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Extending information system continuance theory with system quality in e-learning context

A.K.M. Najmul Islam
University of Turku, najmul.islam@tse.fi

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A.K.M. Najmul Islam
Turku Centre for Computer Science (TUCS), University of Turku, Finland
najmul.islam@tse.fi

ABSTRACT

Ten years ago, Bhattacherjee proposed the information system continuance model, which received considerable attention in the literature. This study proposes an extended information system continuance model by incorporating system quality to the original model in the context of educators' utilization of e-learning technology for conducting courses. Our proposed model is tested using a sample of 175 university educators using PLS modeling. The results show that there is no significant direct association between system quality and continuance intention. However, system quality affects continuance intention indirectly via perceived usefulness and satisfaction. All the relationships of the original information system continuance model were supported. The determinants of continuance intention explained around 64% of its total variance.

Keywords

Continued use, e-learning, Expectation-confirmation theory, and Satisfaction.

INTRODUCTION

With the latest development of the Internet technologies, universities are investing considerable resources in e-learning systems to support traditional teaching methods. These systems feature educators with easy communication to the students, the ability to track students' progress, and a mean to present content for online courses securely. Such e-learning tools are very attractive to the universities because they have many useful features. However, while evaluating an e-learning system, educators' perspective must be considered. The success of such system depends on the educators' willingness of its continued utilization. It is because, if an educator chooses to discontinue his/her use of a system, the students generally do not have another choice than to leave the system and adapt to the educator's alternative choice. Thus, the educators play roles as initiators, administrators and facilitators to students' utilization of such systems.

As argued in the previous paragraph, educators' willingness to utilize e-learning systems is important because of their role as initiators and facilitators to the students' utilization of the systems. To research on this particular topic area, the researchers often depend on the general Information System (IS) usage behavioral theories (Hayashi et al., 2004; Chiu et al., 2005; Chiu et al., 2008; Roca and Gagne, 2008; Sorebo et al., 2009; Larsen et al., 2009). According to Bhattacherjee (2001), long-term viability of an IS and its eventual success depend on its continued use. The research on IS continuance is mainly dominated by the expectation-confirmation theory framework (Bhattacherjee, 2001) with some exceptions (e.g., Lin, 2011; Hsu and Chiu, 2004). The expectation-confirmation theory based IS continuance model was developed with the argument that the psychological motivation in shaping continuance behavior is different from that of acceptance behavior (Bhattacherjee, 2001). Several attempts were made to extend the expectation-confirmation theory based IS continuance model by integrating other theoretical frameworks with it (e.g., Lee, 2010; Liao et al., 2007). However, very few studies were found that took system characteristics into account to understand IS continuance (e.g., Chiu et al., 2007). Without considering the system characteristics, the IS continuance model provides only limited guidance about how to influence usage through design and implementation. For example, designers receive feedback regarding usefulness in a general sense, but they do not receive actionable feedback about the important aspects of a system's characteristics. Such feedback would be very important, especially for organizations, as online and distance courses using e-learning systems are still evolving. Thus, an extended IS continuance model using system characteristics related factors may provide more guidance for the e-learning system designers and managers.

THEORETICAL BACKGROUND

Research into consumers' post-purchase behavioral process is a dominant theme since 1970s (Churchill and Surprenant, 1982). Among the research frameworks used in this theme, the expectancy-confirmation paradigm is extensively used to explain consumers' satisfaction and repurchase decisions in variety of post-purchase contexts (Churchill and Surprenant, 1982; Oliver, 1980; Bhattachejee, 2001).

The expectation-confirmation theory hypothesizes that consumers' level of satisfaction with a product/service determines repurchase intention. In turn, consumer satisfaction is determined by two major constructs: initial expectations (pre-purchase expectations) on a product/service, and discrepancies between expectations and product/service performance (disconfirmation). According to this theory, buyers first develop expectations about a product/service before purchase. Second, their consumption experiences with it build perceptions about its performance. This leads to the buyer either confirming or disconfirming the pre-purchase expectations, after assessing perceived performance against the earlier frame of reference (pre-purchase expectations). A buyer's expectations are confirmed when the product/service performs as much as expected; negatively disconfirmed when it performs worse than expected; positively disconfirmed when it performs better than expected (Churchill and Surprenant, 1982).

Drawing attention to the substantial difference between initial adoption and continued usage, Bhattacherjee (2001) developed and empirically tested the information system continuance model in voluntary environment from the expectation-confirmation theory. Despite the structural adaptation from expectation-confirmation paradigm, Bhattacherjee's information system continuance model possesses a few differences. First, it focuses importance on post-adoption expectations rather than pre-adoption expectations. A user keeps updating expectations towards using a system as he/she gains more experiences by using it. After assimilation of such experiences, the user's expectation can be different from his/her initial expectations prior to use the system (Bhattacherjee, 2001). From this perspective, information system continuance model posits that post-adoption expectations (rather than pre-adoption expectations) are the relevant determinants of satisfaction. Second, information system continuance model selected perceived usefulness as the surrogate for post-adoption expectation. The expectation-confirmation paradigm defined expectation as individual beliefs or sum of beliefs about the level of attributes possessed by a product/service (Churchill and Surprenant, 1982). Following this definition, Bhattacherjee (2001) used perceived usefulness as the measure of expectation, since among the cognitive beliefs in IS adoption and usage, perceived usefulness demonstrated itself to be the most consistent and salient one in determining the user intention over time. Third, perceived performance is not included in the information system continuance theory. Bhattacherjee (2001) argued that the effect of perceived performance could be captured by the confirmation construct. The IS continuance model is shown in Figure 1.

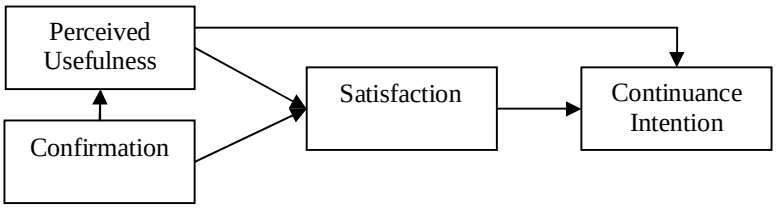


Figure 1. IS continuance model

One of the major limitations of the information system continuance model which is often pointed in the literature is using only one post-adoption belief (perceived usefulness) as the surrogate for post-adoption expectation (Hong et al., 2006). Thus, many researchers extended the expectation-confirmation based IS continuance theory using different factors, mostly borrowed from IS acceptance research (e.g., Roca et al., 2006; Hong et al., 2006). However, despite the importance of system quality very few studies used system quality as an extension to the theory. To fill the research gap, we decided to extend the IS continuance framework using system quality. We conceptualize and model system quality as a multi-dimensional construct and another post-adoption belief in addition to perceived usefulness.

RESEARCH CONTEXT

The target system of this study is an e-learning system, Moodle (http://moodle.org/about/). Moodle is an open source course management system, also known as a learning management system or a virtual learning environment. It has become very popular among the educators to create online dynamic course websites for the students. Moodle can be used to conduct fully online courses and also to augment face-to-face courses. Moodle provides tools such as forums, databases and wikis to build

collaborative learning communities. It also provides ways to deliver contents to students and assess learning using assignments and quizzes. To work, it needs to be installed on a web server.

This study was conducted in the University of Turku, Finland. The university has seven faculties. The university has been using Moodle since 2007 as the platform to create course pages online. However, educators are mostly free to choose the traditional way to create course pages under the university domain. Thus, using Moodle is not seen as mandatory in the university in this sense.

RESEARCH MODEL DEVELOPMENT

Our research model is shown in Figure 2. As the relationships of the IS continuance theory have been verified extensively in the literature in different contexts including e-learning system continuance (e.g., Roca et al., 2006; Limayem and Cheung, 2008; Larsen et al., 2009; Hong et al., 2006), we argue these hypotheses would be valid for our context too. Thus, we propose the following expectation-confirmation theory related hypotheses without any argument.

H1. Educators' satisfaction with an e-learning system positively affects their continued e-learning system usage intention.
H2. Educators' confirmation of expectations positively affects their satisfaction with e-learning system.
H3. Educators' perceived usefulness of an e-learning system positively affects their satisfaction with e-learning system.
H4. Educators' perceived usefulness with an e-learning system positively affects their continued e-learning system usage intention.
H5. Educators' confirmation of expectations positively affects their perceived usefulness with e-learning system.

System quality is a general perception about a system in terms of its performance and can be a second-order construct reflected by various system features (Lee et al., 2009). Depending on the target technologies, the variables related to system quality may vary. Given that our target system is a web-based system, the manifest variables of system quality in terms of a web-based system are access convenience, flexibility, integration, response time, sophistication, reliability, accessibility, stability, system speed, usability, ease of use, navigation and network speed (Lee et al., 2009). In this paper, we model system quality as a second-order construct with four reflective factors: access, ease of use, integration and reliability. Access refers to the degree of accessibility, responsiveness, stability, and availability of e-learning system (Lee et al., 2009). Ease of use refers to the degree to which an individual perceives using the e-learning system is free of effort (Davis, 1989). Integration refers to the way the e-learning system allows data to be integrated from various sources (Wixom and Todd, 2005). Reliability refers to the dependability of the e-learning system operation (Wixom and Todd, 2005). DeLone and McLean (2003) described that system quality has a direct effect on user satisfaction and IS use. Thus, we hypothesize the following.

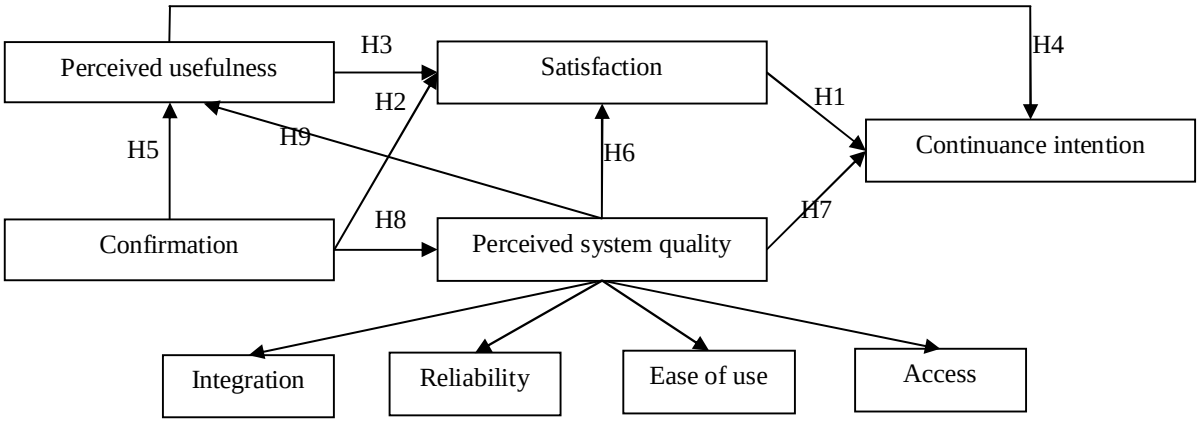
H6. Educators' perceived system quality of an e-learning system positively affects their satisfaction with the e-learning system.
H7. Educators' perceived system quality of an e-learning system positively affects their continued e-learning system usage intention.

At the post-adoption stage, actual interaction with the e-learning system shapes users' mental representation about its characteristics. We argue that users of a system during their actual usage develop expectations about its system quality. This argument is supported by both expectation-confirmation and theory of reasoned actions paradigms. Specifically, these paradigms have defined expectation as individual belief or sum of beliefs about the levels of attributes possessed by a system (Davis, 1989; Churchill and Surprenant, 1982). Repeated interaction with the e-learning system may also help the users to identify gaps between their expectations and system capabilities. Thus, we make the following hypothesis.

H8. Educators' confirmation of expectations positively affects their perceived system quality with e-learning system.

We argue that experience of using the e-learning system to conduct various tasks can invoke better understanding of its characteristics, which can assist the user in forming cognitions about its overall usefulness. We further argue that if the users of a system develop cognitions about its perceived system quality, it would affect their cognitions about its perceived usefulness in turn. Thus, we make the following hypothesis.

H9. Educators' perceived system quality of an e-learning system positively affects their perceived usefulness with e-learning system.



Note: Perceived system quality is a second order construct

Figure 2. Research model

STUDY DESIGN AND METHOD

Questionnaire development

Each item corresponding to the constructs was measured using seven-point Likert scale, with answer choices ranging from "Strongly disagree (1)" to "Strongly agree (7)". Most of these items were adapted from the literature with minor changes in wording reflecting the target context. The measures of confirmation, perceived usefulness, satisfaction, and continuance intention were adapted from Limayem et al., (2007) and Bhattacherjee (2001). The measures of reliability and integration were adapted from Wixom and Todd (2005) while the measures of access and ease of use were adapted from Lee et al., (2009) and Hong et al., (2006) respectively. After the questionnaire was drafted, it was first sent to two academic researchers for their review, and then it was revised according to their comments and suggestions to make the wording of the items more precise. Then, the questionnaire was sent to 30 educators in the university for their review. Overall, the educators 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. The questionnaire was revised according to the given suggestions. To avoid common method bias problem to some extent, we decided to randomize the questions in the questionnaire during data collection (Straub et al., 2004).

Data collection

Data was collected via a web-based survey from the educators who use Moodle for their teaching purpose. A list of educators' email addresses was collected from the Moodle support team in the university. A total of 1012 email invitations were sent to the educators of the university who had been the registered Moodle users. Two reminders were sent to increase the response rate in two weeks gaps. The survey ran for approximately one and half months. After filtering invalid and incomplete responses, we had total 207 survey responses. In this paper, we were interested about those users who had been conducting at least one course using Moodle at that particular academic period. After filtering the survey responses according to this criterion, we ended up with 175 usable responses. Table 1 shows the detailed demographic information of the participants. The response rate was low in the study. However, only faculty members who used Moodle for conducting their courses were asked to respond. There were many users registered with Moodle who were from Open University (not belonging to any faculty) and never used Moodle to conduct teaching. Instead, they used Moodle for project management purposes. Thus, the response rate is judged as being acceptable.

		Frequency	Percentage
Gender	Male	74	42.3
	Female	101	57.7
Age	21-40 years	90	51.4
	>41 years	85	48.6
Experience with the target system	0 – 18 months	54	30.9
	>18 – 36 months	83	47.4
	>36 months	38	21.7

Table 1: Demographic information

Data analysis

We employed partial least squares (PLS) as our analysis approach and utilized the tool smartPLS (Ringle et al., 2005). PLS is a second generation regression method that combines confirmatory factor analysis with linear regression, and this makes it possible to run the measurement and structural models simultaneously.

Table 2 shows items, means, and standard deviations. For each construct the assessment of convergent validity or internal consistency is also included. Convergent validity indicates the extent to which the items of a scale that are theoretically related are also related in reality. As we can see from Table 2, all items have significant ($p<0.001$) path loadings exceeding threshold value 0.7 recommended by Fornell and Larcker (1981). All the constructs have composite reliability values between 0.88 to 0.95 that fulfills the recommended value by Nunnally (1978). Testing for discriminant validity involves checking whether the items measure the construct in question or other (related) constructs. Discriminant validity was verified with both correlation analysis and factor analysis as recommended by Gefen and Straub (2005). The inspection of discriminant validity among variables is based on the correlation between variables and the square root of their respective average variance extracted (Fornell and Larcker, 1981). As Table 3 shows, the square root of the average variance extracted value for the variables is consistently greater than the off-diagonal correlations, suggesting satisfactory discriminant validity among variables. From Table 4 we see that all items have cross loadings coefficients considerably lower than the factor loading on their respective assigned latent variable, suggesting that discriminant validity on the item level is met for all the constructs.

Structural model results

The test of the structural model includes estimates of the path coefficients, which indicate the strengths of the relationships between the dependent and independent variables, and the R-square values, which represent the amount of variance explained by the independent variables. Figure 3 shows the results of the hypothesized structural model. As expected, confirmation ($\beta=0.45$, $p<0.001$) and perceived system quality ($\beta=0.39$, $p<0.001$) had significant effect on perceived usefulness, accounting for 57% of the variance in that measure. Confirmation ($\beta=0.61$, $p<0.001$) had significant influence on perceived system quality, explaining its 37% variance. Confirmation ($\beta=0.34$, $p<0.001$), perceived usefulness ($\beta=0.22$, $p<0.001$) and perceived system quality ($\beta=0.45$, $p<0.001$) had significant influences on satisfaction, accounting for 78% of its variance. Perceived usefulness ($\beta=0.48$, $p<0.001$) and satisfaction ($\beta=0.38$, $p<0.001$) had significant influence on intention. Interestingly, perceived system quality ($\beta=0.07$, ns) had no significant influence on intention. Perceived usefulness, satisfaction and perceived system quality altogether accounted around 64% of the variance in intention.

Construct	Item	Mean	std	Loading
IS continuance intention (CR = 0.92)	INT_1:I intend to continue using Moodle rather than discontinue its use	6.00	1.20	0.92*
	INT_2:My intentions are to continue using Moodle than use any alternative means	5.23	1.32	0.93*
Satisfaction (CR = 0.95)	SAT_1:My overall experience of using Moodle is very satisfied	4.84	1.49	0.91*
	SAT_2:My overall experience of using Moodle is very pleased	4.74	1.51	0.93*
	SAT_3:My overall experience of using Moodle is absolutely delighted	4.27	1.50	0.93*
Perceived usefulness (CR = 0.92)	PU_1:Using Moodle increases the control with my teaching plan	4.59	1.33	0.88*
	PU_2:Using Moodle is of benefit to me	5.18	1.28	0.90*
	PU_3:The advantages of Moodle outweigh the disadvantages	5.31	1.23	0.89*
Confirmation (CR = 0.94)	CON_1:My experience with using Moodle was better than what I expected	4.55	1.39	0.94*
	CON_2:The benefit provided by Moodle was better than what I expected	4.59	1.25	0.93*
Integration (CR = 0.90)	INTGR_1:Moodle effectively integrates data from existing course pages to a new course page	4.15	1.19	0.91*
	INTGR_2:Moodle pulls together information from different existing course pages to a new course page	3.93	1.22	0.90*
Reliability (CR = 0.95)	REL_1:Moodle is stable	4.35	1.45	0.95*
	REL_2:Moodle operates reliably	4.42	1.52	0.96*
Ease of use (CR = 0.94)	EOU_1:My interaction with Moodle is clear and understandable	4.46	1.52	0.89*
	EOU_2:I find Moodle to be easy to use	4.59	1.52	0.94*
	EOU_3:I find it easy to get Moodle to do what I want to do	4.27	1.61	0.93*
Access (CR = 0.88)	ACCESS_1:Moodle quickly loads all the text and graphics	3,96	1.79	0.88*
	ACCESS_2:Moodle provides good access	4.81	1.39	0.88*

*Note: CR = Composite Reliability; * = p<0.001*

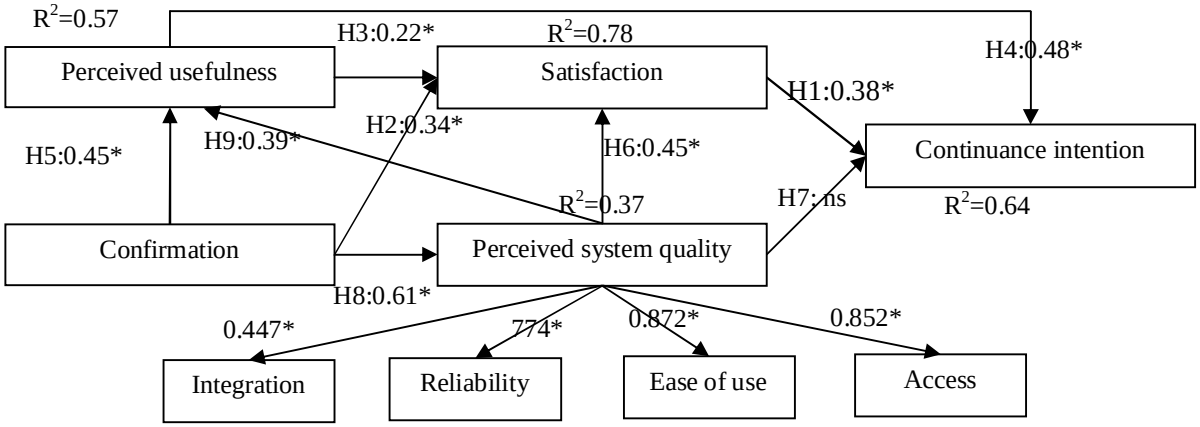
Table 2: Item means, standard deviation, and internal consistencies

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Access (1)	**0.88**							
Confirmation (2)	0.60	**0.94**						
Ease of Use (3)	0.60	0.50	**0.92**					
Integration (4)	0.27	0.24	0.30	**0.90**				
Intention (5)	0.58	0.65	0.60	0.20	**0.93**			
PU (6)	0.62	0.69	0.62	0.25	0.76	**0.89**		
Reliability (7)	0.65	0.44	0.47	0.21	0.33	0.41	**0.95**	
Satisfaction (8)	0.71	0.76	0.74	0.44	0.73	0.75	0.58	**0.92**

Table 3: Correlation among variables and square root of average variance extracted

	Access	Confirmation	Integration	Intention	Ease of Use	Perceived usefulness	Reliability	Satisfaction
ACCESS_1	**0.88**	0.47	0.22	0.43	0.51	0.47	0.61	0.57
ACCESS_2	**0.88**	0.58	0.24	0.59	0.55	0.62	0.53	0.68
CON_1	0.59	**0.94**	0.25	0.64	0.50	0.65	0.47	0.74
CON_2	0.52	**0.93**	0.21	0.57	0.44	0.64	0.35	0.68
INTGR_1	0.23	0.25	**0.91**	0.20	0.28	0.28	0.18	0.19
INTGR_2	0.24	0.19	**0.90**	0.16	0.24	0.16	0.20	0.17
INT_1	0.54	0.63	0.16	**0.92**	0.56	0.69	0.31	0.68
INT_2	0.53	0.57	0.21	**0.93**	0.54	0.71	0.29	0.66
EOU_1	0.48	0.37	0.25	0.52	**0.89**	0.49	0.37	0.61
EOU_2	0.61	0.49	0.23	0.54	**0.94**	0.59	0.48	0.71
EOU_3	0.56	0.51	0.33	0.59	**0.93**	0.62	0.44	0.70
PU_1	0.49	0.62	0.27	0.65	0.54	**0.88**	0.36	0.67
PU_2	0.58	0.59	0.20	0.65	0.58	**0.90**	0.35	0.67
PU_3	0.57	0.62	0.18	0.71	0.53	**0.89**	0.37	0.65
REL_1	0.58	0.40	0.20	0.30	0.41	0.38	**0.95**	0.53
REL_2	0.65	0.44	0.20	0.33	0.48	0.39	**0.96**	0.58
SAT_1	0.67	0.70	0.21	0.68	0.64	0.69	0.58	**0.91**
SAT_2	0.65	0.69	0.16	0.66	0.73	0.68	0.51	**0.93**
SAT_3	0.65	0.71	0.19	0.67	0.66	0.70	0.52	**0.93**

Table 4: Factor analysis results



Note: Perceived system quality is a second order construct

**p < 0.001; ns: non-significant*

Figure 3. PLS Model results

DISCUSSION AND IMPLICATIONS

We found support for three out of four added hypotheses in our extended information system continuance model. All the hypotheses of original model were also supported. The obtained results suggest that the variables of system quality are important in explaining users' satisfaction. Many studies found that perceived usefulness to be the most dominant predictor of satisfaction and intention to use (e.g., Limayem and Cheung, 2008; Roca et al., 2006). Our finding is in line with this in the

sense that we also found that perceived usefulness dominantly impacts continuance intention. Our results also revealed that system quality is the most dominating factor in shaping user satisfaction.

We did not find significant relationship between system quality and continuance intention. The lack of significant relationship between system quality and intention is a bit surprising according to IS success model proposed by DeLone and McLean (2003). However, it is in line with the IS acceptance research (Davis, 1989) and the modified IS success model proposed by Seddon (1997). In both research streams, system quality is viewed to have indirect impact on behavioral intention via behavioral beliefs such as perceived usefulness and perceived ease of use. Our finding is also in line with Wixom and Todd (2005) who argued that object based beliefs (perceived system quality) is not a good predictor of behavioral intention. According to our findings, perceived usefulness and satisfaction dominantly affect usage intention. Thus, system quality loses its significant direct impact on intention but have indirect effects via both perceived usefulness and satisfaction. However, further research is necessary to confirm the association between system quality and continuance intention.

We also observed that confirmation has a significant effect on perceived system quality. This suggests that perceived system quality is a post-adoption belief that is determined by the confirmation of initial expectations. Furthermore, we found that perceived usefulness can be predicted by confirmation and perceived system quality. These findings are also in line with prior findings. First, prior studies on IS continuance have supported the associations between confirmation and perceived usefulness (Bhattacherjee, 2001). Second, our finding on the association between perceived system quality and perceived usefulness is supported by both IS success (e.g., Seddon, 1997) and IS acceptance (e.g., Davis, 1989) studies.

Our study has three main theoretical implications. First, this study is an extension of the continuance theory with the IT artifact's system characteristics. We encourage researchers to investigate the effects of the IT artifact itself as an antecedent to perceived usefulness, satisfaction, and continuance intention. This is supported by Wixom and Todd (2005) who encouraged similar in IS acceptance context. Second, we used four system quality related factors that are salient for information system continuance. It would be useful for researchers to investigate whether there is a core set of system quality features that apply broadly across a wide range of system. Future studies should systematically investigate various technologies that differ on important dimensions such as systems with high analytical capabilities vs. systems with high information richness. It may allow us to compare how information system continuance might differ between such systems. Third, our results suggest that in the post-adoption stage, confirmation and perceived usefulness are not the sole focus for shaping users' satisfaction as indicated in the IS continuance theory. Users' perceived system quality is the most critical factor in shaping users' satisfaction.

Our research has practical implications too. The research results suggest that design and developing a useful system is an antidote against IS discontinuance in the e-learning context. The educators will discontinue using an e-learning system, if it is not useful for their purpose, even if they are satisfied with the system. Thus, in order to retain educators' e-learning system usage, appropriate actions should be taken by the management to advertise the system among the educators such that they could develop appropriate level of expectation about that particular e-learning system. In addition, educators' expectations about the e-learning system use will be adjusted during their use of the system. Furthermore, their expectations will become concrete and clear through frequent use of the e-learning system. This process will help the educators to set their post-consumption expectation (perceived usefulness) to appropriate level.

Second, we found that user satisfaction is another important determinant of continuance intention. Thus, the IT management team should develop strategies that will help increase user satisfaction with the e-learning system. Specifically, we found that system quality dominantly affects user satisfaction. It suggests that there is a clear need to set strategies to improve system quality related features. We found that reliability, ease of use, and access are the three most important system quality related features that should be ensured in order to retain satisfied users.

CONCLUSIONS

This study extended the expectation-confirmation based IS continuance theory with system quality. We developed an integrated research model with original IS continuance theory and system quality. Then, we conducted a test using survey data from 175 university educators, and analyzed the data using PLS analysis. Study's findings show that IS continuance is mainly determined by perceived usefulness and satisfaction. System quality affects IS continuance intention indirectly via perceived usefulness and satisfaction. The results were largely consistent with the hypothesized model and demonstrated the potential to integrate system quality and IS continuance theory into a single unified model. The combined model explained around 64% of the total variance of continuance intention.

One of the major limitations of this study is that it was conducted among the university educators using a course management system. Thus, caution should be taken when generalizing the findings of this study to business organization settings and other e-learning systems. It would therefore be useful to replicate this study in different contexts to further validate the extended IS continuance model proposed in this paper.

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