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Critical success factors for e-learning in developing countries: A comparative analysis between ICT experts and faculty

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ABSTRACT

This study identifies the critical success factors that influence the acceptance of e-learning systems in developing countries. E-learning is a popular mode of delivering educational materials in higher education by universities throughout the world. This study identifies multiple factors that influence the success of e-learning systems from the literature and compares the relative importance among two stakeholder groups in developing countries, ICT experts and faculty. This study collected 76 usable responses using the Delphi method and Analytic Hierarchy Process (AHP) approach. The results reveal 6 dimensions and 20 critical success factors for e-learning systems in developing countries. Findings illustrate the importance of curriculum design for learning performance. Technology awareness, motivation, and changing learners' behavior are prerequisites for successful e-learning implementations. Several recommendations are provided to aid the implementation of e-learning systems for developing countries which have relevance for researchers and practitioners. Limitations as well as possible research directions are also discussed.

1. Introduction

Information technology has created new opportunities for education. More than 1000 institutions in 50 countries provide e-learning options (Sharma & Kitchens, 2004). E-learning is a useful tool for enhancing the quality of teaching and learning. E-learning is an "innovative approach to education delivery via electronic forms of information that enhance the learner's knowledge, skills, or other performance" (Siritongthaworn, Krairit, Dimmitt, & Paul, 2006, p. 139). Arbaugh (2002) defined e-learning as the use of the Internet by users to learn specific content. Other researchers define e-learning as using modern Information and Communications Technology (ICT) and computers to deliver instruction, information, and learning content (Selim, 2007). The stakeholders of e-learning are learners, faculty, administrative and technical staff, and employers (Ozkan & Koseler, 2009).

Online learning systems provide benefits for stakeholders located around the world. Advantages of e-learning for learners include an increased accessibility to information, better content delivery, personalized instruction, content standardization, accountability, on-demand availability, self-pacing, interactivity, confidence, and increased convenience. E-learning reduces costs, enables a consistent delivery of content, and improves tracking, among other benefits for faculty (Kruse, 2002; Ruiz, Mintzer, & Leipzig, 2006; Welsh, Wanberg, Brown, & Simmering, 2003; Zhang, Zhao, Zhou, & Nunamaker, 2004). E-learning reduces classroom and facilities cost, training cost, travel cost, printed materials cost, labor cost, and information overload (Ruiz et al., 2006; Wang, Xu, Chan, & Chen, 2002; Welsh et al., 2003; Zhang & Nunamaker, 2003). E-learning initiatives also require considerable investments in technology such as hardware costs, software licenses, learning material development, equipment maintenance, and training (Childs, Blenkinsopp, Hall, & Walton, 2005; Welsh et al., 2003). Welsh

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et al. (2003) concluded that e-learning has huge potential and can reduce costs in comparison to a traditional classroom environment after initial course development. Despite these benefits, e-learning has a higher drop-out rate than traditional delivered instruction (Bell & Kozlowski, 2002; Brown, 2001; Zhang et al., 2004).

Further, e-learning is still in its infancy in developing countries which experience challenges unique from developed countries. Many developing countries have expressed an interest to implement e-learning (Grönlund & Islam, 2010) but face obstacles in infrastructure, resources, information access (Raab, Ellis, & Abdon, 2002), personal characteristics, support from institution (Brinkerhoff, 2006), technology and connectivity, instructors' design and technology confidence (Hussein, Aditiawarman, & Mohamed, 2007), as well as culture and policy (Shraim & Khlaif, 2010).Alshare, Al-Dwaire, and Akour (2003) reported that technology integration within education in developing countries is lagging due to cultural, political, and economic concerns. The objective of e-learning in developing countries is to provide basic education to a large number of poor students. This is very different than the objective of e-learning in developed countries, which aims to develop an effective knowledge economy and enhance lifelong education (Gulati, 2008). Despite these challenges, opportunities still exist to improve the effectiveness and success of e-learning (Alavi & Leidner, 2001; Gupta & Bostrom 2005; Olfman, Bostrom, & Sein, 2006; Santhanam, Sasidharan, & Webster, 2008).

Various aspects of e-learning have been examined in developed countries including technology-based components (Islas et al., 2007), student and teacher satisfaction (Liaw, Huang, & Chen, 2007), the effectiveness of e-learning (Douglas & Vyver, 2004), participants' interaction in an online environment (Arbaugh & Fich, 2007), and the student experience (Gilbert, 2007). For example, learner attitudes, instructor quality, system quality, information (content) quality, service quality, and support are important factors for learners' satisfaction (Ozkan & Koseler, 2009). Fuller, Vician, and Brown (2006) recommends that any effective e-learning system implementation address technology, pedagogy, and the individual. Lee (2008) identifies several factors which influence e-learning adoption besides perceived usefulness and perceived ease of use.

Studies that examine e-learning adoption critical success factors (CSFs) in a single country are more common than studies that examine CSFs from multiple developing countries. This study uses the Delphi and Analytic Hierarchy Process (AHP) methods to identify the relative importance of factors that impact the success of e-learning. The objective of this study is to identify CSFs that influence the acceptance of e-learning systems in developing countries. The rest of this paper is organized as follows. Section 2 discusses the theoretical backgrounds of e-learning, and influential factors for the adoption and success of e-learning systems in education; Section 3 develops the research framework of this study; Section 4 describes the research methodology that this study employs; the results are presented in Section 5; discussions of the results and implications are provided in Section 6; the paper concludes in Section 7.

2. Theoretical backgrounds

The e-learning literature indicates that both external (social, environment) and internal sources (individual characteristics) are crucial for e-learning implementation. Previous e-learning studies applied various theories to examine the determinants of e-learning adoption and effectiveness. This section reviews CSF studies in the e-learning literature and identifies major theoretical perspectives related to e-learning research, namely social cognitive theory, IS success model, technology acceptance model, and motivation theory.

2.1. Critical success factors in e-learning

There are a number of factors important for e-learning. A higher level of individual computer self-efficacy is positively associated with a higher level of learning performance which increases the use of e-learning (Wu, Tennyson, & Hsia, 2010). Intrinsic motivations (Davis, Bagozzi, & Warshaw, 1992) and extrinsic motivations (Teo, Lim, & Lai, 1999; Roca & Gagné, 2008) are additional factors examined for learners and instructors using e-learning systems. Lee (2010) found that perceived usefulness has a direct positive effect to the intention to use e-learning while perceived ease of use and perceived enjoyment have an indirect positive effect to intention to use. In contrast, Roca and Gagné (2008) found that perceived usefulness, perceived ease of use, and perceived playfulness are primary determinants of e-learning continuance intention.

A number of CSFs of e-learning studies have been found in both developed and developing countries. Volery and Lord (2000) conducted a CSF study with students at an Australian University finding that technological factors (ease of access, support interaction, design, etc.), instructors' characteristics (attitude toward students, teaching style, technical competence, encourage students interaction, etc.) and students' characteristics impacted online delivery effectiveness. Soong, Chan, Chua, and Loh (2001) found that human factors, instructors and students' technical competency, instructors and students' mindset about online learning, level of collaboration, and IT infrastructure are CSFs for online course resources in Singapore. Selim (2007) classified the CSFs for e-learning into four factors based on student observations including instructors' characteristics (teaching style, attitude toward students, technology control, etc.), students' characteristics (motivation, technical competency, perception of content and system, collaboration in interaction, etc.), technology (ease of access, internet speed, screen design, etc.), and institution support (technical support, computer availability, learning material accessibility and printing, etc.). Govindasamy (2002) reported seven important factors for e-learning implementation including institution support, faculty support, student support, teaching and learning, course structure, evaluation and assessment. Strong pedagogical foundations, especially content issues, student support and assessment, are essential for the success of e-learning implementation.

CSFs for e-learning include technology and infrastructure, design, instructor and learner characteristics, support, and content issues. Additional success factors include course and environmental dimensions (Sun, Tsai, Finger, Chen, & Yeh, 2008), transactional presence (Shin, 2003), and knowledge management (Mosakhani & Jamporazmey, 2010). Numerous factors affect e-learning implementation success but the majority of CSF studies is conducted in one country and use students as the primary data source (Mosakhani & Jamporazmey, 2010; Selim, 2007; Shin, 2003; Sun et al., 2008; Volery & Lord, 2000).

2.2. Social cognitive theory (SCT)

SCT analyzes human behavior, attempts to predict human action, and develops a clearer understanding of changes in human behavior. SCT also explains IT adoption and guides research in the field of social and psychology studies (Bandura, 1977, 1986). SCT explains the

relationship in how personal factors, environmental factors, and behavioral factors influence each other (Bandura, 1977, 1986). The theory presumes that higher outcome expectations and self-efficacy determine individual decisions, actions, level of effort to invest, and strategies to use in any situation (Yi & Hwang, 2003). Outcome expectations and self-efficacy are key elements of SCT that influence human behavior. Self-efficacy refers an individual's belief in their own abilities (Bandura, 1986) while outcome expectations refer to an individual's belief that he/she will receive a desired outcome after accomplishing a task (Henry & Stone, 1994). Outcome expectations are an important construct in IS research (Compeau & Higgins, 1995). Self-efficacy is also important as numerous studies found that it significantly affects outcome expectations, behavior intention to use, and actual technology usage (Gong, Xu, & Yu, 2004; Yi & Hwang, 2003). Previous studies found that SCT could explain individual satisfaction and adoption of e-learning systems (Brown, 2002; Hussein et al., 2007; Liaw, Chang, Hung, & Huang, 2006; Wu et al., 2010).

2.3. Information system success model

DeLone and McLean's (1992, 2003) information system (IS) success model is widely used to evaluate IS implementation. The updated model consists of six constructs, which are net benefits, intention to use system, user satisfaction, and three independent variables including system quality, information quality and service quality (DeLone & McLean, 2003). System quality in e-learning studies is defined as help functions and end-user facilitation in the education process. Information quality is defined as end-user performance enhancement resulting from using system information. Service quality is defined as providing quality support to end-users to facilitate system usage (Wang & Wang, 2009).

E-learning studies that applied the IS success model found that system quality and information quality significantly influence learner satisfaction (Chiu, Chui, & Chang, 2007; Roca, Chiu, & Martínez, 2006), performance expectation (Wu et al., 2010), perceived usefulness (Chen, 2010), and behavior intention to use e-learning systems (Lin, 2007). Service quality is another factor found to influence perceived ease of use (Wang & Wang, 2009), satisfaction (Lin, 2007; Roca et al., 2006), and behavior intention to use e-learning systems (Lin, 2007). Chiu et al. (2007) reported that high information quality increases end-user system satisfaction while poorly designed e-learning courses increases learner dropout. Ozkan and Koseler (2009) found that system quality increased the effectiveness of learning management systems while content quality created value and learner satisfaction.

2.4. Technology acceptance model (TAM)

The technology acceptance model (TAM) was adopted from the theory of reasoned action (Davis, 1989). TAM is a popular IS model that many researchers employ to investigate user acceptance of information systems (Chau, 1996). The four constructs in this model are perceived usefulness, perceived ease of use, behavioral intention to use, and actual system use. Perceived usefulness is the degree to which a person believes that using IS enhances his/her performance while perceived ease of use is the degree a person believes that using IS is free of effort (Hsu & Lin, 2008).

Perceived usefulness and perceived ease of use have been applied to various applications such as e-mail, word processing, microcomputer, telemedicine technology, e-banking, e-library, e-commerce, smartcard, e-tax filing, and e-learning (Deng, Doll, Hendrickson, & Scazzero, 2005). Many studies extend TAM with additional constructs. Warkentin, Gefen, Pavlou, and Rose (2002) examined citizen's adoption of e-government in different countries by integrating TAM with trust, perceived risk, perceived behavior control, and culture. Ilias, Razak, and Yasoa (2009) extended TAM with perceived credibility, information system quality, as well as information quality and investigated the differences in the demographics of taxpayers in Malaysia. Lee (2010) integrated TAM with the expectation-confirmation model, theory of planned behavior, and flow experience to investigate e-learning in Taiwan. Many researchers have applied TAM in e-learning studies and found that perceived ease of use and perceived usefulness have significant effects on an individual's behavioral intention to use e-learning systems (Liu, Liao, & Pratt, 2009; Ong, Lai, & Wang, 2004; Sheng, Jue, & Weiwei, 2008).

2.5. Motivation theory

Motivation is the extent persistent effort is directed toward a goal (Johns, 1996). There are two types of motivation: intrinsic and extrinsic (Ryan & Deci, 2000a,b). Intrinsic motivation refers to doing an activity for enjoyment and interest while extrinsic motivation refers to doing an activity for a specific purpose or outcome (Ryan & Deci, 2000a; Vallerand, 2000; Meyer & Gagné, 2008). There are four types of extrinsic motivation: external, introjected, identified, and integrated forms of regulation (Deci, Vallerand, Pelletier, & Ryan, 1991; Müller & Louw, 2004; Walker, Greene, & Mansell, 2006). External regulation refers to behaviors for which the locus of initiation is external to the person while introjected regulation refers to internalized rules or demands that pressure one to behave or not behave a certain way. Identified regulation occurs when a person does an activity willingly and feels a sense of choice or volition while integrated regulation is closely related to intrinsic motivation (Deci et al., 1991; Müller & Louw, 2004).

Law, Lee, and Yu (2010) examined the effect of motivation in an e-learning environment. Their study found that extrinsic motivation constructs had a significant effect on student learning and that both intrinsic and extrinsic motivation had a significant positive effect on student self-efficacy. Sheng et al. (2008) found intrinsic and extrinsic motivation to have a significant effect on the behavior to use e-learning in a developing country.

3. Research framework

This study categorizes e-learning success factors into seven dimensions based on several theories such as social cognitive theory, IS success model, and motivation theory. Seven dimensions of e-learning success include learners' characteristics, instructors' characteristics, e-learning environment, institution and service quality, infrastructure and system quality, course and information quality, and motivation. The dimensions are summarized and presented in Fig. 1.

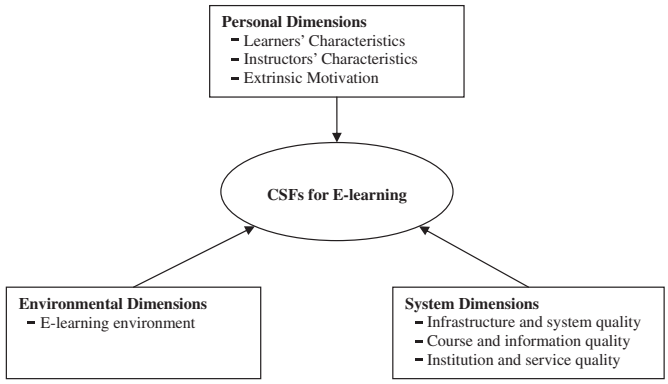

Fig. 1. Research framework.

3.1. Learners' characteristics

Learners perceive benefits using e-learning systems. E-learning has no value without learners using the e-learning systems. Students have become more diverse while the demand for education is increasing. For example, increases in the demand for education is coming from female non-traditional students with grown children, full-time students that work part-time, and part-time students that work full time (Sharma & Kitchens, 2004). Various learners' characteristics may influence e-learning system adoption as a result of this increasing diversity in the classroom (Volery & Lord, 2000). Prior studies indicate several pertinent learner characteristics, including computer self-efficacy, Internet self-efficacy, computer experience, Internet experience, computer anxiety, and attitude toward e-learning (Arbaugh, 2002; Chiu & Wang, 2008; Chu & Chu, 2010; Fuller et al., 2006; Pituch & Lee, 2006; Shih, Muñoz, & Sanchez, 2006; Sun et al., 2008; Thompson, Higgins, & Howell, 1994).

3.2. Instructors'characteristics

Instructors' characteristics also play an important role in the perception of the effectiveness of learning management systems (Ozkan & Koseler, 2009; Selim, 2007). Collis (1995) states that both technology as well as the implementation of technology impacts educational learning outcomes. Attitude toward technology, teaching styles, and technology control also influence learning outcomes (Webster & Hackley, 1997). Previous studies found that an instructor's control of technology along with providing enough time to interact with students impacts learning outcomes (Arbaugh, 2000; Khan, 2005; Leidner & Jarvenpaa, 1993). Relevant instructor characteristics include timely response, self-efficacy, technology control, focus on interaction, attitude toward e-learning, attitude toward students, distributive fairness, procedural fairness, and interaction fairness (Arbaugh, 2002; Chiu et al., 2007; Liaw et al., 2007; Lim, Lee, & Nam, 2007; Sun et al., 2008; Webster & Hackley, 1997).

3.3. E-learning environment

E-learning environment refers to where students access online resources, use systems for access to online curriculum and communication, obtain tutor assistance, and receive assessment (Lennon & Maurer, 2003). A positive e-learning environment contributes to e-learning success (Siritongthaworn et al., 2006). Successful outcomes of e-learning include providing opportunities for interactions, facilitating the exchange of information among learners and instructors, synchronous and asynchronous communication, and online assessment (Cao, Griffin, & Bai, 2009). Online interactions among learners as well as between learners and instructors increase learners' participation in educational activities (Swan, 2001). An e-learning environment also includes instruction and university support (Selim, 2007). Factors relevant for a positive e-learning environment include social influence, learners' perceived interactions with others, diversity in assessment, and perceived autonomy support (Arbaugh, 2002; McLeod, Pippin, & Mason, 2009; Roca & Gagné, 2008; Sørebø, Halvari, Gulli, & Kristiansen, 2009; Sun et al., 2008).

3.4. Institution and service quality

Service quality significantly influences customer satisfaction (Brown & Chin, 2004; Zhu, Wymer, & Chen, 2002). Service quality is measured by five dimensions of SERVQUAL: tangibles, reliability, responsiveness, assurance, and empathy (DeLone & McLean, 2003). Service quality in e-learning research is defined as the overall support delivered by the e-learning system to the learners who use the system (Chiu et al., 2007). Providing support, equipment accessibility, and training are important issues for e-learning acceptance (Lee, 2008). Service quality, which includes administrative concerns such as management, funding, maintenance, and the delivery of resources, are positively related to learners' satisfaction (Ozkan & Koseler, 2009). Program and course flexibility also have a positive effect on learners' satisfaction with e-learning courses (Arbaugh, 2000), especially for learners that must manage conflict among time, work, and family (Arbaugh, 2002). Service quality also includes teaching assistant support, computer training, and program flexibility (Arbaugh, 2000, 2002; Arbaugh & Duray, 2002; Lee, 2008; Teo, 2010).

3.5. Infrastructure and system quality

Technology has an important role in delivering learning outcomes because learners interact more in e-learning environments than with traditional face to face instruction (Webster & Hackley, 1997). System design facilitates formative interactions, controls organizational activities, and provides correct and sufficient information to reduce uncertainty (Daft & Lengel, 1986). System quality relates to a learner's belief about e-learning performance characteristics (Chiu et al., 2007) and is measured by functionality, ease of use, reliability, flexibility, data quality, portability, integration, and importance (DeLone & McLean, 2003). System quality has a strong positive effect on learners' satisfaction (Ozkan & Koseler, 2009) and directly affects user beliefs (Davis, 1989). Factors that are relevant for infrastructure and system quality include Internet quality, facilitating conditions, reliability, ease of use, system functionality, system interactivity, system response, and equipment accessibility (Arbaugh, 2000, 2002; Arbaugh & Duray, 2002; Lee, 2010; Lim et al., 2007; Pituch & Lee, 2006; Roca & Gagné, 2008; Sun et al., 2008; Teo, 2010; Webster & Hackley, 1997; Wu et al., 2010).

3.6. Course and information quality

Well-designed courses, curriculum, and learning materials facilitate meaningful educational experiences (Brophy, 2000). Information quality is defined as the accuracy, completeness, ease of understanding, and relevance of online course materials (Chiu et al., 2007; McKinney, Yoon, & Zahedi, 2002). Information quality is measured in terms of accuracy, timeliness, completeness, relevance, and consistency (DeLone & McLean, 2003). Learning is a complicated activity because in addition to teaching skills, curriculum and teaching resources influence the learning process (Sharma & Kitchens, 2004). Ozkan and Koseler (2009) found that information quality has a strong positive effect toward learners' satisfaction. Characteristics of information quality include content relevance, course quality, and course flexibility (Arbaugh, 2002; McKinney et al., 2002; Sun et al., 2008).

3.7. Motivation

Motivation is a key concern for online instruction as attrition rates remain relatively high for online learning (Chen & Jang, 2010). There are two types of motivation, intrinsic and extrinsic. Intrinsic motivation refers to an activity that an individual does even in the absence of a reward contingency or control (Deci & Ryan, 1985). Extrinsic motivation refers to the perception that a person will perform any activity and achieve valued outcomes distinct from the activity itself (Davis et al., 1992). Course design and learning context are not enough to achieve e-learning success because of the importance of learners' motivation (Law et al., 2010). Factors that are essential to capture learning motivation include individual attitude and expectations, setting challenging goals, perceived enjoyment (intrinsic motivation), perceived usefulness (extrinsic motivation), clear direction, reward and recognition, punishment/regulation, social pressure and competition (Arbaugh, 2000; Law et al., 2010; Lee, Cheung, & Chen, 2005; Roca & Gagné, 2008).

4. Research method

A prioritization of critical success factors that influence e-learning adoption for developing countries has not been studied. This study develops a hierarchical model starting with seven dimensions of CSFs derived from previous studies on e-learning adoption. Salient factors among the seven initial dimensions were collected from ICT experts and faculty from developing countries and were then compared.

This study employs the Delphi method, which is a widely used technique in the technology, education, and policy determination fields (Khan, Moon, Rhee, & Rho, 2010). The AHP method optimally solves problems with multiple criteria (Chen & Wang, 2010) and was used in this study to identify and rank e-learning CSFs. The AHP method complements the weakness of score ranking in the Delphi method which does not allow a participant to weigh the relative difference between item rankings (Couger, 1988).

Eighty-two e-learning experts in twenty-five developing countries from Asia, the Middle East, South America, Africa, and Europe were invited to participate in this study. Thirty-nine of the eighty-two participants are faculty teaching in e-learning site from four developing countries in Southeast Asia and forty-three of the eighty-two participants are IT specialists, IT managers, as well as researchers who have had experience and worked with e-learning issue.

Clear separation among quality experts and non-experts from respondents was necessary to ensure the efficiency and value of the study since study respondents were from different countries. This study followed the recommendations of prior Delphi research (Keeney, Hasson, & McKenna, 2006; Hasson, Keeney, & McKenna, 2000) that study participants not be selected randomly. Participants were selected based on their knowledge, current related work, and experiences on the e-learning issue. The study also follows McKenna (1994) in which direct contact and interviews with the participants were performed by both face to face and online methods to determine the quality experts before conducting research. The study incorporated measurement items in a paper-based questionnaire to identify multiple sources of data, control method variance, and ensure a high accuracy of results (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). This study identified quality participants through two responses in paper-based questionnaire; is the participants' work related to e-learning and what is the number of years of work related to the e-learning field. Each participant incorporated within this study indicated that their work was related to e-learning and both groups had roughly 7 years of e-learning experience (7.05 years for ICT experts and 6.56 years for instructors). Tables 1 and 2 present the demographic profiles of the ICT experts and faculty.

4.1. Delphi method

Dalkey and Helmer (1963) introduced the Delphi method, which is an opinion survey technique that gathers information from experts' opinions (Jensen, 1996). The Delphi method is a tool for organizing and prioritizing collected factors (Dekleva & Zupančič, 1996) for solving problem by experts (Okoli & Pawlowski, 2004) from different perspectives (Turoff & Hilts, 1995). A Delphi survey can be conducted by both paper–pencil Delphi and real-time Delphi (Hasson et al., 2000; Skulmoski, Hartman, & Krahn, 2007). Paper–pencil Delphi is a sequence of

Table 1
ICT experts demographic profile.

Demographic	Frequency	Percent
Gender:		
Male	36	84
Female	7	16
Age:		
21–30	14	33
31–40	21	49
41–50	7	16
51–60	1	2
Education:		
Bachelor Degree	1	2
Master Degree	29	67
Doctorate Degree	13	30
Functional Area:		
IT & System Technical	24	56
Research & Development	10	23
Others	9	21
Region:		
Asia (14 countries)	28	65
Africa (6 countries)	10	23
America (3 countries)	3	7
Europe (1 country)	1	2
Middle East (1 country)	1	2
Experience:		
Average experience with ICT		11 years
Average experience with e-learning		7 years

paper–pencil questionnaires that are sent through the mail whereas real-time Delphi research participants access the sequence of questionnaires through a web-based method (Geist, 2010; Gordon & Pease, 2006).

The Delphi method in this study incorporated a group survey technique involving an iterative multistage process that is widely applied in the social sciences, information system, information technology, and health fields (Hasson et al., 2000; Skulmoski et al., 2007). Hasson et al. (2000) detailed multiple reasons why the Delphi method is appropriate. Consensus in the Delphi technique could enhance the effectiveness of decision making. The Delphi technique is appropriate to examine a specific problem, qualitative options, and data could be collected from a specific group. The Delphi technique results from each round help formulate additional quantitative survey rounds. The Delphi technique can be pilot tested with a small group. Turoff (1970) also stated that the Delphi method could explore and lead judgment about an issue, generate consensus on an issue by a group of experts, as well as correlate a judgment on an issue by various disciplines. Selecting CSFs from an experts' point of view can be performed using the Delphi method (Duncan, 1995). This study employed the open-ended question technique in which panels independently complete a questionnaire. The open-ended survey has less bias compared to a closed set questionnaire, which may limit experts' options (Hasson et al., 2000).

Table 2
Faculty demographic profile.

Demographic	Frequency	Percent
Gender:		
Male	26	67
Female	13	33
Age:		
21–30	11	28
31–40	10	26
41–50	15	38
51–60	3	8
Education:		
Master Degree	21	54
Doctorate Degree	18	46
Faculty/Department:		
Economics & Business Administration	8	21
Education	11	28
Engineering/Computer Science	11	28
Information Technology	9	23
Region:		
Indonesia	7	18
Laos	11	28
Thailand	15	38
The Philippines	6	15
Experience:		
Average experience with ICT		18 years
Average experience with e-learning		7 years

The first and second round of surveys in this study was conducted using the Delphi method to collect and analyze data from participants to identify the CSFs of e-learning. This study employed paper-based and web-based questionnaires. Both questionnaire approaches were appropriate and perform equal with respect to quantity and quality of data (Khan et al., 2010). A third round of surveys was conducted with paper-based questionnaires using the AHP method.

Participants were requested to list at least six important factors that influence e-learning success in the first round of surveys using brainstorming (Okoli & Pawlowski, 2004) or a process for determining issues (Hasson et al., 2000) to identify factors. The participants were asked during the second round of surveys: "How important are the factors that influence e-learning success in developing countries?" Participants had to rate the factors in each dimension on a five-point Likert scale ranging from *totally unimportant* (=1) to *very important* (=5). Participants were also given open-ended questions to either add or remove factors believed to be either important or unimportant. A pilot test was carried out with 6 experts before the second round surveys commenced to remove ambiguity and ensure the reliability of the Delphi instrument (Khan et al., 2010).

The second round of surveys revealed 6 major dimensions (see Table 3) as important for e-learning success, which was a reduction from the 7 dimensions identified in Section 3. The second round of surveys also revealed 22 factors (ICT experts' opinion) and 20 factors (faculty opinion) rated as important to very important factors for e-learning from an original list of 41 possible factors. Factors with an average mean equal to or higher than four was the threshold for importance. The primary difference between ICT experts and faculty from the second round of surveys was that interaction fairness and system response were not identified in faculty opinions. Table 4 presents the definition of each factor.

4.2. Analytic hierarchy process (AHP) method

This study developed a hierarchical model of e-learning success factors for developing countries using the AHP method, illustrated in Fig. 2. The proposed model consists of three layers, the research objective, e-learning dimensions, and the critical success factors that influence e-learning success. This study designed a pair-wise comparative question based on Bozbura, Beskese, and Kaharman (2007). The weight of each factor was calculated by AHP software and Microsoft Excel 2007. Satty (1980) recommended a consistency ratio of 0.10 or less as acceptable. Responses that did not meet the consistency ratio requirement were removed. The details of complete AHP procedure can be found in Chen and Wang (2010) and Satty (1980).

5. Results

Data was collected with questionnaires sent to eighty-two participants in developing countries using the Delphi method. The response rate for the first and second round of surveys was 100%. Eighty-two AHP questionnaires were then sent to the same participants for the third round of surveys. Seventy-nine participants responded to the AHP questionnaires for a response rate of 96.3%. The weight of each factor was calculated using AHP software and Microsoft Excel 2007. Seventy-six replies to the questionnaire reached the consistency ratio while 3 replies were removed due to a relatively high inconsistency ratio. The final acceptable sample included thirty-seven ICT experts and thirty-nine faculties. Table 5 shows the mean and standard deviation for each factor by ICT experts and faculty. Nineteen factors from the original set of forty-one were removed for having a mean response lower than four, which was the threshold rating for unimportant.

Table 6 shows that learners' characteristic was the most important dimension and that extrinsic motivation was the least important dimension in ICT experts' opinion. Infrastructure and system quality were the most important dimensions while institution and service quality were the least important dimensions in the opinion of faculty. The overall weight of the dimension and rankings are shown in Table 6.

Table 7 shows that computer training (0.0869), perceived usefulness (0.0813), attitude toward e-learning (0.0758), computer self-efficacy (0.0740), and program flexibility (0.0653) are the top five influential factors that impact e-learning success in developing countries from an ICT expert's perspective. Perceived usefulness (0.08154), attitude toward e-learning (0.07935), program flexibility (0.07113), clear direction (0.06861), and course quality (0.06543) are the top five essential factors that influence e-learning success in developing countries from a faculty perspective.

6. Discussion and implications

6.1. Discussion

The objective of this study is to identify and prioritize the CSFs of e-learning system adoption in developing countries. Through the Delphi survey technique and Analytic Hierarchy Process (AHP) analyses, this study aides practitioners and researchers with a better understanding of

Table 3
Reduced CSF dimensions and factors.

Dimension	Factor	Literature
Learners' characteristics	Computer self-efficacy, Internet self-efficacy, attitude toward e-learning	Arbaugh, 2002; Chu & Chu, 2010; Chiu & Wang, 2008; Sun et al., 2008
Instructors' characteristics	Timely response, self-efficacy, technology control, focus on interaction, attitude toward student, interaction fairness	Arbaugh, 2002; Chiu et al., 2007; Liaw et al., 2007; Lim et al., 2007; Sun et al., 2008; Webster & Hackley, 1997
Institution and Service Quality	Computer training, program flexibility	Arbaugh, 2000, 2002; Arbaugh & Duray, 2002; Lee, 2008
Infrastructure and System Quality	Internet quality, reliability, ease of use, system functionality, system interactivity, system response	Arbaugh, 2000, 2002; Arbaugh & Duray, 2002; Lee, 2010; Lim et al., 2007; Pituch & Lee, 2006; Roca & Gagné, 2008; Sun et al., 2008; Webster & Hackley, 1997; Wu et al., 2010
Course and Information Quality	Course quality, relevant content, course flexibility	Arbaugh, 2002; McKinney et al., 2002; Sun et al., 2008
Extrinsic Motivation	Perceived usefulness, clear direction	Arbaugh, 2000; Law et al., 2010; Lee et al., 2005; Roca & Gagné, 2008

Table 4
CSF definitions.

Dimension	Factor	Definition
Learners' characteristics	Computer self-efficacy	One's perceptions of his or her ability to use computer to complete a specific tasks
	Internet self-efficacy	One's perceptions of his or her ability to interact with the Internet
	Attitude toward e-learning	Learners' impression of participating in e-learning activities through computer usage
Instructors' characteristics	Timely response	Whether students perceive that instructors responded promptly to their problems
	Self-efficacy	One's belief about the ability to perform certain tasks successfully
	Technology control	The extent to which the learner can control the instructional presentation. Control is a continuum enabling the design of varying degrees of learner control
	Focus on interaction	The degree of contact and educational exchange among learners and between learners and instructors
	Attitude toward student	Instructors provide various forms of office hours and methods of contacts for the students
	Interaction fairness	The extent to which the learner feels having been treated fairly regarding his or her online interaction with the instructor throughout the web-based learning process
Institution and Service Quality	Computer training	The amount of specialized instruction and practice that is afforded to the learner to increase the learner's proficiency in utilizing the computer capability that is unavailable
	Program flexibility	Ability to arrange the course to serve a student's need to complete the entire degree program
Infrastructure and System Quality	Internet quality	The quality of the Internet that can be measured by transmission rate, error rates, and other characteristics
	Reliability	Concerned with the degree of accuracy, dependability, and consistency of the information
	Ease of use	Refers to the degree to which the prospective user expects the use of the e-learning system to be free of effort
	System functionality	The perceived ability of an e-learning system to provide flexible access to instructional and assessment media
	System interactivity	The degree a system allows for interaction
	System response	The time that elapses from a user action until feedback is received from the system
Course and Information Quality	Course quality	The quality of writing, images, video, or flash to meets generally accepted standards of semantics, style, grammar, and knowledge
	Relevant content	The degree of congruence between what the learners wants or requires and what is provided by the information, course content, and services
	Course flexibility	Learners' perception of the efficiency and effects of adopting e-learning in their working, learning, and commuting hours
Extrinsic Motivation	Perceived usefulness	The degree to which a person believes that using e-learning system would enhance his or her learning performance
	Clear direction	A direction that free from confusion or ambiguity

the CSFs for e-learning adoption in developing countries. Focusing on developing countries is relevant because previous research exclusively employs data from developed countries. E-learning system adoption is not a one-size-fits-all approach that is applied equally among stakeholders located throughout the world. This research accounts for this bias by eliciting the perspectives of participants in developing countries.

A number of interesting findings are revealed when comparing the responses from the two groups of participants. Faculty opinion, in comparison with ICT experts' opinion, had twenty essential factors influential to the success of e-learning implementation. First, the majority of the CSFs for e-learning systems was identical for ICT experts and faculty with the exception of interaction fairness and system response. At least 20 factors from 6 dimensions were revealed as important for e-learning system success in developing countries for each group of participants. The distinction that 6 dimensions emerged is important because this is consistent with previous e-learning research finding a similar number of dimensions occurring.

The findings also reveal that an e-learning environment does not have a high effect on learning outcomes as compared to instructional strategies (Alavi, Marakas, & Yoo, 2002; Santhanam et al., 2008). Practitioners would be wise to provide computer and Internet training to users to become familiar with e-learning technology and enhance users' skills and attitude toward technology (Miller, Lu, & Thammetar, 2004; Webster & Hackley, 1997). This is consistent with Lee (2008) who found that universities' providing computer support and training to learners strongly influence a learner's perceived ease of use and usefulness of the system.

Well-designed courses, curriculums, and learning materials are key factors that influence learning performance (Brophy, 2000). E-learning systems must attain curriculum quality certification from independence sources to both promote and bolster educational excellence. Organizations that provide quality assurance for e-learning should have a strong market for their services in developing countries.

The findings also indicate that creating technology awareness, motivation, and changing learners' behavior are required for the success of e-learning implementation. Learners are accustomed to traditional teaching approaches (Miller et al., 2004) especially in developing countries where ICT is still in the early stages of adoption. The findings for system design are consistent with a study from Lennon and Maurer (2003) which indicated that system design should be easy to use or else it will create confusion among users.

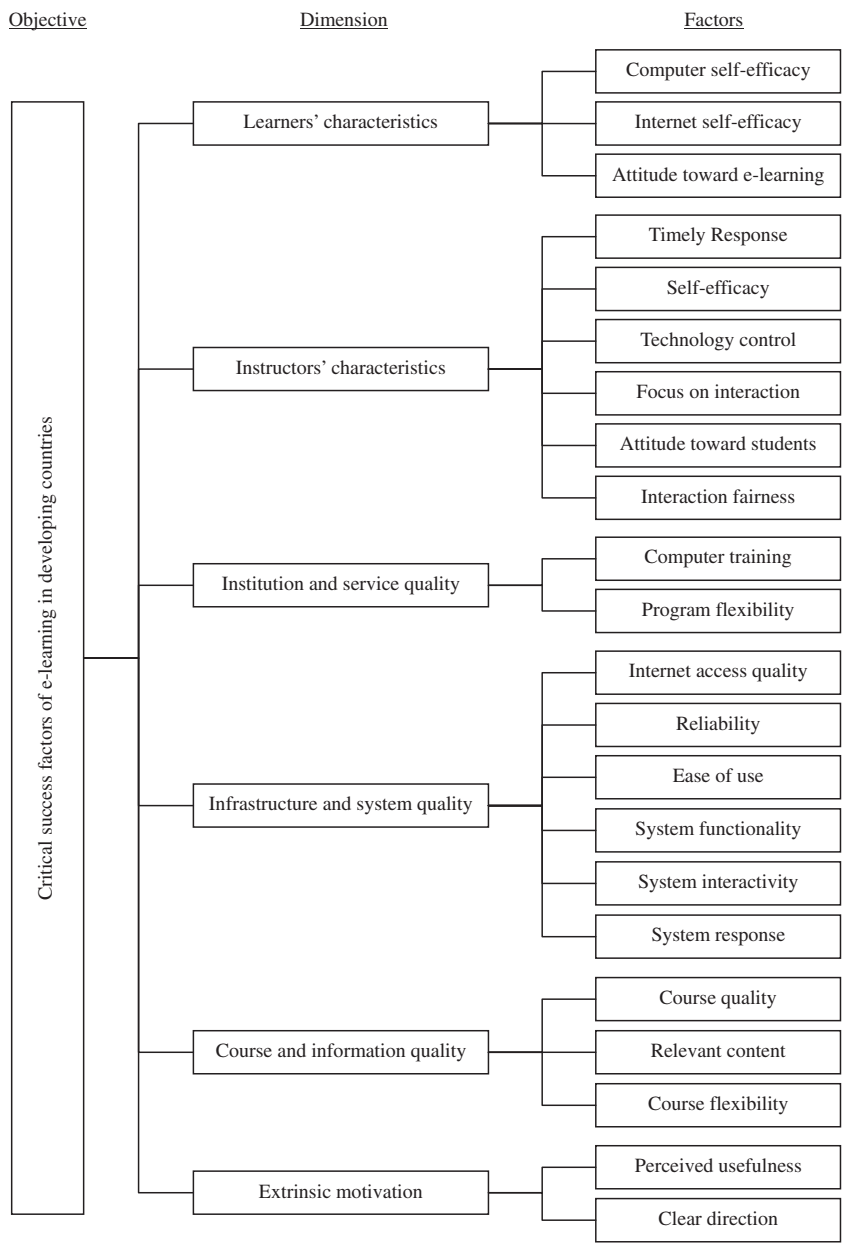

Fig. 2. Hierarchical model for e-learning CSFs in developing countries.

The study also found that intrinsic motivation is less important compared to extrinsic motivation in the educational systems of developing countries. E-learning system adopters should take advantage by promoting external rewards for members that participate. Financial incentives or certifications structured to elicit e-learning engagement can be important investments that encourage adoption.

Computer skills, technical background, training programs and computer literacy are key factors for faculty to implement e-learning in developing countries (Siritongthaworn et al., 2006). Users in developing countries are not as familiar with technology as users in developed countries and will not likely see the importance of technology in education. Increasing technology awareness as well as familiarity, computer skills, and knowledge are important factors of e-learning success in developing countries.

6.2. Implications

This research provides several important implications for building and promoting effective e-learning systems in developing countries. There are many parties involved in e-learning including "a combination of different stakeholders such as learner, instructor, administrative, faculty, technical staff, supporter, and the use of the Internet and other technologies" (Siritongthaworn et al., 2006, p. 139). Universities in developing countries should provide computer training, promote the advantages of e-learning services, provide an incentive to motivate users, provide and manage flexible e-learning programs and courses, develop the computer self-efficacy of users, and improve the quality of courseware. These were e-learning system adoption CSFs in developing countries and present specific actions that stakeholders can promote to ensure e-learning success.

Table 5
Mean and Standard Deviation for each CSF.

Dimension	Factor	ICT Expert ($N = 37$)		Pedagogue ($N = 39$)	
		Mean	Std. deviation	Mean	Std. deviation
Learners' characteristics	Computer Self-efficacy	4.41	0.551	4.51	0.644
	Internet Self-efficacy	4.32	0.580	4.41	0.637
	Attitude Toward e-learning	4.14	0.751	4.36	0.628
Instructors' characteristics	Timely Response	4.16	0.727	4.44	0.788
	Self-efficacy	4.16	0.602	4.21	0.615
	Technology Control	4.03	0.763	4.36	0.668
	Focus on Interaction	4.05	0.743	4.38	0.711
	Attitude Toward Student	4.03	0.726	4.21	0.695
	Interaction Fairness	4.00	0.745	–	–
Institution and Service Quality	Computer Training	4.32	0.626	4.56	0.598
	Program Flexibility	4.16	0.764	4.23	0.777
Infrastructure and System Quality	Internet Quality	4.59	0.644	4.49	0.556
	Reliability	4.35	0.789	4.41	0.850
	Ease of Use	4.24	0.760	4.33	0.577
	System Functionality	4.32	0.580	4.36	0.707
	System Interactivity	4.24	0.641	4.21	0.732
	System Response	4.14	0.713	–	–
Course and Information Quality	Course Quality	4.41	0.599	4.46	0.600
	Relevant Content	4.32	0.626	4.44	0.718
	Course Flexibility	4.27	0.732	4.33	0.898
Extrinsic Motivation	Perceived Usefulness	4.22	0.534	4.49	0.644
	Clear Direction	4.14	0.713	4.31	0.655

Policy makers in developing countries should adopt the following implementation strategies to enhance Internet quality, system functionality, system interactivity, and the reliability of e-learning services: (a) enhance the broadband Internet infrastructure that links all institutes and universities; (b) promote and increase e-learning awareness to society; (c) increase infrastructure and systems reliability through well-designed e-learning systems.

Universities in developing countries should encourage computer usage among stakeholders and promote various applications of the Internet to develop computer and Internet self-efficacy. This may be done by providing support to users and setting up Internet access points or computer rooms for users. Universities and system developers need to focus on the following items to facilitate e-learning success: (a) disseminating up-to-date and useful learning information; (b) expanding electronic learning services while promoting the usefulness and convenience of this service; (c) continuing to establish user-friendly websites and promoting the ease of use of electronic learning services; (d) increasing technology awareness and providing training to all types of technology users, both learners and faculty; (e) increasing users' motivation to improve the overall number of users.

6.3. Limitations

This study has limitations despite the relevance that the findings have for stakeholders in developing countries in the process of implementing e-learning systems. The research focus was participants in developing countries. There were some similarities in the findings of this research with previous research that focused exclusively on developed countries. The pressing challenges faced by developing countries (e.g., infrastructure, political, cultural, etc.) are not the same as those shared by developed countries. The study findings may not be directly applicable for stakeholders in developed countries. Since e-learning opportunities in developed countries are accessible to stakeholders in developing countries (e.g., online degrees), the study findings should have some salience among stakeholders in developed countries that serve stakeholders located in developing countries. Further examination of the specific challenges serving different populations of stakeholders is needed.

Another limitation of this research is the focus on only two groups of stakeholders in developing countries, ICT experts and faculty. Though there were many similarities in the findings between these two groups, such similarities cannot be assumed among different stakeholder groups (e.g., learners', administrators, etc.). Different stakeholder groups have different constraints, needs, and different motivations for using e-learning systems. Future research should consider additional stakeholder groups and different factors to get a better representation of the issues facing e-learning system success in developing countries.

Finally, the participants in this study were drawn from developing countries that are in the early stages of employing ICT in education. The influences and challenges affecting stakeholders that are in the earlier stages of e-learning systems diffusion will likely be different than where e-learning systems are mature. A longitudinal study examining how the CSFs revealed in this study change over time may reveal additional interesting findings.

Table 6
AHP weights and dimension rankings.

Dimensions	ICT experts' perspective		Faculty perspective	
	Weights	Ranking	Weights	Ranking
Learners' characteristics	0.1983	1	0.1795	2
Instructors' characteristics	0.1743	2	0.1647	3
Institution and Service Quality	0.1522	5	0.1296	6
Infrastructure and System Quality	0.1709	3	0.2149	1
Course and Information Quality	0.1651	4	0.1614	4
Extrinsic Motivation	0.1393	6	0.1502	5

Table 7
AHP weight and factor rankings.

Factor (CSF)	ICT experts' perspective			Faculty perspective		
	Weights (global)	Ranking (local)	Ranking (global)	Weights (global)	Ranking (local)	Ranking (global)
Computer Self-efficacy	0.0740	2	4	0.05298	2	8
Internet Self-efficacy	0.0483	3	10	0.04718	3	11
Attitude Toward e-learning	0.0758	1	3	0.07935	1	2
Timely Response	0.0354	1	12	0.03345	3	16
Self-efficacy	0.0337	2	14	0.03507	2	15
Technology Control	0.0266	5	18	0.03176	4	19
Focus on Interaction	0.0285	3	16	0.02693	5	20
Attitude Toward Student	0.0271	4	17	0.03765	1	14
Interaction Fairness	0.0230	6	20	–	–	–
Computer Training	0.0869	1	1	0.05846	2	6
Program Flexibility	0.0653	2	5	0.07113	1	3
Internet Quality	0.0379	1	11	0.05349	1	7
Reliability	0.0339	2	13	0.05191	2	9
Ease of Use	0.0250	4	19	0.04475	3	13
System Functionality	0.0330	3	15	0.03179	5	18
System Interactivity	0.0212	5	21	0.03291	4	17
System Response	0.0199	6	22	–	–	–
Course Quality	0.0643	1	6	0.06543	1	5
Relevant Content	0.0506	2	8	0.04897	2	10
Course Flexibility	0.0502	3	9	0.04692	3	12
Perceived Usefulness	0.0813	1	2	0.08154	1	1
Clear Direction	0.0580	2	7	0.06861	2	4

7. Conclusion

Information technology is increasing in importance in education and is becoming much more prevalent. Institutions in developing countries face unique challenges compared to developed countries and must understand what drives learners and faculty toward e-learning system. A greater appreciation of these challenges allows stakeholders to take appropriate action to ensure e-learning system success. The primary focus of this study was to classify and prioritize CSFs for e-learning implementations in developing countries and identify practical implications. This study prioritized CSFs for multiple stakeholders of e-learning systems in developing countries using the Delphi and AHP methods. This study found that the most important factors influencing e-learning success in developing countries were related to increasing technology awareness and an attitude toward e-learning, enhancing basic technology knowledge and skills, improving learning content, requiring computer training, motivating users to utilize e-learning systems, and requiring a high level of support from the university.

This study found six dimensions for implementing e-learning systems in developing countries, including learners' characteristics, instructors' characteristics, institution and service quality, infrastructure and system quality, course and information quality, and extrinsic motivation. Based on the results, the most important dimension for ICT experts was learners' characteristics whereas infrastructure and system quality were the most important dimensions from the faculty perspective. This study also revealed at least 20 critical factors for e-learning success in developing countries from both an ICT expert and faculty perspective. For ICT experts, learners and instructors' characteristics were very important factors. For faculty, infrastructure and system quality was the most important consideration for e-learning success. Future research should examine the study results and focus on different groups of stakeholders (e.g., learners, administrators), stakeholders in different contexts, as well as how the results might change over time.

CSFs are classified and prioritized by their level of importance. Research at the individual level of analysis for e-learning adoption has been widely studied in the literature. E-learning success in developing countries must also consider viewpoints from institutional and national perspectives as these may be crucial in fully understanding successful e-learning implementations. Future studies should incorporate perspectives from national level-policy makers along with perspectives from leaders in various industries. These insights may reveal additional useful information regarding e-learning implementations in developing countries.

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