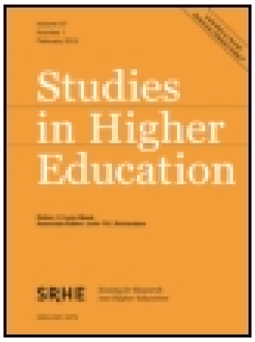

Studies in Higher Education

ISSN: 0307-5079 (Print) 1470-174X (Online) Journal homepage: http://www.tandfonline.com/loi/cshe20

E-learning continuance satisfaction in higher education: a unified perspective from instructors and students

Hosam Al-Samarraie, Bee Kim Teng, Ahmed Ibrahim Alzahrani & Nasser Alalwan

To cite this article: Hosam Al-Samarraie, Bee Kim Teng, Ahmed Ibrahim Alzahrani & Nasser Alalwan (2017): E-learning continuance satisfaction in higher education: a unified perspective from instructors and students, Studies in Higher Education, DOI: 10.1080/03075079.2017.1298088

To link to this article: http://dx.doi.org/10.1080/03075079.2017.1298088

Published online: 08 Mar 2017.

STUDIES IN HIGHER EDUCATION, 2017
http://dx.doi.org/10.1080/03075079.2017.1298088

E-learning continuance satisfaction in higher education: a unified perspective from instructors and students

Hosam Al-Samarraie[a], Bee Kim Teng[b], Ahmed Ibrahim Alzahrani[c] and Nasser Alalwan[c]

[a]Centre for Instructional Technology & Multimedia, Universiti Sains Malaysia, Penang, Malaysia; [b]School of Educational Studies, Universiti Sains Malaysia, Penang, Malaysia; [c]Computer Science Department, Community College, King Saud University, Saudi Arabia

ABSTRACT

This study aims to determine the key factors affecting students' and instructors' continuance satisfaction with e-learning in the higher education context. In order to identify the factors that impact e-learning continuation in higher education institutions, a systematic review of the literature was conducted, revealing that the majority of studies have reported the essential role of satisfaction in mediating the relationship between 11 factors and users' decisions to continue using e-learning systems. This study then proposed that users, both students and instructors, must continually be satisfied with the e-learning systems offered by higher education institutions if they are to continue using them. We term this 'e-learning continuance satisfaction.' The formation of a unified perspective of instructors and students on the core factors that impact e-learning continuance was then investigated, in addition to the causal relationships between these factors and e-learning continuance satisfaction. The Fuzzy Decision Making Trial and Evaluation Laboratory (DEMATEL) method was used to analyze data collected from 9 instructors and 38 students via an interview survey and the results yielded five core factors – information quality, task–technology fit, system quality, utility value, and usefulness – that influence users' e-learning continuance satisfaction. Several different causal relationships between the factors identified from both students' and instructors' perspectives were also identified and used to form a single viewpoint. Our findings provide new insights into how higher education institutions can promote continuance satisfaction in order to ensure continuation of e-learning.

KEYWORDS
E-learning systems; lifelong learning; continuance learning; satisfaction; Fuzzy DEMATEL in higher education

1. Introduction

Along with the development of information and communication technology (ICT), e-learning has emerged as an innovative approach for the promotion of learning delivery in higher education. E-learning provides an alternative to traditional classroom education and enables students to access course information without time restrictions or geographical constraints (Al-Samarraie et al. 2016; Goi and Ng 2009; Sun et al. 2008). It also provides interactivity and active learning, which promote collaboration and idea sharing among students and instructors (Alsabawy, Cater-Steel, and Soar 2016; Al-Samarraie, Selim, and Zaqout 2016; Masrom, Zainon, and Rahiman 2008). Thus, e-learning appears to promote current learning and teaching practices by providing a more efficient and effective exchange of learning experiences and, for this reason, it is essential to ensure that e-

CONTACT Hosam Al-Samarraie hosam@usm.my; hosamalsamarraie@gmail.com
Supplemental data for this article can be accessed here: http://dx.doi.org/10.1080/03075079.2017.1298088

learning systems successfully incorporate characteristics that ensure long-term usage of an innovation or piece of information technology following its initial acceptance.

In this study, we examine users' continuance satisfaction with regard to e-learning systems, because continued technology use, as explained by Bhattacherjee and Barfar (2011), is 'a temporal phenomenon, and can only be measured using the initial set of perceptions intentions related to technology continuance' (4). However, intention itself is not the equivalent of behavior, as, in the case of behavior, system users may intend to act differently than they, in fact, do. In light of this, it is suggested that future studies should consider the potential of satisfaction as a factor that drives users, both students and instructors, to continue using e-learning systems within the context of higher education.

Astin (1993) defined satisfaction in higher education as students' perceived experience and their perceived value of the education they have received while attending university (Astin 1993). Thus, students' level of satisfaction with an e-learning system may affect their overall levels of satisfaction with their university experience. In previous studies, the factors affecting e-learning satisfaction have mostly been extracted from different descriptive or analytical studies that come from different perspectives. For example, Sun et al. (2008) identified which factors are critical for ensuring successful e-learning design and operation from a holistic viewpoint, and then used these factors as a basis to propose guidelines for managing e-learning courses. Similarly, Wu, Tennyson, and Hsia (2010) conducted online interviews with university students in order to elicit the main aspects of learning and teaching by asking them about their experiences of an e-learning system. They used content analysis to categorize students' answers in relation to their achievements and satisfaction, as related to all categories of course design, interaction with the instructor, interaction with peers, individual learning processes, and learning achievements.

Thus, while previous studies have served to identify perspectives from either the students' or instructors' perspectives, this study aims to obtain a unified perspective of both students and instructors regarding the principal factors that affect their continuance satisfaction with e-learning systems. In the following sections, the context and rationale for the study are discussed, in addition to a literature review on factors that commonly influence both students' and instructors' satisfaction with e-learning systems. The Fuzzy Decision Making Trial and Evaluation Laboratory (DEMATEL) design based on the factors identified in the literature is described and examined for both groups. Finally, the results are discussed, analyzed, and presented.

2. Context and rationale

Although extensive research on e-learning continuation has been conducted from various perspectives and in different learning contexts, a number of e-learning systems have been discontinued following their initial implementation (Penna, Stara, and De Rose 2009; Sun et al. 2008), causing scholars to investigate various aspects of this situation. For example, at the time of their study, McGill, Klobas, and Renzi (2014) found a significant number of discontinued learning initiatives. By means of a literature review, they identified several issues related to the institution, developer, instructor, students, and technology. They first addressed users' satisfaction with e-learning sustainability conditions for continued and non-continued initiatives and then administered a survey to authors of previous studies to confirm their viewpoints regarding continued and non-continued e-learning initiatives. They concluded that technology needs to be up to date but stable for sustainable e-learning initiatives. Furthermore, Romiszowski (2004) linked the increased possibility of e-learning malfunctioning or failing to the wide variety of instructional designs, tools, and technologies, while Cronje (2006) attributed the problem of non-continuance to a misalignment between objectives and training needs, the key indicator being e-learning strategies based on cost-driven models.

With this in mind, various studies (e.g. Chiu et al. 2005; Limayem and Cheung 2008; McGill, Klobas, and Renzi 2014) have emphasized that users' continuance usage is the principal indicator for e-learning success. Hence, determining the main predictors of students' continuance satisfaction with e-learning systems can provide evaluators with valuable information to improve a given course or program (Bolliger 2004). On the other hand, determining the principal drivers of instructors' continuance satisfaction with e-learning systems can provide clear insights regarding how to stimulate instructors' cognitive perceptions of technology use in learning (Liaw, Huang, and Chen 2007).

3. Literature review

To determine the key factors that drive students' and instructors' continuance satisfaction with using e-learning systems, this section will review previous studies on users' intentions to continue using a given system. It will also shed light on why continuance satisfaction with online learning has been proposed as the key determinant of e-learning systems' success in higher education.

With the rapid growth of e-learning, particularly in higher education institutions (Demirkan, Goul, and Gros 2010; Loh et al. 2016; Weng, Tsai, and Weng 2015), successful e-learning has been discussed and investigated in various studies, from different perspectives, and in different contexts (Alias et al. 2012; Bhuasiri et al. 2012; Govindasamy 2001; Holsapple and Lee-Post 2006; Lieblein 2000; Sela and Sivan 2009; Selim 2007; Soong et al. 2001; Sun et al. 2008; Swan et al. 2000; Volery and Lord 2000). In this regard, Bhattacherjee (2001) pointed out that although initial acceptance is essential for the success of an information system, its long-term viability and eventual success depend on its continued usage rather than its initial use. In this regard, Chiu at al. (2005) stated that users' continuation intentions after initial use are the major indicator of e-learning success. Other studies (Chiu, Chiu, and Chang 2007; Limayem and Cheung 2008; McGill, Klobas, and Renzi 2014) have also emphasized continued usage as the major determinant of e-learning success. Thus, issues related to the continuation of e-learning have frequently been examined by researchers, particularly those factors that affect e-learning continuation.

For example, Bhattacherjee (2001) proposed a post-acceptance model of information system usage continuance by adapting expectation-confirmation theory. This theoretical model reflects users' perceptions of the usefulness of and satisfaction with a system as related to their continuance intention. Demirkan, Goul, and Gros (2010) discussed a reference model for sustainable e-learning systems. Ho (2010) proposed an integrated technology acceptance model (TAM), an expectation-confirmation model (ECM), a cognitive model, and a self-determination model, and examined how motivational factors affect the synthesized model. Ho (2010) demonstrated that perceived usefulness, user satisfaction, and attitudes can significantly predict users' e-learning continuance intention. Lin, Chen, and Fang (2011) developed a model that examined users' e-learning continuance intention in relation to negative critical incidents. They found that negative critical incidents, perceived ease of use, perceived usefulness, satisfaction, and attitudes were the core factors related to users' e-learning continuance intentions. Lee (2010) noted that the intention to continue using e-learning systems remains very low, particularly after initial acceptance of the system, and that satisfaction was found to be the strongest predictor for driving users' continuance intention. Based on Ifinedo (2006), this may be due to certain technological characteristics that influence students' perceived behavior and hence affect their usage and continuation intention with regard to e-learning systems. In addition, Liao, Palvia, and Chen (2009) integrated TAM, ECM, and the cognitive model in order to explain what drives users to continue with information system use. They proposed the constructs of confirmation, perceived usefulness, perceived ease of use, satisfaction, attitude, and continuance intention to shape their technology continuance theory. Gunn (2010) identified issues related to institutional structures and found that cultural issues were obstacles for e-learning continuation. Gunn (2010) also highlighted that the perspectives of different stakeholders should be accommodated and that this needs to be achieved within specific contexts. Ismail et al. (2012) found that students' continuance intentions regarding e-learning were moderate and that this was due to a low level of interpersonal influence and the information quality offered by the e-learning services. McGill, Klobas, and Renzi (2014) emphasized that the difference between continued and discontinued e-learning initiatives was dominated by institutional support, financial support in particular. They further indicated that the technology used must be up-to-date, mature, and stable in order to support e-learning continuation.

Moreover, e-learning continuance intention, defined as the subjective probability that an individual will continue using e-learning (Chiu et al. 2007), has frequently been used in studies as a dependent construct for predicting e-learning continuation. Notably, many studies have examined users' e-learning continuance intentions and found that they were strongly dependent on the satisfaction users felt regarding the use of an e-learning system (Chiu et al. 2005, 2007; Cho, Cheng, and Lai 2009; Hung, Chang, and Hwang 2011; Larsen, Sørebø, and Sørebø 2009; Liao, Palvia, and Chen 2009; Limayem and Cheung 2008; Lin 2012; Lin and Wang 2012; Roca, Chiu, and Martínez 2006; Sørebø et al. 2009; Zhang et al. 2012), where satisfaction is measured by an individual's post-consumption evaluation of a specific transaction (Bolton and Drew 1991). In these studies, satisfaction was often found to play a role in mediating between other e-learning continuation factors (such as confirmation, i.e. a user's perception that a system offers the desired services, perceived ease of use, perceived usefulness, perceived quality, and perceived value) and users' intentions to continue using e-learning. Bhattacherjee (2001) added that users' satisfaction is associated with their continuance intention and is key to creating and retaining long-term users. From the higher education perspective, we assume that if learners are to continue using e-learning, they need to continue to be satisfied with the e-learning services offered by higher education institutions.

Despite various findings in previous studies that are often based on one particular stakeholder's perspective – the perspective of either instructors, students, experts, developers, or institutional support staff – a unified view of e-learning continuation from the perspective of the principal users (instructors and students) is lacking. In this regard, we propose that e-learning continuance satisfaction is a core element in sustaining e-learning usage among students and instructors. Our systematic review of the literature revealed possible predictors of continuance satisfaction based on the factors affecting e-learning continuation. These factors were then used to construct a unified view by mapping the direct and indirect relations of satisfaction to continuation intentions using Fuzzy DEMATEL.

Based on these observations, it can be noted that most previous studies have investigated what factors are related to students' continued use of e-learning systems. Our review of the literature has demonstrated that most studies on e-learning continuation point to the essential role of satisfaction in mediating the effect of other factors on users' intentions to continue using e-learning (Chiu et al. 2007; Cho, Cheng, and Lai 2009; Hung, Chang, and Hwang 2011; Larsen, Sørebø, and Sørebø 2009; Liao, Palvia, and Chen 2009; Limayem and Cheung 2008; Lin 2012; Sørebø et al. 2009; Zhang et al. 2012). Most of these studies have emphasized the positive relationship between users' satisfaction and their intention to continue using e-learning systems, which leads us to assume that in order to want to continue using an e-learning platform, users need to continue to be satisfied with that platform's services, which may vary from one system to another. As such, we propose 'e-learning continuance satisfaction' as a term for measuring users' continued satisfaction with an e-learning system. Taking into consideration the different demands that students and instructors place on e-learning systems, the following questions were asked:

(1) What are the core factors related to e-learning continuance satisfaction?
(2) What are the causal relationships between these factors from students' and instructors' perspectives?

To answer these questions, a systematic review (a meta-analysis) was conducted to identify the potential predictors of e-learning continuance satisfaction (see Section 4). Next, the Fuzzy DEMATEL approach was employed to determine the core factors from the perspectives of students and instructors (see Sections 5 and 6). We then combined the students' and instructors' perspectives to establish a unified view of e-learning continuance satisfaction in higher education institutions.

4. Meta-analysis

We adopted certain criteria recommended by previous studies (e.g. Schmidt and Hunter (2014)) in our procedures for searching, selecting, and extracting data from articles.

4.1. Search strategy

We used Google Scholar, ISI Web of Knowledge, and Scopus as the main sources for retrieving research articles. Moreover, we only retrieved articles that had been published in English peer-reviewed journals between the years 2000 and 2015. The combination of keywords used to search for articles related to the following:

- continuation: satisfaction, continuance, continued use, sustainability, or sustaining; and
- e-learning: online learning, web-based learning, blended learning, distance learning, course management systems (CMS), learning management systems (LMS), or virtual learning environments (VLE).

4.2. Selection criteria

In the initial phase, a total of 69 articles were retrieved, from which 37 articles were excluded after an initial screening of the abstracts, as they did not meet our inclusion criteria (e.g. with respect to the context of information systems). We then retrieved the full texts of the remaining 32 articles and reviewed them in detail. During this stage, we also screened the reference lists in these articles, resulting in the addition of five further potential articles to our review. The full texts of the 37 articles were then reviewed and analyzed with respect to their research methods, participants, and contexts. At this stage, we included only articles that provided sufficient statistical data (means and standard deviations) and that involved members of higher education institutions or ICT e-learning experts. As a result, a further 21 articles were excluded that did not meet our inclusion criteria. This left us with 16 articles for inclusion in the systematic review, as shown in Figure 1.

4.3. Data extraction

After identifying the articles for inclusion, we extracted such information as factors relating to e-learning continuation, number of participants, and means and standard deviations (Table 1). In our compilation of factors, we only included those that were mentioned in more than one of the selected studies. Thus, we selected 11 factors (attitude, confirmation, attainment value, intrinsic value, utility value, information quality, system quality, task–technology fit, ease of use, usefulness, and social influence) as shown in Table 1. We then added together the means and standard deviations of the selected factors and divided the figures obtained by the total number of studies in which the given factor had appeared in order to obtain a net mean and standard deviation for each factor.

In the 37 primary studies that reported the potential influence of the selected key factors on users' satisfaction and intention to continue using e-learning systems, these factors achieved significant scores, with a resulting large effect size difference of $d = 5.20$ (95% CI: 5.00–5.39, $p < .001$). This finding suggests that these factors greatly affect users' e-learning continuance satisfaction. A test for the heterogeneity of the meta-analysis showed Q values of 700.93 using Cohen's standard with 10 degrees of freedom ($p < .001$).

5. Fuzzy DEMATEL

The DEMATEL method allowed us to construct an intelligible structural model that visualized and analyzed the causal relationships among complex factors (Wu and Lee 2007). This method is usually based on matrices or digraphs in which factors are presented in cause and effect groups

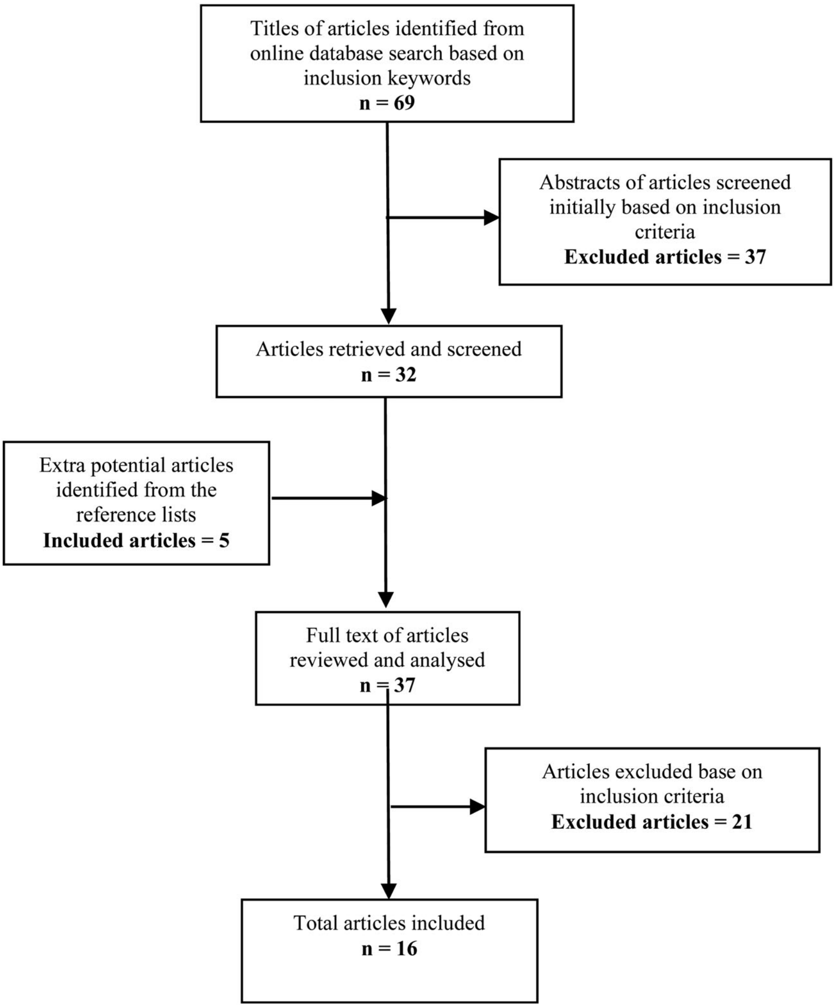

Figure 1. Selection process for the systematic review on continuance intention and satisfaction with e-learning.

and the strengths of the influences among the factors are shown in numerals. Thus, the DEMATEL method can be used to identify the relationship between the causes and effects that pertain between different factors (Chang, Chang, and Wu 2011; Jassbi, Mohamadnejad, and Nasrollahzadeh 2011; Wu and Lee 2007). Although this method is capable of revealing the causal relationships between mutually influencing factors (Chang, Chang, and Wu 2011), decision-making is difficult in a fuzzy environment due to the lack of clarity regarding the numerical values for human judgement (Wu and Lee 2007). This was addressed by extending the DEMATEL method with fuzzy logic to ensure a more accurate analysis and better judgement in decision-making environments (Chang, Chang, and Wu 2011). Fuzzy logic is also used to overcome the vagueness of human thought and expressions in decision-making processes (Jeng and Tzeng 2012; Wu and Lee 2007). We used this method to investigate possible causal relationships between the selected core factors of e-learning continuance satisfaction from the instructors' and students' perspectives, where their judgment regarding these relationships was based on their own experiences with e-learning systems.

We conducted a structured interview survey in order to provide inputs to infer the causal effects related to the core factors of e-learning continuance satisfaction. Purposive sampling was used to select the participants for data collection purposes. To ensure the credibility of the collected data,

Table 1. Results of data extraction.

Effect name	Sources	Statistics: Repetition	*N*	Net *M*	Net *SD*	Meta-analysis results: Effect size	Lower	Upper	*p*
Attitude	Liao, Palvia, and Chen 2009; Lin 2011	2	882	5.55	1.13	5.16	4.96	5.37	<.001
Confirmation	Hung, Chang, and Hwang 2011; Larsen, Sørebø, and Sørebø 2009; Liao, Palvia, and Chen 2009; Limayem and Cheung 2008; Roca, Chiu, and Martínez 2006; Sørebø et al. 2009;	6	1514	4.73	1.29	5.25	5.07	5.43	<.001
Attainment value	Chiu et al. 2007; Chiu and Wang 2008	2	488	5.81	0.94	5.14	4.96	5.32	<.001
Intrinsic value	Chiu et al. 2007; Chiu and Wang 2008	2	488	5.31	1.08	5.19	4.98	5.40	<.001
Utility value	Chiu et al. 2007; Chiu and Wang 2008	2	488	4.84	1.28	5.24	5.03	5.44	<.001
Information quality	Lin and Wang 2012; Roca, Chiu, and Martínez 2006	2	260	5.39	0.92	5.18	4.97	5.39	<.001
System quality	Lin and Wang 2012; Roca, Chiu, and Martínez 2006	2	260	5.34	0.92	5.19	4.98	5.40	<.001
Ease of use	Roca, Chiu, and Martínez 2006; Cho, Cheng, and Lai 2009; Liao, Palvia, and Chen 2009; Lin 2011; Sun and Jeyaraj 2013; McGill, Klobas, and Renzi 2014	6	1701	5.38	1.02	5.18	4.96	5.40	<.001
Usefulness	Cho, Cheng, and Lai 2009; Hung, Chang, and Hwang 2011; Larsen, Sørebø, and Sørebø 2009; Liao, Palvia, and Chen 2009; Limayem and Cheung 2008; Roca, Chiu, and Martínez 2006; Sørebø et al. 2009; Lin 2011; Sun and Jeyaraj 2013	9	2347	5.07	1.09	5.21	4.98	5.44	<.001
Task–technology fit	Larsen, Sørebø, and Sørebø 2009; Lin and Wang 2012	2	223	4.96	1.16	5.22	5.02	5.43	<.001
Social influence	Chiu and Wang 2008; Sun and Jeyaraj 2013	2	418	4.81	1.09	5.24	5.04	5.44	<.001

we selected students who had a minimum of three years' experience with e-learning and instructors who had a minimum of eight years' experience with e-learning, during which time they had used the system on a daily basis to manage and organize their courses. The reason for considering experienced users (students and instructors) is that experience has always been found to be an important determinant of behavior. Specifically, it has been suggested that knowledge gained from past behavior helps to shape intention. For example, Taylor and Todd (1995) stated that information technology use may be more effectively modeled for experienced users. E-learning experience here refers to students' use of a current e-learning system (Moodle and Mooc) to access and manage various learning activities, including participation in group discussions, project analysis, assignment submission, etc. The part-time students in our study were thus ICT literate and were typical of students for whom it is widely recommended that e-learning systems comprise the best online mode of learning delivery.

Based on the selection criteria, a total of 38 postgraduate students (20 males and 18 females, age range: 26–35 years) and 9 instructors (5 males and 4 females, age range: 36–55 years) from five public universities in Malaysia were included in this study.

All participants were asked to rank the level of influence of factors extracted from the systematic review, and their responses were used to construct a pairwise relationship matrix. The response of each participant was presented in the following matrix format:

$$D = \begin{bmatrix} 0 & d_{12} & \cdots & d_{1n} \\ d_{21} & 0 & \cdots & d_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ d_{n1} & d_{n2} & \cdots & 0 \end{bmatrix},$$

where $n = 11$.

Table 2. Linguistic scale (Source: Jeng and Tzeng 2012).

Code	Linguistic variable	Corresponding triangular fuzzy numbers		
		L	*m*	*u*
0	No influence	0.00	0.10	0.30
1	Very low influence	0.10	0.30	0.50
2	Low influence	0.30	0.50	0.70
3	High influence	0.50	0.70	0.90
4	Very high influence	0.70	0.90	1.00

As the participants would be judging the causal relations between the core factors of e-learning continuance satisfaction according to their own preferences and experiences, we extended the linguistic scale to fuzzy triangular numbers (Jeng and Tzeng 2012), as shown in Table 2.

The participants' judgements regarding the causality between each pair of factors were measured using the fuzzy triangular numbers. Next, a fuzzy matrix was constructed for each participant, resulting in 47 fuzzy matrices (for 38 students and 9 instructors) in the following format:

$$\tilde{z}^i = \begin{bmatrix} 0 & l, m, u_{12} & \cdots & l, m, u_{1n} \\ l, m, u_{21} & 0 & \cdots & l, m, u_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ l, m, u_{n1} & l, m, u_{n2} & \cdots & 0 \end{bmatrix},$$

where $n = 11$ (the number of factors) and i is the number of the participant (i ranges from 1 to 47).

Then, we proceeded as follows:

Step 1: The means of the participants' pairwise comparisons were calculated using the formula

$$\tilde{z}_{ij} = \frac{\tilde{z}^1 \oplus \tilde{z}^2 \oplus \tilde{z}^3 \oplus \ldots \oplus \tilde{z}^p}{p},$$

where p is the number of participants.

Then, the initial direct-relation fuzzy matrix was produced, as shown below:

$$\tilde{Z} = \begin{bmatrix} 0 & \tilde{z}_{12} & \cdots & \tilde{z}_{1n} \\ \tilde{z}_{21} & 0 & \cdots & \tilde{z}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{z}_{n1} & \tilde{z}_{n2} & \cdots & 0 \end{bmatrix}.$$

Step 2: The initial direct-relation fuzzy matrix was normalized as

$$\tilde{X} = \begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \cdots & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & \cdots & \tilde{x}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{x}_{n1} & \tilde{x}_{n2} & \cdots & \tilde{x}_{nn} \end{bmatrix},$$

where

$$\tilde{X}_{ij} = \frac{\tilde{z}_{ij}}{r} = \left(\frac{l'_{ij}}{r}, \frac{m'_{ij}}{r}, \frac{u'_{ij}}{r}\right) = (l''_{ij}, m''_{ij}, u''_{ij}), \quad r = \max_{1 \le i \le n}\left(\sum_{j=1}^{n} u_{ij}\right).$$

Step 3: The total-relation fuzzymatrix $\tilde{T}$ was calculated as

$$\tilde{T} = \begin{bmatrix} \tilde{t}_{11} & \tilde{t}_{12} & \cdots & \tilde{t}_{1n} \\ \tilde{t}_{21} & \tilde{t}_{22} & \cdots & \tilde{t}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{t}_{n1} & \tilde{t}_{n2} & \cdots & \tilde{t}_{nn} \end{bmatrix},$$

where $\tilde{t}_{ij} = (l^t_{ij}, m^t_{ij}, u^t_{ij})$ and $[l^t_{ij}] = H_l \times (I - H_l)^{-1}$, $[m^t_{ij}] = H_m \times (I - H_m)^{-1}$, $[u^t_{ij}] = H_u \times (I - H_u)^{-1}$.

Step 4: $\widetilde{D}_i$ and $\widetilde{R}_i$ were calculated based on the sum of the rows and the sum of the columns, respectively, of the total-relation fuzzy matrix $\tilde{T}$, as shown:

$$\widetilde{D} = (\tilde{D}_i)_{n\times 1} = \left[\sum_{j=1}^{n} \tilde{T}_{ij}\right]_{n\times 1},$$

$$\widetilde{R} = (\tilde{R}_i)_{1\times n} = \left[\sum_{i=1}^{n} \tilde{T}_{ij}\right]_{1\times n}.$$

These were used to obtain the importance and cause–effect table, which consist of $\widetilde{D}_i + \widetilde{R}_i$ and $\widetilde{D}_i - \widetilde{R}_i$.

Step 5: During this final step, all computed $\widetilde{D}_i + \widetilde{R}_i$ and $\widetilde{D}_i - \widetilde{R}_i$ were defuzzified using the following formula:

$$\tilde{A} = (a_1, a_2, a_3),$$

$$B = \frac{(a_1 + a_3 + 2 \times a_2)}{4}.$$

Two sets of numbers, $(\widetilde{D}_i + \widetilde{R}_i)^{def}$ and $(\widetilde{D}_i - \widetilde{R}_i)^{def}$, were produced. $(\widetilde{D}_i + \widetilde{R}_i)^{def}$ shows the importance of a factor, while $(\widetilde{D}_i - \widetilde{R}_i)^{def}$ shows whether a factor is a cause or effect. If the value of $(\widetilde{D}_i - \widetilde{R}_i)^{def}$ is positive, the factor belongs to the cause group, while a negative value of $(\widetilde{D}_i - \widetilde{R}_i)^{def}$ shows that the factor belongs to the effect group (Jassbi, Mohamadnejad, and Nasrollahzadeh 2011).

6. Results

A matrix was constructed, consisting of the means of the pairwise comparisons; this is the initial direct-relation fuzzy matrix (see Table I(a,b)in the supplementary materials). Next, we normalized the initial direct-relation fuzzy matrix (see Table II(a,b) in the supplementary materials), and generated the total-relation fuzzy matrix (see Tables 3 and 4). Based on the total-relation fuzzy matrix, the importance and cause–effect tables were generated (see Table III(a,b) in the supplementary materials) in order to map the causal relation diagram (Figure 2). The threshold values were obtained by first defuzzifying the total-relation fuzzy matrix and then calculating the mean and standard deviation

Table 3. Importance and cause–effect table (instructors).

Factors	$\widetilde{D}_i + \widetilde{R}_i$	$\widetilde{D}_i - \widetilde{R}_i$	$(\widetilde{D}_i + \widetilde{R}_i)^{def}$	$(\widetilde{D}_i - \widetilde{R}_i)^{def}$
Attitude	1.70, 4.14, 14.69	−7.65, −0.81, 5.33	6.17	−0.99
Confirmation	1.61, 3.97, 14.28	−5.99, 0.19, 6.68	5.96	0.27
Attainment value	1.56, 3.90, 14.12	−6.13, 0.12, 6.42	5.87	0.13
Intrinsic value	1.41, 3.64, 13.53	−6.54, −0.29, 5.58	5.56	−0.39
Utility value	1.52, 3.82, 13.96	−6.21, 0.02, 6.24	5.78	0.02
Information quality	1.45, 3.69, 13.55	−5.01, 0.69, 7.10	5.59	0.87
System quality	1.17, 3.24, 12.48	−5.32, 0.19, 5.99	5.03	0.27
Task–technology fit	1.48, 3.74, 13.83	−5.72, 0.30, 6.63	5.70	0.38
Ease of use	0.98, 2.89, 11.66	−5.88, −0.35, 4.80	4.61	−0.45
Usefulness	1.45, 3.73, 13.69	−5.91, 0.19, 6.33	5.65	0.20
Social influence	0.98, 2.90, 11.69	−5.72, −0.24, 4.98	4.62	−0.31

Table 4. Importance and cause–effect table (students).

Factors	$\widetilde{D}_i + \widetilde{R}_i$	$\widetilde{D}_i - \widetilde{R}_i$	$(\widetilde{D}_i + \widetilde{R}_i)^{def}$	$(\widetilde{D}_i - \widetilde{R}_i)^{def}$
Attitude	2.10, 5.06, 21.92	−11.12, −0.73, 8.71	8.54	−0.97
Confirmation	2.18, 5.21, 22.43	−10.45, −0.22, 9.81	8.75	−0.27
Attainment value	1.72, 4.39, 19.91	−9.80, −0.42, 8.38	7.60	−0.57
Intrinsic value	1.59, 4.12, 19.07	−8.76, −0.03, 8.73	7.23	−0.02
Utility value	1.88, 4.66, 20.67	−9.05, 0.22, 9.73	7.97	0.28
Information quality	1.65, 4.21, 19.24	−7.65, 0.66, 9.95	7.33	0.91
System quality	1.58, 4.09, 18.90	−8.12, 0.33, 9.19	7.16	0.43
Task–technology fit	1.81, 4.51, 20.19	−8.23, 0.58, 10.15	7.75	0.77
Ease of use	1.57, 4.09, 19.02	−8.61, 0.08, 8.84	7.19	0.09
Usefulness	2.02, 4.93, 21.59	−9.96, −0.07, 9.61	8.37	−0.12
Social influence	1.29, 3.56, 17.29	−8.67, −0.40, 7.33	6.43	−0.53

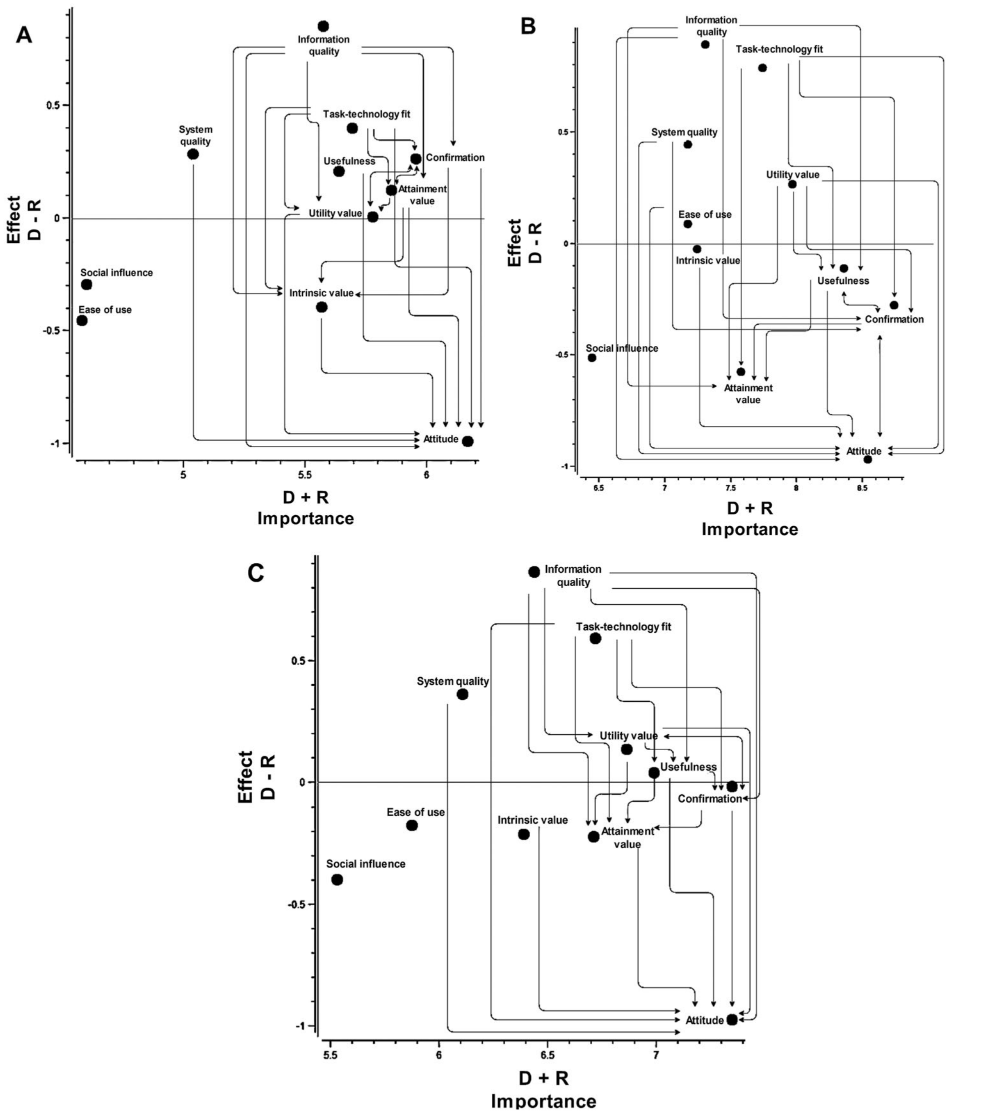

Figure 2. Causal relation diagrams. (A) Instructors' views; (B) Students' views; (C) Unified views of instructors and students.

Table 5. Importance and cause–effect table (instructors and students).

Factors	$\widetilde{D}_i + \widetilde{R}_i$	$\widetilde{D}_i - \widetilde{R}_i$	$(\widetilde{D}_i + \widetilde{R}_i)^{def}$	$(\widetilde{D}_i - \widetilde{R}_i)^{def}$
Attitude	1.89, 4.60, 18.30	−0.45, −0.76, −1.93	7.35	−0.97
Confirmation	1.89, 4.59, 18.37	−0.02, −0.03, 0.03	7.36	−0.01
Attainment value	1.64, 4.13, 17.01	−0.09, −0.16, −0.46	6.73	−0.22
Intrinsic value	1.49, 3.87, 16.29	−0.08, −0.17, −0.41	6.38	−0.21
Utility value	1.70, 4.23, 17.30	0.10, 0.12, 0.27	6.86	0.15
Information quality	1.55, 3.94, 16.39	0.37, 0.68, 1.81	6.45	0.88
System quality	1.37, 3.66, 15.70	0.14, 0.27, 0.74	6.09	0.35
Task–technology fit	1.63, 4.14, 17.01	0.25, 0.45, 1.17	6.73	0.58
Ease of use	1.27, 3.49, 15.31	−0.09, −0.13, −0.35	5.89	−0.17
Usefulness	1.73, 4.32, 17.64	0.05, 0.04, −0.01	7.00	0.03
Social influence	1.14, 3.22, 14.50	−0.18, −0.32, −0.85	5.52	−0.42

for the defuzzified matrix. These two values were then added in order to obtain the threshold values, which were 0.300 for instructors and 0.408 for students. Using these threshold values, the causal relationships based on the instructors' and students' perceptions were identified.

The results for the instructors demonstrate that they found characteristics related to information quality, task–technology fit, system quality, confirmation, usefulness, attainment value, and utility value to be the core factors for their continued satisfaction with e-learning services. Figure 2(A) shows that confirmation and attainment have a two-way causal relationship. These effects were justified by the instructors because their confirmation of fulfilling their expectations regarding system usage is usually associated with the personal importance they assign to doing well on tasks.

Turning to the students, the distribution of factors in Figure 2(B) shows that information quality, task–technology fit, system quality, utility value, and ease of use were the core factors for their continued satisfaction with e-learning services. Additionally, both task–technology fit and utility value affected the students' attitudes and perceived confirmation, attainment value, and usefulness.

To unify the instructors' and students' perspectives, the average of their respective total-relation fuzzy matrices was calculated. This helped to articulate a unified understanding of the importance and cause–effect table (Table 5). A threshold value of 0.351 was obtained, and the causal relation diagram (Figure 2) was mapped. The unified view in Figure 2(C) demonstrates that information quality, task–technology fit, system quality, utility value, and usefulness are the core factors that impact both instructors and students with respect to being continually satisfied with e-learning services. The results reveal that information quality is the most significant effect factor that impacts both instructors' and students' e-learning continuance satisfaction. This factor was found to be associated with their attitude and perceived confirmation, attainment value, utility value, and usefulness. In contrast, ease of use and social influence were the least significant causal factors; they neither affected nor were affected by other factors.

7. Discussion

Various studies have discussed the strengths of e-learning as an alternative to traditional face-to-face classroom education. Despite its dissemination among higher education institutions, e-learning has faced challenges related to its successful continuation. Therefore, many researchers have examined various perspectives related to environmental, institutional, technical, pedagogical, and human factors. However, few studies have been conducted to provide a richer understanding of the relationships among certain factors that are related to instructors' and students' e-learning continuance satisfaction.

Based on a systematic review, in this study, a total of 11 core factors of e-learning continuance satisfaction were identified – attitude, confirmation, attainment value, intrinsic value, utility value, information quality, system quality, ease of use, usefulness, task–technology fit, and social influence – and the fuzzy DEMATEL approach was used to investigate the causal relationships between these factors from instructors' and students' current usage perspectives regarding e-learning. Based on a unified causal relation diagram, we found that information quality, task–technology fit, system quality, utility value, and usefulness were perceived as the core factors for e-learning continuance satisfaction by both instructors and students at higher education institutions. These factors are discussed in the following subsections.

7.1. Information quality

According to the information system success model proposed by Delone and McLean (2003), information quality measures semantic success, such as the accuracy, timeliness, completeness, relevance, and consistency of the information provided by an information system. Delone and McLean (2003) and Ghasemaghaei and Hassanein (2015) agreed that a higher level of information quality would increase users' satisfaction. In this study, we found that information quality had the highest score among the core factors for e-learning continuance satisfaction. This finding adds a new insight to those provided by previous studies (e.g. Chiu et al. 2005; Lin and Wang 2012; Raspopovic and Jankulovic 2016; Roca, Chiu, and Martínez 2006) regarding the role of information quality in predicting users' continuance satisfaction with a system. Gay (2016) asserted the role of information quality in characterizing the suitability of online environments, which is essential for driving instructors' satisfaction with technology. This leads us to argue that when users' perception of a system's information quality is high, they will perceive that such a system is important and useful for them in performing their tasks. At the same time, the information quality perceived by users might also influence their confirmation and perceived utility value of a system and positively affect their overall attitude regarding their continuance satisfaction. Hence, higher education institutions should ensure that their e-learning systems have a high information quality, including the scope, relevance, and accuracy of the information for users' needs and expectations, in order to provide a better learning experience that ensures continued user satisfaction with their e-learning.

7.2. Task–technology fit

Task–technology fit has been characterized as the degree to which a technology assists individuals in performing their tasks, with the technology providing features and support that fit the users' requirements (Goodhue and Thompson 1995). In the context of e-learning, task–technology fit refers to an e-learning system's capability to support users in performing their learning tasks, through such means as interactions with other users, accessing learning materials, or answering online assessments, while suiting a variety of user abilities (McGill and Klobas 2009). We found that task–technology fit was one of the core factors affecting instructors' and students' e-learning continuance satisfaction. A previous finding by Larsen, Sørebø, and Sørebø (2009) demonstrated that task–technology fit is essential in explaining users' e-learning continuance intentions. Gu and Wang (2015) found that task–technology fit is one of the main predictors of e-learning satisfaction. In contrast, we claim that when users perceive that a system is capable of helping them perform tasks, their positive attitude will be promoted because they consider the system to be an important and useful tool that will continue to satisfy them. As such, higher education institutions should pay extra attention to the technology capabilities and services of the e-learning systems that are being offered to instructors and students.

7.3. System quality

Since technology and infrastructure form the backbone of e-learning systems, higher education institutions need to be careful to select adequate system technologies and resources that support current learning and teaching needs via e-learning (Martínez-Caro, Cegarra-Navarro, and Cepeda-Carrión 2015; McPherson and Baptista Nunes 2006; Porter et al. 2016). Such needs have been found to correspond to the information system success model (Delone and McLean 2003), which states that system quality is measured based on its operational characteristics such as system reliability, user interface consistency, documentation quality, and response rates in interactive systems. Delone and McLean (2003) indicated that higher system quality was expected to lead to greater user satisfaction and usage, which thus leads to positive impacts on individual and organizational productivity. McGill, Klobas, and Renzi (2014) added that issues related to system technology are critical for sustainable e-learning initiatives. Thus, the continuance of e-learning initiatives is influenced by the maturity and stability of a system's technology. We found system quality to be one of the core antecedents for promoting users' continued satisfaction with e-learning. This result supports the claim in Roca, Chiu, and Martínez (2006) that perceived quality (information quality, service quality, and system quality) influences user confirmation and satisfaction, which, in turn, affects users' continued use of e-learning. It also supports Saba's (2012) findings on how e-learning system quality will lead to a higher level of user satisfaction within the higher educational institutions. On the other hand, our finding conflicts with the findings of some previous studies, such as that of Lin and Wang (2012), who stated that system quality is not a critical factor that affects students' continued use of e-learning. As such, we argue that when a system's quality is positively perceived by users, they will develop a positive attitude towards its contents. We therefore suggest that higher education institutions should emphasize a system's operational characteristics to ensure continual user satisfaction with e-learning.

7.4. Utility value

In the expectancy-value model (Wigfield and Eccles 2000), utility value is a subjective task value that refers to the helpfulness of e-learning tasks for users' current and future goals. Our study found that the utility value of e-learning was considered a core factor in favoring users' continuance satisfaction. This result aligns with previous studies (e.g. Chiu and Wang 2008; Chiu et al. 2007) that state that utility value acts as a predictor of users' satisfaction and that together the two factors play an essential role in users' continued intention to engage in e-learning. Shiau and Chau (2016) highlighted the importance of considering the utility value of technology in order to maximize users' usage intention. We assume that when users feel that using a system can help them achieve their current and future goals, they will maintain a positive attitude towards that system. We also found that utility value and confirmation had a two-way causal relationship, which leads us to consider that instructors' and students' confirmation of e-learning is associated with how well the e-learning tasks are related to their goals. Because the utility value is also affected by information quality, higher education institutions might consider enhancing the information quality of e-learning systems in order to increase the utility value perceived by users so that they will be continually satisfied with e-learning.

7.5. Usefulness

Usefulness refers to the degree to which use of an e-learning system will enhance a user's performance (Davis 1989). We found that users' perception of the usefulness of a system was a core factor stimulating their e-learning continuance satisfaction. It is unsurprising that our finding aligns with previous research (e.g. Ma, Chao, and Cheng 2013; Cho, Cheng, and Lai 2009; Larsen, Sørebø, and Sørebø 2009; Liao, Palvia, and Chen 2009; Limayem and Cheung 2008; Lin 2011; Roca, Chiu, and Martínez 2006; Sun and Jeyaraj 2013; Zhang et al. 2012), which found that users' perceived usefulness has positive impacts on e-learning continuation. In addition, this result partially supports the claims of Liao, Palvia, and Chen (2009), Sørebø et al. (2009), and Hung, Chang, and Hwang (2011), who stated that confirmation and usefulness were the mediators of users' e-learning continuance satisfaction. Islam and Azad (2015) stated that both students and educators have positive perceptions regarding the usefulness of the learning management system, which drive their satisfaction to continually use it. What we found particularly noteworthy is that users' perceptions that e-learning was useful at enhancing their performance positively influenced their attitude towards e-learning, and also led them to report greater confirmation and attainment value. Since usefulness is driven by information quality, task–technology fit, and utility value, higher education institutions should consider improving or enhancing these aspects of their e-learning systems in order to increase users' perceptions of the systems' usefulness.

8. Implications and limitations

An examination of users' e-learning continuance satisfaction can provide new opportunities for research into users' adoption of learning technology. It also brings new understanding to the field of instructional technology, with an emphasis on users' behavioral intentions regarding e-learning tools. The importance and cause–effect relationships among the predetermined factors, along with the causal relationships between these factors and continuance satisfaction, can be used to explore students' and instructors' perceptions in other contexts, such as mobile learning, e-commerce, social network sites, e-medicine, and so forth. The unified view provided in this study can be used by other researchers as a base/reference to examine e-learning continuance among instructors and students in higher education institutions.

However, the study had a number of limitations. The sample used was limited to postgraduates and lecturers; hence, any generalization of the findings in this study should be made with caution.

Furthermore, in this study, we were able to retrieve a total of 11 factors related to users' e-learning continuance satisfaction based on our systematic literature review. However, our article filtering and selection process was limited to certain criteria that were established based on the recommendations of previous studies, in which only articles published in peer-reviewed journals were included.

9. Conclusion and future work

The use of a Fuzzy DEMATEL approach for obtaining instructors' and students' views led us to confirm the importance of continuance satisfaction for sustaining the use of e-learning in higher education institutions. The five factors – information quality, task–technology fit, system quality, utility value, and usefulness – were found to be the key components for promoting e-learning continuance satisfaction in the context of higher education. With regard to the limitation of the article filtering and selection process, future explorations might consider investigating other factors from other sources. We suggest that other studies might replicate this study in other contexts, using alternative scales in order to validate and confirm our findings. Future studies might also consider investigating the demographic backgrounds of different groups of users, as this may provide additional insights regarding the present study's findings. Future studies might also apply other modeling approaches, such as structural equation modeling, partial linear squares, and other decision-making-related approaches (e.g. fuzzy cognitive maps or analytical hierarchical processes), in order to infer possible new causal relations between factors related to e-learning continuance satisfaction.

Acknowledgements

The authors extend their appreciation to King Saud University, Deanship of Scientific Research, Community College Research Unit for supporting this research.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This study was funded in part by Research University Grant [No. 1001/PMEDIA/816288] of Universiti Sains Malaysia.

References

Alias, N., Z. Zakariah, N. Z. Ismail, and M. N. A. Aziz. 2012. "E-learning Successful Elements for Higher Learning Institution in Malaysia." *Procedia-Social and Behavioral Sciences* 67: 484–89.

Alsabawy, A. Y., A. Cater-Steel, and J. Soar. 2016. "Determinants of Perceived Usefulness of E-learning Systems." *Computers in Human Behavior* 64: 843–58.

Al-Samarraie, H., H. Selim, T. Teo, and F. Zaqout. 2016. "Isolation and Distinctiveness in the Design of E-learning Systems Influence User Preferences." *Interactive Learning Environments* 1–15. doi:10.1080/10494820.2016.1138313.

Al-Samarraie, H., H. Selim, and F. Zaqout. 2016. "The Effect of Content Representation Design Principles on Users' Intuitive Beliefs and Use of E-learning Systems." *Interactive Learning Environments* 24 (8): 1758–77.

Astin, A. W. 1993. *What Matters in College? Four Critical Years Revisited*. San Francisco, CA: Jossey-Bass.

Bhattacherjee, A. 2001. "Understanding Information Systems Continuance: An Expectation-confirmation Model." *MIS Quarterly* 25 (3): 351–70.

Bhattacherjee, A., and A. Barfar. 2011. "Information Technology Continuance Research: Current State and Future Directions." *Asia Pacific Journal of Information Systems* 21 (2): 1–18.

Bhuasiri, W., O. Xaymoungkhoun, H. Zo, J. J. Rho, and A. P. Ciganek. 2012. "Critical Success Factors for E-learning in Developing Countries: A Comparative Analysis between ICT Experts and Faculty." *Computers & Education* 58 (2): 843–55.

Bolliger, D. U. 2004. "Key Factors for Determining Student Satisfaction in Online Courses." *International Journal on E-learning* 3 (1): 61–67.

Bolton, R. N., and J. H. Drew. 1991. "A Longitudinal Analysis of the Impact of Service Changes on Customer Attitudes." *The Journal of Marketing* 55 (January): 1–9.

Chang, B., C. W. Chang, and C. H. Wu. 2011. "Fuzzy DEMATEL Method for Developing Supplier Selection Criteria." *Expert Systems with Applications* 38 (3): 1850–58.

Chiu, C. M., C. S. Chiu, and H. C. Chang. 2007. "Examining the Integrated Influence of Fairness and Quality on Learners' Satisfaction and Web-based Learning Continuance Intention." *Information Systems Journal* 17 (3): 271–87.

Chiu, C. M., M. H. Hsu, S. Y. Sun, T. C. Lin, and P. C. Sun. 2005. "Usability, Quality, Value and E-learning Continuance Decisions." *Computers & Education* 45 (4): 399–416.

Chiu, C. M., S. Y. Sun, P. C. Sun, and T. L. Ju. 2007. "An Empirical Analysis of the Antecedents of Web-based Learning Continuance." *Computers & Education* 49 (4): 1224–45.

Chiu, C. M., and E. T. Wang. 2008. "Understanding Web-based Learning Continuance Intention: The Role of Subjective Task Value." *Information & Management* 45 (3): 194–201.

Cho, V., T. E. Cheng, and W. J. Lai. 2009. "The Role of Perceived User-interface Design in Continued Usage Intention of Self-paced E-learning Tools." *Computers & Education* 53 (2): 216–27.

Cronje, J. C. 2006. "Who Killed E-learning?" Academic Libraries: Proactive Partners in Learning and Research Symposium at University of Stellenbosch, South Africa, November, 2–3. Accepted May 2, 2015. http://www.researchgate.net/profile/Johannes_Cronje/publication/228884266_Who_killed_e-learning/links/0912f5140a00411fd6000000.pdff.

Davis, F. D. 1989. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology." *MIS Quarterly* 13 (3): 319–40.

Delone, W. H., and E. R. McLean. 2003. "The DeLone and McLean Model of Information Systems Success: A Ten-year Update." *Journal of Management Information Systems* 19 (4): 9–30.

Demirkan, H., M. Goul, and M. Gros. 2010. "A Reference Model for Sustainable E-learning Service Systems: Experiences with the Joint University/Teradata Consortium." *Decision Sciences Journal of Innovative Education* 8 (1): 151–89.

Gay, G. H. 2016. "An assessment of Online Instructor E-learning Readiness Before, During, and After Course Delivery." *Journal of Computing in Higher Education* 28 (2): 199–220.

Ghasemaghaei, M., and K. Hassanein. 2015. "Online Information Quality and Consumer Satisfaction: The Moderating Roles of Contextual Factors – A Meta-analysis." *Information & Management* 52 (8): 965–81.

Goi, C. L., and P. Y. Ng. 2009. "E-learning in Malaysia: Success Factors in Implementing E-learning Program." *International Journal of Teaching and Learning in Higher Education* 20 (2): 237–46.

Goodhue, D. L., and R. L. Thompson. 1995. "Task-technology Fit and Individual Performance." *MIS Quarterly* 19 (2): 213–36.

Govindasamy, T. 2001. "Successful Implementation of E-learning: Pedagogical Considerations." *The Internet and Higher Education* 4 (3): 287–99.

Gu, L., and J. Wang. 2015. "A Task Technology Fit Model on E-learning." *Issues in Information Systems* 16 (1): 163–69.

Gunn, C. 2010. "Sustainability Factors for E-learning Initiatives." *Research in Learning Technology* 18 (2): 89–103.

Ho, C. H. 2010. "Continuance Intention of E-learning Platform: Toward an Integrated Model." *International Journal of Electronic BusinessManagement* 8 (3): 206–15.

Holsapple, C. W., and A. Lee-Post. 2006. "Defining, Assessing, and Promoting E-learning Success: An Information Systems Perspective." *Decision Sciences Journal of Innovative Education* 4 (1): 67–85.

Hung, M. C., I. C. Chang, and H. G. Hwang. 2011. "Exploring Academic Teachers' Continuance Toward the Web-based Learning System: The Role of Causal Attributions." *Computers & Education* 57 (2): 1530–43.

Ifinedo, P. 2006. "Acceptance and Continuance Intention of Web-based Learning Technologies (WLT) Use among University Students in a Baltic Country." *The Electronic Journal of Information Systems in Developing Countries* 23: 1–20.
Islam, A. N., and N. Azad. 2015. "Satisfaction and Continuance with a Learning Management System: Comparing Perceptions of Educators and Students." *The International Journal of Information and Learning Technology* 32 (2): 109–23.
Ismail, N. Z., M. R. Razak, Z. Zakariah, N. Alias, and M. N. A. Aziz. 2012. "E-learning Continuance Intention Among Higher Learning Institution Students' in Malaysia." *Procedia-Social and Behavioral Sciences* 67: 409–15.
Jassbi, J., F. Mohamadnejad, and H. Nasrollahzadeh. 2011. "A Fuzzy DEMATEL Framework for Modeling Cause and Effect Relationships of Strategy Map." *Expert Systems with Applications* 38 (5): 5967–73.
Jeng, D. J. F., and G. H. Tzeng. 2012. "Social Influence on the Use of Clinical Decision Support Systems: Revisiting the Unified Theory of Acceptance and Use of Technology by the fuzzy DEMATEL technique." *Computers & Industrial Engineering* 62 (3): 819–28.
Larsen, T. J., A. M. Sørebø, and Ø. Sørebø. 2009. "The Role of Task-technology Fit as Users' Motivation to Continue Information System Use." *Computers in Human Behavior* 25 (3): 778–84.
Lee, M. C. 2010. "Explaining and Predicting Users' Continuance Intention Toward E-learning: An Extension of the Expectation–Confirmation Model." *Computers & Education* 54 (2): 506–16.
Liao, C., P. Palvia, and J. L. Chen. 2009. "Information Technology Adoption Behavior life Cycle: Toward a Technology Continuance Theory (TCT)." *International Journal of Information Management* 29 (4): 309–20.
Lieblein, E. 2000. "Critical Factors for Successful Delivery of Online Programs." *The Internet and Higher Education* 3 (3): 161–74.
Liaw, S. S., H. M. Huang, and G. D. Chen. 2007. "Surveying Instructor and Learner Attitudes Toward E-learning." *Computers & Education* 49 (4): 1066–80.
Limayem, M., and C. M. Cheung. 2008. "Understanding Information Systems Continuance: The Case of Internet-based Learning Technologies." *Information & Management* 45 (4): 227–32.
Lin, K. M. 2011. "E-Learning Continuance Intention: Moderating Effects of User E-learning Experience." *Computers & Education* 56 (2): 515–26.
Lin, W. S. 2012. "Perceived Fit and Satisfaction on Web Learning Performance: Is Continuance Intention and Task-technology Fit Perspectives." *International Journal of Human-Computer Studies* 70 (7): 498–507.
Lin, K. M., N. S. Chen, and K. Fang. 2011. "Understanding E-learning Continuance intention: A Negative Critical Incidents Perspective." *Behaviour & Information Technology* 30 (1): 77–89.
Lin, W. S., and C. H. Wang. 2012. "Antecedences to Continued Intentions of Adopting E-learning System in Blended Learning Instruction: A Contingency Framework Based on Models of Information System Success and Task-technology Fit." *Computers & Education* 58 (1): 88–99.
Loh, C., D. H. Wong, A. Quazi, and R. P. Kingshott. 2016. "Re-examining Students' Perception of E-learning: An Australian Perspective." *International Journal of Educational Management* 30 (1): 129–39.
Ma, C. M., C. M. Chao, and B. W. Cheng. 2013. "Integrating Technology Acceptance Model and Task-technology Fit Into Blended E-learning System." *Journal of Applied Sciences* 13 (5): 736–42.
Martínez-Caro, E., J. G. Cegarra-Navarro, and G. Cepeda-Carrión. 2015. "An Application of the Performance-evaluation Model for E-learning Quality in Higher Education." *Total Quality Management & Business Excellence* 26 (5–6): 632–47.
Masrom, M., O. Zainon, and R. Rahiman. 2008. "Critical Success in E-learning: An Examination of Technological and Institutional Support Factors." *International Journal of Cyber Society and Education* 1 (2): 131–42.
McGill, T. J., and J. E. Klobas. 2009. "A Task–technology Fit View of Learning Management System Impact." *Computers & Education* 52 (2): 496–508.
McGill, T. J., J. E. Klobas, and S. Renzi. 2014. "Critical Success Factors for the Continuation of E-learning Initiatives." *The Internet and Higher Education* 22: 24–36.
McPherson, M., and M. Baptista Nunes. 2006. "Organisational Issues for E-learning: Critical Success Factors as Identified by HE Practitioners." *International Journal of Educational Management* 20 (7): 542–58.
Penna, M. P., V. Stara, and M. De Rose. 2009. "The Failure of E-learning: Why Should We Use a Learner Centred Design." *Journal of E-learning and Knowledge Society* 3 (2): 127–35.
Porter, W. W., C. R. Graham, R. G. Bodily, and D. S. Sandberg. 2016. "A Qualitative Analysis of Institutional Drivers and Barriers to Blended Learning Adoption in Higher Education." *The Internet and Higher Education* 28: 17–27.
Raspopovic, M., and A. Jankulovic. 2016. "Performance Measurement of E-learning Using Student Satisfaction Analysis." *Information Systems Frontiers* 1–12. doi:10.1007/s10796-016-9636-z.
Roca, J. C., C. M. Chiu, and F. J. Martínez. 2006. "Understanding E-learning Continuance Intention: An Extension of the Technology Acceptance Model." *International Journal of Human-Computer Studies* 64 (8): 683–96.
Romiszowski, A. J. 2004. "How's the E-learning Baby? Factors Leading to Success or Failure of an Educational Technology Innovation." *Educational Technology* 44 (1): 5–27.
Saba, T. 2012. "Implications of E-learning Systems and Self-efficiency on Students Outcomes: A Model Approach." *Human-Centric Computing and Information Sciences* 2 (1): 1–11.
Schmidt, F. L., and J. E. Hunter. 2014. *Methods of Meta-analysis: Correcting Error and Bias in Research Findings*. London: Sage.

Sela, E., and Y. Sivan. 2009. "Enterprise E-learning Success Factors: An Analysis of Practitioners' Perspective (with a Downturn Addendum)." *Interdisciplinary Journal of E-learning and Learning Objects* 5 (1): 335–43.
Selim, H. M. 2007. "Critical Success Factors for E-learning Acceptance: Confirmatory Factor Models." *Computers & Education* 49 (2): 396–413.
Shiau, W. L., and P. Y. Chau. 2016. "Understanding Behavioral Intention to Use a Cloud Computing Classroom: A Multiple Model Comparison Approach." *Information & Management* 53 (3): 355–65.
Soong, M. B., H. C. Chan, B. C. Chua, and K. F. Loh. 2001. "Critical Success Factors for On-line Course Resources." *Computers & Education* 36 (2): 101–20.
Sørebø, Ø., H. Halvari, V. F. Gulli, and R. Kristiansen. 2009. "The Role of Self-determination Theory in Explaining Teachers' Motivation to Continue to Use E-learning Technology." *Computers & Education* 53 (4): 1177–87.
Sun, Y., and A. Jeyaraj. 2013. "Information Technology Adoption and Continuance: A Longitudinal Study of Individuals' Behavioral Intentions." *Information & Management* 50 (7): 457–65.
Sun, P. C., R. J. Tsai, G. Finger, Y. Y. Chen, and D. Yeh. 2008. "What Drives a Successful E-learning? An Empirical Investigation of the Critical Factors Influencing Learner Satisfaction." *Computers & Education* 50 (4): 1183–1202.
Swan, K., P. Shea, E. E. Fredericksen, A. M. Pickett, and W. E. Pelz. 2000. "Course Design Factors Influencing the Success of Online Learning." Paper presented at the WebNet 2000 World Conference on the WWW and Internet, San Antonio, TX.
Taylor, S., and P. Todd. 1995. "Assessing IT Usage: The Role of Prior Experience." *MIS Quarterly* 19: 561–70.
Volery, T., and D. Lord. 2000. "Critical Success Factors in Online Education." *International Journal of Educational Management* 14 (5): 216–23.
Weng, C., C. C. Tsai, and A. Weng. 2015. "Social Support as a Neglected E-learning Motivator Affecting Trainee's Decisions of Continuous Intentions of Usage." *Australasian Journal of Educational Technology* 31 (2): 177–92.
Wigfield, A., and J. S. Eccles. 2000. "Expectancy–value Theory of Achievement Motivation." *Contemporary Educational Psychology* 25 (1): 68–81.
Wu, W. W., and Y. T. Lee. 2007. "Developing Global Managers' Competencies Using the Fuzzy DEMATEL Method." *Expert Systems with Applications* 32 (2): 499–507.
Wu, J. H., R. D. Tennyson, and T. L. Hsia. 2010. "A Study of Student Satisfaction in a Blended E-learning System Environment." *Computers & Education* 55 (1): 155–64.
Zhang, Y., Y. Fang, K. K. Wei, and Z. Wang. 2012. "Promoting the Intention of Students to Continue their Participation in E-learning Systems: The Role of the Communication Environment." *Information Technology & People* 25 (4): 356–75.