Communications of the Association for Information Systems

Volume 30 Paper

1-2012

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Recommended Citation
Al-Busaidi, K. A. (2012). Learners' Perspective on Critical Factors to LMS Success in Blended Learning: An Empirical Investigation. Communications of the Association for Information Systems, 30, pp-pp.
https://doi.org/10.17705/1CAIS.03002

Communications of the Association for Information Systems

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Learners' Perspective on Critical Factors to LMS Success in Blended Learning: An Empirical Investigation

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Abstract:

The use of Learning Management System (LMS) in academic institutions is becoming an imperative for many institutions. The success of LMS in academic institutions may be initiated by instructors' adoption; however, LMS survives in the long run by learners' continuous adoption and use. Consequently, the objective of this article is to examine the critical factors that influence the success of LMS in blended learning in terms of actual usage, perceived usefulness, perceived ease of use, and user satisfaction from the learners' perspective. The study also examines how these success measures impact learners' continuous intention to use LMS in blended learning. These critical factors are related to the major entities of LMS adoption: learner characteristics (computer anxiety, technology experience, self-efficacy, and personal innovativeness), instructor characteristics (attitude, teaching style, control, and responsiveness), LMS characteristics (system quality, information quality, and service quality), classmates characteristics (attitude and interaction), course characteristics (quality and flexibility), and organization characteristics (management support and training). Based on 512 learners, the results showed that all of these factors are critical to one or several success measures, except for learner self-efficacy, instructor online responsiveness, and management support. The results also showed that all success measures are critical to learners' continuous intention to use LMS in blended learning.

Keywords: Learning Management Systems, learners' adoption of LMS, blended learning, e-learning, LMS success, LMS critical factors

Volume 30, Article 2, pp. 11-34, January 2012

The manuscript was received 4/8/2011 and was with the authors 2 months for 1 revision.

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I. INTRODUCTION

The use of Information Communication Technology (ICT) to develop human resources (people) is a vital prerequisite for the development of a knowledge-based economy, especially for a developing country. A Learning Management System (LMS) not only provides academic institutions with efficient means to train and teach individuals, but also enables them to efficiently codify and share their academic knowledge. Recently, the adoption of e-learning systems has been increasing in the academic world. In 2004, the e-learning market was worth more than US$18 billion worldwide [Saady, 2005]. Current reports indicate that more than 90 percent of all participating universities and colleges in the U.S. [Hawkins and Rudy, 2007] and about 95 percent of participating institutions in the UK have adopted LMS for students' and instructors' use [Browne et al., 2006]. In the Middle East, e-learning projects are expected to exceed a compound average growth rate of 32 percent by 2008, based on the Madar research group [Saady, 2005]. All forms of electronic or Internet-mediated learning continue to thrive across all levels of higher education and are increasing on a daily basis [Fathi and Wilson, 2009].

E-learning is the use of Web-based communication, collaboration, learning, knowledge transfer, and training to add value to learners and businesses [Kelly and Bauer, 2004). LMSs, or e-learning systems, are used by some academic and technical training institutions to support distance learning (pure exclusive e-learning), while others use it to supplement more traditional ways of teaching (blended learning). For distance learning, e-learning systems can be fully used to build a virtual learning environment wherein all coursework is conducted exclusively online [Rainer et al., 2007]. On the other hand, blended learning is defined as a combination (blend) of e-learning and face-to-face classroom learning environments [Graham, 2006; Wu et al., 2010]. A blended learning environment integrates instructional delivery in a face-to-face context with online learning, either synchronously or asynchronously [Gribbins et al., 2007]. There are several learning management systems on the market, such as Blackboard and Moodle. These systems include several tools that can be utilized for blended learning or pure e-learning. For example, Moodle offers instructors several tools that allow them to develop course activities, such as assignments, surveys, choices, forums, chat rooms, resources (files, websites), quizzes, journals, glossaries, and workshops.

There are several individual and organizational benefits to LMS. Learners can access course materials online at any time. LMS also offers students some flexibility in terms of place, time, and pace [Rainer et al., 2007]. Other benefits are cost-effectiveness, consistency, timely content, flexible accessibility, and customer value [Cantoni et al., 2004; Kelly and Bauer, 2004]. In addition, LMS allows students to interact with others, control their own learning, develop critical thinking skills, and a sense of community with other learners. However, the deployment of LMS may be costly, may require new skills for content producers and may require more responsibility and self-discipline from learners [Cantoni et al., 2004]. Thus, students might be intimidated by LMS. Likewise, organizations can alleviate the risks associated with LMS deployment by using it initially as a supplementary tool to traditional classroom teaching, creating a blended learning environment. Recently, blending learning has been increasing in higher education, as students are involved in collaborative learning and interaction with instructors and classmates [Wu et al., 2010].

Examining the success of LMS deployment is essential for its continuous use. The success of LMS, as for any information system, can be assessed in terms of user acceptance, usage, and satisfaction. Learners' continuous acceptance and use is significant for the success of LMS deployment. Measuring user acceptance and satisfaction is a "basic marketing element" to manage e-learning initiatives [Kelly and Bauer, 2004]. Consequently, the objective of this article is to examine the critical factors that influence the success of LMS in a blending learning context, from the learner's perspective. It also examines how this success is linked to learner intention to continuously use LMS in blended learning. These critical factors are related to the major LMS entities: the learner, the instructor, the LMS, the course, the classmates, and the organization. LMS success can be measured by several factors, such as perceived ease of use, perceived usefulness, user satisfaction, and actual usage.

A number of studies have investigated the success of information technologies in education from the learner's perspective. Some of these studies are Webster and Hackly [1997], Arbaugh [2000], Roca et al. [2006], Gotthardt et al. [2006], Pituch and Lee [2006], Selim [2007], Liaw et al. [2007], Wan et al. [2007], Lee [2008], Liaw [2008], Raaij and Schepers [2008], Sun et al. [2008], Al-Busaidi [2009], Lee [2010], Cheng [2011], Limayem and Cheung [2011], Lin et al. [2011], and Wang and Chiu [2011]. None of these studies, however, provided an examination of all major issues related to LMS success: learner characteristics (computer anxiety, technology experience, self-efficacy, and personal innovativeness), instructor characteristics (attitude, teaching style, control and responsiveness), LMS

characteristics (system quality, information quality, and service quality), classmates characteristics (attitude and interaction), course characteristics (quality and flexibility), and organization characteristics (management support and training). In addition, none of these studies assessed learners' perspectives on LMS success from several dimensions: learners' perceived ease of use, perceived usefulness, user satisfaction, and system usage. Finally, none of them examined the impact of all these success measures on learners' continuous intention to use LMS in blended learning environment.

II. BACKGROUND LITERATURE

Success of LMS

The success of a technology is a multidimensional issue; it may be affected by various technical and nontechnical factors. Technology success has been assessed in the literature based on several measures, such as perceived ease of use, perceived usefulness, user's satisfaction, intention to use, and actual usage of the technology. Various frameworks have investigated the determinants of individual acceptance. The technology acceptance model [Davis, 1989; Venkatesh and Davis, 2000] and information system (IS) success model [DeLone and McLean, 1992; 2003] are two popular models of user acceptance of information technologies. According to Davis [1989] and Venkatesh and Davis [2000], technology acceptance can be assessed by perceived usefulness and perceived ease of use, whereas, according to DeLone and McLean [1992; 2003], technology success can be assessed by actual use (or intention to use), user satisfaction and, eventually, net benefits.

There are several factors that might impact the success of technology. DeLone and McLean [2003] indicated that information quality, system quality, and service quality are the success factors of an information system (IS). For the use of technology in learning, Webster and Hackly [1997], following Dillon and Gunawardena's [1995] recommendation, indicated that the success of technology-mediated learning might be influenced by several issues related to technology, the instructor, course, learners, and classmates. Issues related to the organization might also have some influence on the success of learning management systems; Sumner and Hostetler [1999] indicated that organizational factors such as training, incentives, strategic alignment, and technical support might affect the adoption of technology in teaching. Likewise, Wan et al. [2007], in a theoretical study, proposed that primary participants (learners and instructors), technology quality, and instructional design impact learning processes, and, consequently, learning outcomes. Furthermore, in a confirmatory study, Selim [2007] categorized the critical factors of LMS acceptance according to learner, instructor, technology, and university support factors.

Consequently, this study categorizes critical factors for learner adoption of LMS in blended learning as learner characteristics (computer anxiety, technology experience, self-efficacy, and personal innovativeness), instructor characteristics (attitude, teaching style, control, and online responsiveness), LMS characteristics (system quality, information quality, and service quality), classmates characteristics (attitude and interaction), course characteristics (quality and flexibility), and organization characteristics (management support and training). The success of LMS in blended learning is assessed by four factors: (1) perceived ease of use and (2) perceived usefulness, as suggested by Davis [1989], (3) actual use and (4) user satisfaction, as suggested by DeLone and McLean [1992; 2003].

Prior Studies on LMS Success from Learners' Perspective

There are a number of studies that have examined the success of LMS from instructors' and learners' perspectives. The empirical studies that have investigated the success of e-learning system in academic institutions from the learner's perspective are Arbaugh [2000], Pituch and Lee [2006], Roca et al. [2006], Liaw et al. [2007], Lee [2008], Liaw [2008], Raaij and Schepers [2008], Sun et al. [2008], Al-Busaidi [2009], Lee [2010], Cheng [2011], Limayem and Cheung [2011], Lin, Chen, and Fang [2011], and Wang and Chiu [2011]. Table 1 illustrates these investigations in the context of this study's investigated dimensions. As indicated in the table, none of these studies examined the impact of learner characteristics, instructor characteristics, LMS characteristics, classmates characteristics, course characteristics, and organization characteristics on several success measures (perceived ease of use of LMS, perceived usefulness, actual use, and satisfaction). Arbaugh [2000] investigated the impact of instructor characteristics on learner satisfaction with LMS. Pituch and Lee [2006] examined the impact of learner characteristics and system characteristics on learners' perceived ease of use, perceived usefulness, and use. Roca et al. [2006] investigated the impact of learner characteristics on perceived ease of use and the impact of system quality, information quality and service quality on learner satisfaction with e-learning. Liaw et al. [2007] examined the impact of learner characteristics and system characteristics on learners' perceived usefulness of e-learning. Lee [2008] examined the effect of intraorganizational factors and extraorganizational factors on the perceived ease of use and perceived usefulness of online learning. Liaw [2008] assessed the impact of perceived self-efficacy, system quality, and multimedia instruction on learners' perceived satisfaction and usefulness of e-learning systems. Raaij and Schepers [2008] examined the impact of learner characteristics on learners' perceived ease of use and perceived usefulness of e-learning. Sun et al. [2008] examined the impact of learner characteristics, instructor characteristics, course characteristics, system quality, and classmates' interaction on learner satisfaction with e-

learning. Al-Busaidi [2009] examined the impact of learner characteristics and LMS characteristics on LMS use. Cheng [2011] investigated the effect of system factors and individual factors on the learner's perceived ease of use and perceived usefulness of e-learning. Wang and Chiu [2011] investigated the impact of information quality, system quality and service quality on learner satisfaction. Lee [2010], Limayem and Cheung [2011], and Lin et al. [2011] examined the predictors of intention to continue e-learning. Examining the direct impact of these critical factors on each of these success measures is vital. Perceived usefulness, perceived ease of use, user satisfaction, and continuous intention to use are important measures for technology acceptance and eventually may correlate with actual usage behavior. However, measuring attitudes and their link to actual usage behavior is extremely difficult [DeLone and McLean, 2003]. An earlier theoretical study by the author proposed critical factors that might impact learners' acceptance (perceived ease of use and perceived usefulness) of LMS [Al-Busaidi, 2010]. This study empirically assesses the impacts of all these factors on all the success measures of LMS and continuous intention to use it.

Table 1: Empirical Studies on LMS Success

		Dependent Constructs			
		Perceived Ease of Use	Perceived Usefulness	System Use	User Satisfaction
Independent Constructs	*Computer Anxiety (CA)*	Raaij and Schepers [2008]		Al-Busaidi [2009]	Sun et al. [2008]
	Technology Experience (TE)	Pituch and Lee [2006]; Roca et al. [2006]; Cheng [2011]	Pituch and Lee [2006]; Liaw [2008]; Cheng [2011]	Pituch and Lee [2006]; Al-Busaidi [2009]	Liaw [2008]; Sun et al. [2008]
	Self-Efficacy (SE)			Al-Busaidi [2009]	
	Personal Innovativeness (PI)	Raaij and Schepers [2008]	Raaij and Schepers [2008]		
	Instructor Style (IS)				Sun et al. [2008]
	Instructor Attitude (IA)				Arbaugh [2000]
	Instructor Control (IC)				
	Instructor Responsiveness (IR)				Sun et al. [2008]
	System Quality (SQ)	Pituch and Lee [2006]; Cheng [2011]	Pituch and Lee [2006]; Liaw et al. [2007]; Liaw [2008]; Cheng [2011]	Pituch and Lee [2006]; Al-Busaidi [2009]	Roca et al. [2006]; Liaw [2008]; Sun et al. [2008]; Wang and Chiu [2011]
	Information Quality (IQ)		Cheng [2011]	Al-Busaidi [2009]	Roca et al. [2006]; Wang and Chiu [2011]
	Service Quality (SvQ)				Roca et al. [2006]; Wang and Chiu [2011]
	Classmates' Attitude (CMA)				
	Classmates' Interactivity (CMI)				Sun et al. [2008]
	Course Quality (CQ)				Sun et al. [2008]
	Course Flexibility (CF)				Arbaugh [2000]; Sun et al. [2008]
	Management Support (MS)				Lee et al. [2007]
	Training (TR)	Lee [2008]	Lee [2008]		

III. RESEARCH MODEL

LMS Success Model

As previously mentioned, this study examines the critical factors for LMS success in blended learning from the learner's perspective. These factors are learner characteristics (computer anxiety, technology experience, self-efficacy, and personal innovativeness), instructor characteristics (attitude, teaching style, control, and responsiveness), LMS characteristics (system quality, information quality, and service quality), classmates characteristics (attitude and interaction), course characteristics (quality and flexibility), and organization

characteristics (management support and training). The success of blended learning is assessed according to four factors: perceived ease of use, perceived usefulness, actual use, and user satisfaction. Furthermore, the study examines the impact of these success measures on learners' continuous intention to use LMS in blended learning. Figure 1 illustrates the study model.

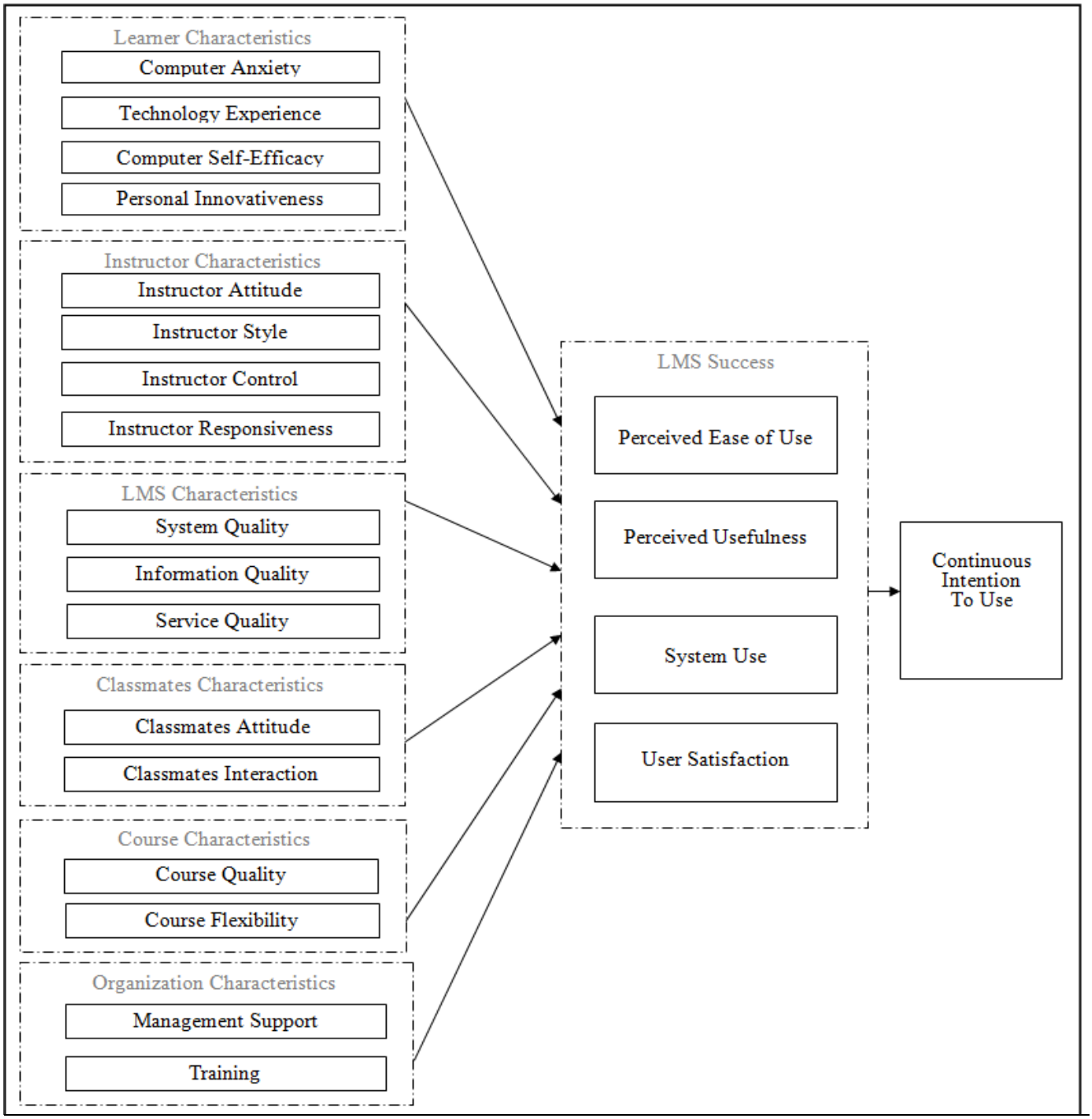

Figure 1. Critcal Factors to LMS Success from Learners' Perspective

Learner Characteristics

Computer Anxiety

Computer anxiety can be a critical factor for learners' acceptance of LMS. Computer anxiety is defined as "the fear or apprehension felt by individuals when they used computers, or when they considered the possibility of computer utilization" [Simonson et al., 1987, p. 238]. Thus, computer anxiety can negatively impact learners' acceptance and use of LMS. Several empirical studies found a significant negative effect of users' computer anxiety on their perceived satisfaction of e-learning [Sun et al., 2008], perceived ease of use of e-learning [Raaij and Schepers,

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2008], and usage of LMS [Al-Busaidi, 2009]. A fear of computers will negatively impact the e-learning environment and, consequently, the user's perceived satisfaction [Piccoli et al., 2001]. Learners with high computer anxiety will probably not accept and use LMS and will not be satisfied with it. They may consider it difficult and not useful. Thus:

Hypothesis 1a: A learner's computer anxiety is negatively related to his/her perceived ease of use of LMS in a blended learning environment.

Hypothesis 1b: A learner's computer anxiety is negatively related to his/her perceived usefulness of LMS in a blended learning environment.

Hypothesis 1c: A learner's computer anxiety is negatively related to his/her use of LMS in a blended learning environment.

Hypothesis 1d: A learner's computer anxiety is negatively related to his/her satisfaction with LMS in a blended learning environment.

Technology Experience

Learners' experience with the use of technology (EUT) plays a role in the success of technology. An individual's EUT is the individual's exposure to the technology (e.g., LMS) and the skills and abilities that s/he gains through using a technology [Thompson et al., 2006]. Learners' technology experience has a major impact on learning processes and, consequently, learning outcomes [Wan et al., 2007]. Learners' experience is important for learners' perceived ease of use and perceived usefulness of LMS [Pituch and Lee, 2006]. In addition, the current level of computer skills and extent of use of computing skills in teaching are important for acceptance of ICT in education [Sumner and Hostetler, 1999]. The more technology experience a learner has, the more accustomed the learner will be to ICT in education and will perceive it as easy and useful and use it. Moreover, long-term technology experience indicates that learners are satisfied with the technology. Therefore:

Hypothesis 2a: A learner's technology experience is positively related to his/her perceived ease of use of LMS in a blended learning environment.

Hypothesis 2b: A learner's technology experience is positively related to his/her perceived usefulness of LMS in a blended learning environment.

Hypothesis 2c: A learner's technology experience is positively related to his/her use of LMS in a blended learning environment.

Hypothesis 2d: A learner's technology experience is positively related to his/her satisfaction with LMS in a blended learning environment.

Self-Efficacy

Learners' self-efficacy may also impact their perception of LMS. Computer self-efficacy refers to self-assessment of the ability to apply computer skills to accomplish tasks [Compeau et al., 1995]. Bandura defined self-efficacy as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" [1986, p. 391). Computer self-efficacy is significantly positively associated with the perceived usefulness of information systems [Chau, 2001; Vankatesh and Davis, 1996], perceived ease of use of e-learning systems [Cheng, 2011; Pituch and Lee, 2006; Roca et al., 2006] and perceived usefulness and satisfaction of e-learning systems [Liaw, 2008]. The higher the learners' computer self-efficacy, the more likely they are to perceive it as easy to use and useful and to become satisfied with it.

Hypothesis 3a: A learner's computer self-efficacy is positively related to his/her perceived ease of use of LMS in a blended learning environment.

Hypothesis 3b: A learner's computer self-efficacy is positively related to his/her perceived usefulness of LMS in a blended learning environment.

Hypothesis 3c: A learner's computer self-efficacy is positively related to his/her use of LMS in a blended learning environment.

Hypothesis 3d: A learner's computer self-efficacy is positively related to his/her satisfaction with LMS in a blended learning environment.

Personal Innovativeness

Personal innovativeness is another factor that may be critical for learners' acceptance of LMS. In information technology, personal innovativeness refers to a person's attitude: the tendency to experiment with and to adopt new information technologies independently of the experience of others [Schillewaert et al., 2005]. Learners' innovativeness is important to the acceptance of e-learning systems. When users are accustomed to adapting to a

new system, they more quickly reveal its usefulness and ease of use [Schillewaert et al., 2005]. Thus, the higher the learners' innovativeness, the more likely they are to reveal LMS usefulness, adopt it, use it, accept it, and be satisfied with it. Students' personal innovativeness significantly impact their perceived ease of use and perceived usefulness of Internet technologies [Lewis et al., 2003]. Similarly, learners' personal innovativeness has a significant impact on their perceived ease of use of e-learning systems [Raaij and Schepers, 2008]. Thus,

Hypothesis 4a: A learner's personal innovativeness is positively related to his/her perceived ease of use of LMS in a blended learning environment.

Hypothesis 4b: A learner's personal innovativeness is positively related to his/her perceived usefulness of LMS in a blended learning environment.

Hypothesis 4c: Learner's personal innovativeness is positively related to his/her use of LMS in a blended learning environment.

Hypothesis 4d: Learner's personal innovativeness is positively related to his/her satisfaction with LMS in a blended learning environment.

Instructor Characteristics

Instructor Attitude

The instructor's attitude toward e-learning is essential to learners' acceptance of technology and learning outcomes [Dillon and Gunawardena, 1995; Piccoli et al., 2001; Webster and Hackley, 1997]. The instructor's attitude is also crucial to learners' perceptions, use, and satisfaction of LMS. Social influence (i.e., subjective norms) impacts user acceptance and perceived usefulness of a technology [Venkatesh and Davis, 2000]. Based on subjective norms, if a user believes that a superior or colleague thinks using a system is useful, then that person may believe it is actually useful. In a virtual learning environment, social influence impacts its acceptance positively [Keller, 2009]. Likewise, in video-mediated learning, instructor attitude significantly impacts learners' technology self-efficacy and their attitude toward the technology [Webster and Hackley, 1997]. Thus, if the instructor has a good attitude (views it as easy, useful, and satisfactory) toward the LMS, then learners will also have the same attitude. Consequently,

Hypothesis 5a: The instructor's attitude is positively related to learners' perceived ease of use of LMS in a blended learning environment.

Hypothesis 5b: The instructor's attitude is positively related to learners' perceived usefulness of LMS in a blended learning environment.

Hypothesis 5c: The instructor's attitude is positively related to learners' use of LMS in a blended learning environment.

Hypothesis 5d: The instructor's attitude is positively related to learners' satisfaction with LMS in a blended learning environment.

Instructor Style

The instructor's teaching style may be a crucial factor for the success of LMS from the learner's perspective. Instructors with an interactive teaching style are critical for a positive learning outcome [Webster and Hackley, 1997; Wan et al., 2007]. Instructors with an interactive teaching style significantly impact the learners' involvement and participation, cognitive engagement and attitudes toward the technology [Webster and Hackley, 1997]. Interactivity improves e-learning satisfaction [Arbaugh, 2000] and learning effects [Piccoli et al., 2001]. Thus, instructors with an interactive teaching style enhance learners' use, acceptance, and satisfaction with the LMS. Accordingly,

Hypothesis 6a: The instructor's teaching style is positively related to the learner's perceived ease of use of LMS in a blended learning environment.

Hypothesis 6b: The instructor's teaching style is positively related to the learner's perceived usefulness of LMS in a blended learning environment.

Hypothesis 6c: The instructor's teaching style is positively related to the learner's use of LMS in a blended learning environment.

Hypothesis 6d: The instructor's teaching style is positively related to the learner's satisfaction with LMS in a blended learning environment.

Instructor Control

The instructor's control over LMS is another critical factor for learners' acceptance, use, and satisfaction of LMS. Learners become impatient when instructors face technical problems [Leidner and Jarvenpaa, 1993]. Students may view instructors as not qualified when they have little control over the technology. Consequently, instructor control

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over the technology may indicate the ease of use of the technology. Moreover, in the context of video-technology-mediated learning, instructor control over the technology significantly impacts learners' cognitive engagement and attitudes toward the technology [Webster and Hackley, 1997]. Instructor control over the technology improves learners' commitment, usefulness, and satisfaction with the technology. Consequently:

Hypothesis 7a: The instructor's control over the technology is positively related to the learner's perceived ease of use of LMS in a blended learning environment.

Hypothesis 7b: The instructor's control over the technology is positively related to the learner's perceived usefulness of LMS in a blended learning environment.

Hypothesis 7c: The instructor's control over the technology is positively related to the learner's use of LMS in a blended learning environment.

Hypothesis 7d: The instructor's control over the technology is positively related to the learner's satisfaction with LMS in a blended learning environment.

Instructor Responsiveness

Furthermore, instructors' online responsiveness is critical to the success of LMS. Instructor responsiveness refers to the learner's perception of a prompt response from the instructor to online problems and requests [Sun et al., 2008]. If instructors are responding to students' needs and problems promptly, learners' satisfaction will improve [Arbaugh, 2002]. The instructors' prompt responsiveness illustrates to learners the usefulness and success of using LMS in blended learning. Thus, instructors' prompt online responsiveness encourages learners to adopt LMS, perceive it as easy and useful, and be satisfied with it. Accordingly:

Hypothesis 8a: The instructor's responsiveness is positively related to the learner's perceived ease of use of LMS in a blended learning environment.

Hypothesis 8b: The instructor's responsiveness is positively related to the learner's perceived usefulness of LMS in a blended learning environment.

Hypothesis 8c: The instructor's responsiveness is positively related to the learner's use of LMS in a blended learning environment.

Hypothesis 8d: The instructor's responsiveness is positively related to the learner's satisfaction with LMS in a blended learning environment.

LMS Characteristics

System Quality

System quality plays a major role in the success of LMS. System quality is related to the characteristics of a system. Researchers (such as Bailey and Pearson [1983], DeLone and McLean [1992], and Seddon [1997]) have introduced several ways to measure system quality. The common measures of system quality are response time, reliability, flexibility, accessibility, and ease of use. In the context of e-learning, system characteristics were found to be significant for e-learning success (acceptance and use). Some of these system characteristics are reliability [Wan et al., 2007; Webster and Hackley, 1997]; accessibility [Wan et al., 2007]; and system's functionality, interactivity, and response [Pituch and Lee, 2006; Cheng, 2011]. Good system quality is empirically positively related to system use and user satisfaction [DeLone and McLean, 1992]. In the e-learning system context, system quality was found to be significant for the satisfaction with e-learning systems [Liaw, 2008; Roca et al., 2006; Wang and Chiu, 2011], perceived usefulness of e-learning systems [Liaw, 2008], and use of e-learning systems [Al-Busaidi, 2009]. Empirically, the higher the system's interactivity, functionality, and response, the higher the users' perceived ease of use of the e-learning system, the perceived usefulness of the e-learning system, and the use of the e-learning system [Pituch and Lee, 2006]. Likewise, Cheng [2011] significantly showed that system interactivity and functionality significantly impact learners' perceived ease of use and usefulness of the e-learning system. Therefore:

Hypothesis 9a: System quality of LMS is positively related to the learner's perceived ease of use of LMS in a blended learning environment.

Hypothesis 9b: System quality of LMS is positively related to the learner's perceived usefulness of LMS in a blended learning environment.

Hypothesis 9c: System quality of LMS is positively related to the learner's use of LMS in a blended learning environment.

Hypothesis 9d: System quality of LMS is positively related to the learner's satisfaction with LMS in a blended learning environment.

Information Quality

Information quality refers to the perceived output produced by the system. The common characteristics of information quality include accuracy, relevance, timeliness, sufficiency, completeness, understandability, format, and accessibility [Bailey and Pearson, 1983; Seddon, 1997]. Generally, information quality plays a significant role in the use of an information system and user satisfaction [DeLone and McLean, 1992] and perceived usefulness of the technology [Venkatesh and Davis, 2000]. In the e-learning context, Roca et al. [2006] measured information quality by indicators related to relevance, timeliness, sufficiency, accuracy, clarity, and format. In addition, they demonstrated that information quality is significant directly on satisfaction and indirectly on perceived usefulness. Likewise, Cheng [2011] empirically illustrated the significant impact of information quality on learners' perceived usefulness of e-learning systems. Information quality may also enhance learners' perceived ease of use of LMS. If the information provided by LMS is of good quality, easy to understand, accurate, and complete, learners may believe LMS is easy overall. Therefore:

Hypothesis 10a: Information quality of LMS is positively related to the learner's perceived ease of use of LMS in a blended learning environment.

Hypothesis 10b: Information quality of LMS is positively related to the learner's perceived usefulness of LMS in a blended learning environment.

Hypothesis 10c: Information quality of LMS is positively related to the learner's use of LMS in a blended learning environment.

Hypothesis 10d: Information quality of LMS is positively related to the learner's satisfaction with LMS in a blended learning environment.

Service Quality

Service quality refers to the quality of support services provided to the system's end users. Service quality plays a significant role for the user of information systems and user satisfaction [DeLone and McLean, 2003]. Common measurements of service quality are tangibles, reliability, responsiveness, assurance and empathy [Kettinger and Lee, 1994; Parasuraman et al., 1988]. Online service quality may also be a critical factor for learners' acceptance, use, and satisfaction with LMS in blended learning. Good service quality enables learners to understand the LMS, be able to use it, and perceive its usefulness. In the e-learning context, Roca et al. [2006] measured service quality by measurements related to responsiveness, reliability, and empathy, and they confirmed its direct impact on satisfaction and indirect impact on perceived usefulness. Likewise, service quality of LMS significantly impacts learner satisfaction [Wang and Chiu, 2011]. Thus:

Hypothesis 11a: Service quality of LMS is positively related to the learner's perceived ease of use of LMS in a blended learning environment.

Hypothesis 11b: Service quality of LMS is positively related to the learner's perceived usefulness of LMS in a blended learning environment.

Hypothesis 11c: Service quality of LMS is positively related to the learner's use of LMS in a blended learning environment.

Hypothesis 11d: Service quality of LMS is positively related to the learner's satisfaction with LMS in a blended learning environment.

Classmate Characteristics

Classmate Attitude

The effect of classmates' characteristics on learners' acceptance of LMS is essential but rarely assessed. Classmates' characteristics (in terms of their attitude toward the LMS) are critical to learner acceptance, use, and satisfaction of LMS in blended learning. The classmates' attitudes affect learning outcomes [Fulk et al., 1990; Webster and Hackley, 1997]. Classmates' attitude is significant on learners' involvement and participation, cognitive engagement, and attitude toward the technology in a video-mediated learning environment [Webster and Hackley, 1997]. Classmates' attitude is also crucial to learners' perceptions, use, and satisfaction with LMS. Social influence (subjective norms) also suggests that if a user believes that a colleague thinks that a system is useful, then that person may also believe that it is useful [Venkatesh and Davis, 200]. Likewise, if the use of an innovation enhances one's social status or image, then it will enhance the perceived usefulness and use of the innovation [Venkatesh and Davis, 2000]. Thus, classmates, as colleagues and part of a learner's social system, and their attitudes are important to learners' adoption, use, acceptance, and satisfaction. Therefore:

Hypothesis 12a: Classmates' attitude toward LMS is positively related to the learner's perceived ease of use of LMS in a blended learning environment.

Hypothesis 12b: Classmates' attitude toward LMS is positively related to the learner's perceived usefulness of LMS in a blended learning environment.

Hypothesis 12c: Classmates' attitude toward LMS is positively related to the learner's use of LMS in a blended learning environment.

Hypothesis 12d: Classmates' attitude toward LMS is positively related to the learner's satisfaction with LMS in a blended learning environment.

Classmate Interaction

In addition, classmates' interaction in an e-learning environment is a very important factor for learners' acceptance, use, and satisfaction with LMS in blended learning. Interaction in an e-learning environment not only involves learners with the instructor, but also learners with other learners [Moore, 1989]. The frequency, quality, and promptness of interaction in an e-learning environment might affect the learner's satisfaction and learning success [Sun et al., 2008]. Hence, classmates' interaction through the LMS enhances the learner's perception of ease of use and usefulness of LMS stimulates learner use and satisfaction. Thus:

Hypothesis 13a: Classmates' interaction is positively related to the learner's perceived ease of use of LMS in a blended learning environment.

Hypothesis 13b: Classmates' interaction is positively related to the learner's perceived usefulness of LMS in a blended learning environment.

Hypothesis 13c: Classmates' interaction is positively related to the learner's use of LMS in a blended learning environment.

Hypothesis 13d: Classmates' interaction is positively related to the learner's satisfaction with LMS in a blended learning environment.

Course Characteristics

Course Quality

Course characteristics are critical to the success of e-learning and LMS. Few studies have investigated the impact of course characteristics on the success of learning technology. These studies are Webster and Hackley [1997] and Sun et al. [2008]. Webster and Hackly [1997], however, focused on videoconference-mediated distance learning. The quality of LMS-mediated coursework is another critical determinant of the success of LMS in blended learning. LMS offers several rich tools that enable and enrich the development of a well-designed course. The well-designed online course should provide a rich environment for online communication, collaboration, and sharing of course materials. Specifically, it should offer learners interactive online discussions, multimedia presentation of course materials, and the online management of learning processes [Piccoli et al., 2001; Sun et al., 2008]. A well-designed course improves learners' perceived ease of use of LMS and it use. It also enables them to realize the usefulness of LMS, and hence it helps improves their satisfaction with the LMS. Therefore:

Hypothesis 14a: Course quality of LMS is positively related to the learner's perceived ease of use of LMS in a blended learning environment.

Hypothesis 14b: Course quality of LMS is positively related to the learner's perceived usefulness of LMS in a blended learning environment.

Hypothesis 14c: Course quality of LMS is positively related to the learner's use of LMS in a blended learning environment.

Hypothesis 14d: Course quality of LMS is positively related to the learner's satisfaction with LMS in a blended learning environment.

Course Flexibility

Course flexibility is another course characteristic that might impact learners' acceptance, use and satisfaction with LMS in blended learning. Course flexibility refers to the learner's perception of the effectiveness and efficiency of adopting e-learning [Sun et al., 2008]. Flexibility in time, location, and learning is a major factor for the learner's acceptance of LMS [Arbaugh, 2000]. One of the main promising aspects of e-learning is that it enables learners to acquire education and learn without time and location constraints. If the course enables them to learn and complete some learning tasks electronically through LMS, they become more satisfied with its use. This flexibility gives learners a sense of convenience and ease and enables them to realize the benefits of the LMS in blended learning. Thus:

Hypothesis 15a: Course flexibility of LMS is positively related to the learner's perceived ease of use of LMS in a blended learning environment.

Hypothesis 15b: Course flexibility of LMS is positively related to the learner's perceived usefulness of LMS in a blended learning environment.

Hypothesis 15c: Course flexibility of LMS is positively related to the learner's use of LMS in a blended learning environment.

Hypothesis 15d: Course flexibility of LMS is positively related to the learner's satisfaction with LMS in a blended learning environment.

Organization Characteristics

Management Support

Management support is an important factor for learners' acceptance and use of LMS. Senior managers' support is important for learners to accept and adopt LMS. Senior managers should support technology deployment and clearly identify the goal of the technology and its importance for the organization's success. Very limited research has investigated the impact of management support on learners' acceptance and use of e-learning systems. Managerial support assures users that using LMS is part of the organization's culture and is useful and, consequently, encourages them to adopt and use the system. Managers are recognized as a high authority [Ali, 1990]; thus, learners' acceptance, use, and satisfaction with LMS may be associated with the endorsement of their senior managers. Management support of end users significantly improves computer usage [Igbaria, 1990]. In the e-learning context, organizational support has a significant impact on learner satisfaction [Lee et al., 2007]. Therefore:

Hypothesis 16a: Management support is positively related to the learner's perceived ease of use of LMS in a blended learning environment.

Hypothesis 16b: Management support is positively related to the learner's perceived usefulness of LMS in a blended learning environment.

Hypothesis 16c: Management support is positively related to the learner's use of LMS in a blended learning environment.

Hypothesis 16d: Management support is positively related to the learner's satisfaction with LMS in a blended learning environment.

Training

Furthermore, training is considered important for end users. Training is a process by which the trainee gains technology skills and concepts necessary to accomplish a task [Nelson and Cheney, 1987]. It is critical to the acceptance of the technology because it enhances end users' understanding and attitudes toward the technology [Igbaria et al., 1997]. Thus, with good training, learners perceive the technology as easy to use and useful, become satisfied with it, and use it. Training can be in the form of workshops, online tutorials, courses, and seminars. Training significantly affects the acceptance of the technology [Igbaria et al., 1997]. Likewise, training significantly impacts learners' perceived usefulness and perceive ease of use of the online learning environment [Lee, 2008]. Consequently:

Hypothesis 17a: Training is positively related to the learner's perceived ease of use of LMS in a blended learning environment.

Hypothesis 17b: Training is positively related to the learner's perceived usefulness of LMS in a blended learning environment.

Hypothesis 17c: Training is positively related to the learner's use of LMS in a blended learning environment.

Hypothesis 17d: Training is positively related to the learner's satisfaction with LMS in a blended learning environment.

LMS Success Factors

Relationships Among LMS Success Factors

LMS success factors have interrelationships among them. According to the technology acceptance model, perceived ease of use impacts perceived usefulness, and both of these factors, consequently, impact technology use [Venkatesh and Davis, 2000]. According to the information system success model, user satisfaction impacts usage [DeLone and McLean, 1992]. Furthermore, user satisfaction with an information system is determined by its perceived usefulness [Bhattacherjee, 2001]. In the e-learning literature, empirical studies indicate that learners' perceived ease of use significantly impacts perceived usefulness [Cheng, 2011; Lin et al., 2011; Raaij and

Schepers, 2008], satisfaction [Roca et al., 2006], and use [Pituch and Lee, 2006]. Moreover, learners' perceived usefulness of the e-learning system significantly determines their use of the system [Pituch and Lee, 2006; Raaij and Schepers, 2008] and satisfaction [Roca et al., 2006; Lee, 2010; Limayem and Cheung, 2011]. Thus, the higher the learners' perceived ease of use of LMS, the higher their perceived usefulness, satisfaction, and use. Furthermore, the higher the learners' perceived usefulness of LMS, the higher their satisfaction and use. Therefore:

Hypothesis 18a: A learner's perceived ease of use of LMS is positively related to his/her perceived usefulness of LMS in a blended learning environment.

Hypothesis 18b: A learner's perceived ease of use of LMS is positively related to his/her satisfaction of LMS in a blended learning environment.

Hypothesis 18c: A learner's perceived ease of use of LMS is positively related to his/her use of LMS in a blended learning environment.

Hypothesis 18d: A learner's perceived usefulness of LMS is positively related to his/her satisfaction with LMS in a blended learning environment.

Hypothesis 18e: A learner's perceived usefulness of LMS is positively related to his/her use of LMS in a blended learning environment.

Hypothesis 18f: A learner's satisfaction with LMS is positively related to his/her use of LMS in a blended learning environment.

Continuous Intention to LMS Use in Blended Learning

The intention to use a technology is significantly determined by user acceptance (perceived ease of use and perceived usefulness) of the technology [Venkatesh and Davis, 2000]; hence, perceived ease of use and perceived usefulness can still be valid determinants of continuous use of the technology. Additionally, users are more likely to continue using a system if their level of satisfaction with the system and perceived usefulness of the system are high [Bhattacherjee, 2001]. In the same vein, learners' continuous intention to use LMS in blended learning is, to a large extent, determined by their current use, perceived ease of use, perceived usefulness, and satisfaction [Hyashi et al., 2004]. Empirical studies in the e-learning context indicate that continuous intention to use LMS is determined by its perceived usefulness [Lee, 2010; Limayem and Cheung, 2011] and satisfaction [Roca et al., 2006; Lee, 2010; Lin et al., 2011; Limayem and Cheung, 2011]. Thus:

Hypothesis 19a: A learner's perceived ease of use of LMS in blended learning is positively related to his/her continuous intention to use LMS in a blended learning environment.

Hypothesis 19b: A learner's perceived usefulness of LMS in blended learning is positively related to his/her continuous intention to use LMS in a blended learning environment.

Hypothesis 19c: A learner's use of LMS in blended learning is positively related to his/her continuous intention to use LMS in a blended learning environment.

Hypothesis 19d: A learner's satisfaction with LMS in blended learning is positively related to his/her continuous intention to use LMS in a blended learning environment.

IV. METHODOLOGY

Participants' Profile

This study included 512 students from Sultan Qaboos University (SQU), the first and only public university in Oman. SQU is currently adopting open-source Moodle LMS. Instructors can voluntarily adopt LMS to supplement their traditional classes.

The students in the sample are from different colleges in the university and vary demographically. Approximately 65 percent were male, and 35 percent were female. Approximately 22 percent of the students were from the college of science, 7 percent were from medicine, 38 percent were from engineering, 9 percent were from commerce, 5 percent were from art, 13 percent were from education, and 7 percent from agriculture. Approximately 34 percent indicated that their computer skills were average, 54 percent of students indicated that their computer skills were above average, while 13 percent were below average. Approximately 29 percent were first-year students, 22 percent were second-year students, 16 percent were third-year students, 17 percent were fourth-year students, 11 percent were fifth-year students, and 6 percent were more than fifth-year students. Approximately 4 percent of students had less than a semester of LMS experience, 19 percent of students had one semester of LMS experience, 14 percent of students had two semesters of LMS experience, 25 percent of students had three semesters of LMS experience, and 38 percent had more than three semesters of LMS experience.

Research Questionnaire

The data were collected through an online questionnaire. An invitation to participate in the questionnaire, including the website link of the questionnaire, was posted on the SQU's Moodle login webpage for a month.

The questionnaire included indicators related to the study constructs to be measured for quantitative analysis, along with demographic questions (e.g., gender, age, degree, LMS usage experience, work experience, and job title). The measurement indicators of constructs were phrased according to a five-point Likert scale (1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree, and 5 = strongly agree). Table 2 shows the measures of independent constructs. First, information quality and service quality constructs were adopted and modified from Roca et al. [2006], while a system quality construct was adopted and modified from Pituch and Lee [2006]. Second, computer anxiety, self-efficacy and technology experience constructs were adopted from Ball and Levy [2008], while a personal innovativeness construct was adopted from Raaij and Schepers [2008]. Third, instructor attitude, instructor control and instructor style constructs were self-developed, based on Webster and Hackley [1997], while instructor responsiveness construct was adopted from Sun et al. [2008]. Fourth, classmates interaction construct was adopted from Sun et al. [2008], while classmates attitude construct was self-developed based on Webster and Hackley [1997]. Fifth, course quality and course flexibility constructs were adopted and modified from Arbaugh [2000]. Sixth, management support and training constructs were self-developed based on Sumner and Hostetler [1999]. Table 3 shows the measures of dependent constructs. First, perceived ease of use and perceived usefulness constructs were adopted and modified from Venkatesh and Davis [2000], and user satisfaction was adopted from Sun et al. [2008]. Second, LMS use in blended learning and continuous intention to LMS use in blended learning constructs were adopted and modified from Pituch and Lee [2006].

V. DATA ANALYSIS & RESULTS

PLS Analysis Methodology

Data was analyzed by PLS-Graph 3.0 software. PLS (partial least square) is a variance-based structural equation model (SEM) technique that allows path analysis of models with latent variables [Chin, 1998; Chin, 2001]. The evaluation of the model is based first on the assessment of the model measurements by assessing their validity, reliability, and discriminant validity. Second, it is based on the analysis of the paths of the structural model [Chin, 1998]. Tables 2 and Table 3 show the independent and dependent constructs' measures and loading respectively.

Table 2: Independent Constructs' Measures and Loadings

Constructs' Measures	Loading	Mean	S.D
Computer Anxiety (CA)—adopted from Ball and Levy [2008]			
1. I believe that working with computers is very difficult.	0.8473	2.287	1.11
2. Computers make me feel uncomfortable.	0.9474	2.385	1.13
3. I get a sinking feeling when I think of trying to use a computer.	0.9051	2.43	1.17
Self Efficacy (SE)—adopted from Ball and Levy [2008]			
1. I could use the e-learning system if I had never used a system like it before.	0.8225	3.16	1.05
2. I could use the e-learning system if I had seen someone else using it before trying it myself.	0.8118	3.11	1.06
3. I could use the e-learning system if I had only the system manuals for reference.	0.8261	2.98	1.06
Technology Experience (TE)—adopted from Ball and Levy [2008]			
1. I feel confident using the e-learning system.	0.8738	3.52	0.96
2. I feel confident downloading/uploading necessary materials from the Internet.	0.8820	3.52	1.04
3. I feel confident using online communication tools.	0.7492	3.57	1.09
Personal Innovativeness (PI)—adopted from Raaij and Schepers [2008]			
1. I like to experiment with new information technologies.	0.9147	3.61	1.04
2. Among my peers, I am usually the first to try out new information.	0.8167	3.23	0.99
3. In general, I am hesitant to try out new information technologies.(Reversed)**	0.4122	1.87	1.08
Instructor Attitude (IA)—self-developed based on Webster and Hackley [1997]			
1. The instructor shows a positive attitude toward the e-learning system.	0.8944	3.46	0.99
2. The instructor considers the use of e-learning system is useful.	0.8978	3.63	0.99
Instructor Style (IS)—self-developed based on Webster and Hackley [1997]			
1. The instructor exhibits an interactive teaching style.	0.8721	3.39	0.94
2. The instructor encourages students' interactions.	0.8758	3.51	0.96
Instructor Control (IC)—self-developed based on Webster and Hackley [1997]			
1. The instructor exhibits a good control over the e-learning system.	0.9129	3.43	0.94
2. The instructor handled the e-learning system effectively.	0.9215	3.53	0.93
**The indicator is dropped out from the analysis because of low loading(<0.5).			

Table 2: Independent Constructs' Measures and Loadings – Continued			
Constructs' Measures	Loading	Mean	S.D
Instructor Online Responsiveness (IR)—adopted from Sun et al. [2008			
1. The instructor responds to online inquiries and discussions on timely manner.	0.8675	3.28	1.00
2. I receive comments on assignments or examinations for this course on a timely manner.	0.8361	3.15	1.10
System Quality (SQ)—adopted from Pituch and Lee [2006]			
1. The system offers flexibility in learning as to time and place.	0.7642	3.34	1.06
2. The system offers multimedia (audio, video, and text) types of course content.	0.7308	3.51	1.00
3. The system has sufficient functions for my learning.	0.7918	3.45	0.89
4. The system is reliable.	0.7600	3.33	0.93
5. The response time of the system is reasonable.	0.7905	3.35	0.91
6. The system enables interactive communication between instructor and students.	0.6659	3.35	1.00
Information Quality (IQ)—adopted from Roca et al. [2006]			
1. The information provided by the system is relevant for my learning.	0.7808	3.55	0.86
2. The information provided by the system is easy to understand.	0.7974	3.55	0.93
3. The information content in the system is very good.	0.7924	3.55	0.92
4. The information from the e-learning system is up-to-date.	0.7676	3.45	0.94
5. The information provided by the system is complete.	0.7567	3.37	0.88
6. The information provided by the system is accurate.	0.7052	3.42	0.89
Service Quality (SVQ)—adopted from Roca et al. [2006]			
1. The system support service gives me prompt service.	0.7371	3.27	0.92
2. The system support service has convenient operating hours.	0.8196	3.26	0.89
3. The system support service is reliable.	0.8069	3.30	0.91
4. The system support service is accessible.	0.8039	3.31	0.89
5. The system support service is easy to communicate with.	0.8115	3.33	0.92
Classmates Attitude (CMA)—self-developed based on Webster and Hackley [1997]			
1. The classmates show a positive attitude toward the e-learning system.	0.8748	3.31	0.93
2. The classmates support the use of e-learning system.	0.9064	3.37	0.92
3. The classmates consider the use of e-learning system is useful.	0.8882	3.46	0.94
Classmates Interaction (CMI)—adopted from Sun et al. [2008]			
1. Student-to-student interactions were easier in this course than other courses.	0.8722	3.26	0.97
2. Class discussions were easier to participate in than other courses.	0.8591	3.30	0.94
Course Quality (CQ)—adopted from Arbaugh [2000]			
1. Using the e-learning system to supplement this course improved the quality of the course compared to other courses.	0.8993	3.43	0.94
2. With the e-learning system, the quality of the course compared favorably to my other courses.	0.8914	3.46	0.91
3. I feel the quality of the course I took was largely affected by supplementing it with e-learning system.	0.8368	3.38	0.90
Course Flexibility (CF)—adopted from Arbaugh [2000]			
1. Taking this course with e-learning system allowed me to finish my study more effectively.	0.8803	3.43	0.95
2. Taking this course with e-learning system saved me a lot of time commuting to class.	0.9216	3.35	0.98
Management Support (MG)—self-developed based on Sumner and Hostetler [1999]			
1. My University highlights the importance of e-learning system on my curriculum.	0.8766	3.36	1.03
2. Senior administrators clearly identify the importance of e-learning tools to the university curriculum.	0.9051	3.33	1.00
3. Senior administrators strongly support the use of e-learning system.	0.8849	3.41	0.94
Training (TR)—self-developed based on Sumner and Hostetler [1999]			
1. I receive training workshops on how to use e-learning tools.	0.8561	2.89	1.12
2. I receive on-line manuals on how to use e-learning tools.	0.8710	3.02	1.09
3. I receive seminars on the use of e-learning tools.	0.8838	2.84	1.08

Table 3: Dependent Constructs' Measures and Loadings			
Construct Measures	Loading	Mean	S.D.
Perceived Ease of Use (PEU)—adopted from Venkatesh and Davis [2000]			
1. Using e-learning tools is easy to me.	0.8888	3.66	0.99
2. E-learning tools are clear and understandable to me.	0.8966	3.64	0.98
3. I find it easy to get the e-learning system to do what I want it to do.	0.8597	3.45	1.01
Perceived Usefulness (PU)—adopted from Venkatesh and Davis [2000]			
1. Using e-learning system enables me to accomplish tasks more quickly.	0.7560	3.42	1.03
2. Using e-learning system improves my performance.	0.8418	3.52	1.00
3. Using e-learning system increases my productivity.	0.8471	3.48	1.00
4. Using e-learning system enhances the effectiveness on the job.	0.8164	3.40	0.98
5. Using e-learning system makes it easier to do my learning.	0.8059	3.56	0.99
6. Using e-learning system gives me greater control over my work.	0.8058	3.42	0.98
System Use (SU)—adopted from Pituch and Lee [2006]			
1. I use the e-learning system as many occasions as possible for my classes.	0.7939	3.35	1.00
2. I use the e-learning system on regular basis for my classes.	0.7883	3.48	0.93
3. I frequently use the e-learning system to supplement my learning.	0.7228	3.28	0.99
4. I use the e-learning system to share/seek course information.	0.6961	3.51	1.05
5. I use the e-learning system to communicate with instructor and students.**	0.4034	2.99	1.18
6. I use the e-learning system to make friends or do other social activities.**	0.3445	2.37	1.12
User Satisfaction (US)—adopted from Arbaugh [2000]			
1. I am satisfied with the performance of the e-learning system.	0.8080	3.21	0.99
2. I am pleased with the experience of using the e-learning system.	0.8733	3.46	0.98
3. My decision to use the e-learning system was a wise one.	0.7875	3.45	1.03
Continuous Intention to Use (CIU)—adopted from Pituch and Lee [2006]			
1. I will frequently use e-learning system in the future to supplement my classes.	0.8370	3.51	1.03
2. I will use e-learning system on regular basis in the future to do a learning task.	0.8753	3.54	0.97
3. I always try to use the e-learning system to do a learning task whenever it has a feature.	0.7855	3.38	0.97
**The indicator is dropped out from the analysis because of low loading(< 0.5).			

Construct Validity and Reliability

With PLS, the reliability of the measurements was evaluated by internal consistency reliability, and the validity was measured by the average variance extracted (AVE), which refers to the amount of variance a latent variable captures from its indicators. The recommended level for internal consistency reliability is at least 0.70, and is at least 0.50 for AVE [Chin, 1998]. The factor loadings from the confirmatory factor analysis (CFA) provide evidence for convergent validity as all items load sufficiently high on the corresponding constructs (see Table 2 and Table 3). They all exceed the threshold value of 0.50 suggested by Peterson [2000] except indicator 3 of personal innovativeness construct, indicator 5 and indicator 6 of system use. Therefore, these indicators were dropped from the final analysis. Table 4 shows that the study constructs' reliability and AVE are above the recommended levels for all the constructs.

To achieve the discriminant validity of the constructs, Fornell and Larcker [1981] suggest that the square root (SQRT) of AVE of each construct should exceed the correlations shared between the constructs and other constructs in the model. Table 5 shows that the model constructs satisfy that rule, as the SQRT of the AVE (on the diagonal) is greater than the correlations with other constructs. Thus, all the model constructs have a satisfactory discriminant validity construct.

Model Evaluation and Path Analysis

With PLS, R-square values are used to evaluate the predictive relevance of a structural model for the dependent latent variables, and the path coefficients are used to assess the effects of the independent variables. In PLS, the statistical significant of the paths' coefficients was measured by t-values.

Table 6 shows the R2 values of the dependent constructs: perceived ease of use, perceived usefulness, system use, and user satisfaction. The model explains 50.8 percent of variance in the learner's perceived ease of use of LMS in blended learning, 59.8 percent of variance in the learner's perceived usefulness of LMS in blended learning, 53.8 percent of variance in the learner's use of LMS in blended learning, 52.5 percent of variance in learner satisfaction with LMS in blended learning, and 54.3 percent of the learner's continuous intention to use LMS in blended learning. Table 6 also shows analysis of the path coefficients between the independent constructs (learner

Table 4: Constructs' Reliability and Validity			
Construct	Total Items	Reliability	AVE
Computer Anxiety (CA)	3	0.928	0.812
Technology Experience (TE)	3	0.875	0.701
Self-Efficacy (SE)	3	0.860	0.673
Personal Innovativeness (PI)	2	0.858	0.752
Instructor Style (IS)	2	0.866	0.764
Instructor Attitude (IA)	2	0.891	0.803
Instructor Control (IC)	2	0.914	0.841
Instructor Responsiveness (IR)	2	0.841	0.726
System Quality (SQ)	6	0.886	0.565
Information Quality (IQ)	6	0.896	0.589
Service Quality (SvQ)	5	0.896	0.634
Classmates' Attitude (CMA)	3	0.919	0.792
Classmates' Interaction (CMI)	2	0.857	0.749
Course Quality (CQ)	3	0.908	0.768
Course Flexibility (CF)	2	0.896	0.812
Management Support (MS)	3	0.919	0.790
Training (TR)	3	0.904	0.758
Perceived Ease Of Use (PEU)	3	0.913	0.778
Perceived Usefulness (PU)	6	0.921	0.661
System Use (SU)	4	0.838	0.565
User Satisfaction (US)	3	0.863	0.679
Continuous Intention to Use (CIU)	3	0.872	0.695

Table 5: Constructs' Correlations and Discriminant Validity

Con-struct	CA	TE	SE	PI	IA	ITS	IC	IR	SQ	IQ	SVQ	CQ	CF	CMA	CMI	MS	TR	PEU	PU	SU	US	CIU
CA	**0.90**																					
TE	-0.002	**0.84**																				
SE	-0.073	0.368	**0.82**																			
PI	-0.024	0.579	0.344	**0.87**																		
IA	0.009	0.355	0.220	0.303	**0.87**																	
ITS	0.019	0.325	0.153	0.298	0.672	**0.90**																
IC	0.050	0.387	0.222	0.300	0.649	0.622	**0.92**															
IR	0.092	0.309	0.153	0.319	0.496	0.472	0.486	**0.85**														
SQ	0.072	0.487	0.266	0.464	0.554	0.532	0.570	0.553	**0.75**													
IQ	0.013	0.533	0.325	0.505	0.510	0.468	0.500	0.456	0.646	**0.77**												
SVQ	0.180	0.395	0.269	0.373	0.421	0.420	0.471	0.499	0.686	0.687	**0.80**											
CQ	0.015	0.540	0.338	0.533	0.444	0.473	0.447	0.456	0.614	0.660	0.558	**0.88**										
CF	0.046	0.454	0.266	0.476	0.390	0.353	0.379	0.437	0.595	0.554	0.525	0.664	**0.90**									
CMA	0.035	0.478	0.252	0.509	0.475	0.445	0.468	0.467	0.650	0.594	0.560	0.665	0.638	**0.89**								
CMI	0.203	0.412	0.309	0.419	0.420	0.431	0.450	0.485	0.567	0.526	0.530	0.582	0.567	0.568	**0.87**							
MS	0.123	0.373	0.244	0.362	0.537	0.417	0.443	0.471	0.587	0.557	0.572	0.501	0.441	0.485	0.416	**0.89**						
TR	0.040	0.231	0.260	0.188	0.193	0.240	0.283	0.373	0.408	0.326	0.476	0.301	0.332	0.309	0.442	0.427	**0.87**					
PEU	-0.174	0.469	0.91	0.438	0.548	0.469	0.492	0.399	0.565	0.548	0.417	0.487	0.454	0.500	0.360	0.357	0.161	**0.88**				
PU	-0.050	0.411	0.185	0.421	0.531	0.532	0.524	0.472	0.666	0.617	0.557	0.588	0.538	0.565	0.444	0.472	0.308	0.626	**0.81**			
SU	-0.112	0.397	0.175	0.352	0.556	0.463	0.459	0.406	0.540	0.505	0.391	0.423	0.385	0.403	0.296	0.412	0.165	0.581	0.606	**0.75**		
US	-0.069	0.361	0.156	0.346	0.515	0.495	0.486	0.446	0.592	0.575	0.490	0.473	0.456	0.538	0.391	0.420	0.245	0.572	0.637	0.615	**0.82**	
CIU	-0.068	0.370	0.196	0.388	0.498	0.443	0.415	0.425	0.522	0.499	0.408	0.423	0.395	0.472	0.348	0.372	0.183	0.558	0.647	0.645	0.600	**0.83**

Note: Numbers in the diagonal represent the SQRT(AVE) of the construct

characteristics, instructor characteristics, LMS characteristics, classmates characteristics, course characteristics, and organization characteristics), and the dependent success constructs (LMS perceived ease of use, LMS perceived usefulness, system use, and user satisfaction, and the learner's continuous intention to use LMS in blended learning).

The analysis showed first that the critical factors for the learner's perceived ease of LMS in blended learning are, in order of their significance, instructor attitude (Beta-β = 0.2425 ; p-value < 0.0005;), computer anxiety (β = -0.1851; value < 0.0005), system quality (β = 0.1606; p-value < 0.005), technology experience (β = 0.1236; p-value < 0.01),

Table 6: Critical Factors to LMS Success in Blended Learning—Model Evaluation and Paths Analysis

		Dependent Constructs				
		Perceived Ease of Use (R^2=0.508)	Perceived Usefulness (R^2=0.598)	System Use (R^2=0.538)	User Satisfaction (R^2=0.525)	Continuous Intention to Use (R^2=0.543)
Independent Constructs	*Computer Anxiety (CA)*	-0.1851****	-0.0690	-0.0566	-0.0581	N/A
	Technology Experience (TE)	0.1236***	0.0015	0.0791*	0.0104	N/A
	Self-Efficacy (SE)	0.0341	-0.0249	0.0205	-0.0019	N/A
	Personal Innovativeness (PI)	0.0887*	0.0111	0.0123	-0.0197	N/A
	Instructor Style (IS)	0.046	0.1100**	0.0011	0.0838*	N/A
	Instructor Attitude (IA)	0.2425*****	0.0113	0.1604****	0.0522	N/A
	Instructor Control (IC)	0.0801*	0.0121	0.011	0.0201	N/A
	Instructor Responsiveness (IR)	0.0317	0.0074	0.0023	0.0507	N/A
	System Quality (SQ)	0.1606****	0.1872****	0.1126**	0.0622	N/A
	Information Quality (IQ)	0.1164**	0.0787*	0.0193	0.1562****	N/A
	Service Quality (SvQ)	0.0164	0.0800*	-0.0217	0.0341	N/A
	Classmates' Attitude (CMA)	0.0691	0.0274	-0.0054	0.1442****	N/A
	Classmates' Interaction(CMI)	0.0789*	0.0208	0.0015	0.0011	N/A
	Course Quality (CQ)	0.0017	0.1223***	-0.001	0.0219	N/A
	Course Flexibility (CF)	0.0592	0.0890*	0.0021	0.0211	N/A
	Management Support (MS)	-0.0094	0.0014	0.0403	0.0004	N/A
	Training (TR)	0.0025	0.0801*	0.0003	0.0034	N/A
	Perceived Ease of Use (PEU)	N/A	0.2501*****	0.1381****	0.1566****	0.1026**
	Perceived Usefulness (PU)	N/A	N/A	0.2114*****	0.2501*****	0.2966*****
	System Use (SU)	N/A	N/A	N/A	N/A	0.2970*****
	User Satisfaction (US)	N/A	N/A	0.271*****	N/A	0.1671*****

*= $p < 0.05$
**= $p < 0.025$
***= $p < 0.01$
****= $p < 0.005$
*****= $p < 0.0005$
N/A = Not Applicable

information quality (β = 0.1164; p-value < 0.025), personal innovativeness (β = 0.0887; p-value < 0.05), instructor control (β = 0.0801; p-value < 0.05), and classmates interaction (β = 0.0789; p-value < 0.05). Self-efficacy (β = 0.0341), instructor style (β = 0.046), instructor responsiveness (β = 0.0317), service quality (β = 0.0164), course quality (β = 0.0017), course flexibility (β = 0.0592), classmates attitude (β = 0.0691), management support (β = -0.0094), and training (β = 0.0025) are not significant factors for the learner's perceived ease of use of LMS.

Second, the critical factors for the learner's perceived usefulness of LMS in blended learning are, in order of their significance, learners' perceived ease of use (β = 0.2501; p-value < 0.0005), system quality (β = 0.1872, p-value < 0.005), course quality (β = 0.1223; p-value < 0.01), instructor style (β = 0.1100; p-value < 0.025), course flexibility (β = 0.0890; p-value < 0.05), training (β = 0.0801; p-value < 0.05), service quality (β = 0.0800; p-value < 0.05), and information quality (β = 0.0787; p-value < 0.05). Computer anxiety (β = -0.0690), technology experience (β = 0.0015), self-efficacy (β = -0.0249), personal innovativeness (β = 0.0111), instructor attitude (β = 0.0113), instructor control (β = 0.0121), instructor responsiveness (β = 0.0074), classmates attitude (β = 0.0274), classmates interaction (β = 0.0208), and management support (β = 0.0014) are not significant factors for learners' perceived usefulness of LMS.

Third, the critical factors for the learner's actual use of LMS in blended learning are, in order of their significance, learner satisfaction (β = 0.271; p-value < 0.0005), perceived usefulness (β = 0.2114; p-value < 0.0005), instructor attitude (β = 0.1604; p-value < 0.005), perceived ease of use (β = 0.1381; p-value < 0.005), system quality (β = 0.1126; p-value < 0.025), and technology experience (β = 0.0791; p-value < 0.05). Computer anxiety (β = -0.0566), self-efficacy (β = 0.0205), personal innovativeness (β = 0.0123), instructor style (β = 0.0011), instructor control (β = 0.011), instructor responsiveness (β = 0.0023), information quality (β = 0.0193), service quality (β = -0.0217), course quality (β = -0.001), course flexibility (β = 0.0021), classmates attitude (β = -0.0054), classmates interaction (β = 0.0015), management support (β = 0.0403), and training (β = 0.0003) are not significant factors for the learner's actual use of LMS.

Fourth, the critical factors for the learner's satisfaction with LMS in blended learning are, in order of their significance, perceived usefulness (β = 0.2501; p-value < 0.0005), perceived ease of use (β = 0.1566; p-value < 0.005), information quality (β = 0.1562; p-value < 0.005), classmates attitude (β = 0.1442; p-value < 0.005), and instructor style (β = 0.0838; p-value < 0.05). Computer anxiety (β = -0.0581), technology experience (β = 0.0104), self-efficacy (β = -0.0019), personal innovativeness (β = -0.0197), instructor attitude (β = 0.0522), instructor control (β = 0.0201), instructor responsiveness (β = 0.0507), system quality (β = 0.0622), service quality (β = 0.0341), course quality (β = 0.0219), course flexibility (β = 0.0211), classmates interaction (β = 0.0011), management support (β = 0.0004), and training (β = 0.0034) are not significant factors for the learner's satisfaction with LMS in blended learning.

Finally, the learner's system use (β = 0.2970; p-value < 0.0005), perceived usefulness (β = 0.2966; p-value < 0.0005), satisfaction (β = 0.1671; p-value < 0.0005), and perceived ease of use (β = 0.1026; p-value < 0.025) are significant factors for the learner's intention to continuously use LMS in blended learning. Figure 2 illustrates the significant paths in this study.

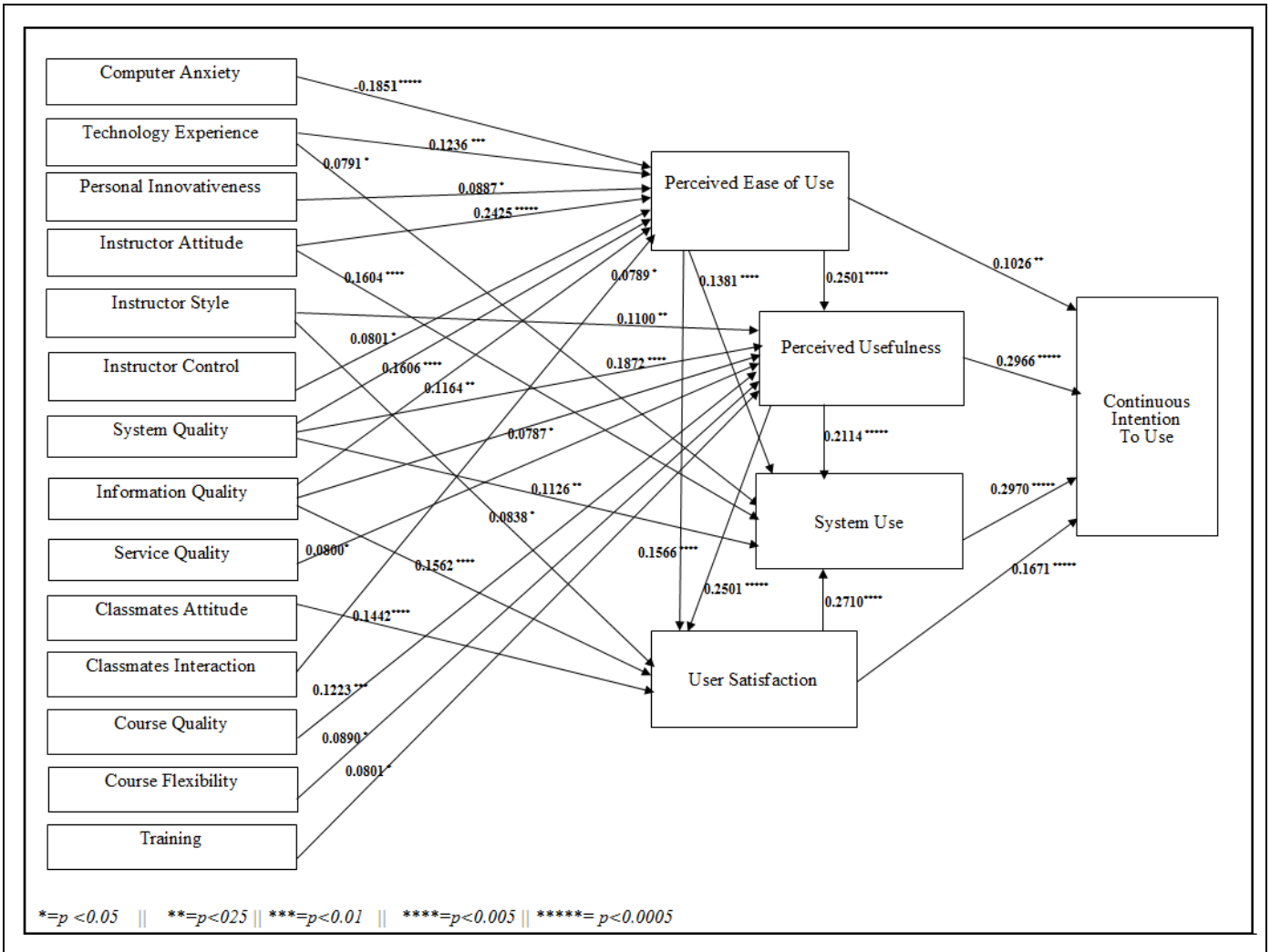

Figure 2. Significant Factors to LMS Success from Learners' Perspective

VI. CONCLUSION

Discussion of Findings and Implications

Learning management system (LMS) provides efficient means to train and teach individuals. LMS also provides academic institutions means to store, manage, and share its academic resources and knowledge. The success of LMS in academic institutions may be initiated by instructor acceptance, but it survives in the long run because of learners' continuous acceptance and use.

The objective of this article was to provide a comprehensive examination of the critical factors that influence the success of LMS in blended learning and its continuous use, from the learner's perspective. These critical factors are

related to the major LMS entities: the learner, the instructor, the course, the classmates, the organization, and the LMS. This study provides useful implications and insights for researchers and practitioners on the acceptance of LMS.

Based on 512 learners, the results show that most of these factors are critical to one or several success measures, except for learner self-efficacy, management support, and instructor online responsiveness. First, learners' characteristics (computer anxiety, technology experience, and personal innovativeness) are significant factors for learners' perceived ease of use of LMS, whereas technology experience is a significant factor for its actual use. The impact of learners' self-efficacy is not significant for LMS success. Second, instructors' attitude toward LMS and their control over LMS are significant factors for learners' perceived ease of use; instructors' interactive teaching style is a significant factor for learners' perceived usefulness and satisfaction, whereas the instructor's attitude is a significant factor for learners' actual use. The impact of the instructor's online responsiveness is not significant for the success of LMS. Third, system quality, information quality, and service quality are significant factors for learners' perceived usefulness of LMS; system quality and information quality are significant factors for learners' perceived ease of use of LMS; system quality is a significant factor for learners' actual use, whereas information quality is a significant factor for satisfaction. Fourth, classmates' attitude is a significant factor for learners' perceived ease of use, while classmates' attitude is a significant factor for their satisfaction with LMS. Fifth, both course quality and course flexibility are significant factors only for learners' perceived usefulness of LMS. Sixth, training is a significant factor for learners' perceived usefulness of LMS; the impact of management support on LMS success is not significant. Finally, the results also illustrate that all success factors (system use, perceived usefulness, satisfaction, and perceived ease of use) are critical to learners' continuous intention to use LMS in blended learning. Thus, all of the above critical factors are significant for the success of LMS in blended learning and its continuous use.

LMS is promising for developing countries, as it provides tools to efficiently build human resources (citizens and workforce). Based on the World Bank's statistics, indexes of education and information communication technologies in developing countries are much lower than those in developed countries [World Bank, 2009]. In addition, the e-learning market in developed countries, such as North American countries, is mature, whereas the e-learning market in developing countries such as Middle Eastern countries is growing and represents significant opportunities for e-learning products sellers [Ambient Insight Research, 2011]. Thus, this study offered significant findings for e-learning researchers, practitioners, and software developers.

First, it comprehensively examined the critical factors influencing learners' adoption of LMS in blended learning. Learners' computer and Internet literacy and IT adoption are lower in developing countries than developed countries. Therefore, academic and training institutions should support LMS deployment through good training. Improving learners' characteristics (computer comfort, personal innovativeness, and technology experience), classmates' characteristics (attitude and interaction), and course characteristics (quality and flexibility) are vital to LMS success. In addition, institutions adopting LMS should ensure the quality of the utilized system, its embedded information, and support services. Moreover, institutions need to ensure that instructors are completely on board regarding the use of LMS in blended learning. Some instructor characteristics (i.e., attitude, interactive teaching style, and control over the technology) are important to learners' adoption of LMS in blended learning.

The results illustrated that instructors play a major role on learners' adoption of LMS. Instructors should know how to position their courses online; they should design their courses and online learning content and activities in a way that is useful to learners and improves the learning outcomes. Also, instructors should illustrate a good attitude toward the technology and make sure that they are trained and experienced well with LMS before adopting it in their courses. Moreover, instructors need to ensure that learners are trained well and have good perception about the ease and usefulness of LMS. Likewise, LMS developers should constantly improve the quality of LMS and ensure its richness, capability, flexibility, reliability, speed, and interactivity for learners in different regions and cultures.

The study also illustrated that the success of adopting LMS in blended learning is positively impacting learners' intention to continuously use LMS in blended learning. Once learners use LMS, perceive it to be easy and useful, and are satisfied with it, they will continue to use it. Users' satisfaction and acceptance of LMS is an important element for its survival. Thus, all major entities of LMS adoption (learners, instructors, LMS, course, classmates, and organization) are critical to the success and survival of LMS. Third, this study confirmed some findings of previous studies, and found several significant new findings (see Tables 1 and 6). Finally, few studies have made such investigations in the Middle East, and very few studies have been conducted in Oman. Therefore, this study provided useful insights for practitioners (instructors and academic institutions). This study provided these organizations with useful insights on critical factors for learners' adoption of LMS in blended learning.

Limitations and Future Research

This study has limitations. First, the sample was collected from one academic institution in Oman; more research can be conducted at several organizations in different countries to improve the generalization of the findings. Second, the study assessed LMS success from the learner's perspective; further research may assess it from an instructor's perspective. Third, in this study, instructors could voluntarily adopt LMS to supplement traditional classes. Further investigations are needed in the context of mandatory use. Moreover, future research might also examine in detail the benefits of LMS for learners and the critical factors influencing organizations' deployment of LMS. Cross-cultural investigation in the Middle East and across the globe will provide more significant insights into learners' adoption of LMS.

ACKNOWLEDGMENT

This study was funded by Sultan Qaboos University in Oman.

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ISSN: 1529-3181