural intention to use (BI)

(1) I intend to use the e-learning system as often as possible.
(2) Assuming that I had access to the e-learning system, I intend to use it.