

Understanding e-learning continuance intention: An extension of the Technology Acceptance Model

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Abstract

Based on the expectancy disconfirmation theory, this study proposes a decomposed technology acceptance model in the context of an e-learning service. In the proposed model, the perceived performance component is decomposed into perceived quality and perceived usability. A sample of 172 respondents took part in this study. The results suggest that users' continuance intention is determined by satisfaction, which in turn is jointly determined by perceived usefulness, information quality, confirmation, service quality, system quality, perceived ease of use and cognitive absorption.

Keywords: Technology acceptance model; Expectancy disconfirmation theory; Satisfaction

Introduction

Information technology (IT) has the potential to transform the means by which we learn and access information in two important ways. First, IT enables us to do many of the things we already do faster, more flexibly, more efficiently and with greater access for all. Second, IT enables us to do things that we cannot now do, or to do them in ways that are significantly different. IT makes possible an entirely new environment and experience of learning that goes well beyond the classrooms, curricula, and text-based formats to which we are accustomed. Like any other information system, the success of e-learning depends largely on user satisfaction and other factors that will eventually increase users' intention to continue using it. In the information systems (IS) domain, we find a considerable amount of academic research examining the determinants of IT acceptance and utilization among users, (e.g. Venkatesh, 2000; Jiang et al., 2002; Heo and Han, theoretical models that attempt to explain the relations between user attitudes, satisfaction and behavioural intention to use and system usage. Among these models, one of the most widely accepted is the technology acceptance model (TAM) proposed by Davis and his colleagues (Davis, 1989; Davis et al., 1989). TAM is derived from the theory of reasoned

action (TRA, Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980) and predicts user acceptance based on the influence of two factors: perceived usefulness and perceived ease of use. TAM posits that user perceptions of usefulness and ease of use determine attitudes toward using the system.

Another significant area of IS research is users' satisfaction because it is considered an important determinant in measuring IS success and use (Bailey and Pearson, 1983; Ives et al., 1983; Doll and Torkzadeh, 1988; Delone and McLean, 1992). Among models developed for measuring user satisfaction are a 39-item tool by Bailey and Pearson (1983), the instrument by Ives et al. (1983), and a 12-item End-user Computing Satisfaction instrument by Doll and Torkzadeh (1988).

In the IS success model (Delone and McLean, 1992; Seddon, 1997), system quality and information quality are expected to affect both use and user satisfaction. In the meantime, use and user satisfaction become the antecedents of individual impacts and organizational impacts. Seddon (1997) also included perceived usefulness as a determinant of user satisfaction. Rai et al. (2002) extended the Seddon model in which perceived ease of use, perceived usefulness, and information quality are depicted as the antecedents of satisfaction. Some studies have re-examined the IS success model including service quality as another important antecedent to user satisfaction (e.g. Kettinger and Lee, 1994, 1997; Pitt et al., 1995; Negash et al., 2003; Wang and Tang, 2003; Landrum and Prybutok, 2004).

Recently, the expectancy disconfirmation theory (EDT, Oliver, 1980) has emerged as an important candidate for explaining the variables that motivate individuals to continue using an IT (Bhattacharjee, 2001a,b; Khalifa and Liu, 2002a,b; McKinney et al., 2002; Hayashi et al., 2004; Chiu et al., 2005; Lin et al., 2005). The EDT model proposes the causal relationship among the consumer's perceived performance, perceived disconfirmation, satisfaction and repurchase intention.

We argue that in EDT, satisfaction is an important antecedent of repurchase intentions, and in TAM perceived usefulness, cognitive absorption, perceived ease of use, perceived behavioural control and subjective norm jointly determine usage intentions. Therefore, our research makes important contributions to the growing body of technology acceptance literature by examining the relationships between EDT and TAM variables in the same model. To better identify the factors contributing to the formation of the user's decision to continue using the e-learning system, this study extends TAM and EDT research by dividing perceived performance into two constructs, perceived quality and perceived usability. In this study, perceived quality is represented as information quality, service quality and system quality. Also, perceived usability is divided into perceived usefulness, cognitive absorption and perceived ease of use. In addition, confirmation, perceived behavioural control and subjective norm are included in our model.

2. Theoretical background

2.1. The technology acceptance model

Davis (1989) first introduced the TAM as a theoretical extension of TRA. TRA is a well-known model in the social psychology domain, which suggests that a person's behaviour is determined by the individual's intention to perform the behaviour and that this intention is, in turn, a function of his/her attitude toward the behaviour and his/ her subjective norm. Attitudes toward the behaviour describe the positive or negative feelings toward a specific behaviour, and subjective norm assesses the social pressures on the individual to perform or not to perform a behaviour.

The theory of planned behaviour (TPB, Ajzen 1988,1991) can be considered as an extension of the

TRA. It posits that behavioural intention is jointly determined by attitude and subjective norm, similar to TRA, but with the addition of perceived behavioural control. Perceived behavioural control is the individual's "perception of easy or difficult of performing the behaviour of interest" (Ajzen, 1991, p. 183).

TAM adapted from TRA 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, p. 320). 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 behavioural intentions, which in turn lead to actual system use. The causal relationships have been validated empirically in many studies of user acceptance (Mathieson, 1991; Taylor and Todd, 1995a; Venkatesh and Davis, 1996, 2000; Venkatesh, 2000; Moon and Kim, 2001).

TAM has been extended by the addition of other constructs such as computer self-efficacy (Compeau and Higgins, 1995), Internet self-efficacy (Igbaria and Iivari, 1995; Eastin and LaRose, 2000; Joo et al., 2000; Hsu and Chiu, 2004a), subjective norm (Taylor and Todd, 1995a; Venkatesh and Davis, 2000; Bhattacharjee, 2000) or playfulness (Liu and Arnett, 2000; Moon and Kim, 2001; Hsu and Chiu, 2004a).

2.2. User information satisfaction

In the IS domain, a number of instruments have been developed to measure user information satisfaction (Bailey and Pearson, 1983; Ives et al., 1983) or end-user computing satisfaction (Doll and Torkzadeh, 1988). The instrument developed by Bailey and Pearson (1983) is a questionnaire of 39 items concerned with top management involvement, personal relationship with the EDP staff, vendor support, information quality, volume of output or confidence in the security of data among many other factors. Ives et al. (1983) condensed in short-form the Bailey and Pearson instrument using a sample of production managers. This short form was later empirically validated by Baroudi and Orlikowski (1988). Doll and Torkzadeh (1988) developed an end-user Computing Satisfaction instrument which included 12 items and five components: content, accuracy, format, timeliness and ease of use.

DeLone and McLean (1992) proposed a taxonomy and an interactive model as frameworks for conceptualising and operationalising IS success. They included six main dimensions of IS success: system quality, information quality, use, user satisfaction, individual impacts and organisational impacts, but did not empirically test. In this model, system quality and information quality singularly and jointly affect both system use and user satisfaction. Also, the amount of system use affects the degree of user satisfaction. System use and user satisfaction directly affect individual impact, which in turn is expected to influence organizational impact.

Since 1992, a number of studies have explicitly tested the associations among the measures identified in this model (Seddon and Kiew, 1994; Jurison, 1996; Igbaria and Tan, 1997). Seddon and Kiew (1994) partially tested DeLone and McLean's model of IS success, they found support for some of the model paths. In a study of a 3-year evaluation of user productivity and organisational effectiveness, Jurison (1996) found that individual benefits occur first, while improvements in organisational effectiveness develop over a longer period of time. Igbaria and Tan (1997) suggested that user satisfaction is an important factor affecting system usage and that user satisfaction has the strongest, direct effect on individual impact. Seddon (1997) used theoretical considerations to modify DeLone and McLean's model and incorporated the additional construct of perceived usefulness adapted from TAM. Rai et al. (2002) extended Seddon's model in which perceived ease of use, perceived usefulness and information quality are included as the antecedents of satisfaction.

Other IS research on IS success, (Kettinger and Lee 1994, 1997; Pitt et al., 1995) also included service quality as a determinant of user satisfaction using the SERVQUAL measurement instrument from marketing (Parasuraman et al., 1985). Parasuraman and his colleagues define service quality in terms of the difference between expected and perceived service, and they stated "the key to ensuring good service quality is meeting or exceeding what (customers) expect from the service" (Parasuraman et al., 1985, p. 46).

Two aspects of IS service quality, reliability and empathy, were found to be the most significant predictors of user satisfaction (Kettinger and Lee, 1994). Pitt et al. (1995) included service quality within the IS success model and concluded that SERVQUAL is an appropriate instrument for researchers seeking a measure of IS service quality. In this vein, Wang and Tang (2003) adapted IS-SERVQUAL to e-commerce service quality and empirically validated a new multiple-item instrument with good reliability and validity.

2.3. Expectancy disconfirmation theory

As described by Oliver (1980), EDT posits that consumers first form expectations of products or service performance prior to purchasing or use. Then, satisfaction outcomes are a function of perceived performance and perceived disconfirmation, and perceived disconfirmation depends on perceived performance and expectations, therefore, customer satisfaction is shown as a positive function of the difference between perceived performance and expectations. Some studies have shown that the higher the perceived performance, the more likely that expecta-

tions will be exceeded, resulting in a positive relationship between perceived performance and confirmation (Spreng et al., 1996). Therefore, perceived performance has a strong direct impact

on satisfaction and also an indirect effect through confirmation (Churchill and Surprenant, 1982; Tse and Wilton, 1988; Cronin and Taylor, 1992). When a consumer's expectations are negatively disconfirmed, that is the product performance is less than expected, it implies dissatisfaction (Oliver and Bearden, 1985). Fig. 1 depicts the relationships among EDT constructs. A number of empirical studies have confirmed the predictive capacity of the EDT in many product or service contexts, including restaurant service (Swan and Trawick, 1981), automobile repurchase (Oliver, 1993), compact disc players (Tse and Wilton, 1988), photographic products (Dabolkar et al., 2000), telephone services (Bolton and Drew, 1991) and professional services usage (Patterson et al., 1997).

One of the earliest researchers using EDT in the IS continuance context was Bhattacharjee (2001a). Using a sample of on-line banking users', he found that the most significant antecedent of continuance intention was satisfaction, which in turn is determined by users' confirmation and by perceived usefulness. In a second study, Bhattacharjee (2001b) confirmed that the consumer's confirmation of expectations predicts satisfaction and perceived usefulness, and both influence the consumer's intention to continue using business-to-consumer e-commerce services. Khalifa and Liu (2002a) empirically demonstrated the need to consider not only the expectations of customers with Internet-based services but their desires in predicting their satisfaction. Within the expectation-disconfirmation paradigm, McKinney et al. (2002) distinguished between information quality satisfaction and systems quality satisfaction, and for each of these constructs they measured expectations, perceived performance and disconfirmation.

3. The proposed model and research hypotheses

Using as theoretical background TPB, TAM, EDT and users' satisfaction we propose a research which identifies several attributes as likely predictors of e-learning continuance intention. Prior research into consumer satisfaction literature has represented perceived performance as perceived quality which is defined as the consumer's global judgement of the overall excellence of a product (Anderson et al., 1994; Fornell et al., 1996; Zeithaml, 1988). In the IT domain, some studies have identified information quality, system quality, and service quality as three different constructs for operationalising perceived performance (Hsu et al., 2003; Khalifa and Liu, 2002b).

Perceived usability is defined by the International Standards Organization (ISO) as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" (ISO 9241-11, 1998). EDT was also extended by decomposing the perceived performance component into usability, quality and value (Chiu et al., 2005), and it empirically demonstrated that users' continuance intention is determined by satisfaction, which in turn is jointly determined by perceived usability, perceived quality, perceived value, and usability disconfirmation. Lin et al. (2005) identified perceived playfulness as an important factor in determining users' satisfaction and continuance intentions.

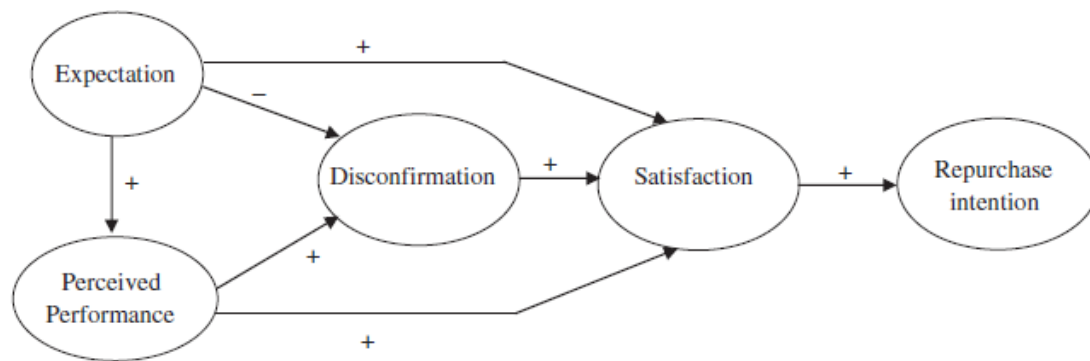


Fig. 1. Expectancy disconfirmation theory.

Therefore, this study discusses the perceived performance construct of the EDT model in terms of perceived usability and perceived quality. The relationships among these constructs are integrated in a conceptual model depicted in Fig. 2. The basic assumption is that e-learning continuance intention is determined by satisfaction, which is a function of perceived quality, perceived usability, confirmation and subjective norm.

3.1. Confirmation and perceived usability

In an application of the EDT to two studies of drivers of the consumer's intention to continue using e-services, Bhattacharjee (2001a) empirically validated that perceived usefulness is influenced by users' confirmation level in on-line banking services, and also in the business-to-consumer e-commerce services (Bhattacharjee, 2001b). The positive correlation between confirmation and perceived usefulness has also been confirmed in three virtual learning environments (Hayashi et al., 2004) and in the use of a web portal (Lin et al., 2005). Hence, this leads to the first hypothesis:

H1. Confirmation has a positive effect on perceived usefulness of the e-learning system.

Cognitive absorption in the IS domain indicates a state of deep involvement and enjoyment with software (Agarwal and Karahanna, 2000). Enjoyment refers to the extent to which the activity of using a computer system is perceived to be personally enjoyable in its own right aside from the instrumental value of the technology (Davis et al., 1992), and it is similar to computer playfulness, which refers to an individual's tendency to interact spontaneously, inventively and imaginatively with computers (Webster and Martocchio, 1992). Csikszentmihalyi (1990, p. 3) defined flow as "the state in which people are so intensely involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it". This state is characterised by loss of self-consciousness, by a responsiveness to clear goals and a deep sense of enjoyment. Lin et al. (2005) noted "since perceived usefulness and perceived playfulness are common motivations, it is reasonable to believe that confirmation would impact on perceived playfulness", and finally found empirical

support for this relationship. In our model, cognitive absorption further incorporates the dimensions of temporal dissociation and focused immersion. We hypothesise:

H2. Confirmation while using the e-learning system has a positive effect on cognitive absorption.

Bhattacharjee (2001a) removed perceived ease of use of his model because Karahanna et al. (1999) found that when users gain experience with the system, ease of use is displaced by perceived usefulness, as a result perceived ease of use has not been tested in the application of the EDT to the IS domain. However, in a critical review of TAM literature, Legris et al. (2003) showed that perceived ease of use has a high proportion of positive correlation with attitude (similar to satisfaction), thus, perceived ease of use affects attitude in 10 studies (e.g., Mathieson, 1991; Taylor and Todd, 1995a,b; Jackson et al., 1997; Bajaj and Nidumolu, 1998) and does not influence attitude in three studies (e.g., Hu et al., 1999). We argue that perceived ease of use is also a strong belief in the TAM context, therefore, we consider it necessary to examine its effect in the EDT area. This leads to the third hypothesis:

H3. Confirmation has a positive effect on perceived ease of use of the e-learning system.

3.2. Cognitive absorption, perceived usefulness and perceived ease of use

Prior research has studied the impact of cognitive absorption on perceived usefulness and perceived ease of use. In the World Wide Web context, Agarwal and Karahanna (2000) found that cognitive absorption had a significant effect on perceived usefulness and perceived ease of use. Saade and Bahli (2005) applied TAM, including cognitive absorption, in an empirical study to explain the acceptance of Internet-based learning systems. The results

suggested that cognitive absorption was a stronger predictor of perceived usefulness than of perceived ease of use. In a study of determinants of on-line shopping, Shang et al. (2005) also found a positive relationship between these constructs. These findings indicate that users' perception of the complexity and the usefulness of the e-learning system are influenced by the degree to which they feel involved and have a sense of enjoyment. Therefore, we hypothesise:

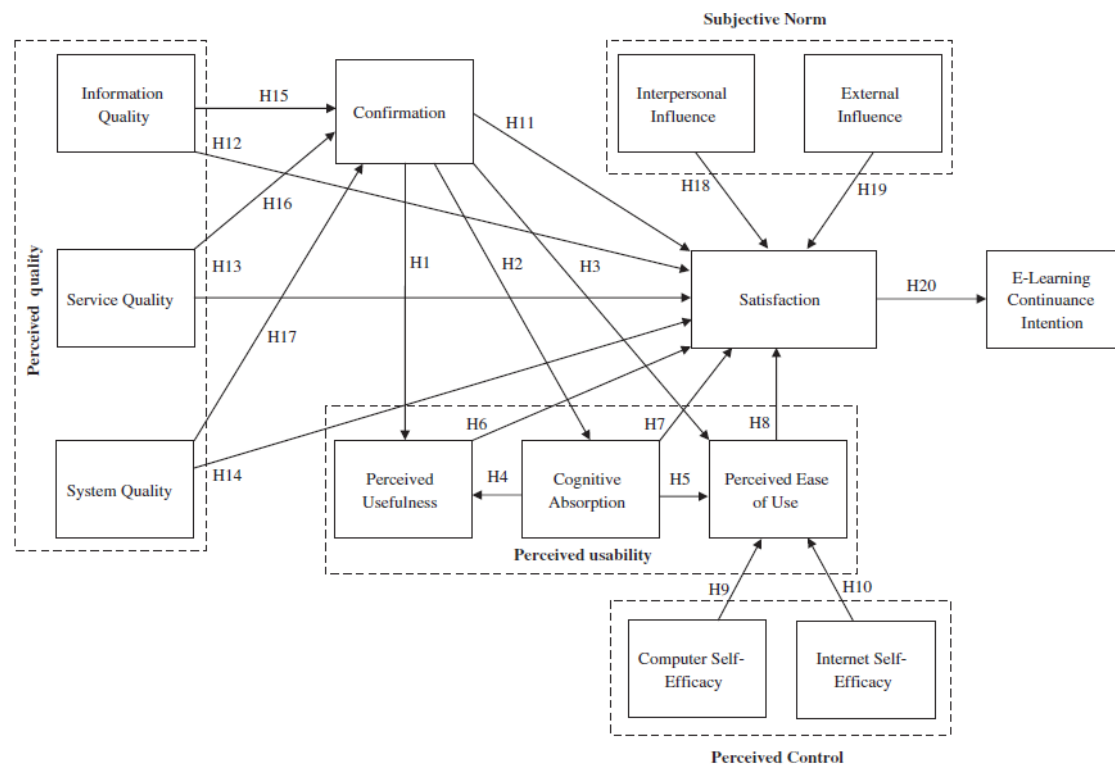


Fig. 2. Research model.

H4. Cognitive absorption while using the e-learning system has a positive effect on perceived usefulness.

H5. Cognitive absorption while using the e-learning system has a positive effect on perceived ease of use.

3.3. Perceived usability and satisfaction

The results of the two studies of Bhattacharjee (2001a,b) suggested that perceived usefulness was a significant determinant of user satisfaction. Hayashi et al. (2004) indicated that perceived usefulness was positively correlated with satisfaction in three different on-line training environments with differential degrees of social presence (low, medium and high). Rai et al. (2002) empirically assessed the Seddon IS success model (Seddon, 1997) and

specified user satisfaction as impacted by perceived usefulness and perceived ease of use. In the e-commerce environment, Devaraj et al. (2002) found that perceived usefulness and perceived ease of use were significant antecedents of consumer satisfaction. Woszczynski et al. (2002) developed a theoretical model of playfulness in computer interactions. They suggested that user satisfaction might be a consequence of the playful behaviour, and that more-satisfied users will tend to continue to behave more playfully in their computer interactions. Lin et al. (2005), in a study of continued use of a web site, reported a direct relationship between perceived playfulness and satisfaction. We argue that introducing cognitive absorption into EDT can

improve our understanding of users' e-learning continuance intention. Therefore, the following hypotheses are proposed:

H6. Perceived usefulness while using the e-learning system has a positive effect on satisfaction.

H7. Cognitive absorption while using the e-learning system has a positive effect on satisfaction.

H8. Perceived ease of use while using the e-learning system has a positive effect on satisfaction.

3.4. Self-efficacy and perceived ease of use

Bandura (1986) defined self-efficacy as "people's judgments of their capabilities to organise and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with the judgments of what one can do with whatever skills one possesses" (p. 391). Self-efficacy, then, is an individual's belief that he or she can perform a particular task or behaviour. In the IS domain, computer self-efficacy refers to the self-assessment of individual ability to apply computer skills to complete specified tasks (Compeau and Higgins, 1995). Thus, computer self-efficacy has been shown to influence perceived ease of use in prior studies (Venkatesh and Davis, 1996; Agarwal et al., 2000; Chau, 2001). Internet self-efficacy may be distinguished from computer self-efficacy as the belief that one can successfully perform a distinct set of behaviours required to establish, maintain and utilise effectively the Internet over and above basic personal computer skills (Eastin and LaRose, 2000). Joo et al. (2000) examined the effects of student motivation on performance in Web-based instruction. The results indicated that Internet self-efficacy significantly and positively predicted the student's performance in search tasks. Others found that Internet self-efficacy has a significant influence on on-line shopping (Eastin, 2002) and e-service continuance intention (Hsu and Chiu, 2004b). We argue that it is reasonable to predict a relationship between Internet self-efficacy and perceived ease of use, since Internet self-efficacy and computer self-efficacy are self-efficacy judgements, and previously, computer self-efficacy and perceived ease of use have been found to be related. We hypothesise:

H9. Computer self-efficacy has a positive effect on perceived ease of use of the e-learning system.

H10. Internet self-efficacy has a positive effect on perceived ease of use of the e-learning system.

3.5. Confirmation and satisfaction

Spreng et al. (1996) defined satisfaction as "an affective state that is the emotional reaction to a product or a service experience". In a number of studies, it has been empirically established that confirmation has a causal link with satisfaction (Oliver, 1980; Oliver and Bearden, 1985; Oliver and DeSarbo, 1988). Based on this, Bhattacharjee (2001a,b) established that confirmation

influences satisfaction. Similarly, Hayashi et al. (2004) and Lin et al. (2005) also found that confirmation directly affects satisfaction. Therefore, we hypothesise:

H11. Confirmation while using the e-learning system has a positive effect on satisfaction.

3.6. Perceived quality and satisfaction

In the IS domain, information quality, service quality and system quality are concerned with the quality of the outcomes or attributes of one's specific IS. Thus, information quality refers to quality of the output, such as timeliness, scope, relevance, and accuracy of information generated by an information system (Bailey and Pearson, 1983; DeLone and McLean, 1992; McKinney et al., 2002). Seddon (1997) considers system quality to be concerned with "bugs" in the system (system reliability), user interface consistency, ease of use, documentation quality, and quality and maintainability of the program code. Service quality can be defined as "a global judgement or attitude relating to the superiority of a service" (Parasuraman et al., 1988). Therefore, these constructs are similar to perceived quality in marketing. Further, McKinney et al. (2002) proposed a measurement of Web-customer satisfaction in which perceived performance was measured in terms of quality, including information quality and system quality. The results showed that both constructs have a significant influence on satisfaction.

DeLone and McLean (1992) found that system quality and information quality have a direct effect on user satisfaction and IS use. McGill et al. (2003) adapted this model for user-developed applications and they found strong support for the relationships between information quality and satisfaction and system quality and satisfaction. Recently, Bharatia and Chaudhury (2004) conducted an empirical study on web-based decision support systems. The results indicate that information quality and system quality are strong antecedents of decision-making satisfaction. In a study of Web-based customer support systems, Negash et al. (2003) indicated that information and system quality determine satisfaction while service quality has no impact. In contrast, Lai (2004) showed that service quality is an antecedent of satisfaction in a short-message service. These positive effects were also found in previous research, thus, Kettinger and Lee (1994) found reliability and empathy as antecedents of satisfaction. Seddon and Kiew (1994) indicated that information quality and system quality positively affected user satisfaction in a partial test of DeLone and McLean's model. Rai et al. (2002) empirically assessed the Seddon IS success model (Seddon, 1997) and found that user satisfaction was impacted by

information quality. Therefore, we hypothesise:

H12. Information quality has a positive effect on satisfaction of the e-learning system.

H13. Service quality has a positive effect on satisfaction of the e-learning system.

H14. System quality has a positive effect on satisfaction of the e-learning system.

3.7. Perceived quality and confirmation

According to EDT, product performance during and after the consumption experience has a positive effect on disconfirmation since higher performance is more likely to be above expectations, creating positive confirmation and finally customer satisfaction (Spreng and Chiou, 2002). This article extends EDT in the IS context by studying the relationship between perceived quality modelled in terms of information quality, service quality and system quality. We hypothesise:

H15. Information quality has a positive effect on con-firmation of the e-learning system.

H16. Service quality has a positive effect on confirmation of the e-learning system.

H17. System quality has a positive effect on confirmation of the e-learning system.

3.8. Subjective norm and satisfaction

Researchers have rarely studied the relationship between satisfaction and subjective norm in IS acceptance literature. In marketing literature, it has been shown that post-purchase communication among consumers influences satisfaction (Swan and Oliver, 1989), thus, we represent post-purchase communication in our model by subjective norm. Swan and Oliver (1989) identified three types of post-purchase communication by consumers, namely positive/negative word-of-mouth, recommendations/warn-ings to other people, and complaints or compliments, and indicated that satisfaction was related to more positive post-communications. Hsu and Chiu (2004b) modelled post-purchase communications as interpersonal and ex-ternal influences to predict electronic service continuance. The results showed that interpersonal influence exerts a stronger influence on satisfaction than external influence. Bhattacharjee (2000) defined interpersonal influence as the “influence of friends, family members, colleagues, superiors, and experienced individuals known to the potential adopter” and external influence as the “influence of mass media reports, expert opinions, and other non-personal information considered by individuals in performing a behaviour”. However, we propose to study the relation-ships of these constructs with satisfaction in order to enhance our understanding of the e-learning continuance intention. We hypothesise:

H18. Interpersonal influence has a positive effect on satisfaction.

H19. External influence has a positive effect on satis-faction.

3.9. Satisfaction and continuance intention

Past research has indicated that satisfaction has a positive effect on future repurchase intentions (Oliver, 1981; Bitner, 1990; LaBarbera and Mazursky, 1983; Patterson, 1995). Prior studies on IS

satisfaction have found a causal link between these constructs (Bhattacharjee, 2001a,b; Hayashi et al., 2004; Chiu et al., 2005; Lin et al., 2005). We hypothesise:

H20. Users' satisfaction has a positive effect on e-learning continuance intention.

4. Empirical methodology

A survey was employed in this study to test the hypotheses discussed in the previous sections, the data collection method used and the items selected for each of the constructs are presented in the following sections.

4.1. Data collection

The data used to test the research model were obtained from four international agencies of the United Nations: International Labour Organization (ILO), United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Development Programme (UNDP), Office of the United Nations High Commissioner for Human Rights (OHCHR). The questionnaire was designed to be placed as a Web-based survey on the Huelva University Website. Web-based surveys have been used in previous studies (Teo et al., 1999; Negash et al., 2003). The link to the on-line survey was sent by email to a total of 425 individuals who had taken at least one e-learning course offered by the United Nations System Staff College or by the International Training Centre of the ILO. We received a total of 184 responses (93 men and 79 women). Since 12 questionnaires were incomplete, a total of 172 usable surveys were used, thus, a net response of 40%. The respondents averaged 33.7 years in age and 45% had completed one college or university degree, and 19% had completed postgraduate degrees.

4.2. Measures

The measures used in this article were mainly adapted from relevant prior studies. All items were measured using a seven-point Likert-type scale with anchors from "Strongly disagree" to "Strongly agree". Items for perceived usefulness and perceived ease of use were adapted from prior work by Davis (1989). Items for cognitive absorption were adapted from Agarwal and Karahanna (2000). Scales of information quality and system quality were measured by the items derived from Bailey and Pearson (1983), Delone and McLean (1992), and Baroudi and Orlikowski (1988). The scale of service quality was measured by the items obtained from Kettinger and Lee (1994, 1997), Parasuraman et al. (1985, 1988), and Pitt et al. (1995).

Computer self-efficacy was measured by four items adapted from Compeau and Higgins (1995). Items for measuring interpersonal influence and external influence were adapted from Bhattacharjee (2000). We selected nine items from General Internet Self-efficacy from Hsu and Chiu (2004a), who previously adapted them from Torkzadeh and Van Dyke's Internet self-

efficacy instrument (Torkzadeh and Van Dyke, 2001). Since the size of the sample was small, the scores of interpersonal influence and external influence were averaged to form a single indicator for each latent variable, this was necessary for creating an adequate ratio of cases to parameter. The scales of Internet self-efficacy and computer self-efficacy were also averaged to create a single indicator for each latent variable.

Confirmation was measured using the confirmation items from Bhattacharjee (2001a). Items related to satisfaction were adapted from prior work by Oliver (1980) and Spreng et al. (1996). Items measuring continuance intention were adapted from prior work by Mathieson (1991) and Bhattacharjee (2001b).

5. Data analysis

The reliability and validity of the measurement instrument was evaluated using reliability and convergent validity criteria. Reliability of the survey instrument was established by calculating Cronbach's alpha to measure internal consistency. As shown in Table 1, all values were above the recommended level of 0.7, one exception was for the scale of interpersonal influence (0.67).

We also examined the convergent and discriminant validity of the model using the procedure outlined by Fornell and Larcker (1981). We conducted a confirmatory factor analysis (CFA) to test the convergent validity of each construct, this analysis showed that most items had factor loadings higher than 0.7, with only two exceptions, the second and third items for interpersonal influence. For satisfactory discriminant validity, the square root of the AVE from the construct should be greater than the correlation shared between the construct and other constructs in the model (Fornell and Larcker, 1981). As shown in Table 2, the square root of the AVE is much larger than all other cross-correlations for the sample.

The test of the structural model was performed using the LISREL procedure, a software package designed to perform the structural equations model approach to path analysis. To assess how well the model represented the data, we evaluated five goodness of fit indices: the χ^2 -square test statistic, the goodness-of-fit index (GFI), the normed fit index (NFI), the non-normed fit index (NNFI), and the comparative fit index (CFI). Table 3 shows that the research model provides a very good fit to the data. The χ^2/df was 3.16, the remaining four indices (NFI $\geq$ 0.95; NNFI $\geq$ 0.91; GFI $\geq$ 0.94; CFI $\geq$ 0.95). Therefore, we conclude that goodness of fit indices

exceeded the recommended levels, suggesting that the research model provided a good fit to the data.

The standardised path coefficients for the research model are presented in Fig. 3. Most of the paths were significant in the expected direction. Exceptions were the two paths connecting interpersonal influence and external influence with satisfaction. Results indicated that confirmation was associated with perceived usefulness, perceived ease of use and cognitive absorption. Hypotheses 1–3 were supported. Consistent with Hypotheses 4 and 5, cognitive absorption was positively related to perceived usefulness and perceived ease of use, respectively. Also, Hypotheses 6–8 were supported, confirming the hypothesised effect of perceived usefulness, cognitive absorption and perceived ease of use on satisfaction. Both

computer self-efficacy and Internet self-efficacy were found to positively affect perceived ease of use. Hypotheses 9 and 10 were supported. Hypothesis 11, which posited that confirmation should influence satisfaction, was supported. The hypothesised effects of information quality, system quality and service quality on satisfaction were also confirmed, supporting Hypotheses 12–14, respectively. Contrary to our predictions, Hypotheses H18 and H19, related to subjective norm, were not supported by the data. As proposed in H20, continuance intention was a positive function of satisfaction.

6. Discussion and implications

The goal of the present study was to empirically extend TAM using EDT as background by introducing information quality, service quality and system quality as direct antecedents of confirmation and satisfaction. We have also examined the effects of perceived usefulness, cognitive absorption, perceived ease of use and subjective norm on satisfaction, and the effect of confirmation on perceived usefulness, cognitive absorption and perceived ease of use. The present study provides a good explanation of users' satisfaction, thus, a significant amount of variance in e-learning satisfaction was explained (65%).

The results of the empirical analysis provide strong support for our hypotheses. Confirmation was found to be a strong determinant of perceived usefulness, satisfaction, perceived ease of use and cognitive absorption. Consistent with Hayashi et al. (2004), the strongest influence of confirmation was on perceived usefulness.

More importantly, this study found that the influence of perceived quality—information quality, service quality and system quality—on confirmation and satisfaction was strong. The empirical results show that information quality had a strong influence on confirmation, and the effect of information quality on satisfaction was stronger than service quality and system quality on satisfaction. The findings are consistent with prior studies indicating that it is not enough to build an e-learning system with a modern interface and friendly screens to influence users' continuance intention (Ong et al., 2004). The most important determinants of perceived ease of use are

Table 1

Table 1
Summary of measurement scales

	Mean	S.D.	Loading
<i>Perceived usefulness: Cronbach's $\alpha = 0.86$</i>			
Using the e-learning service can improve my learning performance	4.56	1.01	0.86
Using the e-learning service can increase my learning effectiveness	4.82	0.96	0.94
I find the e-learning service to be useful to me	5.02	1.03	0.84
<i>Perceived cognitive absorption: Cronbach's $\alpha = 0.92$</i>			
Time flies when I am using the e-learning system	4.68	1.05	0.75
Most times when I get on to the e-learning system, I end up spending more time than I had planned	4.83	0.98	0.81
When I am using the e-learning system I am able to block out most other distractions	4.79	0.97	0.86
While using the e-learning system, I am absorbed in what I am doing	4.62	1.06	0.94
I have fun interacting with the e-learning system	4.25	1.02	0.78
I enjoy using the e-learning system	4.37	1.04	0.84
<i>Perceived ease of use: Cronbach's $\alpha = 0.96$</i>			
Learning to operate the e-learning service is easy for me	5.23	1.10	0.71
It is easy for me to become skilful at using the e-learning service	5.08	1.12	0.85
My interaction with the e-learning service is clear and understandable	4.42	1.08	0.83
<i>Perceived Internet self-efficacy: Cronbach's $\alpha = 0.89$</i>			
I feel confident in navigating the e-learning system by following hyperlinks	5.63	1.02	0.84
I feel confident in the e-learning system finding information	5.78	1.02	0.91
I feel confident in the e-learning system receiving e-mail messages	5.38	0.98	0.87
I feel confident in the e-learning system sending e-mail messages	5.19	1.08	0.78
I feel confident in the e-learning system posting messages on a bulletin board	5.84	1.12	0.83
I feel confident in the e-learning system exchanging messages with other users in discussion forums.	5.69	1.04	0.84
I feel confident in the e-learning system chatting	5.71	1.03	0.88
I feel confident in the e-learning system downloading files	5.62	0.95	0.73
I feel confident in the e-learning system attaching files to e-mails	5.14	1.01	0.79
<i>Perceived computer self-efficacy: Cronbach's $\alpha = 0.94$</i>			
I could complete my learning activities using the e-learning system if I had never used a system like it before	5.16	0.93	0.92
I could complete my learning activities using the e-learning system if I had only the system manuals for reference	5.17	1.06	0.87
I could complete my learning activities using the e-learning system if I had seen someone else using it before trying it myself	4.93	0.97	0.89
I could complete my learning activities using the e-learning system if I had just the built-in-help facility for assistance	5.36	1.05	0.84
<i>Interpersonal influence: Cronbach's $\alpha = 0.67$</i>			
My family thought I should use the e-learning system	4.12	1.12	0.72
My colleagues thought I should use the e-learning system	4.06	1.32	0.68
My friends thought I should use the e-learning system	4.29	1.17	0.61
<i>External influence: Cronbach's $\alpha = 0.93$</i>			
I read/saw news reports that using the e-learning system was a good way of learning	4.37	1.21	0.71
Expert opinions depicted a positive sentiment for using the e-learning system	4.65	1.10	0.76
Mass media reports convinced me to use the e-learning system	4.19	1.19	0.74
<i>Information quality: Cronbach's $\alpha = 0.96$</i>			
The e-learning system provides relevant information for my job	5.21	1.02	0.73
The e-learning system does not provide easy-to-understand information (R)	5.26	1.05	0.82
The output information from the e-learning system is not clear (R)	5.72	1.06	0.79
The e-learning system presents the information in an appropriate format	5.63	0.98	0.86
The information content in the e-learning system is very good	5.02	1.06	0.91
The information from the e-learning system is up-to-date enough for my purposes	5.03	1.08	0.73
The completeness of output information that the e-learning system delivers is not sufficient for my purposes (R)	5.27	1.11	0.82
The reliability of output information from e-learning system is high	5.38	1.23	0.84
The e-learning system provides the information I need in time	5.32	1.14	0.74
<i>Service quality: Cronbach's $\alpha = 0.89$</i>			
The e-learning system has a modern looking interface	5.33	1.17	0.91
The e-learning system has visually appealing materials	5.68	1.16	0.89
The e-learning system provides the right solution to my request	5.51	1.08	0.76
The e-learning system gives me prompt service	5.42	0.99	0.82
The e-learning system does not give me individual attention (R)	5.36	1.12	0.89
The e-learning system has a good interface to communicate my needs	4.87	1.09	0.87
The e-learning system does not have convenient operating hours (R)	5.39	1.13	0.88
<i>System quality: Cronbach's $\alpha = 0.72$</i>			
Number of steps per task in the e-learning system are too many (R)	4.85	1.16	0.87

Table 1 (continued)

	Mean	S.D.	Loading
Steps to complete a task in the e-learning system follow a logic sequence	5.18	1.19	0.77
Performing an operation in the e-learning system always leads to a predicted result	5.35	1.22	0.89
The organisation of information on the e-learning system screens is clear	5.32	1.17	0.90
The e-learning system has natural and predictable screen changes	4.98	1.09	0.85
The e-learning system responds quickly during the busiest hours of the day	5.16	1.08	0.78
<i>Confirmation: Cronbach's $\alpha = 0.79$</i>			
My experience with using the e-learning system was better than I expected	5.44	1.65	0.81
The service level provided by the e-learning system was better than I expected	5.56	1.78	0.84
Overall, most of my expectations from using the e-learning system were confirmed	5.39	1.89	0.83
<i>Satisfaction: Cronbach's $\alpha = 0.97$</i>			
I am satisfied with the performance of the e-learning service	5.47	1.39	0.93
I am pleased with the experience of using the e-learning service	5.38	1.48	0.89
My decision to use the e-learning service was a wise one	5.46	2.05	0.86
<i>Continuance Intention = 0.95</i>			
I will use the e-learning system on a regular basis in the future	5.09	1.69	0.92
I will frequently use the e-learning system in the future	5.26	1.16	0.91
I will strongly recommend others to use it	5.34	1.27	0.87

Table 2

Diagonal elements are the square root of average variance extracted. These values should exceed the inter-construct correlations for adequate discriminant validity.

INT, continuance intention; SAT, satisfaction; CONF, confirmation; SYSQ, system quality; SERVQ, service quality; INFOQ, information quality; EINF, external influence; IINF, interpersonal influence; CSE, computer self-efficacy; ISE, Internet self-efficacy; PEOU, perceived ease of use; CA, cognitive absorption; PU, perceived usefulness.

Table 3
Overall model fit indices for the research model

Model fit indices	Results	Recommended value
χ^2 -statistic χ^2/df	3.16	≤ 5
NFI	0.95	≥ 0.9
NNFI	0.91	≥ 0.9
GFI	0.94	≥ 0.9
CFI	0.95	≥ 0.9

Table 3

In this research, the influence of perceived usefulness, information quality and confirmation on satisfaction are much stronger than that of service quality, system quality, perceived ease of use and cognitive absorption. 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 or his perception of satisfaction. This is consistent with previous research which found that perceived usefulness plays a more significant and stronger role than perceived ease of use (Davis et al., 1989; Karahanna and Straub, 1999; Devaraj et al., 2002) and perceived enjoyment (Igbaria et al., 1995; Teo et al., 1999) on usage. As found by Shang et al. (2005), cognitive absorption exerted a stronger influence on perceived ease of use than on perceived usefulness.

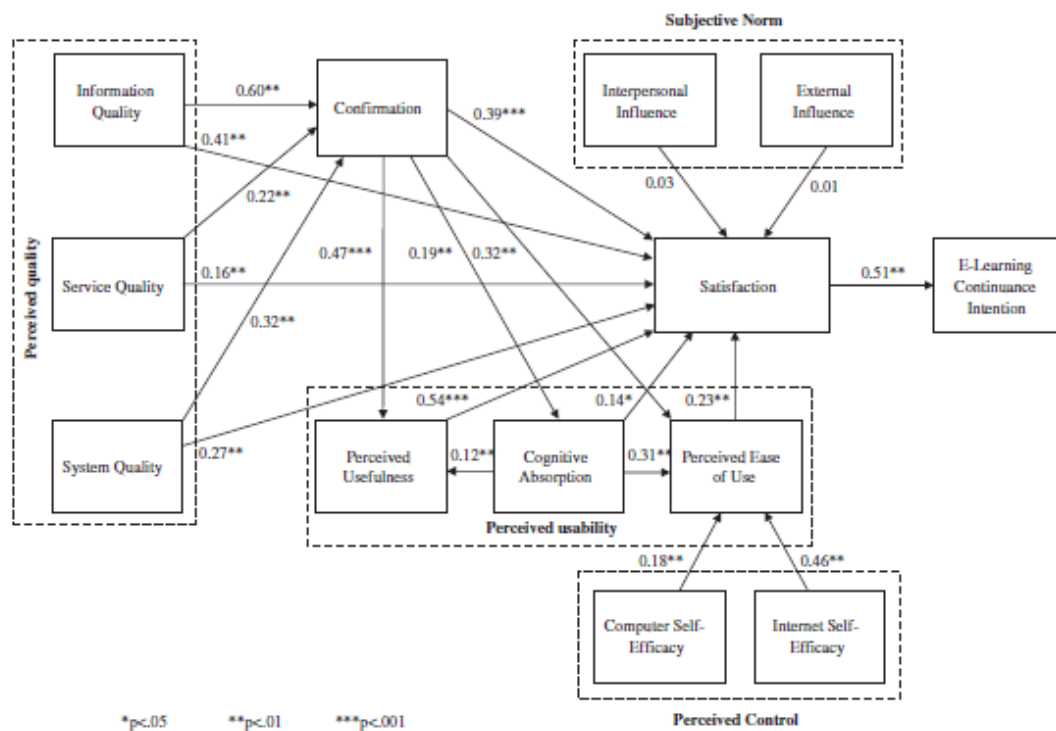


Fig. 3. SEM analysis of the research model.

As expected, information quality was found to be another important factor influencing users' satisfaction, thus, e-learning systems should provide more relevant information to achieve user goals. Our study suggests that when e-learners considered that the e-learning system was able to provide useful information for their jobs, they were more interested in using it and this increased their satisfaction. Therefore, perceived usability and perceived quality constructs play important roles in predicting user satisfaction. In this manner, TAM extended with EDT should be considered a valuable tool to evaluate e-learning systems in certain contexts.

Inconsistent with our hypotheses, interpersonal and external influence had no significant effect on satisfaction. Since we used a sample of workers, a possible explanation could be that the social influence comes through direct communication among members of the organization, because information about the benefits of the technology flows from some individuals to others, leading to an increase in the shared beliefs about the benefits of the system (Carter et al., 2001). For example, Amoako-Gyampah and Salam (2004) showed that project communication affects beliefs in the benefits of the enterprise resource planning system. Consistent with prior studies, there was a significant positive impact of satisfaction on continuance intention (Chiu et al., 2005).

The study has several limitations. First, since the users were from different countries, cultural differences might be reflected in our results, thus, users may vary considerably from culture to culture in satisfaction formation and technology acceptance. Second, responses to this study were voluntary and thus inevitably subject to self-selection variance (Woszczynski and Whitman, 2004). A commonly used statistical procedure of control for the common method bias is the Harmon one-factor test (Podsakoff et al., 2003). The test resulted in several factors with eigenvalues greater than one and the variance explained was 37.6%, therefore, this finding

suggests that a significant amount of common method variance was not present. Third, this study was conducted using a short-term snapshot of users' behaviour, so additional research efforts are also required to determine the validity of the proposed model and our findings, thus, longitudinal studies should allow the researcher to get an idea of how the users and the relationships among variables change over time.

Further research should separate users' confirmation of expectation following prior use of the e-learning system into three sub-constructs, including information quality confirmation, system quality confirmation and service quality confirmation. Users' satisfaction should be divided into information quality satisfaction, system quality satisfaction, and service quality satisfaction. Therefore, there is a need for further investigation of the antecedents of user judgements to be used by managers to target resources more efficiently, achieve improvements in user satisfaction and increase the probability that users will reuse the e-learning system.

The findings of the present study have various implications for research as well as practice. First, perceived usefulness and information quality are critical to the success of an e-learning system. Both, jointly with confirmation, were found to be the strongest antecedents of satisfaction. Second, confirmation was a significant mediator of the effects that information quality, system quality and service quality had on satisfaction. Third, information quality, system quality and service quality were found to be significant direct antecedents of satisfaction. Fourth, Internet self-efficacy and computer self-efficacy play important roles in affecting users' beliefs of ease of use. Since perceived usefulness is the most important antecedent of continuance intention, managers can increase users' usage intention by improving their beliefs of how the e-learning system can enhance their performance and effectiveness.

In addition, e-learning managers must improve the attributes of the target system, thus, information quality should be considered an important issue during the e-learning system's design because users are more favourably inclined toward using it when they perceive that the information provided by the system is clear, understandable and relevant for their job. Service quality, system quality and perceived ease of use also play an important role, thus, managers should develop a system that provides a prompt and reliable service with good user interface consistency. Therefore, this suggests that a user-friendly system should encourage people to reuse it, because when technologies are visually appealing and accessible users tend to experience cognitive absorption.

To conclude, the results from this study suggest that ease of use, playfulness and usefulness are considered important issues in IT usage. Our findings suggest that IS practitioners must improve the attributes of the target system, since after the initial period of utilisation, users form perceptions about its perceived quality (information quality, system quality and service quality), and when these perceptions are confirmed, they form a feeling of either satisfaction or dissatisfaction. Finally, satisfied users form intentions to use the system in the future. Therefore, in an e-learning context users are more concerned about how an e-learning system provides information and how it will make them more productive in their tasks.

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