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# Explaining and predicting users' continuance intention toward e-learning: An extension of the expectation–confirmation model

Ming-Chi Lee

*Department of Computer Science and Information Engineering, National Pingtung Institute of Commerce, Taiwan, ROC*

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ABSTRACT

Although e-learning has been prompted to various education levels, the intention to continue using such systems is still very low, and the acceptance-discontinuance anomaly phenomenon (i.e., users discontinue using e-learning after initially accepting it) is a common occurrence. This paper synthesizes the expectation–confirmation model (ECM), the technology acceptance model (TAM), the theory of planned behavior (TPB), and the flow theory to hypothesize a theoretical model to explain and predict the users' intentions to continue using e-learning. The hypothesized model is validated empirically using a sample collected from 363 learners of a Web-based learning program designed for continuing education. The results demonstrate that satisfaction has the most significant effect on users' continuance intention, followed by perceived usefulness, attitude, concentration, subjective norm, and perceived behavior control as significant but weaker predictors. The implications of these findings for e-learning practitioners are discussed at the end of this work.



## 1. Introduction

With the rapid growth of the Internet, numerous education/training institutes and companies have devoted great efforts and large sum of money to develop e-learning programs for users. However, while e-learning has been promoted to various levels of users, the intention to continue using such system is still very low (Chiu, Sun, et al., 2007). In addition, the acceptance–discontinuance anomaly phenomenon (users discontinue using e-learning after initially accepting it) frequently occurs (Roca, Chiu, et al., 2006). Although initial acceptance of e-learning is an important first step toward achieving e-learning success, actual success still needs continued usage. Therefore, understanding the factors affecting customers' intention to continue using e-learning will not only assist e-learning developers in designing popular contents, but also help teachers and vendors design strategies that are more likely to increase the use of e-learning.

In this paper, we synthesize the expectation–confirmation model (ECM), technology acceptance model (TAM), theory of planned behavior (TPB), and flow theory to hypothesize a new model to explain users' intention to continue using e-learning. We combine these four theoretical perspectives for the following three reasons. First, although previous research has found ECM to be a robust model for continued IT adoption (Bhattacherjee, 2001a, 2001b), it employs only three variables to explain behavioral intention, namely satisfaction, confirmation, and post-adoption expectations. However, a user's behavioral intention toward adopting IT will also be affected by other factors, such as the opinions of important individuals (subjective norms) (Fishbein & Ajzen, 1975). Furthermore, even if users have a strong intention to perform a behavior, they may feel that they lack the necessary resources and skills (perceived behavioral control) (Ajzen, 1991), and the use of TPB addresses this gap. Second, while TPB captures the roles of individuals, organizational members, and social influences on behavioral intention, it does not inform us what attitudinal beliefs would affect a user's attitude toward e-learning (Wu & Chen, 2005). According to Taylor's research (Taylor &Todd, 1995a, 1995b), TAM provides two attitudinal beliefs, namely perceived ease of use and perceived usefulness as two major antecedents of attitude, which make up precedent factors of attitude for TPB. Moreover, since each theory has distinct roots and is based on a different set of antecedent variables, we contend that they independently provide a partial understanding of users' cognitive processes related to IT usage. It is therefore possible that, when combined, these theories may collectively provide an improved and more comprehensive understanding of the cognitive processes and behaviors related to IT usage than when each theory considered alone. Third, adding the flow theory allows us to capture the elements of motivation related to fun and entertainment, with regard to the adoption of e-learning (Koufaris, 2002). Flow has been used to describe a state in which "people are so involved in an activity that nothing else seems to matter" (Csikszentmihalyi, 1997), such as when users play online games. During the states of flow, other events occurring

*E-mail address:* lmc@npic.edu.tw

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in users' surrounding environment lose significance and their sense of time becomes distorted (Hoffman & Novak, 1996). When people use e-learning systems, there is potential for them to experience flow, as most e-learning products provide chats room, message boards, and entertainment functions, all of which may provide enjoyment and lead to concentration and engagement in users. Therefore, we will also use flow theory to examine user's continued usage of e-learning.

While prior research has examined ECM, TAM, and TPB independently in explaining information technology (IT) usage, to the best of our knowledge, no study has yet theoretically combined these three models. The primary contributions of this study are its examination of the integration of ECM, TAM, TPB and flow theory in explaining long-term e-learning usage intention and an empirical evaluation of which factors are critical to affecting this intention. The findings from this paper may therefore help bridge the existing gap between acceptance and continuance streams of e-learning usage research. The results of this work are expected to give both practitioners and academics an increased understanding of users' continuance intention, which can then be used as a guideline to devise more appropriate e-learning products.

The rest of the paper is organized as follows. Section 2 presents our research model and hypotheses, while Section 3 proposes the measurement method and scales. We present the research results in Section 4, followed by discussion in Section 5. Finally, the implications and conclusions of this work are presented in Sections 6 and 7.

## 2. Research model and hypotheses

We next develop our research model and hypotheses based on the expectation–confirmation model, the technology acceptance model, the theory of planned behavior, and flow theory.

### *2.1. Expectation–confirmation model (ECM)*

In the IT literature, Bhattacherjee (2001a, 2001b) proposed an ECM of IT continuance based on the congruence between individuals' continued IT usage decisions and consumers' repeat purchase decisions. The ECM posits that an individual's intention to continue IT usage is dependent on three variables: the user's level of satisfaction with the IT; the extent of user's confirmation of expectations; and post-adoption expectations, in the form of perceived usefulness. Fig. 1 presents the ECM.

There are five main hypotheses in the ECM. First, users' satisfaction with IT has a positive effect on their intention to continue using the IT. Studies in marketing have discovered that the major reason for a consumer's decision to repurchase products or patronize services is their level of satisfaction (e.g. (Bearden & Teel, 1983; Oliver, 1993; Szymanski & Henard, 2001)). Owing to the similarity between re-purchasing products/services in a consumer context and the continued usage of IT products/services, the ECM posits an equivalent relationship in the latter context. In turn, user's satisfaction with IT is determined by the user's confirmation of expectations and their perceived usefulness of IT (which is one type of post-adoption expectation). The confirmation of expectations suggests that users obtained expected benefits through their usage experiences with the IT, and thus leads to a positive effect on users' satisfaction. On the other hand, based on the expectancy-confirmation paradigm, users' perceived usefulness of IT has a positive effect on their satisfaction with IT by working as a baseline for reference against confirmation judgments. This relationship is supported by the adaptation level theory, which proposes that users perceive stimuli only in relation to an adapted level.

Prior marketing studies have found that the higher the users' expectations, the higher are their satisfaction (Oliver & DeSarbo, 1988). Moreover, the IT adoption literature has consistently found that perceived usefulness is the most important determinant of users' adoption intentions (Davis, Bagozzi, et al., 1989; Taylor & Todd, 1995a, 1995b; Venkatesh, 2000). As a result, the ECM posits users' perceived usefulness of IT has a positive effect on their intention to continue IT usage. Lastly, the ECM posits that the users' confirmation of expectations will have a positive effect on the perceived usefulness of IT. Perceived usefulness of IT could thus be adjusted by confirmation experience, particularly when the users' initial perceived usefulness is not concrete due to the uncertainty over what to expect from using the IT (Bhattacherjee, 2001a, 2001b). Because e-learning is a kind of information technology on the Internet, we derived the following hypotheses from the ECM:

**H1.** Users' satisfaction with e-learning is positively related to their continued e-learning usage intention.

**H2.** Users' confirmation of expectations is positively related to their satisfaction with e-learning.

**H3.** Users' perceived usefulness of e-learning is positively related to their satisfaction with e-learning.

**H4.** Users' perceived usefulness of e-learning is positively related to their continued e-learning usage intention.

**H5.** Users' confirmation of expectations is positively related to their perceived usefulness of e-learning.

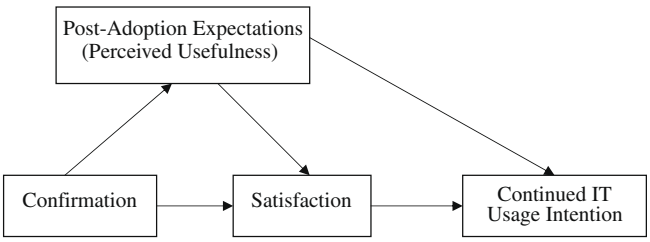


**Fig. 1.** Expectation–confirmation model.

### 2.2. The technology acceptance model (TAM)

Davis (1989) first introduced the TAM as a theoretical extension of the theory of reasoned action (TRA) (Fishbein & Ajzen, 1975) and found that it could better explain user's acceptance. TAM proposes that two particular beliefs, perceived usefulness and perceived ease of use, are the primary drivers for technology acceptance. Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his/her job performance", and perceived ease of use 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). Further, perceived usefulness and perceived ease of use both affect a person's attitude toward using the system, and consistent with TRA, these attitudes toward using the system determine behavioral intentions, which in turn lead to actual system use. TAM has been extensively applied to user acceptance research of various types of technologies including e-mail, word processor, world wide web, enterprise resources planning (ERP) systems, and e-commerce (Davis, 1989; Gefen & Straub, 1997; Lu, Zhou, et al., 2009).

E-learning users need to see e-learning as a useful tool that can improve their learning efficiency, enabling them to better communicate with their teachers, friends, colleagues and others online. Moreover, e-learning users need feel that the system is easy to use. Both perceived usefulness and perceived ease of use are beliefs that, according to TRA, will affect a user's attitude. Thus, we posit that:

**H6.** Perceived usefulness is positively related to behavioral attitude toward e-learning.

**H7.** Perceived ease of use is positively related to behavioral attitude toward e-learning.

In addition, TAM states that perceived usefulness will have a direct effect on user's behavioral intention, and perceived ease of use affects behavioral intention indirectly through perceived usefulness (Davis, 1989). That is, perceived usefulness mediates the effect of perceived ease of use on behavioral intention. Many empirical studies have supported this argument (Venkatesh & Davis, 2000; Wu & Chen, 2005). Thus, we posit that:

**H8.** Perceived ease of use is positively related to perceived usefulness of e-learning.

### 2.3. Theory of planned behavior (TPB)

Both the theory of planned behavior (TPB) and TAM were developed based on the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), which argues that both behavioral attitude and subjective norm affect behavioral intention, which in turn affects the actual behavior. TPB adds to TRA a third factor – perceived behavioral control – that affects behavioral intention and actual behavior (Ajzen, 1991). Many studies have replicated and investigated these three constructs and found that they are valid in explaining individual intention to use various forms of IT (Liao, 1999; Venkatesh, 2000).

Attitude (A) refers to "the degree of a person's favorable or unfavorable evaluation or appraisal of the behavior in question" (Fishbein & Ajzen, 1975). According to the TPB, attitude impacts users' behavioral intention, which in turn influences their actual behavior. When individuals form positive attitude towards e-learning, they will have a stronger intention toward adopting it, and thus they are more likely to use it. Recently, some studies have viewed users' continuance and acceptance decisions as the same as acceptance decisions (Hong, Thong, et al., 2006; Hsu, Yen, et al., 2006). Therefore, the following hypothesis is proposed.

**H9.** Behavioral attitude toward e-learning is positively related to the continued intention to use e-learning.

Subjective norm refers to "the perceived social pressure to perform or not to perform the behavior" (Ajzen, 1991). In other words, subjective norm is related to the normative beliefs about the expectation from other people. Many Internet users choose to use e-learning because their friends are the users of e-learning system, and they recommend it to them. Hence, we propose:

**H10.** Subjective norm is positively related to the continued intention to use e-learning.

Perceived behavioral control refers to "people's perception of ease or difficulty in performing the behavior of interest". It is associated with beliefs about the presence of control factors that may facilitate or hinder the performance of the behavior in question (Liao, Chen, et al., 2007). In this case, although e-learning is a useful tool to improve learning efficiency, users still need to have the basic Internet skills to use it. Thus, we posit that:

**H11.** Perceived behavioral control is positively related to the continued intention to use e-learning.

### 2.4. Flow experience and user acceptance of e-learning

Flow experience is defined as "the holistic experience that people feel when they act with total involvement" (Csikszentmihalyi, 1977, 1997). When people are in the flow state, they become absorbed in their activities and unable to recognize changes in their surroundings. Specially, they lose self-consciousness, concentrating only on their ongoing activity. This concept has been extensively applied in studies in a broad range of contexts, such as sports, shopping, and gaming (Csikszentmihalyi, 1997). From a motivation perspective, people make an effort to use an information technology due to both intrinsic and extrinsic reasons (Davis, Bagozzi, et al., 1992). Extrinsic motivation refers to the desire to perform an activity because it is perceived to lead to distinct and valued outcomes. Intrinsic motivation refers to the desire to engage in an activity for no other reason than the process of performing it (Deci & Ryan, 1985; Teo, Lim, et al., 1999). Compared with perceived usefulness, which deals with users' extrinsic motivation (Davis et al., 1992; Venkatesh, Morris, et al., 2003), flow experience can be seen as an intrinsic motivation.

Flow is a complex concept, and researchers often measure it through multiple dimensions. Ghani, Supnick, et al. (1991) measured flow using two constructs: enjoyment and concentration. Huang (2003) included four constructs to address flow, namely: control, attention focus, curiosity, and intrinsic interest. In addition, Li and Browne (2006) suggested that flow experience has four dimensions: focused

attention, control, curiosity and temporal dissociation. Finally, Koufaris (2002) developed three constructs to measure flow, including perceived enjoyment, perceived control, and concentration, and these are the dimensions adopted in this paper. Perceived control is similar to the perceived behavioral control in TPB, and so we do not examine it repeatedly.

Perceived enjoyment is defined as "the extent to which the activity of using a specific system is perceived to be enjoyable in it's own right, aside from any performance consequences resulting from system use" (Venkatesh, 2000). Perceived enjoyment as an intrinsic motivation has been found to have a significant impact on a technology acceptance, especially for hedonic systems (Davis et al., 1992; Koufaris, 2002). When using a technology can bring them fun and pleasure, users will be intrinsically motivated to adopt it. As noted above, e-learning often has many entertainment interactive functions and users can often obtain great enjoyment when using such systems. We can thus expect that perceived enjoyment will improve their affective attitude toward e-learning and increase their acceptance intention. Thus, we propose that:

**H12.** Perceived enjoyment is positively related to the attitude toward e-learning.

**H13.** Perceived enjoyment is positively related to the behavioral intention to use e-learning.

Concentration is another important component of the flow experience. For users to be in a flow state, they must first concentrate on their activities (Koufaris, 2002). Consequently, if users perform many tasks simultaneously and cannot focus on a limited field, they will not be able to acquire the flow experience. In contrast, e-learning users who focus their attention on learning or discussing on chat-rooms should find it easier to be in a state of flow, which in turn will positively affect their attitude toward and promote their usage of e-learning. Thus, we posit that:

**H14.** Concentration is positively related to the behavioral attitude toward e-learning.

**H15.** Concentration is positively related to the behavioral intention to use e-learning.

Fig. 2 presents our research model and hypotheses.

## 3. Research methodology

### *3.1. Questionnaire development*

We used a questionnaire survey with two parts to test our theoretical model. The first part had questions measuring the constructs in the research model, while the second part had demographic questions about the participants. Each item corresponding to the constructs was measured using a seven-point Likert scale, with answer choices ranging from "disagree strongly" (1) to "agree strongly" (7), and most of these items were adapted from the extant literature. The scale items for perceived usefulness and perceived ease of use were adapted from Davis (1989), while the scale items for subjective norm, perceived behavioral control, and attitude were adapted from Taylor and Todd (1995a, 1995b). In addition, the items measuring perceived enjoyment and concentration were adapted from Moon and Kim (2001), and the continuance intention, satisfaction, confirmation were adapted from Bhattacherjee(2001a, 2001b). The measurement question for the Web use experience is "What kind of web use did you spend most of time when using Internet?", with the answers: (1) Web browsing, (2) downloading (3) e-mail (4) chat-rooms. After the questionnaire was drafted, it was first sent to three academic experts on

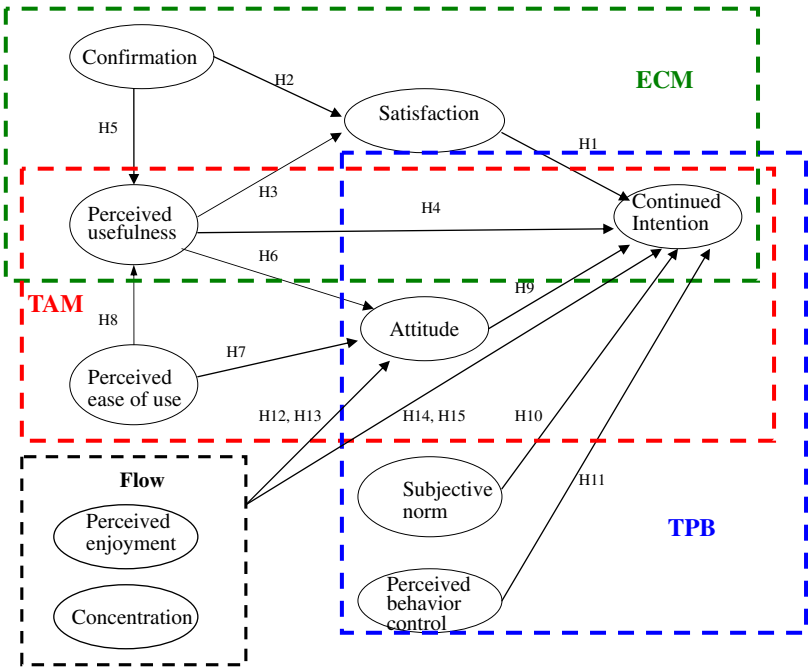


**Fig. 2.** Research model and hypotheses.

e-learning for their review, and then revised according to their comments and suggestions to make the wording of the items more precise. Appendix A lists the items used in this study.

### 3.2. Pilot test

The questionnaire was pilot-tested by convenient sampling. There were 150 responses, of which 123 were complete, giving a valid response rate of 82%, and the results of the pilot test were evaluated by using Cronbach's reliability and factor analysis. The reliability coefficient was first calculated for the items of each construct, and the standard lower bound for Cronbach's alpha set at 0.7 (Anderson & Gerbing, 1988), with items that did not significantly contribute to the reliability being eliminated. A factor analysis was then performed to examine whether the items produced the anticipated number of factors and whether the individual items were loaded on their appropriate factors. All items had high loadings on their related factors and low cross-loadings on other factors, showing good convergent and discriminate validities.

### 3.3. Sample plan and data collection

The sample for the study was taken from 12 class sections that were conducted using the e-learning service in the continuing education program of National Pingtung University in Taiwan. Electronic learning may be delivered via a blend of asynchronous and synchronous technologies. A synchronous e-learning service consists of real-time interaction between learners and instructors, facilitated by technological tools such as videoconferencing, teleconferencing, chat-rooms, and so on. In contrast, an asynchronous e-learning service is a form of self-study that may be supplemented by non-real-time interaction with the instructor, through e-mail, voice mail, message boards, forums, threaded discussions and so on. The e-learning service examined in this study is a Web-based learning system with both synchronous and asynchronous services, and the students were asked to receive one-third of the courses in a synchronous way and two-thirds asynchronously.

A total of 487 surveys were distributed to individuals who at least took one course offered by the e-learning service. Returned questionnaires with incomplete or invalid answers were eliminated, and a total of 363 valid responses were received. In terms of demographics, 62%of the respondents were male, and about 95% of the respondents had internet experience. With respect to age and education, most of our subjects were between 18 and 24 years old (55.4%) and had high school diplomas or Bachelor's degrees (51%). In terms of the Web use experience, 42% of respondents choose Web browsing, 26% choose e-mail, 25% choose chat-rooms, and 7% choose downloading.

All items among the constructs were tested against demographic controls (gender, age, level of educations) and Web use (i.e., Web browsing, downloading, e-mail, chat-rooms) using Students *t*-test or ANOVA. This study further classified all the respondents based on their Web use experience. The mean scores of the item were all insignificant ($p > 0.05$); indicating the validity of analyzing the data as a single group (see page 12).

## 4. Results

In analyzing the collected data, we followed the two-step procedure suggested by Anderson and Gerbing (1988). First, we examined the measurement model to measure convergent and discriminant validity. We then examined the structural model to investigate the strength and direction of the relationships among the theoretical constructs.

### 4.1. Analysis of the measurement model

Convergent validity was assessed based on the criteria that the indicator's estimated coefficient was significant on its posited underlying construct factor. We evaluated the measurement scales using the three criteria suggested by Fornell and Larcker (1981), namely:

(1) All indicator factor loadings ($\lambda$) should be significant and exceed 0.5.
(2) Construct reliabilities should exceed 0.8.
(3) Average variance extracted (AVE) by each construct should exceed the variance due to measurement error for the construct (e.g., AVE should exceed 0.5).

The Cronbach's alpha scores, shown in Table 1, indicated that each construct exhibited strong internal reliability, which all the standard factor loading ($\lambda$) values in confirmatory factor analysis of the measurement model exceeded 0.5 and were significant at $p = 0.001$. In addition, the composite reliabilities of constructs ranged from 0.81 to 0.93, and the AVE, ranging from 0.57 to 0.83, was greater than the variance due to measurement error. Therefore, all three conditions for convergent validity were met.

Discriminant validity assesses the extent to which a concept and its indicators differ from another concept and its indicators (Bagozzi, Yi, et al., 1991). According to Fornell and Larcker (1981), the correlations between items in any two constructs should be lower than the square root of the average variance shared by items within a construct. As shown in Table 2, the square root of the variance shared between the construct and its items was greater than the correlations between the construct and any other construct in the model, satisfying Fornell and Larcker's (1981) criteria for discriminant validity. All diagonal values exceeded the inter-construct correlations, and thus the results confirmed that our instrument had satisfactory construct validity.

### 4.2. Analysis of the structural model

We assessed the overall goodness-of-fit using the chi-square test. The chi-square test assesses the adequacy of a hypothesized model in terms of its ability to reflect the variance and covariance of the data. Due to its tendency to be sensitive to sample size, other fit indices

**Table 1**
Construct reliability and convergent validity.

| Construct/Indicator | Questionnaire items | Factor loading | *t*-Value | Composite reliability (CR) | Average variance extracted | Cronbach alpha |
|---|---|---|---|---|---|---|
| Perceived usefulness | PU1 | 0.866 | 19.410 | 0.92 | 0.7315 | 0.91 |
| | PU2 | 0.846 | 18.739 | | | |
| | PU3 | 0.857 | 19.116 | | | |
| Perceived ease of use | PEOU1 | 0.866 | 19.318 | 0.90 | 0.7534 | 0.90 |
| | PEOU2 | 0.873 | 19.578 | | | |
| | PEOU3 | 0.865 | 19.267 | | | |
| Attitude | AT1 | 0.858 | 19.068 | 0.91 | 0.7242 | 0.91 |
| | AT2 | 0.851 | 18.838 | | | |
| | AT3 | 0.849 | 18.764 | | | |
| Continued intention | CI1 | 0.837 | 12.331 | 0.89 | 0.7882 | 0.89 |
| | CI2 | 0.845 | 11.312 | | | |
| | CI3 | 0.844 | 9.334 | | | |
| Subjective norm | SN1 | 0.847 | 18.437 | 0.89 | 0.7334 | 0.88 |
| | SN2 | 0.862 | 18.941 | | | |
| | SN3 | 0.860 | 18.857 | | | |
| Perceived behavioral control | PBC1 | 0.907 | 20.801 | 0.91 | 0.7736 | 0.89 |
| | PBC2 | 0.861 | 19.139 | | | |
| | PBC3 | 0.870 | 19.419 | | | |
| Satisfaction | IT1 | 0.917 | 21.503 | 0.93 | 0.8257 | 0.92 |
| | IT2 | 0.907 | 21.100 | | | |
| | IT3 | 0.902 | 20.906 | | | |
| Confirmation | CF1 | 0.729 | 9.963 | 0.81 | 0.5978 | 0.80 |
| | CF2 | 0.815 | 10.583 | | | |
| | CF3 | 0.773 | 11.676 | | | |
| Perceived enjoyment | FR1 | 0.816 | 17.289 | 0.82 | 0.6908 | 0.81 |
| | FR2 | 0.846 | 18.179 | | | |
| | FR3 | 0.844 | 17.654 | | | |
| Concentration | Con1 | 0.823 | 16.505 | 0.82 | 0.6906 | 0.81 |
| | Con2 | 0.839 | 16.916 | | | |
| | Con3 | 0.833 | 13.443 | | | |
| | Con4 | 0.867 | 12.776 | | | |

**Table 2**
Correlation matrices and discriminant validity.

| Construct | Perceived usefulness | Perceived ease of use | Subjective norm | Perceived behavior control | Attitude | Continued intention | Confirmation | Satisfaction | Perceived enjoyment | Concentration |
|---|---|---|---|---|---|---|---|---|---|---|
| Perceived usefulness | *0.855* | | | | | | | | | |
| Perceived ease of use | 0.43 | *0.867* | | | | | | | | |
| Subjective norm | 0.41 | 0.32 | *0.851* | | | | | | | |
| Perceived behavior control | 0.34 | 0.34 | 0.35 | *0.856* | | | | | | |
| Attitude | 0.67 | 0.51 | 0.54 | 0.39 | *0.85* | | | | | |
| Continuance intention | 0.69 | 0.55 | 0.67 | 0.51 | 0.62 | *0.90* | | | | |
| Confirmation | 0.52 | 0.43 | 0.12 | 0.22 | 0.54 | 0.51 | *0.88* | | | |
| Satisfaction | −0.61 | −0.23 | −0.20 | −0.20 | −0.58 | −0.24 | −0.23 | *0.77* | | |
| Perceived enjoyment | −0.23 | −0.24 | −0.23 | −0.26 | −0.62 | −0.24 | −0.21 | 0.02 | *0.85* | |
| Concentration | −0.26 | −0.34 | −0.43 | −0.38 | −0.09 | −0.15 | −0.18 | 0.21 | 0.26 | *0.831* |

*Note*: All correlations significant at $p < 0.05$ except where noted. Diagonal elements (in italics) are square roots of average variance extracted.

(namely GFI, AGFI, CFI, NFI, and RFI) were considered in conjunction with the chi-square. For the statistical significance of parameter estimates, *t* values were used. The results of structural equation modeling obtained for the proposed conceptual model revealed a ratio of chi-square to the degree of freedom ($\chi^2/df$) of 2.04 ($p < 0.001$), goodness-of-fit index (GFI) of 0.91, adjusted goodness-of-fit index (AGFI) of 0.85, comparative fit index (CFI) of 0.95, normed fit index (NFI) of 0.95, relative fit index (RFI) of 0.94, and root mean square error of approximation (RMSEA) of 0.05. Generally, fit statistics greater than or equal to 0.9 for GFI, NFI, RFI, and CFI indicate a good model fit (Anderson & Gerbing, 1988). Furthermore, RMSEA values ranging from 0.05 to 0.08 are acceptable, indicating that our model fit was acceptable. The other fit indices, except AGFI, indicated that our proposed model obtained an adequate model fit. The low AGFI values may have been due to the small sample size used.

### 4.3. Hypotheses testing

The fifteen hypotheses presented above were tested collectively using the structural equation modeling (SEM) approach (Bagozzi et al., 1991), also performed using AMOS 6. The path significance of each hypothesized association in the research model and variance explained ($R^2$ *value*) by each path were examined, and Fig. 3 and Table 3 show the standardized path coefficients and path significances. All fifteen hypothesized associations were strongly significant at $p < 0.05$, except for the two links between perceived enjoyment and continuance intention and between concentration and attitude. The continuance intention to use e-learning in this study was jointly predicted by satisfaction ($\beta = 0.518$, < 0.001), perceived usefulness ($\beta = 0.208$, < 0.05) attitude ($\beta = 0.164$, $p < 0.05$), concentration ($\beta = 0.11$, $p < 0.001$), perceived behavior control ($\beta = 0.103$, $p < 0.001$), and subjective norm ($\beta = 0.141$, $p < 0.05$) and these variables together explained 80% of the variance of intention to use ($R^2 = 0.80$, coefficient of determination). In addition to its direct effects, perceived usefulness also had a significant indirect effect on continuance intention ($\beta = 0.33$, $p < 0.05$) via the satisfaction and attitude constructs, explaining 18% of the variance in the dependent variables. Satisfaction, in turn, was predicted by confirmation ($\beta = 0.283$, $p < 0.001$) and perceived usefulness ($\beta = 0.586$, $p < 0.001$). Confirmation also had a small indirect effect ($\beta = 0.11$, $p < 0.05$) on satisfaction, via the perceived usefulness construct (see Table 4).

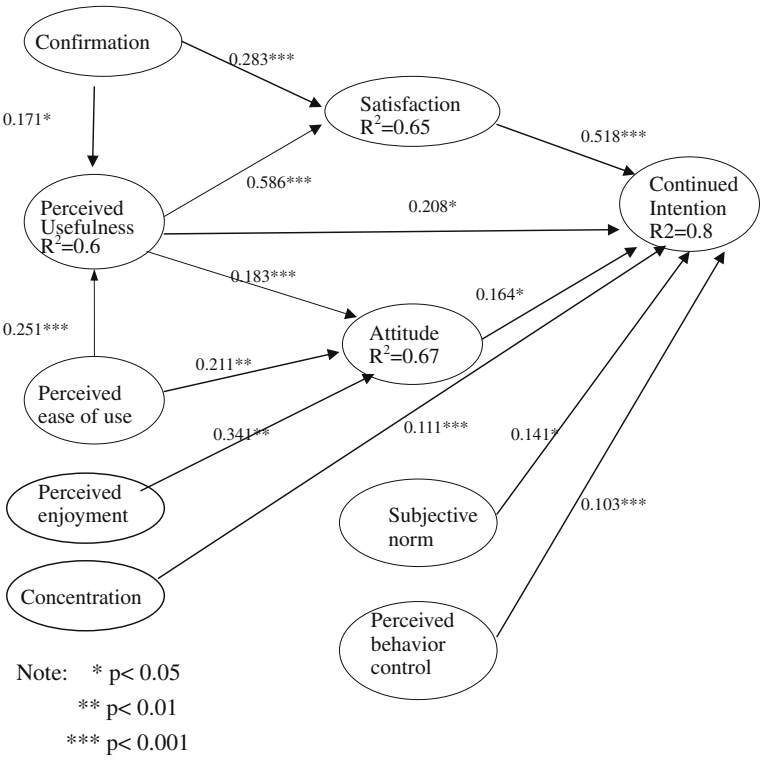


**Fig. 3.** Hypotheses testing results.

**Table 3**
Summary of hypotheses tests.

| | Hypotheses | $\beta$ | $p$-Value | Support |
|---|---|---|---|---|
| H1 | Satisfaction → continuance intention | 0.518 | –*** | Yes |
| H2 | Confirmation → satisfaction | 0.283 | –*** | Yes |
| H3 | Perceived usefulness → satisfaction | 0.586 | –*** | Yes |
| H4 | Perceived usefulness → continuance intention | 0.208 | –*** | Yes |
| H5 | Confirmation → perceived usefulness | 0.171 | 0.04* | Yes |
| H6 | Perceived usefulness → attitude | 0.183 | –*** | Yes |
| H7 | Perceived ease of use → attitude | 0.211 | –*** | Yes |
| H8 | Perceived ease of use → perceived usefulness | 0.251 | –*** | Yes support |
| H9 | Attitude → continuance intention | 0.164 | 0.02* | Yes |
| H10 | Subjective norm → continuance intention | 0.141 | 0.04* | Yes |
| H11 | Perceived behavior control → intention | 0.261 | 0.002** | Yes |
| H12 | Perceived enjoyment → attitude | 0.103 | –*** | Yes |
| H13 | Perceived enjoyment → continuance intention | 0.02 | 0.43 | No |
| H14 | Concentration → attitude | 0.07 | 0.22 | No |
| H15 | Concentration → continuance | 0.111 | –*** | Yes |

Standardized estimates are shown.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

**Table 4**
Direct, indirect and total effects – estimates.

| Predictors | Criterion variable | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Attitude | | | Satisfaction | | | Continuance intention | | |
| | Direct effects | Indirect effects | Total effects | Direct effects | Indirect effects | Total effects | Direct effects | Indirect effects | Total effects |
| Perceived usefulness | 0.183*** | – | – | 0.586*** | | 0.586*** | 0.208* | 0.33** | 0.538* |
| Perceived easy of use | 0.211** | 0.05* | 0.261* | | | | | 0.16* | 0.16* |
| Perceived enjoyment | | | | | | | | 0.06*** | 0.06** |
| Confirmation | | | | 0.283*** | 0.11* | 0.283*** | | | |
| Concentration | | | | | | | 0.11* | | 0.11* |
| Satisfaction | | | | | | | 0.518*** | | 0.518*** |
| Attitude | | | | | | | 0.164* | | 0.164* |
| Subjective norm | | | | | | | 0.141* | | 0.141* |
| Perceived behavioral control | | | | | | | 0.103** | | 0.103** |

* Significant at $p < 0.05$.
** Significant at $p < 0.01$.
*** Significant at $p < 0.001$.

Attitude was predicted by perceived usefulness ($\beta = 0.183$, $p < 0.001$), PEOU ($\beta = 0.211$, $p < 0.01$), and perceived enjoyment, and together these variables explained 67% of the total variance. To further assess the significance of indirect effects of predictor variables on continuance intentions to use e-learning, a decomposition of the effects analysis was conducted (see Table 4). A discussion of these effects for e-learning continuance is presented in Section 5.

## 5. Discussion

The results of this study provide support for the research model and for the hypotheses regarding the directional linkage among the model's variables. The overall explanatory power of our research model had an *R*-square of 80% for continued intention to use e-learning and an *R*-square of 65% for satisfaction, and 65% for attitude toward continued intention, suggesting that the extended ECM model is capable of explaining a relatively high proportion of variation of continued intention to use e-learning. Several insightful results could be summarized from our research framework, and these are presented below.

### *5.1. Understanding associations between antecedent constructs and continuance intention*

We have examined the effects of satisfaction, perceived usefulness, attitude, flow theory, subjective norm, and perceived behavioral control on the adoption and continuance intention of e-learning. The results of the study show that satisfaction is the strongest predictor of users' continuance intention, followed by perceived usefulness, attitude, concentration, and perceived behavioral control as significant but weaker predictors. The satisfaction-intention link has previously been validated in consumer behavior research over a wide range of product and service contexts (Bhattacherjee, 2001a, 2001b; Lin, Wu, et al., 2005), and its revalidation in the e-learning context further attests to the robustness of this association. Further, satisfaction may be the key to explaining the e-learning acceptance-discontinuance anomaly (user discontinuance of e-learning after its initial acceptance), a little-understood phenomenon in the literature. Because satisfaction was the strongest predictor of continuance intention (explaining 43% of variance) relative to the other predictors (which jointly explained 33% of variance), users dissatisfied with e-learning may stop using it, despite having positive perceptions with regard to other elements. In other words, dissatisfaction is the necessary condition for e-learning discontinuance. In contrast, TAM, which predicts user intention based on perceived usefulness and attitude, cannot explain this anomaly satisfactorily, unless the determinants change from the pre-acceptance to post-acceptance phases.

Perceived usefulness was identified in this study as a secondary determinant of continuance intention. When this result is compared with previous TAM-based studies of IS acceptance, some interesting patterns emerge. For example, perceived usefulness was a stronger predictor of acceptance intention in TAM than attitude (Davis, 1989; Taylor & Todd, 1995a, 1995b), while satisfaction was a stronger predictor of continuance intention in this study than perceived usefulness. Perceived usefulness is a cognitive belief, while attitude and satisfaction both reflect user affect (pre- and post-acceptance, respectively). Users' pre-acceptance attitude is based solely on cognitive beliefs (e.g., usefulness and ease of use) formed potentially via second-hand information from referent others, the media, advertising or other sources. These influence sources may be biased, and hence user attitude potentially may be inaccurate, unrealistic, and uncertain. In contrast, post-acceptance satisfaction is grounded in users' first-hand experience, and is therefore more realistic, unbiased, and less susceptible to change. The above findings imply that perceived usefulness is more closely related to acceptance intention, while satisfaction plays a more important role for continuance intention. Therefore, e-learning practitioners should adopt a twofold strategy in order to increase the adoption and continued usage of e-learning: inform new (potential) users of the potential benefits of e-learning use, and educate old (continued) users on how to use e-learning effectively so as to maximize their confirmation and satisfaction with such methods.

While all the TAM and ECM variables are significant in this study, they implicitly assume that behavior is volitional. However, e-learning users face several new constraints, such as the impersonal nature of the online environment, certain necessary resources and skills (perceived behavioral control), and influence of the opinions of other important persons (subjective norms). These issues call for the inclusion of TPB in the e-learning adoption model, and both subjective norm and perceived behavioral control are verified as having a significant influence on continuance intention. This finding implies that when users find that people around them have adopted e-learning services, they will be more willing to use it. E-learning providers may use positive word-of-mouth strategy to enhance the awareness of the e-learn-

ing and promote its benefits. They may need to consider how to bring positive experience to their existing customers to remain their future acceptance, rather than rely on mass media only (Bhattacherjee, 2000).

### 5.2. Understanding associations between antecedent constructs

In this research, perceived usefulness was found to have the most significant effect on satisfaction, which suggests that a user's belief in usefulness is a decisive antecedent of her/his perception of satisfaction. In addition, confirmation was a significant predictor of satisfaction and perceived usefulness in the proposed model, and then it influences continuance intentions in two (indirect) ways: by influencing e-learner satisfaction toward the service and by impacting learners' perceptions of its usefulness.

Perceived enjoyment strongly affected the behavioral attitude (H12), while concentration had a significant influence on the continuance intention (H15). When users log into an e-learning platform, they not only want to learn the online course, but also communicate with others and enjoy themselves, and thus seeking a flow experience (Lee, Christy, et al., 2005). Therefore, perceived enjoyment, as a user's intrinsic motivation, is as important a consideration as perceived usefulness for e-learning providers. However, the results of this work showed that perceived enjoyment had no obvious effect on the continuance intention (H13), and concentration had no significant effect on the behavioral attitude (H14). Thus, users' attitude towards e-learning mediated the relationship between perceived enjoyment and their continued intention. The results found that concentration directly affected users' intention to continue with the e-learning service, and this may be if users can concentrate on such services then it is easier for them to obtain the flow experience. However, a user might not realize when concentrating on e-learning, and as a result it does not affect his/her conscious attitude. It is worth noting that the results of our study were different from those of Koufaris (2002). In his paper, Koufaris did not examine attitude, and found that perceived enjoyment, rather than concentration, significantly affected a user's intention to return to a shopping website. The difference results may be attributed to the different technological contexts—online shopping compared to e-learning.

## 6. Implications

### 6.1. Implications for academics

In terms of theory building, this study attempts to develop a new theory by grounding a new variable in an integration of two schools of the nomological structure model (TRA) as well as a derivation of expectation disconfirmation theory (EDT) and applying them into a new context. It is important to note that the new variable, flow theory, is compatible with the TAM, TPB and ECM variables. This approach is likely to ensure a stable theory development. Hence, the proposed model makes an important contribution to the emerging literature on e-learning.

The present study has two implications for future e-learning research. First, the empirical results show that the unified model supports all the hypotheses and has good explanatory power, implying that the integration of ECM, TAM, and TPB provides a model with a theoretical basis to explain e-learning. This approach may provide an initial blueprint for the further integration of other theoretical acceptance models. For example, information technology (IT) research (Venkatesh et al., 2003) has already yielded many competing models such as innovation diffusion theory (IDT), social cognitive theory (SCT), expectation disconfirmation theory (EDT) and theory of reasoned action (TRA), each with different sets of acceptance determinants. It is anticipated that this study may encourage other research that integrates these competing models into unified ones.

Second, while the results show that the factors in TAM, TPB and ECM all have significantly direct or indirect effects on continuance intention to use e-learning, satisfaction has the strongest effect. Since confirmation and expectations are critical antecedents to satisfaction, future research may explore what factors influence these variables and how they can be manipulated in order to improve eventual user experience with e-learning, and hence its subsequent continuance.

### 6.2. Implications for practitioners

Instructors and system designers should make full use of the rich multimedia capabilities of the Internet to better facilitate student understanding and memorization of the course material. Ultimately, students are more likely to adopt and continue to use e-learning if they find that such services can enhance their learning.

Instructors should make good use of playing-and-learning, quizzes, and other creative approaches to instill more fun and interest in the learning process. Csikszentmihalyi (1997) contended that the concept of flow captures the peak experiences of intrinsic motivation, and his experiments demonstrated that most flow experiences occurred most often when actively involved in challenging task, and thus this knowledge should be applied to use e-learning.

Furthermore, instructors can make use of online chat-rooms and discussion boards to foster student collaboration and a sense of community. The more users there are in an e-learning class, the more user-generated experiences are likely to be exchanged, and the more new users the services will attract. The idea, called a dynamic loop, was found by Hagel and Armstrong (1997) to yield increasing returns in a virtual community.

## 7. Limitation and future research

This study has several limitations. First, the work was conducted using a short-term snapshot of users' behavior, and additional research efforts with longitudinal studies would give a clearer picture of how the users and the relationships among variables change over time. Second, because we collected the data for the independent and dependent variables from the same respondents, concerns about common method bias could arise (Woszczynski & Whitman, 2004), and we conducted Harmon's one-factor test (Podsakoff, MacKenzie, et al., 2003) to assess the risk of this. We entered all the variables into a factor analysis. These factors emerged with the first factor, accounting for 23.4% of the variance in the variables. Because more than a single factor emerged from the factor analysis and no general factor accounted for the

majority of the variance in those variables, we saw no evidence to suggest the presence of common method variance bias. Third, about 62% of the respondents were male in this empirical study, and thus the gender distribution was not symmetric between men and women. Therefore, the results of the current empirical study might tend to model the specific behavior of men, rather than general behavior of all users. Much evidence has shown that gender differences can cause discrepancies in the effects of satisfaction, perceived behavioral control, and subjective norm on a user's behavioral intention (Liao et al., 2007). Other references also show that the effect of ease of use and perceived usefulness on behavioral intention can be moderated by gender difference (Gefen & Straub, 1997). Accordingly, further research may be needed to examine the moderating effect of gender difference on the behavioral performance of an e-learning user.

While this study synthesizes four theoretical perspectives to propose a new model to explain and predict users' continuance intention to use e-learning, other external factors may also be important in understanding users' continuance intention to use e-learning. For example, in Brown's study (2002), he found that individual and technology characteristics are relevant in the acceptance of WebCT. Later, Ifinedo (2006) showed that the two external constructs significantly influence the continuance intention of use for web-based learning tools through TAM constructs. Thus, the technology or user characteristics constructs may be two important external factors in understanding users' continuance intention to use e-learning and possibly should be considered in future research.

DeLone and McLean (1992) reviewed the literature published in 1981–1987 in seven publications and concluded with a model of interrelationships between six IS success variables: (1) "system quality", (2) "information quality", (3) "use", (4) "user satisfaction", (5) "individual impact", and (6) "organizational impact". In the D&M model, "system quality" measures technical success; "information quality" measures semantic success; and "use, user satisfaction, individual impacts, and organizational impacts" measure effectiveness success.

Recently, a large amount of research has applied the D&M model to measure the success of e-learning systems (Holsapple, 2006; Lin, 2007; Wang, Wang, et al., 2007). We agree that the D&M is a very good predictive model. However, a single study may not include all possible features from all previous studies and the D&M model has been well validated in the context of e-learning. Therefore, this study intends to explore new possible explanatory factors to understand the continued usage of e-learning.

This study focused on Electronic-Learning discipline and does not take into account other disciplines in the e-learning service, limiting the breadth of these conclusions. Future study should consider a wider range of e-learning disciplines which may show different relationships between constructs.

## Appendix A. Questionnaire items used in this study

| Constructs | Questionnaire items |
|---|---|
| Perceived usefulness (adapted from Davis (1989)) | Using e-learning can improve my learning performance<br>Using e-learning can increase my learning effectiveness<br>I find e-learning to be useful to me |
| Perceived ease of use (adapted from Davis (1989)) | Learning to operate the e-learning system is easy for me<br>It is easy for me to become skillful at using the e-learning system<br>Overall, the e-learning system is easy to use |
| Attitude (adapted from Davis (1989)) | Using e-learning is a good idea<br>I like using e-learning<br>It is desirable to use e-learning |
| Perceived enjoyment (adapted from Moon and Kim (2001)) | Using e-learning is pleasurable<br>I have fun with using e-learning<br>I find using e-learning to be interesting |
| Concentration (adapted from Moon and Kim (2001)) | The e-learning Web site provides the service I need<br>I feel comfortable in using the functions and services provided by the e-learning Web site<br>The e-learning Web site provides complete information<br>The e-learning Web site provides information that is easy to comprehend |
| Subjective norm (adapted from Taylor and Todd (1995a, 1995b)) | People important to me support my use of e-learning<br>People who influence me think that I should use e-learning<br>People whose opinions I value prefer that I should use e-learning |
| Perceived behavioral control (adapted from Taylor and Todd (1995a, 1995b)) | Using e-learning system was entirely within my control<br>I had the resources, knowledge, and ability to use e-learning<br>I would be able to use the e-learning system well for learning process |
| Confirmation (adapted from Bhattacherjee (2001a, 2001b)) | My experience with using the e-learning system was better than I expected<br>The service level provided by the e-learning system was better than I expected<br>The e-learning systems can meet demands in excess of what I required for the service |
| Satisfaction (adapted from Bhattacherjee (2001a, 2001b)) | I am satisfied with the performance of e-learning<br>I am pleased with the experience of using e-learning<br>My decision to use e-learning was a wise one |
| Continuance Intention (adapted from Bhattacherjee (2001a, 2001b)) | I will use the e-learning system on a regular basis in the future<br>I will frequently use the e-learning system in the future<br>I will strongly recommend that others use it |

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