

The Critical Success Factors of e-Learning in Developing Countries

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ABSTRACT

Information technology (IT) plays an important role in modern education. Many schools or universities have deployed electronic learning in order to gain competitive advantages. While the market for e-Learning has shown a high growth rate, many schools have failed to adopt e-Learning. This research focused on seven areas related to e-Learning—namely, learners, instructors, environment, institution and service quality, infrastructure and system quality, course and information quality, and motivation dimensions. Based on these seven dimensions, 41 factors were quantitatively analyzed to prioritize the critical success factors (CSFs) of e-Learning in developing countries using Delphi and Analytic Hierarchy Process (AHP) approaches. The results indicated that 22 factors affected the success of e-Learning in developing countries. The top ten factors were: computer training, perceived usefulness, learners' attitude toward e-Learning, learners' computer self-efficacy, course quality, program flexibility, clear direction, relevant content, course flexibility, and internet self-efficacy.

Keywords: e-Learning, Delphi, Analytic Hierarchy Process

บทคัดย่อ

เทคโนโลยีสารสนเทศมีบทบาทสำคัญสำหรับการศึกษาระดับมัธยมศึกษา โรงเรียนหรือมหาวิทยาลัยจำนวนมากได้พัฒนาระบบการเรียนการสอนผ่านสื่ออิเล็กทรอนิกส์เพื่อความสะดวกในการแข่งขัน ในขณะที่ยังขาดของระบบการเรียนการสอนผ่านสื่ออิเล็กทรอนิกส์มีอัตราการเติบโตสูง อย่างไรก็ตาม โรงเรียนและมหาวิทยาลัยจำนวนมากไม่สามารถพัฒนาระบบนี้ได้สำเร็จ งานวิจัยนี้มุ่งเน้นที่ปัจจัยที่สำคัญที่สุดที่ส่งผลกระทบต่อระบบการเรียนการสอน

ผ่านสื่ออิเล็กทรอนิกส์ใน 7 มิติ ได้แก่ ผู้เรียน ผู้สอน สภาพแวดล้อมของระบบการเรียนการสอน สถาบัน การศึกษาและคุณภาพการให้บริการ โครงสร้างพื้นฐานและคุณภาพของระบบ หลักสูตรและคุณภาพของสารสนเทศ และแรงจูงใจจากภายนอก ปัจจัยต่างๆ ใน 7 มิติที่จะนำมาวิเคราะห์ในงานวิจัยนี้มีจำนวน 41 ปัจจัย เพื่อจัดลำดับความสำคัญของปัจจัยที่มีผลต่อการพัฒนาระบบการเรียนการสอนผ่านสื่ออิเล็กทรอนิกส์ในประเทศกำลังพัฒนา โดยการวิเคราะห์ด้วยเทคนิคเดลฟายและกระบวนการลำดับชั้นเชิงวิเคราะห์ ผลการวิจัยระบุว่า 22 ปัจจัยที่มีความสำคัญต่อ

การพัฒนากระบวนการเรียนการสอนผ่านสื่ออิเล็กทรอนิกส์ในประเทศกำลังพัฒนา โดย 10 ปีจี้ยแรก ได้แก่ การฝึกอบรมคอมพิวเตอร์ การรับรู้ประโยชน์ของระบบ ทักษะของผู้เรียนต่อระบบความสามารถในการใช้คอมพิวเตอร์ของผู้เรียนคุณภาพของหลักสูตร ความยืดหยุ่นของโปรแกรมวัสดุประสงค์ที่ชัดเจน ความสอดคล้องของเนื้อหาความยืดหยุ่นของหลักสูตร และความสามารถในการใช้อินเทอร์เน็ตของผู้เรียน

คำสำคัญ: ระบบการเรียนการสอนผ่านสื่ออิเล็กทรอนิกส์ เทคนิคเดลฟาย กระบวนการลำดับชั้นเชิงวิเคราะห์

INTRODUCTION

E-learning has been defined as using modern Information and Communication Technology (ICT) and computers to deliver an instruction, information, and content via electronic media such as CD-ROM, the Internet, and Intranet (Ozkan & Koseler, 2009). Many universities use an e-Learning system to strengthen their role in the learning community and to develop new communication channels between instructors and learners. They use this system to transfer content and knowledge to help individuals accomplish personal learning objectives (Clark & Mayer, 2007). Providing online learning services has many advantages for learners, instructors, and organizations including enhancing both teaching and learning methods, increasing information accessibility and interactivity, updating and delivering the content, and convenience; moreover, it reduces the overall cost and information overload and increases an expert's knowledge, provides consistent content delivery and produces student tracking that are advantageous for instructors and organizations (Kruse, 2002; Welsh, Wanberg, Brown, & Simmering, 2003; Ruiz, Mintzer, & Leipzig, 2006).

A number of studies in the e-Learning domain can be briefly summarized as follows. Islas et al. (2007) focused on technology-based components;

Liaw, Huang, and Chen (2007) investigated student and instructor satisfaction; Douglas and Vyver (2004) studied the effectiveness of e-Learning; Arbaugh and Fich (2007) examined the participants' interaction in an online environment; Gilbert (2007) focused on student experience; Ozkan and Koseler (2009) investigated learners' satisfaction with instructors, systems, information, service, and supportive concerns, and the effective implementation of an e-Learning system including technology and pedagogy; and Fuller, Vician, and Brown (2006) focused on individual factors. While e-Learning systems have been studied by many researchers in various dimensions (Pituch & Lee, 2006; Sun, Tsai, Finger, Chen, & Yeh, 2008), few studies have been carried out on the prioritization of critical success factors influencing e-Learning success in developing countries (Selim, 2007; Masrom, Zainon, & Rahiman, 2008). Therefore, the present study focused on factors influencing e-Learning success, specifically in developing countries, by using Delphi and Analytic Hierarchy Process (AHP) methods. The goal of this research was to find out the most critical success factors affecting successful e-Learning implementation from the perspective of the ICT experts and pedagogues having experience in learning and teaching, course and system design, and policy making on integrating ICT in education.

LITERATURE REVIEW

The successful adoption of an e-Learning system can be measured using various factors such as learners' satisfaction, confirmation, post-adoption expectations, individual and social influence, perceived behavioral control, and motivation. DeLone and McLean (2003) identified six dimensions—information quality, system quality, service quality, intention to use system, user satisfaction, and net benefit—as key influences on an Information System (IS) success model. Many e-Learning issues have been studied based on different factors, for example, computer self-efficacy of an individual explicitly associates

with learning performance that increases the use of e-Learning (Wu, Tennyson, & Hsia, 2010). Motivation (both intrinsic and extrinsic) is another concern for the adoption by learners of an e-Learning system (Davis, Bagozzi, & Warshaw, 1992; Teo, Lim, & Lai, 1999; Roca & Gagné, 2008; Lee, 2010). Without the prioritization of critical success factors (CSFs) regarding e-Learning, it is difficult to discover the most important factor affecting e-Learning success in developing countries. Based on previous studies on e-Learning success measurement, the present study grouped various factors into seven dimensions in accordance with their similarity and the opinions of a group of experts.

1. Learners' characteristics

An e-Learning system is a student-centered approach in which students are the main stakeholders and perceived beneficiaries from the system. To date, the number of students demanding e-Learning courses is increasing; therefore, various characteristics of learners have a potential influence on the e-Learning system (Volery & Lord, 2000). Individual characteristics are computer self-efficacy, computer experience, computer anxiety, internet self-efficacy, internet experience, and attitude towards e Learning (Thompson, Higgins, & Howell, 1994; Arbaugh, 2002; Fuller et al., 2006; Pituch & Lee, 2006; Shih, Muñoz, & Sanchez, 2006; Chiu & Wang, 2008; Sun et al., 2008; Chu & Chu, 2010).

2. Instructors' Characteristics

Instructors' characteristics are important determinants that influence the productivity of learning management systems (Selim, 2007; Ozkan & Koseler, 2009). Webster and Hackley (1997) emphasized that the outcome of learning is affected by instructor characteristics, such as teaching styles, attitudes towards a technology, and technology control. Similarly, Khan (2005) pointed out that learners would increase the level of satisfaction when an instructor provided enough time to interact with them during the learning process. Instructors'

characteristics are response timeline, self-efficacy, technology control, focus on interaction, attitude towards e-Learning, attitude towards students, distributive fairness, procedural fairness, and interaction fairness (Webster & Hackley, 1997; Arbaugh, 2002; Chiu, Chiu, & Chang, 2007; Liaw et al., 2007; Lim, Lee, & Nam, 2007; Sun et al., 2008).

3. Environment

The environment in e-Learning can be seen as university instruction and support (Selim, 2007). It consists of social influences, learner-perceived interaction with others, diversity in assessment, and perceived autonomy support (Arbaugh, 2002; Roca & Gagné, 2008; Sun et al., 2008; McLeod, Pippin, & Mason, 2009; Sørebo, Halvari, Gulli, & Kristiansen, 2009).

4. Institution and service quality

Service quality was defined as how the learners perceived the overall support delivered by the e-Learning system (Chiu et al., 2007). Previous studies indicated that service quality had an influence on the satisfaction of users or customers (Ozkan & Koseler, 2009). This dimension includes teacher assistant (TA) support, computer training, and program flexibility (Arbaugh, 2000; Arbaugh, 2002; Arbaugh & Duray, 2002; Lee, 2008; Teo, 2010).

5. Infrastructure and system quality

System quality was defined as the learner's belief about the performance characteristics of e-Learning (Chiu et al., 2007). DeLone and McLean (2003) measured system quality by functionality, ease of use, reliability, information quality, flexibility, portability, and integration. It has a strongly positive effect on learners' satisfaction (Ozkan & Koseler, 2009). This dimension consists of internet quality, facilitating conditions, reliability, ease of use, equipment accessibility, and system characteristics, which includes system interactivity, system functionality, and system response (Webster & Hackley, 1997; Arbaugh, 2000; Arbaugh, 2002;

Arbaugh & Duray, 2002; Pituch & Lee, 2006; Lim et al., 2007; Roca & Gagné, 2008; Sun et al., 2008; Lee, 2010; Teo, 2010; Wu et al., 2010).

6. Course and information quality

Information quality was measured in terms of completeness, consistency, accuracy, relevance, ease of understanding, and timeline of the course materials (McKinney, Yoon, & Zahedi, 2002; DeLone & McLean, 2003; Chiu et al., 2007). It has a strongly positive effect on learners' satisfaction (Ozkan & Koseler, 2009). This dimension consists of relevant content, course quality, and course flexibility (Arbaugh, 2002; McKinney et al., 2002; Sun et al., 2008).

7. Motivation

Motivation is specialized in online teaching and learning study; for example, pressure is considered to be a crucial issue in online learning (Chen & Jang, 2010). Motivation is composed of intrinsic and extrinsic components. Intrinsic motivation refers to the perception that people perform an activity without consideration of the possibility of reward or control (Deci & Ryan, 1985). In contrast, extrinsic motivation refers to an activity where people perform the activity based on their perception of receiving a reward or a value outcome (Davis et al., 1992). The intrinsic motivation consists of individual attitude and expectation, challenging goals, and perceived enjoyment, whereas extrinsic motivation consists of reward and recognition, clear direction, regulation or punishment, competition and social pressure, and perceived usefulness (Arbaugh, 2000; Lee, Cheung, & Chen, 2005; Roca & Gagné, 2008; Law, Lee, & Yu, 2010).

Dimmitt, and Paul (2006) and Selim (2007) suggested that investigations of critical success factors are required; therefore, the present study was conducted based on the aforementioned recommendation and preceding literature, following the Delphi method, which is used for forecasting in different areas such as education, technology, policy determination, decision making, and other fields (Khan, Moon, Rhee, & Rho, 2010) and the Analytic Hierarchy Process (AHP) approach described by Saaty (1994) that used to identify the CSFs regarding e-Learning in developing countries, to develop objective hierarchical structural levels, to rank the dimensions and also to identify the important factors among constructs. The authors analyzed in depth the CSFs with regard to e-Learning in developing countries and its hierarchical structural frameworks through AHP, which being a qualitative and quantitative method is one of the best processes to solve a complicated problem in decision making (Chen & Wang, 2010). Another reason was the weakness of the score ranking in the Delphi method where the weight comparison among issues is absent; for example, how much importance should be allocated to the first and second rank issues and how important is the first rank issue compared to other issues (Couger, 1988). Therefore, the present study used both the Delphi and AHP approaches. The authors invited 47 experts from 27 countries in Asia, the Middle East, South America, Africa, and Europe to participate in the study. The participants were IT specialists, IT managers, researchers, and lecturers with experience in e Learning issues. The participants in the study had an average of 10 years of experience in utilizing ICT for education and 72 percent had Master degrees in education, the others having PhD level qualifications.

METHODOLOGY

Based on the literature review, few studies were found relating to prioritization of CSFs regarding e Learning in developing countries (Selim, 2007; Masrom et al., 2008). Siritongthaworn, Krairit,

1. Delphi method

In the first two rounds of the survey, the authors used the Delphi method to refine and collect ideas from the experts to build a construct by questionnaires. The authors used both classical

paper-pencil and web-based questionnaires as tools. These two alternatives were recommended to obtain equal amounts of both quantitative and qualitative data (Khan et al., 2010), but in the third round survey (the AHP approach), a paper-pencil questionnaire was used due to the difficulty of designing an AHP questionnaire online. To identify factors, in the first round survey, the authors asked the group of 47 experts to list at least six important factors influencing e-Learning success based on a brainstorming stage (Okoli & Pawlowski, 2004) or a process of determining issues (Hasson, Keeney, & McKenna, 2000). This round was conducted from 8 to 15 November, 2010. In the second round survey, experts were asked: "How important are the factors regarding their influence on e Learning success in developing countries?" They had to rate the factors in each dimension with a Likert scale using five rankings from *totally unimportant* (=1) to *very important* (=5) together with open-ended questions for the addition or removal of any factors that the experts thought were important or unimportant, respectively, for each dimension. In order to remove ambiguity and ensure the reliability of the Delphi instrument, the authors carried out a pilot test with six experts to get their feedback on the second round survey (Khan et al., 2010). After finished testing, the second round questionnaire was distributed to 47 panel participants from 19 to 28 November, 2010. The detailed results are provided in the result section.

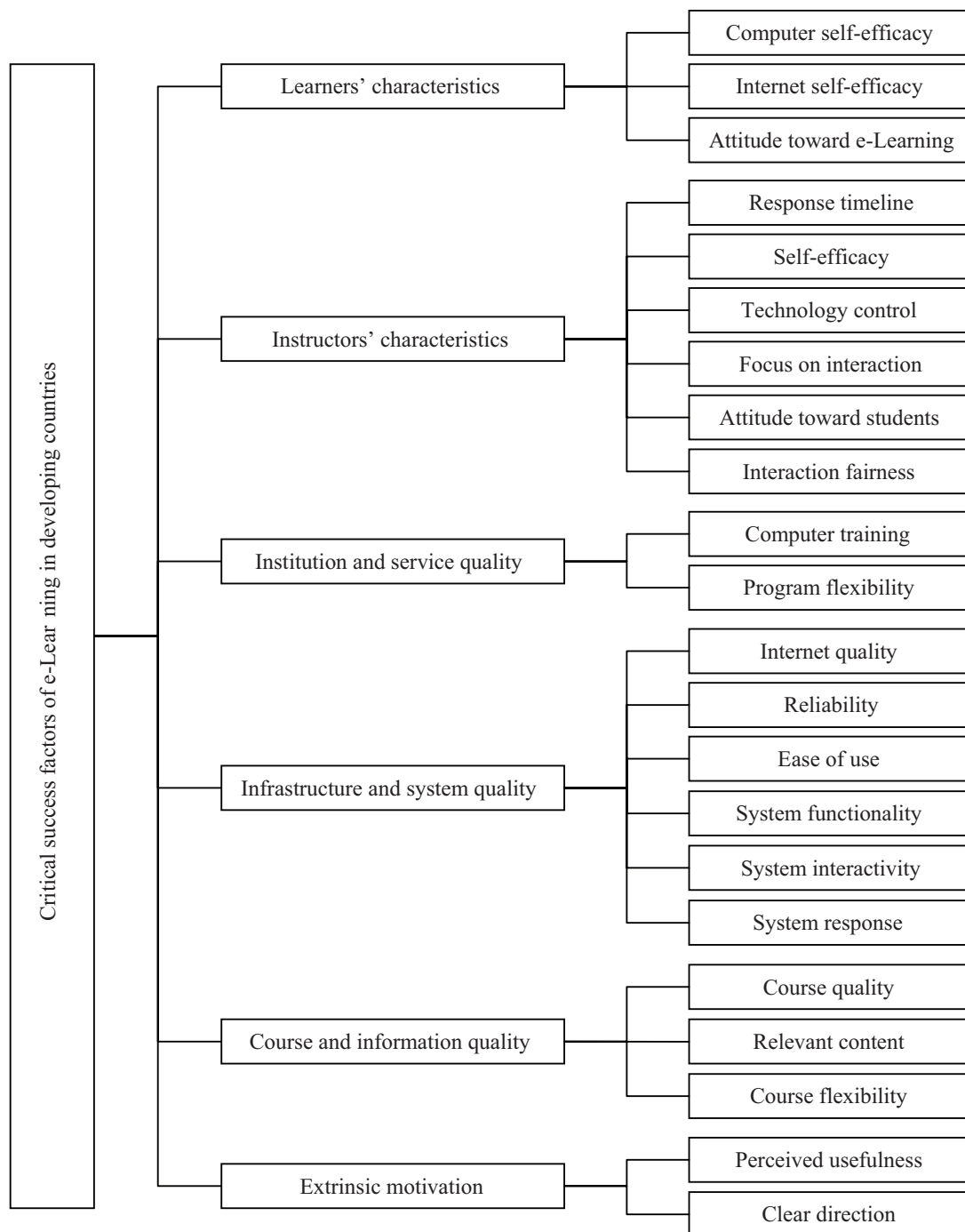
2. AHP approach

Based on the results of the Delphi Method and the AHP steps, the authors derived 22 CSFs through the in-depth survey of the experts. Using the gathered information, the authors designed a hierarchical structural model of e-Learning success in developing countries as shown in Figure 1. The first layer was the research objective; the second layer was the dimension; and the final layer was the critical success factors influencing e-Learning success. Next, the authors developed 53 pair-wise comparative matrices with 38 pairs of comparative factors and 15

pairs of comparative dimensions based on Bozbura, Beskese, and Kahraman (2007). The questionnaires were distributed to the same group of experts on 1 December, 2010. The authors asked the experts to make comparisons among the elements in each level based on their knowledge and experience in e-Learning issues. In each pairwise comparative matrix, the experts were asked to choose which one of two elements was more important and how much more important it was than the other by rating the level of importance from equal importance to extreme importance in the pairwise comparative matrices. In the final step, the authors went through a weighting process dependent upon the experts' ratings and calculated the weight of each factor using both Microsoft Office Excel spreadsheet software and AHP software. The authors assigned a value of 1 to the element when the expert rated that element as having equal importance compared with another element and assigned a value of 3, 5, 7, and 9 corresponding to judgments of slight importance, important, very important, and extreme importance, respectively. The study followed Saaty (1980) so that the consistency ratio was not to be bigger than the acceptable consistency rate of 0.10. More detail of the AHP process can be found in Saaty (1980, 1994) and Chen and Wang (2010).

RESULTS

Based on the Delphi methodology above, data were calculated from the returned questionnaires from the 47 experts. For both the first and second round surveys of the Delphi study, there was a 100 percent response rate from the 47 participants. In the first round survey, 41 factors were identified. The detailed factors were allocated to dimensions. As a result of the second round survey using the Delphi method, the final construct was reduced from 41 to 22 factors (Figure 1) and was adopted as the framework. The percentage of agreement or consensus in the final 22 constructs was higher than 76 percent; thirty-six experts (76.60%) out of 47 experts rated

ObjectiveDimensionFactors**Figure 1** Hierarchical framework for critical success factors of e-Learning in developing countries

instructor's attitude toward student as being important or very important on the Likert scale and 45 experts (95.74%), which was the highest percentage, rated learner computer self-efficacy and the instructor response timeline as important or very important on the Likert scale. The mean and standard deviation of each construct were also calculated and shown to experts for another round of surveying. Nineteen items with a rating mean lower than four were considered as unimportant factors and were removed.

Twenty-two factors were found to influence e-Learning success in developing countries. Forty-seven AHP questionnaires were then distributed to the same group of experts and 44 responses were returned. The authors used the response data to calculate the weight for each factor using AHP software and the Microsoft Excel 2007 spreadsheet software and checked the consistency ratio (CR) on the basis of Saaty (1980, 1994) who recommended that the CR or the ratio of consistency index (CI) divided by the random consistency index (RI) should be equal or smaller than 0.10 in order to demonstrate the degree of consistency to be satisfactory, whereas serious inconsistencies would arise or the findings might not be meaningful if the value of CI/RI was bigger than 0.10. For the present study, 41 replies to the questionnaire achieved the required consistency ratio, while three responses were removed because they had an unacceptably high value for the inconsistency ratio. The study produced a global ranking of the important sequential factors from the largest to smallest of: computer training, perceived usefulness, learner attitude toward e-Learning, learner computer self-efficacy, course quality, program flexibility, clear direction, relevant content, course flexibility, learner internet self-efficacy, Internet quality, system reliability, instructor response timeline, system ease of use, instructor self-efficacy, instructor's technology control, instructor's focus on interaction, system functionality, instructor's attitude toward student, system interactivity, instructor's interaction fairness, and system response. These results indicated that the top four factors and their global ranking

weights that affected the e-Learning success in developing countries were: computer training (0.08537), perceived usefulness (0.08198), learner attitude toward e-Learning (0.07082) and learner computer self-efficacy (0.07072), while the lowest factor was system response with a global ranking weight of 0.02122. The overall weights and rankings of the factors are shown in Table 1.

DISCUSSION AND IMPLICATIONS

The primary goal of the research was to prioritize factors influencing e Learning success in developing countries using both Delphi and AHP approaches. The research results indicated six important sequential dimensions that were (from largest to smallest based on their weight of importance): learners' characteristics play an important role for e-Learning success; without the user, good systems will be useless; infrastructure and system quality influence learners and instructors to use the system; instructors' characteristics, course quality and service quality would help students to learn better and increase e-Learning course attendance; and extrinsic motivation plays a more important role than intrinsic motivation in e-Learning issues. Therefore, increasing extrinsic motivation seemed to be a good approach to persuade learners to participate in e-Learning. The six dimensions with 22 factors showed significantly positive effects on e Learning success in developing countries. This evidence also suggested the recommendation that when planning to deploy an e-Learning system, these six dimensions should be thought over carefully.

Based on the research findings, this study suggested many practical implications for policy makers in government organizations, institutions or universities, and system developers. For government policy makers responsible for e-Learning strategy and planning, there are several suggestions. First, the top four critical success factors identified were: computer training, perceived usefulness, attitude

toward e-Learning, and computer self-efficacy. These top important factors indicated that learners and instructors lacked neither knowledge on the benefit of utilizing ICT for education nor the skills in using both computers and the internet. Policy makers should, therefore, focus not only on system development, but also on planning to enhance knowledge, skills, and awareness of utilizing ICT for educational purposes. Promoting e-Learning and providing computer and Internet training to society should be an important step in developing countries. Finally, in order to increase the acceptance of e-

Learning, the authors recommend that infrastructure and system quality should also be addressed which should include good system designs as a crucial consideration.

The research results indicated that 22 CSFs should be under the responsibility or the management of institutions or universities. Universities should be centers for e-Learning management. There were several implications for universities. First, according to the top ten ranking factors, to enlarge the number of users in e-Learning service and achieve success in e Learning implementation require universities to

Table 1 Weight calculation of the factors influencing e-Learning success

Dimension	Factor	Weights of Local ranks	Weights of Global ranks	Ranking (Local)	Ranking (Global)
Learners' characteristics (0.1889)	Computer self-efficacy	0.3745	0.07072	2	4
	Internet self-efficacy	0.2503	0.04727	3	10
	Attitude toward e-Learning	0.3750	0.07082	1	3
Instructors' characteristics (0.1706)	Response timeline	0.2075	0.03540	1	13
	Self-efficacy	0.1948	0.03324	2	15
	Technology control	0.1592	0.02716	3	16
	Focus on interaction	0.1590	0.02714	4	17
	Attitude toward student	0.1512	0.02579	5	19
Institution and service quality (0.1515)	Interaction fairness	0.1282	0.02187	6	21
	Computer training	0.5635	0.08537	1	1
	Program flexibility	0.4365	0.06612	2	6
Infrastructure and system quality (0.1810)	Internet quality	0.2254	0.04080	1	11
	Reliability	0.2015	0.03647	2	12
	Ease of use	0.1883	0.03408	3	14
	System functionality	0.1441	0.02608	4	18
	System interactivity	0.1234	0.02233	5	20
Course and information quality (0.1687)	System response	0.1172	0.02122	6	22
	Course quality	0.3932	0.06634	1	5
	Relevant content	0.3072	0.05184	2	8
	Course flexibility	0.2294	0.05052	3	9
Extrinsic motivation (0.1394)	Perceived usefulness	0.5880	0.08198	1	2
	Clear direction	0.4120	0.05746	2	7

provide computer and Internet training to enhance the knowledge and ability of both instructors and learners. This will entail making a deliberate decision to promote e Learning by motivation planning with clear direction, to provide good service quality, and to develop course flexibility with courses of good quality and content. Second, increasing instructor ability and awareness is important for institutions. Instructor training, knowledge sharing, and collaboration among instructors, as well as between instructors and ICT coordinators are indispensable. Finally, due to the influence of system characteristics on the user's intention to use the system, universities should select outsourced companies with skilled and experienced system developers to develop the e-Learning system.

For system developers responsible for e-Learning system design, there are several suggestions. First, since the ease of use is a key factor influencing system adoption, system developers should provide a user-friendly interface and design an information flow compatible with the user's work style. Secondly, well designed system characteristics (system functionality, system interactivity, and system response) should be targeted as important issues that increase the user's desire to use the system; for example, a system with a better response time would allow learners to better access learning content; a system with effective interaction, so that learners and instructors would perceive that the system is helping them to learn better; and system functionality that would enable effective interaction and access to course content. System functionality was found to play an important role for learners and instructors using the system.

CONCLUSION

The study was conducted to identify and prioritize critical success factors for e-Learning in developing countries with analysis conducted using Delphi and AHP approaches. The results provided weightings for 22 impact factors for e-Learning

success in developing countries, of which the greatest influence was computer training, the second most important was perceived usefulness, while the least influence among the 22 factors was system response. Therefore, to achieve success in e-Learning implementation in developing countries, related agencies should promote and educate the user on the benefits and efficiency of using ICT for education together with providing computer and Internet training as the first needed step. For future research, the authors hope there would be more research exploring this issue through empirical studies with different groups of users to clearly identify the critical success factors from the perspective of learners.

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