



Usability, quality, value and e-learning continuance decisions

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Abstract

Previous research suggests that an eventual information technology (IT) success depend on both its initial adoption (acceptance) and subsequent continued usage (continuance). Expectancy disconfirmation theory (EDT) has been successfully used to predict users' intention to continue using information technologies. This study proposed a decomposed EDT model to examine cognitive beliefs and affect that influence users' continuance decision in the context of e-learning service. The proposed model extended EDT by decomposing the perceived performance component into usability, quality, and value. Research hypotheses derived from this model are empirically validated using the responses to a survey on e-learning usage among 183 users. The results suggest that users' continuance intention is determined by satisfaction, which in turn is jointly determined by perceived usability, perceived quality, perceived value, and usability disconfirmation. © 2004 Elsevier Ltd. All rights reserved.

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1. Introduction

The explosive growth of the World Wide Web (WWW) has made it a popular platform for providing electronic services (e-service), e.g., electronic learning (e-learning) service. Users' intention to continue using an e-learning service is considered as a major determinant of the e-learning success. While initial use (acceptance) of the e-learning service is the important first step toward realizing e-learning success, an eventual e-learning success further depends on its continued use or "continuance" (in contrast to initial use or "acceptance") after initial use. Clearly, understanding the factors influencing the user's intention to continue using the e-learning service is a critical issue for researchers and practitioners.

A critical factor for establishing long-term client relationships is satisfaction (Patterson, Johnson, & Spreng, 1997), which is the core component of the expectancy disconfirmation theory (EDT). EDT theorizes that repurchase intention is determined by satisfaction, which is jointly determined by two post-usage factors (i.e., perceived performance and disconfirmation) and one pre-usage factor, namely expectation. Some studies have begun to apply EDT to examine variables that motivate individuals to continue using an information technology (IT) (e.g., Bhattacharjee, 2001b; McKinney, Yoon, & Zahedi, 2002). In an application of EDT to the study of drivers of consumers' intention to continue using e-commerce services, Bhattacharjee (2001b) used perceived usefulness to operationalize the perceived performance construct. 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. DeLone and McLean (1992) proposed an information systems (IS) success model in which system quality and information quality are depicted as affecting user satisfaction and IS use. In a respecification of the DeLone and McLean's IS success model, Seddon (1997) modeled system quality, information quality and perceived usefulness as the major determinants of user satisfaction. Rai, Lang, and Welker (2002) proposed an amended Seddon model in which perceived ease of use, perceived usefulness, and information quality are modeled as the antecedents of satisfaction. Some studies in the consumer behavior domain have also identified perceived value as an important determinant of user satisfaction, e.g., Fornell, Johnson, Anderson, Cha, and Bryant (1996), McDougall and Levesque (2000), and Patterson and Spreng (1997). By synthesizing the EDT paradigm with empirical theories in user satisfaction and IS success, we suggest modeling the determinants of satisfaction from three perspectives, i.e., usability, quality, and value.

This study contributes a decomposed EDT model of e-learning continuance in which EDT is adapted from the consumer behavior literature and integrated with theoretical findings from prior IS usage and success research. Using questionnaire data, we employ structural equation modeling (LISREL) to assess the accuracy of the decomposed EDT model and to test the research hypothesis.

2. Theoretical background and the research model

2.1. Expectancy disconfirmation theory

Expectancy disconfirmation theory or disconfirmation of expectation theory is a consumer behavior model that has gained widespread acceptance in the research of explaining and predict-

ing consumer satisfaction and the repurchase intention. The EDT model originally developed by Oliver (1980) theorizes that consumers' intention to repurchase a product or reuse a service is determined primarily by their satisfaction with prior use of that product or service. Satisfaction is jointly determined by disconfirmation and expectation. In this model disconfirmation is the most immediate influence on satisfaction. Churchill and Surprenant (1982) extended the model to explicitly include perceived performance as an antecedent of satisfaction and include effects of expectations and perceived performance on disconfirmation and effects of expectations on perceived performance. Fig. 1 illustrates key constructs and posited relationships among them in EDT.

The EDT model assumes that consumers' degree of satisfaction is an outcome of a five-step process (Oliver, 1980). First, consumers form an initial expectation of a specific product or service prior to purchase. Second, they accept and use that product or service. Following a period of initial consumption, they form perceptions about its performance on the salient attributes. Third, they compare these perceptions of performance with their prior expectation levels and determine the extent to which their expectations are confirmed. Expectations could be positively disconfirmed (perceived performance exceeds expectations), confirmed (perceived performance equals expectations), or negatively disconfirmed (perceived performance falls short of expectations). Fourth, they form a feeling of satisfaction or dissatisfaction based on their disconfirmation level. A moderate satisfaction level will be maintained by confirmation, enhanced by the delight of positive disconfirmation, and decreased by the disappointment of negative disconfirmation. Finally, satisfied consumers form intentions to reuse the product or service in the future, while dissatisfied users discontinue its subsequent use.

The predictive ability of the EDT has been demonstrated over a wide range of consumer satisfaction and product or service continuance contexts, including restaurant service (Swan & Trawick, 1981), health care options (Gilbert, Lumpkin, & Dant, 1992), automobile repurchase (Oliver, 1993; Yoon & Kim, 2000), camcorder usage (Spreng, MacKenzie, & Olshavsky, 1996), business-to-business professional service usage (Patterson & Spreng, 1997), financial service usage (Montfort, Masurel, & Rijn, 2000), and vacation destination revisiting (Petrick, Morais, & Norman, 2001). EDT is also used in the IS literature to study IS continuance intention, electronic commerce service continuance, and Web customer satisfaction. Bhattacharjee (2001b) applied EDT to examine cognitive belief and affect influencing an individual's intention to continue using

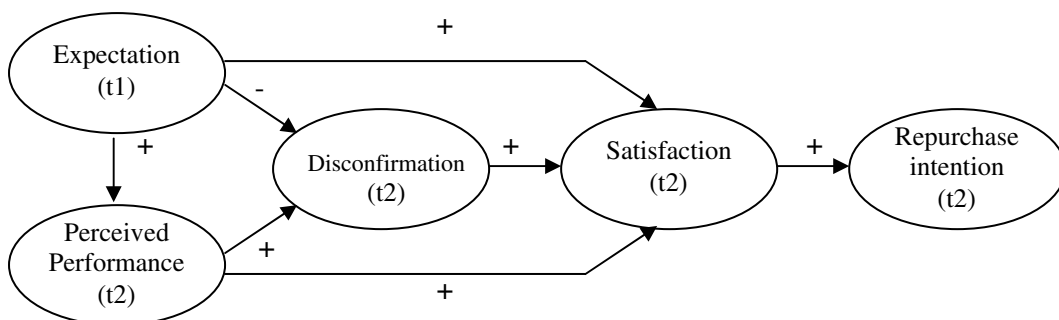


Fig. 1. Expectancy disconfirmation theory. Note: t1 = pre-consumption variable; t2 = post-consumption variable.

information systems. [Bhattacharjee \(2001a\)](#) applied EDT, Technology Acceptance Model (TAM) and agency theory to examine key drivers of consumers' intention to continue using business-to-customer (B2C) e-commerce services in the online brokerage context.

2.2. Development of the research model

This study proposes a decomposed expectancy disconfirmation theory (DEDT) model for e-learning continuance (see [Fig. 2](#)). The decomposed EDT model is adapted from the EDT and consumer behavior literature and integrated with theoretical findings from prior IS usage and success research. Two major post-usage constructs of EDT are perceived performance and disconfirmation. Perceived performance is defined as customers' perception of how product performance fulfills their needs, wants, and desires ([Cadotte, Woodruff, & Jenkins, 1987](#)). [Sprenge et al. \(1996\)](#) defined perceived performance as "beliefs regarding the product attributes, levels of attributes, or outcomes". Prior work in the IT domain has represented perceived performance as perceived usefulness ([Davis, 1989](#)), perceived ease of use ([Davis, 1989](#)), and perceived compatibility ([Taylor & Todd, 1995](#)). [McKinney et al. \(2002\)](#) synthesized perspectives from the user-satisfaction literature in IS and customer-satisfaction literature in marketing to develop constructs for measuring perceived performance and disconfirmation in terms of information quality and system quality. Some studies ([Hsu, Chen, & Chiu, 2003](#); [Khalifa & Liu, 2002](#)) interpreted perceived performance from the aspects of information quality, system quality, and service quality. [McDougall and Levesque \(2000\)](#) modeled service quality and perceived value as contributing factor to satisfaction. The American Customer Satisfaction Index (ACSI) model identifies perceived quality and perceived value as two distinct constructs for operationalizing perceived performance ([Fornell et al.,](#)

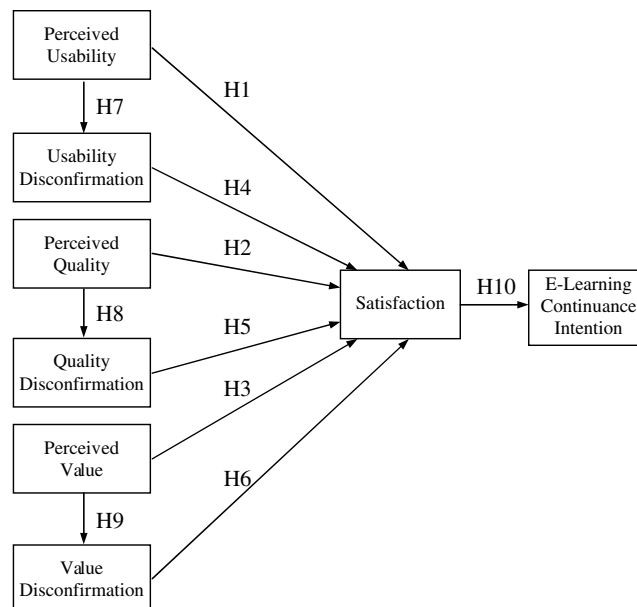


Fig. 2. Research model for e-learning continuance.

1996). Therefore, this study proposes to decompose the perceived performance construct of the EDT model into three components: usability, quality, and value.

The proposed model suggests that usability, quality and, value are interrelated but can be conceptualized and measured as three distinct constructs. Their distinctness can be verified through discriminant validity analysis. A number of prior studies have provided empirical support for the relationships among these three constructs. For example, Patterson and Spreng (1997) found that perceived performance, similar to the perceived usability component of our model, is significantly associated with perceived value, while de Ruyter, Bloemer, and Peeters (1997) found that perceived performance (usability) is significantly associated with perceived quality. Researchers assert that perceived quality has a positive effect on perceived value. This is both intuitively true (Fornell et al., 1996) and demonstrated in prior studies (Cronin, Brady, & Hult, 2000; Dodds, Monroe, & Grewal, 1991; Sweeney, Soutar, & Johnson, 1997). However, this study focuses on examining the effects of usability, quality and value on their disconfirmations and satisfaction. The basic assumption is that e-learning continuance intention is determined by satisfaction, which is in turn jointly determined by perceived usability, perceived quality, perceived value, usability disconfirmation, quality disconfirmation, and value disconfirmation.

Perceived usability refers to the extent to which a product or service 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). In this study, there are three key factors in usability: usefulness, ease of use, and compatibility. Davis, Bagozzi, and Warshaw (1989) theorized that people build positive attitudes toward using computer systems based largely on a cognitive appraisal of how it will improve their performance. Bhattacharjee (2001b) applied EDT to examine cognitive belief and affect influencing an individual's intention to continue using online banking services. The results suggested that perceived usefulness was a significant determinant of user satisfaction. Rai et al. (2002) empirically assessed the Seddon IS success model (Seddon, 1997) in a quasi-voluntary IS usage context and found significant paths from perceived usefulness and perceived ease of use to user satisfaction. Drawing on three established frameworks, namely TAM, Transaction Cost Analysis, and Service Quality (SERVQUAL), Devaraj, Fan, and Kohli (2002) conducted a study to examine consumer satisfaction with the e-commerce channel and found support for perceived usefulness and perceived ease of use as significant determinants of consumer satisfaction. Therefore, the following hypothesis is proposed:

H1. Perceived usability is positively related to user satisfaction.

Prior research has studied the effect of perceived quality on satisfaction from three dimensions: information quality, system quality, and service quality. Information quality is concerned with timeliness, relevance, and accuracy of information generated by an information system (Bailey & Pearson, 1983; DeLone & McLean, 1992; McKinney et al., 2002). Chae and Kim (2001) proposed a model of information quality to identify the important dimensions of information quality in increasing user satisfaction and customer loyalty for mobile Internet services. Results indicated that information quality had a significant effect on user satisfaction, which in turn, was significantly related to customer loyalty. Seddon and Kiew (1994) partially tested DeLone and McLean's model of IS success. They found that there was strong support for the positive relationship between information quality and user satisfaction.

System Quality is concerned with whether or not there are “bugs” in the system, the consistency of the user interface, ease of use, response rates in interactive systems, quality documentation, and sometimes, quality and maintainability of the program code (Seddon, 1997). Seddon and Kiew (1994) partially tested DeLone and McLean’s model of IS Success. The result indicated that system quality positively affected user satisfaction. Rai et al. (2002) empirically assessed the Seddon IS success model (Seddon, 1997) in a quasi-voluntary IS usage context and found a significant path from system quality to user satisfaction.

Parasuraman, Zeithaml, and Berry (1985) suggested that service quality is derived from the comparison between what the customer feels should be offered and what is provided. In recognition of the expanded role of IS department and the importance of information systems (IS) and e-commerce (EC), researchers have begun to include service quality as a measure of IS satisfaction/success in recent years. The Service Quality (SERVQUAL) scale has been used in the measurement of IS service quality (Kettinger & Lee, 1994; Kettinger & Lee, 1997; Myers, Kappelman, & Prybutok, 1997; Pitt, Watson, & Kavan, 1995; Van Dyke, Kappelman, & Prybutok, 1997). The SERVQUAL scale contains five dimensions: tangibles, reliability, responsiveness, assurance, and empathy. Devaraj et al. (2002) found empirical support for the assurance as determinant in EC channel satisfaction. In a study of the impact of information technology (IT) on service quality in consumer-banking sector, Zhu, Wymer, and Chen (2002) found that customer perceived service quality had a significant effect on customer satisfaction.

H2. Perceived quality is positively related to user satisfaction.

Value is an abstract concept with meanings that vary according to context. In terms of personal value, value refers to “an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct” (Rokeach, 1973). In consumer behavior, perceived value has been defined as “the consumer’s overall assessment of the utility of a product based on perceptions of what is received and what is given” (Zeithaml, 1988). Rokeach (1973) classified values into two categories: terminal and instrumental. Terminal values are concerned with preferred end states (goals), for example, happiness and a comfortable life, while instrumental values are related to the ways of behaving to obtain goals, such as broad-minded and capable. Kahle (1983) proposed a List of Value (LOV) inventory that contains nine values relevant to consumer behavior, including self-fulfillment, excitement, being well respected, sense of accomplishment, self-respect, sense of belonging, security, fun and enjoyment, and warm relationships with others.

Bojanic (1996) suggested that high levels of perceived value result in purchase and ultimately higher levels of customer satisfaction. Spreng, Dixon, and Olshavsky (1993) argued that value should be a direct antecedent of satisfaction. Patterson and Spreng (1997) empirically examined the relationships between perceived value, satisfaction, and repurchase intention in the context of business-to-business professional services. They found that perceived value had a significant effect on customer satisfaction, which in turn had a significant effect on repurchase intentions. McDougall and Levesque (2000) examined the contribution of service quality and perceived value towards customer satisfaction and future intentions across four services. The results indicated that service quality and perceived value were significant determinants of customer satisfaction.

H3. Perceived value is positively related to user satisfaction.

Disconfirmation refers to the discrepancy between an individual's perceptions of a product or service's performance and his or her expectation levels (Oliver, 1980; Olson & Dover, 1979; Tse & Wilton, 1988). In this study, we define usability (quality and value) disconfirmation as an individual's perceptions of an e-learning service's usability (quality and value) and his or her expectation levels. In an application of EDT to the study of a retail service usage, Swan and Trawick (1981) found that disconfirmation had a significant effect on satisfaction. Oliver (1993) integrated EDT with affect augmentation to form an expanded attribute-based satisfaction model and applied it to the studies of automobile satisfaction and satisfaction with course instruction. He found that disconfirmation emerged as a major satisfaction influence for both automobile and course instruction studies. Spreng et al. (1996) indicated that expectation congruency (disconfirmation) had significant effects on attribute satisfaction and information satisfaction, which in turn had significant effects on overall satisfaction. Montfort et al. (2000) indicated that disconfirmation played a significant role in the prediction of satisfaction of a consumer of financial services.

Some IS researches have provided empirical support for the relationship between disconfirmation and satisfaction. Bhattacharjee (2001b) found that performance (usability) disconfirmation is an important determinant of user satisfaction with the online banking system. In an application of EDT to the study of satisfaction with Internet-based services, Khalifa and Liu (2002) found that disconfirmation is significantly associated with satisfaction. By synthesizing the above findings, we propose the following hypotheses:

H4. Usability disconfirmation is positively associated with user satisfaction.

H5. Quality disconfirmation is positively associated with user satisfaction.

H6. Value disconfirmation is positively associated with user satisfaction.

According to EDT, disconfirmation is determined by the combination of the expectation and perceived performance. Positive disconfirmation arises when the perceived performance exceed one's expectations. In other words, all things being equal, the higher an individual's perceptions of a product or service's performance, the more likely that perceived performance can exceed expectation levels, resulting in a positive relationship between perceived performance and disconfirmation (Patterson et al., 1997). In a study of determinants of consumer satisfaction, Spreng et al. (1996) found that perceived performance was positively related to expectation congruency (disconfirmation) for camcorder usage. In a study of users satisfaction with Internet-based services, Khalifa and Liu (2002) found that perceived performance exerted a strong effect on disconfirmation. Therefore, the following hypotheses are proposed:

H7. Perceived usability is positively associated with usability disconfirmation.

H8. Perceived quality is positively associated with quality disconfirmation.

H9. Perceived value is positively associated with value disconfirmation.

Satisfaction is an individual's feelings of pleasure or disappointment resulting from comparing a product's perceived performance (or outcome) in relation to his or her expectations. Oliver (1980) theorizes that satisfaction is positively correlated with future intention, both directly and

indirectly via its impact on attitude. In the final step of satisfaction formation processes, satisfaction determines intentions to patronize or not to patronize the store in the future (Swan & Trawick, 1981). Swan and Trawick (1981) found a significant satisfaction-intentions correlation within a retail service context. Patterson and Spreng (1997) found a strong link between satisfaction and repurchase intentions in the context of business-to-business professional services. Bhattacharjee (2001b) indicated that satisfaction was a significant predictor of IS continuance in the context of online banking services. Van Riel, Liljander, and Jurriens (2001) found a strong positive effect of satisfaction on the intention to continue using a portal site. Therefore, the following hypothesis is proposed:

H10. User satisfaction is positively associated with continuance intention.

3. Research methodology

3.1. Sample, setting, and procedures

The sample for the study was taken from 10 class sections that were conducted using an e-learning service in the continuing education program of a university in Taiwan. Electronic learning may be delivered via blend of asynchronous and synchronous technologies. Synchronous e-learning service consists of real-time interaction between learners and instructors, facilitated by technological tools such as videoconferencing, teleconferencing, chat rooms, etc. Asynchronous e-learning service is a self-study that may be supplemented by non-real time interaction with the instructor, for instance through email, voice mail, message boards, forums, and threaded discussions. The e-learning service of this study is an asynchronous Web-based learning system, supplemented by non-real time interaction with the instructor through email, message boards, and forums.

A total of 500 surveys were distributed to individuals who at least took one course offered by the e-learning service. A total of 189 surveys were returned. The exclusion of responses from incomplete questionnaires resulted in a total of 183 usable questionnaires (a net response rate of 36.6%). Among the respondents, 54% had taken one online course, 38% had taken two or three online courses, and 8% had taken at least four online courses. On average, the respondents were 32 years old and had 5.1 years of experience in using the WWW to browse information.

A pretest of the questionnaire (including all constructs) was conducted using six experts in the IS research area to assess logical consistencies, ease of understanding, sequence of items, and task relevance. Overall, the experts indicated that the questionnaire was relatively clear and easy to complete. A number of suggestions were made concerning the wording of several items and the overall structure of the questionnaire, and these suggestions were incorporated into the revised instrument. Furthermore, a pilot study involving 30 part-time master students who had taken an on-line course was also conducted. The purpose of the pilot study was to gain additional feedback about the questionnaire instrument. Respondents were asked to provide any comments on the questionnaire content and structure.

For the main study, the questionnaires were distributed to the selected subjects with a cover letter indicating the purpose and importance of the study. All respondents were guaranteed

confidentiality of individual responses. In order to maximize the response rate, a small gift was provided with the survey, and follow-up mails were made to individuals not having responded after three weeks.

3.2. Instrument

Table 1 lists the instrument for the research construct. Items measuring continuance intention were adapted from prior work by Bhattacharjee (2001b) and Mathieson (1991). Items related to satisfaction were adapted from prior work by Oliver (1980) and Spreng et al. (1996). Items for perceived usability sampled the dimensions of perceived usefulness, perceived ease of use, and perceived compatibility. Items for perceived usefulness and perceived ease of use were adapted from prior work by Davis (1989). Items for measuring perceived compatibility were adapted from prior work by Taylor and Todd (1995). Items for perceived quality sampled the dimensions of the service quality, information quality, and system quality. Items for information quality and system quality were adapted from McKinney et al. (2002), whereas items for service quality was derived from Kettinger and Lee (1994, 1997). Items for measuring perceived value were adapted from the List of Value (LOV) (1983) and the Rokeach Value Survey (RVS) (1973). For the aforementioned measures, a 7-point Likert type was used, with anchors ranging from strongly disagree (1) to strongly agree (7).

There are two main approaches to measuring disconfirmation: inferred and perceived (Swan & Trawick, 1981). The inferred (subtractive) disconfirmation approach, deriving from comparison level theory, assumes that disconfirmation can be expressed as a function of the algebraic difference between the perceived performance and expectation (Tse & Wilton, 1988). The perceived (subjective) disconfirmation represents a subjective evaluation of the discrepancies between the perceived performance and expectation (Tse & Wilton, 1988); that is, the user's perception that the perceived performance is better or worse than expected (Swan & Trawick, 1981).

Oliver (1980) argues that subtractive disconfirmation is a comparative process that may lead to an immediate satisfaction judgment, whereas "subjective disconfirmation represents an intervening distinct cognitive state resulting from the comparison process and preceding a satisfaction judgment" (p. 460). Tse and Wilton (1988) suggest using the subjective disconfirmation approach under the condition that the model theorizes direct relationships between satisfaction and perceived performance, expectation and disconfirmation simultaneously, since expressing disconfirmation as "a subtractive function of the remaining two independent variables will induce overspecification of the customer satisfaction or dissatisfaction (CS/D) model". Subjective disconfirmation, as an independent construct that influences consumer satisfaction, is free of such confounding (Tse & Wilton, 1988). Most of the studies concerning user satisfaction use the subjective disconfirmation approach (Bhattacharjee, 2001b; Churchill & Surprenant, 1982; McKinney et al., 2002; Oliver, 1980; Spreng et al., 1996; Wirtz & Bateson, 1999), considering disconfirmation as a distinct evaluative construct. Therefore, this study employed subjective approach to measuring disconfirmation. Items for measuring usability disconfirmation, quality disconfirmation, and value disconfirmation with the e-learning service were adapted from Oliver (1980) "better than expected/worse than expected" scale. For this measure, a 7-point Likert type was used, with anchors ranging from strongly disagree (1) to strongly agree (7).

Table 1
Summary of measurement scales

| Construct | Measure | Mean | Standard deviation | Loading |
|--------------------------------|---|------|--------------------|---------|
| Perceived usability (PU) | | | | |
| Composite reliability = 0.90 | | | | |
| PU1 | Learning to operate the e-learning service is easy for me | 5.69 | 1.12 | 0.70 |
| PU2 | It is easy for me to become skillful at using the e-learning service | 5.71 | 1.05 | 0.70 |
| PU3 | Using the e-learning service can improve my learning performance | 5.43 | 1.10 | 0.68 |
| PU4 | Using the e-learning service can simplify the learning process | 5.97 | 0.98 | 0.71 |
| PU5 | Using the e-learning service fits well with the way I learn | 5.30 | 1.11 | 0.83 |
| PP6 | The setup of the e-learning service is compatible with the way I learn | 5.53 | 1.03 | 0.77 |
| Usability disconfirmation (UD) | | | | |
| Composite reliability = 0.88 | | | | |
| UD1 | The e-learning service's performance that learning to operate the e-learning service is easy was better than expected | 5.38 | 1.01 | 0.73 |
| UD2 | The e-learning service's performance that is easy to become skillful at using the service was better than expected | 5.5 | 0.96 | 0.72 |
| UD3 | The e-learning service's performance that can improve my learning performance was better than expected | 5.19 | 1.05 | 0.84 |
| UD4 | The e-learning service's performance that can simplify the learning process was better than expected | 5.77 | 0.97 | 0.68 |
| UD5 | The e-learning service's performance that fits with the way I learn was better than expected | 5.24 | 1.03 | 0.91 |
| UD6 | The e-learning service's performance that the setup of the e-learning service is compatible with the way I learn was better than expected | 5.33 | 1.04 | 0.85 |
| Perceived quality (PQ) | | | | |
| Composite reliability = 0.88 | | | | |
| PQ1 | The layout and user interface design of the e-learning Web site is friendly | 5.34 | 0.88 | 0.70 |
| PQ2 | It is easy to navigate the e-learning Web site | 5.49 | 1.03 | 0.77 |
| PQ3 | The e-learning Web site provides the service I need | 5.21 | 1.03 | 0.81 |
| PQ4 | I feel comfortable in using the functions and services provided by the e-learning Web site | 5.44 | 0.93 | 0.78 |
| PQ5 | The e-learning Web site provides complete information | 5.10 | 1.15 | 0.78 |

Table 1 (continued)

| Construct | Measure | Mean | Standard deviation | Loading |
|--|---|------|--------------------|---------|
| PQ6 | The e-learning Web site provides information that is easy to comprehend | 5.06 | 1.06 | 0.74 |
| Quality disconfirmation (QD) Composite reliability = 0.89 | | | | |
| QD1 | The e-learning service's quality that the layout and user interface design of the Web site is friendly was better than expected | 5.04 | 1.12 | 0.73 |
| QD2 | The e-learning service's quality that is easy to navigate the Web site was better than expected | 5.13 | 1.11 | 0.71 |
| QD3 | The e-learning service's quality that provides the service I need was better than expected | 4.89 | 1.17 | 0.85 |
| QD4 | The e-learning service's quality that makes me feel comfortable in using the functions and services was better than expected | 5.14 | 1.10 | 0.82 |
| QD5 | The e-learning service's quality that provides complete information was better than expected | 4.93 | 1.10 | 0.79 |
| QD6 | The e-learning service's quality that provides information that is easy to comprehend was better than expected | 4.98 | 1.09 | 0.79 |
| Perceived value (PV) Composite reliability = 0.90 | | | | |
| PV1 | Using the e-learning service would give me a sense of accomplishment | 5.15 | 1.08 | 0.84 |
| PV2 | Using the e-learning service would give me a sense of self-fulfillment | 5.13 | 1.12 | 0.88 |
| PV3 | Using the e-learning service would give me a sense of following the trend | 5.51 | 1.05 | 0.74 |
| PV4 | Using the e-learning service would give me a sense of fun and enjoyment | 5.45 | 1.06 | 0.80 |
| PV5 | Using the e-learning service would give me a sense of intelligence | 4.92 | 1.32 | 0.73 |
| PV6 | Using the e-learning service would give me a sense of independence | 5.32 | 1.05 | 0.72 |
| Value disconfirmation (VD) Composite reliability = 0.93 | | | | |
| VD1 | The e-learning service's value that gives me a sense of accomplishment was better than expected | 5.06 | 1.11 | 0.89 |
| VD2 | The e-learning service's value that gives me a sense of self-fulfillment was better than expected | 5.07 | 1.17 | 0.94 |
| VD3 | The e-learning service's value that gives me a sense of following the trend was better than expected | 5.32 | 1.14 | 0.81 |
| VD4 | The e-learning service's value that gives me a sense of fun and enjoyment was better than expected | 5.26 | 1.08 | 0.85 |

(continued on next page)

Table 1 (continued)

| Construct | Measure | Mean | Standard deviation | Loading |
|------------------------------|---|------|--------------------|---------|
| VD5 | The e-learning service's value that gives me a sense of intelligence was better than expected | 4.90 | 1.23 | 0.83 |
| VD6 | The e-learning service's value that gives me a sense of independence was better than expected | 5.18 | 1.18 | 0.81 |
| User satisfaction (US) | | | | |
| Composite reliability = 0.90 | | | | |
| US1 | I am satisfied with the performance of e-learning service | 5.33 | 0.95 | 0.84 |
| US2 | I am pleased with the experience of using the e-learning service | 5.51 | 0.88 | 0.83 |
| US3 | My decision to use the e-learning service was a wise one | 5.39 | 1.04 | 0.93 |
| Continuance intention (CI) | | | | |
| Composite reliability = 0.94 | | | | |
| CI1 | I intend to continue using the e-learning service in the future | 5.49 | 1.01 | 0.94 |
| CI2 | I will continue using the e-learning service in the future | 5.44 | 1.06 | 0.97 |
| CI3 | I will regularly use the e-learning service in the future | 5.35 | 1.07 | 0.89 |

4. Data analysis

4.1. Measurement model

The measurement model was first evaluated in terms of reliability, convergent validity, and discriminant validity. Reliability was examined using the Cronbach's alpha values. As shown in Table 1, all were above 0.7; this indicates a commonly acceptable level for explanatory research.

Table 2
Correlations and AVE

| Construct | AVE | Construct | | | | | | | |
|-----------|------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | | PU | UD | PQ | QD | PV | VD | US | CI |
| PU | 0.54 | 0.74 | | | | | | | |
| UD | 0.63 | 0.71 | 0.80 | | | | | | |
| PQ | 0.58 | 0.54 | 0.57 | 0.76 | | | | | |
| QD | 0.61 | 0.51 | 0.61 | 0.73 | 0.78 | | | | |
| PV | 0.62 | 0.53 | 0.62 | 0.60 | 0.57 | 0.79 | | | |
| VD | 0.73 | 0.47 | 0.57 | 0.57 | 0.58 | 0.75 | 0.85 | | |
| US | 0.76 | 0.55 | 0.66 | 0.55 | 0.56 | 0.68 | 0.68 | 0.87 | |
| CI | 0.87 | 0.52 | 0.60 | 0.50 | 0.48 | 0.64 | 0.63 | 0.83 | 0.93 |

Note: diagonal elements (in bold) represent the square root of the average variance extracted (AVE). Off-diagonal elements represent the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

PU, perceived usability; UD, usability disconfirmation; PQ, perceived quality; QD, quality disconfirmation; PV, perceived value; QD, value disconfirmation; US, user satisfaction; CI, continuance intention.

Convergent validity was evaluated for the measurement scales using two criteria suggested by Fornell and Larcker (1981): (1) all indicator factor loadings should be significant and exceed 0.70 and (2) average variance extracted (AVE) for each construct should exceed the variance due to measurement error for that construct (i.e., should exceed 0.50). As shown in Table 1, most items exhibited loading higher than 0.7 on their respective constructs, providing evidence of acceptable item convergence on the intended constructs. Two exceptions were the third item of the perceived usability scale and the fourth item of the usability disconfirmation scale, which loadings were slightly below 0.7. AVE ranged from 0.54 to 0.87 (see Table 2), greater than variance due to measurement error. Hence, all two conditions for convergent validity were met.

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 & Larcker, 1981). Table 2 lists the correlations among constructs, with the square root of the AVE on the diagonal. The diagonal values exceed the inter-construct correlations; hence the test of discriminant validity was acceptable. Therefore we conclude that the measure for each construct satisfies construct validity.

4.2. Model testing results

The research model was tested using LISREL 8.50. Using sample covariance matrices, the overall fit and the explanatory power of research model were examined, together with the relative strengths of the individual causal path. Six common model-fit measures were used to assess the model's overall goodness-of-fit: normed chi-square (chi-square divided by degrees of freedom: χ^2/df), goodness-of-fit index (GFI), normed fit index (NFI), non-normed fit index (NNFI), and comparative fit index (CFI). The χ^2 value indicates the degree of correspondence, or the "goodness-of-fit", between a proposed model and the empirical data. This statistic is sensitive to sample size, and thus the normed chi-square is an alternative measure of model fit. The GFI is analogous to a squared multiple correlation; it indicates the proportion of the observed covariance explained by the model covariance (Kenny, 1998). The NFI indicates the proportion in the improvement of the overall fit of the researcher's model relative to a null model, typically the "independence" model. The NNFI is the NFI adjusted for model complexity. CFI indicates reduction in model misfit of a target model relative to a baseline (independence) model. For models with good fit, it is suggested that χ^2/df should not exceed 5 (Bentler, 1989), and NFI, NNFI, GFI, and CFI should exceed 0.9. As shown in Table 3, all indices exceeded their respective common acceptance levels, suggesting that the research model provided a good fit to the data.

The significance of individual paths was examined and summarized in Fig. 3. Eight out of ten paths exhibited a P -value of <0.05 , while the remaining two were not significant at a P -value of 0.05. Satisfaction exhibited a strong effect on e-learning continuance intention. Hypothesis 10 was supported. The path from perceived usability, perceived quality, perceived value, and usability disconfirmation to e-learning satisfaction were significant, while quality disconfirmation and value disconfirmation seemed to have insignificant influence on e-learning satisfaction. Hypotheses 1, 2, 3, and 4 were. Hypotheses 5 and 6 were not supported. Perceived usability, perceived quality, and perceived value exhibited a strong influence on usability disconfirmation, quality disconfirmation, and value disconfirmation, respectively. Hypotheses 7, 8, and 9 were supported.

Table 3
Overall model fit indices for the research model

| Model fit indices | Results | Recommended value |
|----------------------------------|---------|-------------------|
| Chi-square statistic χ^2/df | 3.49 | ≤ 5 |
| NFI | 0.96 | ≥ 0.9 |
| NNFI | 0.92 | ≥ 0.9 |
| GFI | 0.95 | ≥ 0.9 |
| CFI | 0.96 | ≥ 0.9 |

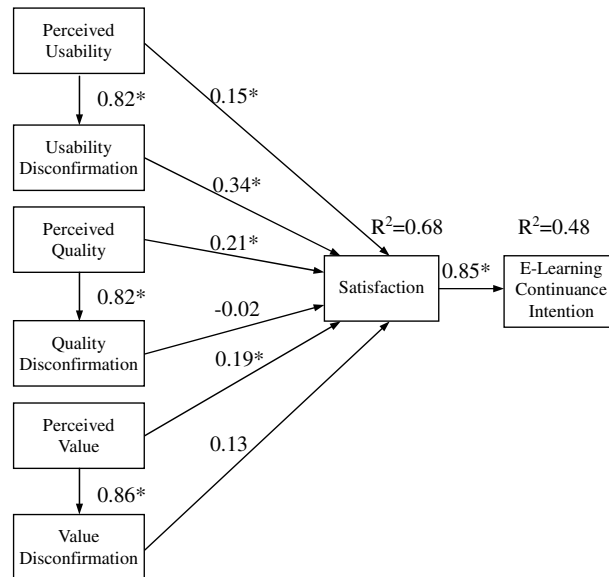


Fig. 3. SEM analysis of the research model.

The explanatory power of the research model was also shown in Fig. 3. R^2 values show that perceived usability, usability disconfirmation, perceived quality, quality disconfirmation, perceived value, and value disconfirmation account for 68% of variance in e-learning satisfaction. E-learning satisfaction accounts for 48% of variance in e-learning continuance intention.

5. Discussion and conclusions

The goal of the present study is to extend expectancy disconfirmation theory (EDT) model for e-learning continuance in the e-learning context by decomposing the perceived performance construct into usability, quality and value and adding disconfirmation constructs of them to the model and examine their effects on user satisfaction and continuance intention. Overall, the results provide strong support for the hypotheses and help clarify the roles of usability, quality, and value in the satisfaction formation process. This study provides an initial step toward integrating usa-

bility, quality, and value concepts into the EDT model, and applies them to the study of users' decisions in the e-learning continuance.

The present study was able to explain a significant amount of variance in e-learning satisfaction (68%) but not continuance intention (48%). The results suggest that the research model provided good explanatory power of user satisfaction. It implies that factors of the extended EDT play important roles in shaping user satisfaction, and thus IS researchers should consider post-usage factors when exploring users' satisfaction with the specific technology. The results also suggest that additional constructs would be necessary to enhance the explanatory power of the EDT model in predicting continuance intention, e.g., affect (Oliver, 1993), computer self-efficacy (Lim, 2001), and expectations (Eccles et al., 1983).

Consistent with prior studies arguing that users perception of the salient attributes of the target system, product, or service is an important determinant of satisfaction, our study found that perceived usability, perceived quality and perceived value had significant effects on satisfaction, which in turn was a strong predictor of users' continuance intention. It implies that an understanding of what usability, quality, and value mean to users offers the promise of establishing long-term user relationships.

This study found that perceived usability, perceived quality and perceived value exerted strong effects on usability disconfirmation, quality disconfirmation, and value disconfirmation, respectively, with path coefficients above 0.8. It means that users perceived the usability, quality, and value of e-learning service as being better than expected. The findings are consistent with prior studies. For example, some studies (Patterson et al., 1997; Spreng & Chiou, 2002; Spreng et al., 1996) found that the path coefficient between perceived performance and expectation disconfirmation was above 0.8.

This study only partially supported the notion that disconfirmation is a significant determinant of satisfaction. The path from usability disconfirmation to satisfaction was significant, whereas the paths from quality disconfirmation and value disconfirmation to satisfaction were not significant. A possible explanation is that the roles of perceived usability, quality, and value are dominant in explaining/predicting users' satisfaction in certain contexts. The results suggest that the e-learning provider should develop a long-term strategy to improve the usability and quality of and add value to the service to maintain or enhance users' loyalties to the service.

Although the findings are encouraging and useful, the present study has certain limitations that necessitate future research. First, whether our findings could be generalized to other systems or e-services is unclear. Further research is necessary to verify the generalizability of our findings. This study found that quality disconfirmation and value disconfirmation are not significantly associated with user satisfaction in the e-learning context. The subjects in this study were primarily part-time students studying courses in the continuing education program. Their continuance decisions may be different from full-time students who also enrolled in the university's e-learning programs. Future research is necessary to examine whether the effects of the three types of disconfirmations on satisfaction would vary according to context. Second, the effects of the determinants in our research model may change with increasing user experience over time. Yet, the user responses in our research were cross-sectional data and did not present an opportunity to examine the long-term trend of these hypothesized relationships. Further longitudinal studies are recommended to validate our research model in this regard. Third, this study only examined the effects of usability, quality, and value on satisfaction from a macro perspective. Further

research is recommended to decompose usability into perceived usefulness, perceived ease of use and perceived compatibility, decompose quality into information quality, system quality and service quality, decompose value into terminal value and instrumental value, and examine their effects on user satisfaction. Finally, this study only modeled satisfaction as the direct determinant of continuance intention. Theory of planned behavior (TPB) (Ajzen, 2002) theorizes that subjective norm and self-efficacy are also important predictors of behavioral intention. Further research should add these two constructs into the extended EDT model and examine their effects on continuance intention and whether additional constructs would significantly enhance the explanatory power of the EDT in predicting continuance intention.

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