The Determinants of the Post-Adoption Satisfaction of Educators with an E-Learning System

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ABSTRACT

This paper examines factors that influence the post-adoption satisfaction of educators with e-learning systems. Based on the expectation-confirmation framework, we propose a research model that demonstrates how post-adoption beliefs affect post-adoption satisfaction. The model was tested at a university by educators (n = 175) who use an e-learning platform to conduct their teaching. The results suggest that post-adoption satisfaction is driven by confirmation, perceived system quality, perceived usefulness, perceived work compatibility and perceived support. These core determinants of satisfaction explained around 83% of the total variance of satisfaction in this study.

Keywords: Faculty attitudes, Learning Management System (LMS), System use, User satisfaction.

1. INTRODUCTION

The traditional context of learning is being altered by e-learning systems within educational institutions and corporations. The extension of the Internet as a delivery platform and the increasing use of location-independent education and training programs have resulted in an increase in educational and business organizations adopting and using e-learning systems. Furthermore, the increase in investment in e-learning systems by educational and business organization has meant they have become increasingly aware of the importance of seeking a return on their investment.

The evaluation of user satisfaction is regarded as one of the most important methods for evaluating e-learning systems (Wang, Wang, and Shee, 2007). Bailey and Pearson (1983, p. 531) define user satisfaction as "the sum of one's positive and negative reactions to a set of factors." Doll and Torkzadeh (1988, p. 261) describe it as "the affective attitude toward a specific computer application by someone who interacts with the application directly." Eagly and Chaiken (1998, p. 296) regard user satisfaction as "a psychological tendency expressed by evaluating a particular entity with some degree of favor and disfavor."

User satisfaction with Information Systems (IS) has been seen as one of the most important issues in IS research and it has often been linked to two important outcomes: IS success (DeLone and McLean, 2003) and the continued use of IS (Bhattachejee, 2001a). User satisfaction is an important measure of IS success and is often regarded as the easiest and the most useful way to evaluate it (DeLone and McLean, 2003). Additionally, the expectation-confirmation based IS continuance model views it as one of the most important predictors of IS continuance intention (Bhattacherjee, 2001a). Due to its importance, organizations often invest significant amounts of financial and human resources in the measurement and analysis of user satisfaction while simultaneously trying to improve the level of satisfaction.

A significant amount of research has been conducted on user satisfaction over the last two decades (Bailey and Pearson, 1983; Benson, 1983; Doll and Torkzadeh, 1988; Muylle, Moenaert, and Despontin, 2004). Although satisfaction has been studied extensively in IS research, the scope has primarily been limited to the study of system characteristics and the quality of service available to end-users (DeLone and McLean, 2003; Doll and Torkzadeh, 1988; Seddon, 1997). Such studies have often ignored the adoption process and selected only a small number of system or service attributes for measuring user satisfaction, despite the fact that IS continuance research has pointed out that the psychological motivations behind initial acceptance and continuance are different (Bhattacherjee, 2001a). The expectation-confirmation based IS continuance model examines user satisfaction from a solid theoretical base and explains it in terms of the adoption process and a single post-adoption belief, perceived usefulness (Bhattacherjee, 2001a). However, this ignores many important variables, such as system characteristics and the availability of support. Subsequent studies built upon the expectation-confirmation based IS continuance framework consider 'the use of a single belief (perceived usefulness) as the basis of satisfaction and continuance intention' to be a major limitation of the model (Hong, Thong, and Tam, 2006; Lin, Wu, and Tsai, 2005; McKinney, Yoon, and Zahedi, 2002; Thong, Hong, and Tam, 2006). To address this limitation later studies added more post-adoption beliefs: perceived ease of use (Recker,

2010; Sorebo and Eikebrokk, 2008); perceived playfulness (Lin, Wu, and Tsai, 2005; Tao, Cheng, and Sun, 2009); perceived enjoyment (Kang, Hong, and Lee, 2009; Thong, Hong, and Tam, 2006). However, the determinants of satisfaction cannot be restricted to just those factors because the IS continuance model provides only limited guidance on how to influence satisfaction through design and support. In fact, designers receive feedback regarding usefulness – but only in a general sense because they do not receive actionable feedback about the important aspects of system characteristics. Furthermore, support teams do not receive feedback on their support. Overall, the IS continuance model does not provide enough feedback on how to continuously improve systems or services, which is something that is important for e-learning service providers, especially as distance courses using e-learning systems are still evolving.

Although many studies have been conducted on user satisfaction, we are not in a position to pinpoint the most important factors that shape post-adoption user satisfaction, particularly in the context of how educators utilize e-learning platforms. The willingness of educators to utilize e-learning systems is very important because they can boost their utilization by students (Sorebo et al., 2009). A lack of willingness by educators to utilize e-learning systems may thus lead to students underutilizing them, resulting in reduced learning outcomes. However, despite the importance of knowing the reasons why educators continue to use an e-learning system or adopt another, very few studies have addressed the factors that shape the post-adoption satisfaction and the continuance intention of educators with regard to e-learning systems.

This paper addresses the following research question: what are the determinants of the post-adoption satisfaction of educators with e-learning systems? To answer this question we have integrated the research streams of IS continuance and user satisfaction. In particular, we have drawn upon different factors from the literature on IS adoption and user satisfaction. Furthermore, we have used the expectation-confirmation based IS continuance model (Bhattacherjee, 2001a) as the foundation for our research model. The research model we propose was tested by collecting survey data from university educators who use the popular e-learning platform, Moodle.

The paper is structured in the following way: in section 2 we present the theoretical background and literature reviews, section 3 presents our research model and section 4 is dedicated to the research method. Section 5 presents the data analysis results and discussion, section 6 describes the theoretical and practical implications of our findings and section 7 concludes the paper.

2. THEORETICAL BACKGROUND

2.1 Expectation-Confirmation Theory

Research into the post-purchase behavioral process of consumers has been a dominant theme in consumer behavior literature since the 1970s (Churchill and Surprenant, 1982). Many research frameworks have been used for this theme, of which the expectation-confirmation paradigm has been extensively used to explain the satisfaction and repurchase decisions of consumers in a variety of post-purchase contexts (Bhattachejee, 2001a; Churchill and Surprenant, 1982; Oliver, 1980).

According to the expectation-confirmation theory (ECT), a consumer's repurchase intention is determined by his/her level of satisfaction with a product. In turn, consumer satisfaction is determined by two major constructs: initial expectations (pre-purchase expectations) about a product, and the gap between those expectations and the product's performance (confirmation). According to this theory, buyers first develop expectations about a product before purchase and then their experience of it builds perceptions about its performance. This leads to the buyer either confirming or disconfirming the pre-purchase expectations when they assess perceived performance against their pre-purchase expectations, in other words, their earlier frame of reference. A buyer's expectations are confirmed when the product performs as expected, positively confirmed when it performs better than expected and disconfirmed when it performs worse than expected (Churchill and Surprenant, 1982).

ECT was first introduced to explain IS continuance by Bhattacherjee (2001a). He argued that a decision to continue IS usage is similar to a repurchase decision because both decisions: i) follow an initial (acceptance or purchase) decision, ii) are influenced by the initial use and experience of the IS or product, and iii) can potentially lead to the ex post reversal of the initial decision. In order to draw attention to the substantial difference between initial adoption and continued usage, he developed and empirically tested the information systems continuance model in a voluntary environment by adapting the expectation-confirmation theory. According to the IS continuance model, users, after their initial acceptance and use of a system, form opinions about which of their pre-acceptance expectations are confirmed, which is termed confirmation in the model. Based on this confirmation, the users form an opinion about their benefits i.e. their perceived usefulness, which can be viewed as post-adoption expectation (Bhattacherjee, 2001a). After a period of time, both confirmation and perceived usefulness become the basis for determining their satisfaction with the IS, which is termed satisfaction. Finally, perceived usefulness and satisfaction influence the willingness of users to continue using the IS, which leads to

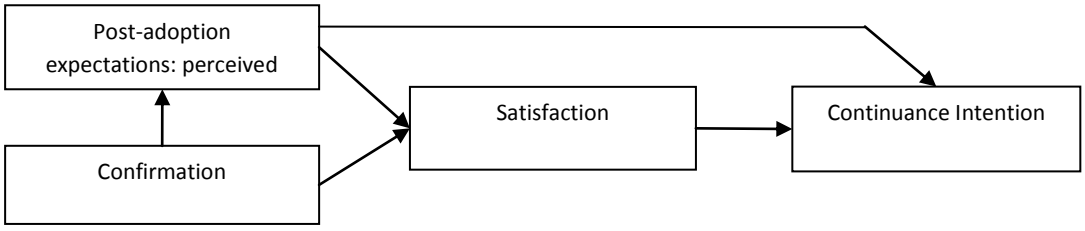


Figure 1. IS continuance model (Bhattacherjee, 2001a)

the creation of the continuance intention. The IS continuance model is shown in Figure 1.

Despite the structural adaptation from the expectation-confirmation paradigm, Bhattacherjee's information system continuance model contains a few differences. Firstly, it focuses on post-adoption expectations rather than pre-adoption expectations. It takes into account the fact that a user will continue to update their expectations of a system as he/she gains more experience of it. Once the user's experiences of the system have been processed it may be that his/her expectations of it will be different to his/her initial expectations prior to using the system (Bhattacherjee, 2001a). From this perspective, the IS continuance model asserts that post-adoption expectations, rather than pre-adoption expectations, are the relevant determinants of satisfaction. Secondly, the information systems continuance model selects perceived usefulness as the surrogate for post-adoption expectations, while the expectation-confirmation paradigm defines expectation as an individual's belief or the sum of his/her beliefs about the level of attributes possessed by a product or a service (Churchill and Surprenant, 1982). Therefore, Bhattacherjee (2001a) adopts perceived usefulness as the measure of expectation for the reason that it has demonstrated itself to be the most consistent and most salient in determining user intention over time (Davis, 1989; Venkatesh and Davis, 2000). Thirdly, perceived performance is not included in IS continuance theory on the grounds that the effect of perceived performance is captured by the confirmation construct.

2.2 Determinants of Post-adoption Satisfaction with E-learning Systems in Prior Studies

Prior studies have found a number of determinants of post-adoption user satisfaction with e-learning systems. The majority of prior studies have used data from students who were participating in online courses that had little or almost no face-to-face interaction, and a few studies were based on faculty educators who utilized e-learning systems to support their face-to-face teaching. Table 1 summarizes the studies.

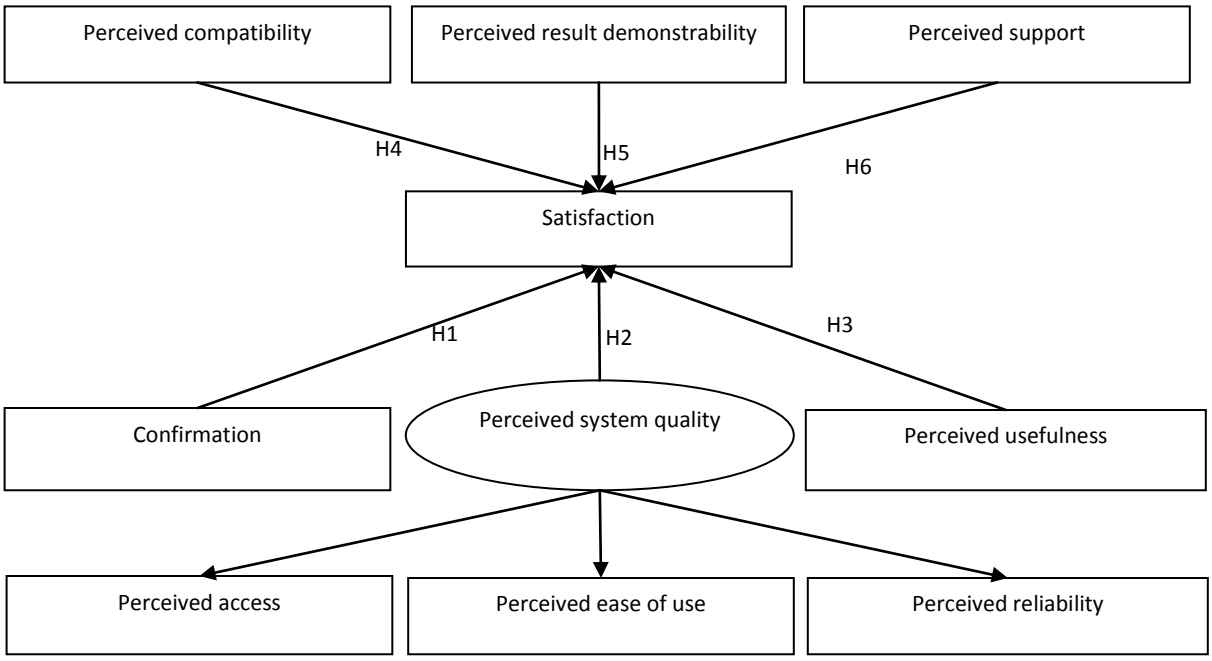
According to the findings of these studies, the different post-adoption beliefs of users are predictors of post-adoption satisfaction. These beliefs can be categorized into two types: behavioral beliefs and object-based beliefs (Hong, Kim, and Lee, 2008; Wixom and Todd, 2005). Behavioral beliefs are concerned with the consequences of using a particular e-learning system, while object-based beliefs are concerned with the characteristics of the e-learning system. There are some behavioral beliefs that have been used as the determinants of post-adoption satisfaction with e-learning systems, such as perceived usefulness, perceived enjoyment and perceived playfulness. The object-based beliefs that have been studied in explaining post-adoption satisfaction with e-learning systems include information quality and system quality.

3. RESEARCH MODEL DEVELOPMENT

The expectation-confirmation based IS continuance model puts forward the hypothesis that confirmation and post-adoption beliefs are the primary determinants of satisfaction. However, this model uses perceived usefulness as the post-adoption expectation belief, although expectations may be a theoretically broader construct that encompass many additional beliefs. In particular, we argue that users may form expectations about various dimensions such as system quality, support quality, result demonstrability, and

Article	Target population	Determinants	Base theory
Chiu et al., (2005)	Students participating in online courses	Usability, usability confirmation, quality, and value.	Expectation-confirmation
Roca, Chiu, and Martinez (2006)	Students participating in online courses	Information quality, system quality, service quality, confirmation, perceived usefulness, cognitive absorption, and perceived ease of use.	Expectation-confirmation
Chiu, Chiu, and Chang (2007)	Students participating in online courses	Distributive fairness, interactional fairness, intrinsic value, attainment value, and utility value.	Fairness theory (Lind et al., 1993)
Liao, Chen, and Yen (2007)	Students participating in online courses	Confirmation and perceived ease of use.	Expectation-confirmation
Liao, Palvia, and Chen (2009)	Students participating in online courses	Confirmation and perceived usefulness (only for short-term users).	Expectation-confirmation
Larsen, Sorebo, and Sorebo (2009)	University faculty teachers	Confirmation.	Expectation-confirmation
Limayem and Cheung, (2009)	University students attending a mixed (face-to-face lectures and e-learning tool) course.	Confirmation and perceived usefulness.	Expectation-confirmation
Sorebo et al., (2009)	University faculty teachers	Confirmation, perceived usefulness and perceived playfulness.	Expectation-confirmation
Lee (2010)	Students participating in online courses	Confirmation and perceived usefulness	Expectation-confirmation
Chen (2010)	Organization employees	Information quality and system quality	IS success
Freeze et al., (2010)	Students participating in online courses	Information quality and system quality	IS success

Table 1. Determinants of e-learning systems post-adoption satisfaction according to prior studies



Note: Perceived system quality is a second order construct

Figure 2. Research model

compatibility after their initial use of a system. The addition of other beliefs to the expectation-confirmation based IS continuance theory is supported by Kwon and Zmud's (1987) call for research on IS adoption research to take into account the influence of context. It is also supported by Wixom and Todd's (2005) view that a system's characteristics should be taken into account in IS adoption research. Most importantly, subsequent studies that have built upon the expectation-confirmation based IS continuance model have pointed that using only one belief for post-adoption expectations limits the model (Hong, Thong, and Tam, 2006).

Prior e-learning continuance research studies mostly investigated behavioral beliefs as the determinants of the post-adoption satisfaction and continuance intention of users in relation to e-learning systems, but have ignored object-based beliefs. However, object-based beliefs are important if one wishes to continuously improve a system or a service's design and development. Thus, in order to determine the post-adoption satisfaction of educators with an e-learning system we add four object-based beliefs to our model: perceived system quality, perceived compatibility, perceived result demonstrability and perceived support. We assert that users, after gaining experience of a particular e-learning platform, will develop these post-adoption expectation beliefs, which will determine satisfaction. The research model is shown in Figure 2.

In the following, we describe these beliefs and build our hypotheses.

3.1 Confirmation of Expectations

Confirmation is a cognitive belief defined as: the extent to which a user's expectation of the performance of an IS is realized during actual IS use (Bhattachejee, 2001a). The expectation-confirmation based IS continuance model posits that the confirmation of expectations has an effect on satisfaction. In other words, if the perceived performance exceeds the initial expectation, the expectation will be confirmed and create satisfaction with the IS. On the other hand, if the initial expectation is not met by the IS, disconfirmation will occur, which can lead to dissatisfaction. Many studies have validated the association between confirmation and user satisfaction in different contexts including e-learning systems (Bhattacherjee, 2001b; Deng et al., 2010; Hong, Thong, and Tam, 2006; Hsu, Chiu, and Ju, 2004; Liao, Chen, and Yen, 2007; Lin, Wu, and Tsai, 2005). Thus, we make the following hypothesis:

H1. The perceived confirmation of the expectations of educators using an e-learning system positively affects their satisfaction with the e-learning system.

3.2 Perceived Usefulness

Perceived usefulness is defined as the degree to which a user believes that using a particular system would enhance his or her job performance (Davis, 1989). Perceived usefulness captures the instrumentality of system use. Bhattachejee (2001a) uses the Technology Acceptance Model (TAM) to show that perceived usefulness is one of the primary motivators of IS acceptance and that it can also influence subsequent continuance decisions. Therefore, the expectation-confirmation based IS continuance model proposes that perceived usefulness has a direct impact on satisfaction. Many subsequent studies have confirmed this association in different contexts (Bhattachejee and Premkumar, 2004; Hong, Thong, and Tam, 2006; Hsieh and

Wang, 2007; Recker, 2010). Thus, it is reasonable to make the following hypothesis:

H2. The perceived usefulness of an e-learning system affects educators' satisfaction with the e-learning system.

3.3 Perceived System Quality

System quality is the general perception of a system in terms of its performance and this is reflected by various system features (Lee, Shin, and Lee, 2009). The role of system quality in IS success literature has been extensively investigated (DeLone and McLean, 2003; Seddon, 1997). There are many system quality related factors, such as flexibility, integration, response time, sophistication, reliability, accessibility, stability, system speed, usability, ease of use, etc. (Lee, Shin, and Lee 2009). The most frequently used system quality related factors for web-based systems are access, ease of use and reliability (McKinney, Yoon, and Zahedi, 2002; Lee, Shin, and Lee, 2009). Hence, in this paper we have used perceived access, perceived ease of use and perceived reliability as the system quality related dimensions. Their operational definitions are given in Table 2.

Factor	Definition
Perceived access	"refers to the degree of accessibility, responsiveness, and availability of the e-learning systems" (Lee, Shin, and Lee, 2009)
Perceived ease of use	"The degree to which an individual perceives using the e-learning system is free of effort" (Davis, 1989)
Perceived reliability	"refers to the dependability of the e-learning system operation" (Wixom and Todd, 2005)

Table 2. The conceptualization of perceived system quality variables

As perceived system quality can be modeled as a second order factor (Lee, Shin, and Lee, 2009) we decided to model perceived system quality as a second-order construct with three reflective factors: perceived access, perceived ease of use and perceived reliability. DeLone and McLean (2003) state that system quality has a direct effect on user satisfaction and IS use, which has been confirmed by numerous subsequent studies in different contexts (Freeze et al., 2010; Halawi, McCarthy, and Aronson, 2008; Negash, Ryan, and Igbaria, 2003). Thus, we hypothesize the following:

H3. The perceived system quality of an e-learning system affects educators' satisfaction with the e-learning system.

3.3 Perceived Compatibility

Moore and Benbasat (1991) define perceived compatibility as the degree to which an IS is perceived as being consistent with the existing values, needs and experiences of its users. Perceived compatibility has been often used in IS adoption literature as a determinant of intention (Karahanna, Straub, and Chervany, 1999; Venkatesh et al., 2003) and perceived usefulness (Sun, Bhattacherjee, and Ma, 2009). Moore and Benbasat (1996) examined the effect of compatibility on continued usage intention and found a significant positive relation. Empirically, user adoption has been linked to other research that uses variables similar to perceived compatibility, for example, job-relevance (Venkatesh and Davis, 2000), cognitive fit (Vessey, 1991), task-technology fit (Goodhue and Thompson, 1995), etc.

In this study, we theorize that perceived compatibility is a post-adoption belief and has a direct impact on satisfaction. It is clear that educators carry distinct knowledge about their teaching and training situations, which they use as the basis for determining which tasks can be performed with a given e-learning system. If the e-learning platform is compatible with the teaching tasks, it is most likely that the educators will remain satisfied with the system. Conversely, if the e-learning platform provides important functionalities with a user-friendly interface, but does not provide the functionalities that are needed for the completion of their teaching tasks, they are unlikely to remain satisfied with the system. Thus, we propose the following hypothesis:

H4. The perceived compatibility of an e-learning system positively affects educators' satisfaction with the e-learning system.

3.3 Perceived Result Demonstrability

Perceived result demonstrability is defined as the degree to which the results of using the IS are observable and communicable to others (Karahanna, Straub, and Chervany, 1999). Agarwal and Prasad (1997) examined the effect of result demonstrability in the context of current and continued usage of the Internet. They found result demonstrability to be significant in determining continued usage but non-significant in determining current usage. We argue that educators, after gaining experience of using an e-learning system, develop beliefs about result demonstrability that directly influence their satisfaction with the e-learning system. This suggests that educators will be satisfied if the co-variation between usage and positive results are readily observable and communicable. Conversely, if the e-learning system produces the results desired by the educators, but does so in manner that is complicated and difficult to explain, educators are unlikely to remain satisfied with the system. Thus, we make the following hypothesis:

H5. The perceived results demonstrability of an e-learning system positively affects educators' satisfaction with the e-learning system.

3.3 Perceived Support

Perceived support is defined as the degree to which assistance is available when educators face difficulties with an e-learning system. In our study, we posit that perceived support has a direct influence on the satisfaction of educators with a system. It implies that if the educators get help from manuals and the e-learning system's support team when they face problems in completing a task, they will be satisfied. The use of perceived support in IS adoption research can be traced from the very first article to use TAM (Davis, 1989), in which it was regarded as an external variable affecting perceived usefulness and perceived ease of use. Support is also seen as part of the facilitating conditions that affect intention (Venkatesh et al., 2003). In IS success literature,

satisfaction is determined by service quality, which is a similar variable to perceived support (DeLone and McLean, 2003). Thus, we hypothesize the following:

H6. Perceived support positively affects educators' satisfaction with the e-learning system.

4. STUDY DESIGN AND METHOD

4.1 Research Context

In order to understand the research context of this study, the e-learning platform and the research environment is presented.

The target e-learning system in this study is the Moodle learning management system. Moodle is an open source course management system or a virtual learning environment. It has become very popular among educators for creating dynamic online course websites for students. Moodle can be used to conduct online courses and also to augment face-to-face courses. Moodle provides tools such as forums, databases and wikis for building collaborative learning communities. It also provides ways to deliver content to students and assess learning. To work, it needs to be installed on a web server.

This study has been conducted in an internationally acknowledged, multidisciplinary university located on the southwest coast of Finland. With 21,000 students and 3,000 employees, it is one of the most important universities in Finland. It has seven faculties but research activities and learning also take place in special units. Such units offer adult education, and promote personal, organizational and regional development. Different university support activities are also taken care of at these facilities. The special units enable the construction of multi-disciplinary and international research environments. Educators at the university (both the faculties and the special units) began using Moodle as the main platform for creating online course pages that support face-to-face teaching in 2007. Additionally, personnel from the special units have used Moodle for project management purposes. The faculty educators are free to choose other methods of creating course pages within the university domain. In some faculties, in-house developed course management systems are also available. Thus, using Moodle is not seen as mandatory for educators.

4.2 Questionnaire Development

Each item corresponding to the constructs has been measured using the seven-point Likert scale, with answer choices ranging from "Strongly disagree (1)" to "Strongly agree (7)". Most of these items are adapted from the literature with only minor changes in the wording to reflect the target technology. After the questionnaire was drafted it was sent to two academic researchers to be reviewed and revised according to their comments and suggestions to make the wording of the items more precise. Then it was sent to 30 educators at the university for 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. The questionnaire is shown in the Appendix. To avoid the common method bias problem, at least to some extent, we decided to randomize the questions in the questionnaire during data collection (Straub, Boudreau, and Gefen, 2004).

4.3 Data Collection

Data was collected via a web-based survey from the educators who use Moodle for their teaching purposes. A total of 1012 users were registered with Moodle as instructors during August, 2010. Two important points are important to note. Firstly, it should be noted that many of the registered Moodle users were from special units of the university. As explained in section 4.1, such users use Moodle for project management purposes. It was not possible to distinguish between educators and personnel from the special units in the registered Moodle user database. Secondly, many faculty educators are registered as Moodle users but do not use it. This is because such educators are busy with other tasks and use assistants to do their Moodle related tasks. It was also difficult to filter out such users. Thus, a total of 1012 email invitations were sent to all registered Moodle users but only faculty members who had recently used Moodle for conducting their courses were asked to respond. Two reminders were sent to increase the response rate after gaps of two weeks. The survey ran for approximately one and half months. After filtering invalid and incomplete responses a total of 207 survey responses were received. For this particular study, we were interested in those users who had conducted at least one course using Moodle during the academic year. After filtering the survey responses we ended up with 175 usable responses. Table 3 shows the detailed demographic information of the participants. The response rate is low in the study. However, the presence of many users who do not actually use Moodle in the way required for the survey explains the low response rate.

		Frequency	Percent
Gender	Male	74	42.3
	Female	101	57.7
Age	21-40 years	90	51.4
	>40 years	85	48.6
Experience with the target technology	0 – 18 months	54	30.9
	>18 – 36 months	83	47.4
	>36 months	38	21.7
Faculty	Humanities	37	21.1
	Mathematics and Natural Science	38	21.7
	Medicine	18	10.3
	Law	15	8.6
	Social Sciences	16	9.1
	Education	16	9.1
	Turku School of Economics	35	20

Table 3. Demographic information

Construct	Item	Mean	std	Loading	t-statistic
Satisfaction (Composite Reliability = 0.94; AVE = 0.81)	SAT-1	4.84	1.49	0.89	47.53
	SAT-2	4.74	1.51	0.93	83.17
	SAT-3	4.58	1.37	0.85	25.08
	SAT-4	4.27	1.50	0.91	56.42
Perceived usefulness (Composite Reliability = 0.91; AVE = 0.72)	PU-1	4.59	1.33	0.86	38.79
	PU-2	5.18	1.28	0.87	25.97
	PU-3	5.31	1.23	0.88	29.80
	PU-4	5.65	1.22	0.79	18.18
Perceived Ease of use (Composite Reliability = 0.93; AVE = 0.76)	PEOU-1	4.46	1.52	0.87	41.06
	PEOU-2	4.38	1.52	0.78	18.80
	PEOU-3	4.59	1.52	0.94	133.56
	PEOU-4	4.27	1.61	0.90	50.53
Perceived Access (Composite Reliability = 0.86; AVE = 0.77)	ACCESS-1	3.96	1.79	0.88	31.69
	ACCESS-2	4.81	1.39	0.88	28.19
Perceived Compatibility (Composite Reliability = 0.91; AVE = 0.77)	COMP-1	4.95	1.40	0.92	38.76
	COMP-2	5.17	1.26	0.89	47.43
	COMP-3	4.66	1.36	0.83	27.95
Perceived Reliability (Composite Reliability = 0.95; AVE = 0.91)	REL-1	4.35	1.45	0.95	100.93
	REL-2	4.42	1.52	0.96	161.87
Confirmation (Composite Reliability = 0.91; AVE = 0.76)	CON-1	4.55	1.39	0.90	54.26
	CON-2	4.59	1.25	0.90	46.93
	CON-3	4.75	1.14	0.82	22.96
Perceived Support (Composite Reliability = 0.93; AVE = 0.86)	SUP-1	4.36	1.86	0.91	25.25
	SUP-2	4.40	1.66	0.95	60.80
Perceived Result Demonstrability (Composite Reliability = 0.88; AVE = 0.71)	RD-1	5.00	1.24	0.83	17.80
	RD-2	5.08	1.30	0.85	35.93
	RD-3	5.18	1.23	0.84	18.23

Table 4. Items' means, standard deviations and internal consistencies

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Perceived Access (1)	**0.88**								
Perceived Compatibility (2)	0.56	**0.88**							
Perceived Ease of Use (3)	0.60	0.67	**0.87**						
Satisfaction (4)	0.70	0.74	0.74	**0.90**					
Confirmation (5)	0.60	0.63	0.56	0.80	**0.87**				
Perceived Usefulness (6)	0.62	0.79	0.61	0.78	0.73	**0.85**			
Perceived Result Demonstrability (7)	0.43	0.70	0.55	0.55	0.51	0.66	**0.84**		
Perceived Reliability (8)	0.65	0.36	0.50	0.58	0.50	0.42	0.31	**0.95**	
Perceived Support (9)	0.30	0.28	0.38	0.38	0.20	0.34	0.31	0.28	**0.93**

Table 5. Correlation among the variables and the square root of average variance extracted

4.4 Data Analysis

Partial least squares (PLS) is the approach used by our analysis and smartPLS is the tool utilized (Ringle, Wende, and Will, 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. PLS has enjoyed increasing popularity in IS research for its ability to model latent constructs under the condition of non-normality (Chin, 1998). A rule of thumb for the required sample size in PLS is that the sample should be at least ten times the most complicated multiple regression in the model (Barclay, Higgins, and Thompson, 1995). The variables in this study are non-normal. Thus, PLS is the right tool for conducting the analysis in this study. In addition, the sample size of this study meets the minimum sample size requirement.

Table 4 shows item wise averages, standard deviations, loadings and t-statistics values for each construct in the model. For each construct the assessment of convergent validity or internal consistency is also included through the composite reliability and average variance extracted (AVE) coefficients. Convergent validity indicates the extent to which the items of a scale that are theoretically related are also related in reality. Table 4 shows that all items have significant path loadings greater than the threshold of 0.7 recommended by Fornell and Larcker (1981) and that all the constructs have composite reliability values that exceed the threshold recommended by Nunnally (1978).

	PA	PC	CON	PS	EOU	PU	PREL	PRD	SAT
ACCESS-1	**0.88**	0.39	0.47	0.23	0.51	0.47	0.61	0.31	0.55
ACCESS-2	**0.88**	0.57	0.58	0.30	0.55	0.61	0.53	0.45	0.69
COMP-1	0.53	**0.92**	0.55	0.29	0.61	0.75	0.28	0.63	0.67
COMP-2	0.54	**0.89**	0.51	0.26	0.53	0.68	0.27	0.60	0.64
COMP-3	0.53	**0.83**	0.58	0.16	0.62	0.65	0.38	0.58	0.63
CON-1	0.66	0.53	**0.90**	0.24	0.50	0.65	0.47	0.39	0.75
CON-2	0.58	0.55	**0.90**	0.12	0.43	0.64	0.35	0.46	0.68
CON-3	0.53	0.56	**0.82**	0.16	0.54	0.60	0.48	0.47	0.65
SUP-1	0.33	0.22	0.18	**0.91**	0.30	0.29	0.25	0.28	0.30
SUP-2	0.39	0.28	0.19	**0.95**	0.39	0.32	0.25	0.29	0.39
PEOU-1	0.55	0.61	0.43	0.35	**0.87**	0.52	0.37	0.52	0.63
PEOU-2	0.49	0.44	0.40	0.26	**0.78**	0.37	0.44	0.32	0.50
PEOU-3	0.67	0.60	0.54	0.36	**0.94**	0.59	0.48	0.51	0.72
PEOU-4	0.63	0.68	0.56	0.34	**0.90**	0.62	0.44	0.54	0.71
PU-1	0.56	0.68	0.64	0.32	0.52	**0.86**	0.36	0.63	0.68
PU-2	0.63	0.73	0.61	0.29	0.57	**0.87**	0.35	0.56	0.68
PU-3	0.61	0.67	0.66	0.24	0.52	**0.88**	0.37	0.51	0.66
PU-4	0.47	0.59	0.55	0.29	0.46	**0.79**	0.33	0.51	0.62
REL-1	0.58	0.31	0.45	0.23	0.44	0.40	**0.95**	0.29	0.51
REL-2	0.65	0.36	0.50	0.29	0.51	0.39	**0.96**	0.30	0.56
RD-1	0.39	0.55	0.42	0.26	0.52	0.52	0.28	**0.83**	0.41
RD-2	0.43	0.63	0.47	0.28	0.43	0.63	0.27	**0.85**	0.56
RD-3	0.31	0.53	0.34	0.22	0.43	0.44	0.20	**0.84**	0.36
SAT-1	0.72	0.67	0.74	0.36	0.64	0.72	0.58	0.45	**0.89**
SAT-2	0.71	0.68	0.73	0.35	0.72	0.70	0.51	0.52	**0.93**
SAT-3	0.61	0.63	0.66	0.35	0.64	0.65	0.40	0.52	**0.85**
SAT-4	0.74	0.66	0.72	0.30	0.64	0.72	0.52	0.48	**0.91**

Table 6. Factor analysis results

Note: Perceived Access (PA), Perceived Compatibility (PC), Perceived Ease of Use (PEOU), Satisfaction (SAT), Confirmation (CON), Perceived Usefulness (PU), Perceived Result Demonstrability (PRD), Perceived Reliability (PREL), Perceived Support (PS).

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). Firstly, the inspection of discriminant validity among the variables is based on the correlation between the variables and the square root of their respective average variance extracted (Fornell and Larcker, 1981). As Table 5 shows, the square root of average variance extracted value for the variables is consistently greater than the off-diagonal correlation values, suggesting satisfactory discriminant validity among the variables. Secondly, in Table 6 we see that all items have cross loading coefficients 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.

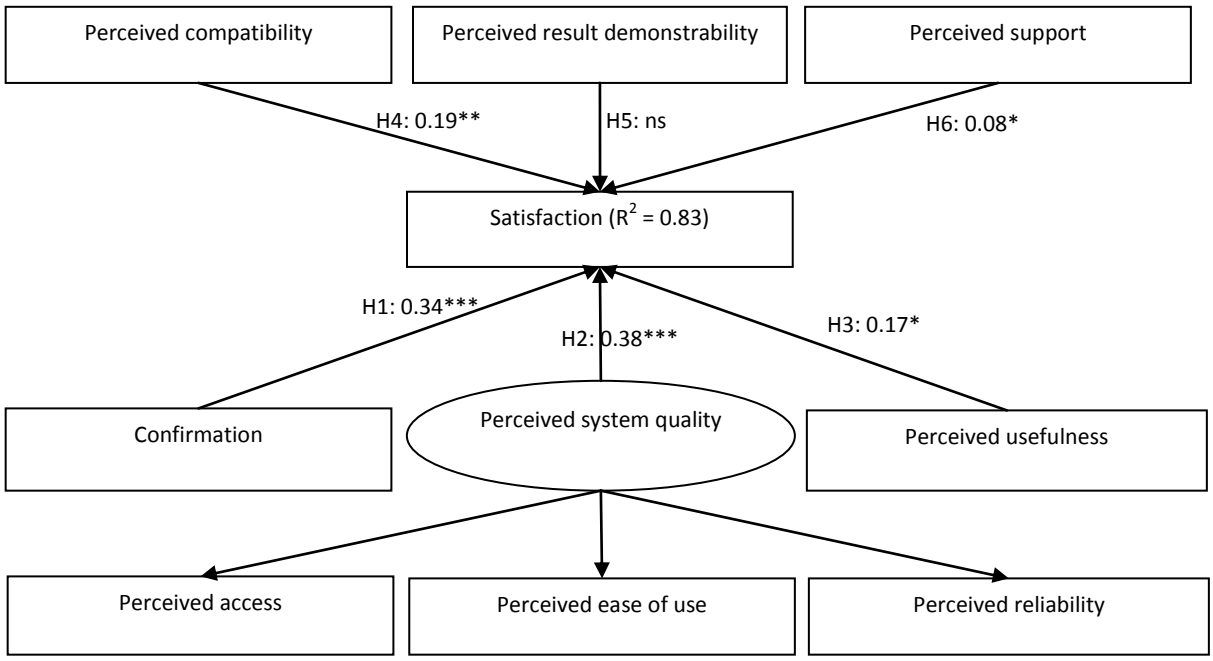
5. RESULTS AND DISCUSSIONS

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 test of the hypothesized structural model. Five of our six hypotheses are supported.

As expected, the confirmation of initial expectations ($\beta = 0.34$; $t = 5.49$; $p < 0.001$), perceived system quality ($\beta = 0.38$; $t = 6.34$; $p < 0.001$), perceived compatibility ($\beta = 0.19$; $t = 2.35$; $p < 0.01$), perceived usefulness ($\beta = 0.17$; $t = 2.29$; $p < 0.05$), and perceived support ($\beta = 0.08$; $t = 2.21$; $p < 0.05$) have a significant impact on the post-adoption satisfaction of educators with regard to the target e-learning platform. However, perceived result demonstrability ($\beta = -0.08$; $t = 1.63$; ns) was found to have no significant effect on their post-adoption satisfaction. Taken as a whole, these predictors explained 83% of the total variance in satisfaction. The supported hypotheses are discussed below.

Our study revealed that perceived system quality has the most dominant impact on the post-adoption satisfaction of educators regarding e-learning system utilization. Prior studies that have used the expectation-confirmation based IS continuance model to investigate post-adoption satisfaction have found confirmation to be the most dominant predictor of satisfaction. The interesting finding of our study is the strength of the relationship between perceived system quality and post-adoption satisfaction.

Secondly, our study results show that the confirmation of initial expectations has a strong impact on the post-adoption



Note: *p < 0.05; **P < 0.01; ***p < 0.001; ns: non-significant

Figure 3. PLS analysis results

satisfaction of educators with regard to the utilization of e-learning systems. This finding echoes the finding of many other previous studies (Limayem and Cheung, 2009; Roca, Chiu, and Martinez, 2006).

Thirdly, perceived compatibility was found to significantly influence the post-adoption satisfaction of educators. Although the association between perceived compatibility and satisfaction is not so common and has not been tested empirically in the IS literature, our study revealed that perceived compatibility is important in shaping user satisfaction during the post-adoption stage.

Fourthly, perceived usefulness was found to have a very weak impact on post-adoption satisfaction. Bhattacherjee (2001a) has claimed that perceived usefulness is the only post-adoption belief that affects post-adoption satisfaction and the IS continuance intention. He argues that perceived usefulness is the most consistent belief in predicting an individual's intention to use IS during the various stages of adoption. However, the finding of our study contradicts this. Nevertheless, as Wixom and Todd (2005) have pointed out, behavioral beliefs, such as perceived usefulness, weakly predict satisfaction, while object-based beliefs, such as perceived system quality, are weak in their ability to predict behavioral intention. Our study findings may complement Wixom and Todd's (2005) views in the sense that we found perceived usefulness to be very weak at predicting satisfaction, but we did find that perceived system quality strongly predicted satisfaction. In prior IS continuance literature, a number of studies have found that perceived ease of use, which is a system quality related factor, is more important than perceived usefulness in predicting user satisfaction (Hong, Thong, and Tam, 2006).

Lastly, we found that perceived support is also important in shaping the satisfaction of educators with an e-learning system during the post-adoption stage. This finding is in line with the IS success model which suggests that service quality influences user satisfaction (DeLone and McLean, 2003).

6. IMPLICATIONS

6.1 Theoretical Implications

Our research findings have theoretical implications. Our study supported the argument that there are other post-adoption beliefs in addition to perceived usefulness that are salient in shaping post-adoption user satisfaction. In fact, our study revealed that behavioral beliefs (perceived usefulness) are very weak in predicting post-adoption satisfaction. We also discovered that object-based beliefs, such as perceived system quality and perceived compatibility, are more important than behavioral beliefs in shaping post-adoption satisfaction. It is clear in prior literature that there are limitations of the IS continuance model. Thus, researchers have tried to overcome those limitations by adding more behavioral beliefs such as perceived enjoyment and perceived playfulness. However, the findings of this study indicate that it is also important to use object-based beliefs to extend the IS continuance model. Furthermore, our study revealed that it is necessary to incorporate more object-based beliefs into the IS continuance model in order to improve the analysis of user satisfaction. Perceived system quality and

perceived compatibility are two potential variables for extending the expectation-confirmation based IS continuance model.

6.2 Practical Implications

Our research findings also have practical implications. Our study revealed a list of factors that are salient in shaping the satisfaction of educators during the post-adoption stage of the utilization of e-learning platforms. Consequently, management and designers should concentrate more effort on the improvement of these dimensions in order to increase user satisfaction. Continuous improvement is particularly important for e-learning systems because the utilization of such systems continues to evolve in both educational and business organizations.

According to our findings, management and development teams may plan for the following actions: Firstly, our study found that perceived system quality is the most important factor for predicting the post-adoption satisfaction of educators with regard to an e-learning system. Thus, in order to maintain user satisfaction, designers should continuously look for opportunities to further improve e-learning platforms that have already been implemented. Designers should concentrate their efforts on making the system easy to use, accessible and reliable. In relation to this, usability tests could be conducted in conjunction with existing users in order to plan for the future improvement of a system. In addition, training for users should be organized by the managers so that they can develop the necessary skills to use an e-learning system, ensuring that users feel the system is easy to use. Additionally, service providers who host e-learning systems should also ensure that it is accessible.

Secondly, we found that the confirmation of initial expectations about an e-learning system also has a very strong influence on the post-adoption satisfaction of educators. Thus, vendors should develop strategies and advertise e-learning systems in ways that build an appropriate level of initial user expectations. This would then allow users to positively confirm their initial expectations and it should also positively affect post-adoption satisfaction during the later stages of their use of the e-learning system.

Thirdly, we found perceived compatibility significantly affects the post-adoption satisfaction of educators. This implies that management and developers should develop e-learning systems that are compatible with the existing values and needs of educators. In essence, designers should understand the teaching tasks that educators have and develop systems that are compatible with those teaching tasks.

Finally, perceived support was found to significantly affect the post-adoption satisfaction of educators. Thus, a support team should improve the support functions of e-learning systems in order to maintain the satisfaction of educators. Prompt, polite and appropriate responses to the problems educators face are the most obvious way to provide support, while the provision of proper instruction manuals would also encourage educators to continue using specific e-learning systems.

7. CONCLUSIONS

In this study, we developed a research model based on the expectation-confirmation framework with the aim of identifying post-adoption beliefs that are salient in shaping the satisfaction of educators during their post-adoption use of an e-learning system. In particular, we hypothesized that confirmation, perceived usefulness, perceived system quality, perceived result demonstrability, perceived support and perceived compatibility would be salient in shaping post-adoption satisfaction. We then collected survey data from 175 university educators who use an e-learning platform for teaching purposes and analyzed the data using PLS analysis. The study's findings revealed that the satisfaction of educators with an e-learning system is mainly determined by the confirmation of their initial expectations, perceived system quality, perceived usefulness, perceived support and perceived compatibility. Perceived result demonstrability was found not to have a significant impact on their satisfaction. Together, these core determinants of satisfaction explained around 83% of the total variance in satisfaction.

This study has several limitations. Firstly, because the study was conducted in a single university and assessed only one e-learning system, caution should be taken before generalizing the results of this study to other contexts, which implies that the replication of this study in other contexts is required. Second, the beliefs of the users regarding a system will change as the users gain experience of a target system but such changes cannot be captured with the type of cross-sectional study undertaken. To do that a longitudinal study is required and this would also provide deeper insights into how changes in the beliefs of users influence user satisfaction. Finally, we did not test how the major demographic variables of the respondents, such as gender, age and computer experience affected their perceptions. Hence, a possible future direction of research would be the testing of the moderating effects that the major demographic variables would have on the associations between the constructs proposed in the research model.

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