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Evaluating Intertwined Critical Success Factors for Sustainable E-learning

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Evaluating Intertwined Critical Success Factors for Sustainable E-learning

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Abstract

Successfully leveraging knowledge transfer in distributed e-learning requires effective combination of pedagogies, technologies, and efficient management of learning resources. As a result, identifying and evaluating the critical success factors within each of these facets is vital for the success of e-learning. This paper explores the critical success factors intertwined within the learning ecosystem namely pedagogy, technology and management of learning resources in a higher education e-learning environment. Adopting a hybrid approach consisting of a systematic literature review and interviews with experts in e-learning, this paper shows that there is a discrepancy between theory and practice in e-learning in regard to the application of pedagogies, use of technology, and management of reusable learning objects. This implies that there is a need for tackling various issues regarding the adoption of appropriate e-learning strategies, knowledge sharing, quality, granularity and reusability of learning object for sustainable e-learning.

Keywords

E-learning, reusable learning object repository, learning object, metadata, ontology

INTRODUCTION

Phenomenal growth and popularity of e-learning is evident from the escalating number of courses offered online in education. The successful and sustained adoption of e-learning necessitates an effective combination of pedagogies, technologies and effective management of resources. However, the effective implementation of e-learning requires an appropriate evaluation of the critical success factors entwined among each of these facets. The lack of rigorous evaluation studies in e-learning has been expressed by a number of researchers, including Howell et al. (Howell et al. 2004) and Swan (2003). To quote Swan (2003), 'we know online learning is effective. What we need to know is what makes it good and how we can make it better'. In this background, this research aims to explore the critical success factors intertwined within three critical components of e-learning namely, pedagogies, technologies and management of learning resources for successful and sustainable e-learning.

Existing research in e-learning pedagogies mainly focuses on the identification of various pedagogic strategies to facilitate effective leverage of knowledge in an e-learning environment. The constructivist principles of learning are adopted for enhancing the effectiveness of e-learning. In this direction, several strategies have been identified for enhancing the use of deep learning methods through active student-centred learning approaches such as collaborative learning, interactive learning, explorative learning, adaptive learning, use of concept mapping techniques, and blended learning. However, the real success of these strategies depends on the technologies that facilitate the effective implementation of strategies and the effective management of learning resources generated from various strategies (Demidova et al. 2005).

Evaluating various functions and features of existing technologies for e-learning (Kim and Lee 2007) such as Blackboard, WebCT, TopClass, Learning Space, First Class, Moodle, and Virtual Laboratory, assists with the identification of systems and specific features of these technologies to enhance effective e-learning. However, these systems are demonstrating to be ineffective (Hatem et al. 2005), both with respect to pedagogy support and management of learning resources. Tackling this ineffectiveness, existing studies have explored a variety of technologies to further scaffold individual strategies.

In regards to the management of learning resources, general studies (Nonaka and Toyamma 2003) as well as studies with particular reference to e-learning (Demidova et al. 2005; Yang et al. 2006) focus on the importance of considering management factors to enhance e-learning effectiveness. Two interrelated aspects of managing learning resources need to be tackled for materialising the real potential of reusable learning object repository (RLOR). The first well-established issue relates to the effective management of learning resources in the form of

capturing, eliciting, organisation, retrieval (Nonaka et al. 2003) and reuse of various learning resources. The second issue concerns about the identification of characteristics describing learning resources for reusability. Addressing this issue, a review of existing literature unveils the development of various standards nationally and internationally (Brase and Nejdil 2003). However, these general-purpose standards do not take into account the relationship between the concepts and the pedagogy-specific elements for effective reusability.

In this background, adopting a new paradigm of e-learning ecosystem, which considers the entwined aspects of pedagogies, technologies and learning resources, proves to be fruitful for facilitating sustainable e-learning success. The learning ecosystem focuses on the interaction between stakeholders (learners, teachers and tutors), learning resources, pedagogies, learning ecosystems conditions determined by external and internal influence (learning objectives, knowledge evolution, peer pressures etc.), and technologies, tools and systems supporting knowledge acquisition process (LMS).

Despite numerous independent studies on the three essential facets of effective e-learning, little definitive research is available considering entwined aspects of learning, teaching strategies, technologies and management of learning resources (e-learning ecosystem). In this context, evaluating intertwined and inter-affected factors influencing e-learning effectiveness is critical for the success of e-learning (McPherson and Nunes 2008). To fill this gap, this study aims at identifying and evaluating intertwined critical success factors of all three components of e-learning effectiveness. To achieve this objective, the research question for this study is defined as follows: *how to evaluate critical interrelated factors of pedagogical strategies, facilitating technologies and management of reusable learning resources from those strategies, concurrently for enhancing effectiveness of e-learning?*

The purpose of this research is (a) to identify comprehensive critical pedagogical strategies contributing towards literature in e-learning, (b) to identify critical success factors, including technological factors, scaffolding each pedagogical strategy to facilitate successful implementation of strategies in reality, (c) to identify critical management factors with the aim of adding value to existing studies in management of learning resources and (d) to identify the comprehensive critical metadata and ontology elements required for realising the semantic web vision, towards creation of a sustainable RLOR in a higher education e-learning environment.

The remainder of this paper is organized as follows. Section 2 covers the definition of relevant terms and presents a review of related work. Section 3 presents the research design and methodologies adopted. Section 4 summarizes the research findings. Section 5 concludes the paper with the discussion of future research.

BACKGROUND AND RELATED STUDIES

The central theme of e-learning is to leverage transfer of knowledge, not just from the experts to learners but also from learners to learners, including both tacit (informal knowledge) and explicit knowledge (formal knowledge), through various means facilitated by information and communication technologies (ICT). In this research a very broad definition of e-learning is adopted encompassing online learning, virtual learning, distributed learning and web-based learning. Apart from this, this study considers both partial and full online learning as part of e-learning to enable wider coverage of issues relating to transition from traditional learning to online learning. Also e-learning in this context includes all four modalities represented by Romiszowski (2004) namely e-learning online, e-learning offline, e-learning synchronously and e-learning asynchronously. A key factor for the success of e-learning is the effective management of learning resources derived from these learning activities, through the application of knowledge management principles. In this context, knowledge management is widely referred to as an integrated and systematic process of acquiring, eliciting, organizing, representing and retrieving information and knowledge in an e-learning environment (Duffy 2001). Embracing recent developments in semantic web approaches and e-learning ecosystems can pave way for the successful and sustainable e-learning solutions.

The semantic web is an extension of the current World Wide Web, which envisions intelligent information processing (Berners-Lee et al. 2006). To make the semantic web vision a reality, structuring and standardizing information is essential. Two key components facilitating the semantic web vision are metadata (learning object metadata (LOM) in an e-learning context) and ontologies. Metadata is “any data which conveys knowledge about an item without requiring examination of the item itself” (Haase 2004). Metadata contains structured information about an information or learning object (LO). In an e-learning context, learning object metadata (LOM) are central components of learning objects (Brase et al. 2003), facilitating the standardization of learning resources. Ontologies are “the meta data schema providing a controlled vocabulary of concepts” (Maedche et al. 2002). In simple words, ontology is a document or file that formally defines the relationship among terms.

E-learning ecosystems “are a system whose members benefit from other’s participation via symbiotic relationships” (Dillon and Hallett 2001). The term originated from biology refers to self-sustaining systems. The components of e-learning ecosystem include web-based training, online university, learning objects, electronic performance support systems, collaboration and intelligent search (Dillon and Hallett 2001).

The review of literature in this section are organized into three major themes, namely pedagogic strategies and technologies supporting pedagogies, and issues related to effective management of learning resources. Apart from the provision of passive learning resources, numerous studies have reinforced the idea for enhancing the effectiveness of e-learning through employing constructivist approaches in learning and teaching. Based on this constructivist learning philosophy, existing literature contains numerous articles promoting student-centred active learning strategies to enhance teaching and learning effectiveness in online learning. Some of the popular approaches identified from the literature include active learning (Alexander and Boud 2001), collaborative or cooperative learning (McConnell, 2005, Anderson 2003), explorative learning (Handschuh and Staab 2003), adaptive learning (Brusilovsky, 2004), concept mapping techniques for representing knowledge (Novak 1998) and blended learning (Lynch et al. 2001).

The key to fulfil the widely accepted Bloom's taxonomy (Bloom 1956) of educational objectives, namely knowledge, comprehension, application, analysis, synthesis and evaluation, is the adoption of learner-centred approaches to teaching and learning. Towards this, facilitating the development of e-learning environments for **active** participation by the learners, through interaction with domain experts or through 'hands on' experience through various means such as computer assisted self assessment quizzes (Bongey et al. 2005) or intelligent tutoring systems is essential. Sharing ideas and responding through **collaborative** learning improves thinking and deeper understanding (Chickering and Gamson 1998). Extensive use of three forms of interaction, namely student-teacher, student-student and student-content are recommended in Anderson (2003) to materialize meaningful and deep learning. **Explorative** learning requires access to rich authentic and alternative sources of information. Through explorative learning, meaningful learning happens through reflection (Or-Bach 2005) and active exploration by uncovering inconsistencies in understanding and experience (Dalgarno 2001). One of the key catalysts for exploratory e-learning strategy is to provide access to alternative resources in an e-learning environment. Recognizing the static nature of e-learning which amounts to "one size fits all" (Brusilovsky 2004), an **adaptive** learning system is proposed to adapt to the levels (beginner, intermediary and advanced), styles and preferences of individual learners. **Concept maps** (Chmielewski and Dansereau 1998) are visual representations of subjects, which facilitate the sharing, exploring, acquiring and synthesizing of knowledge. In this process, learners construct semantic relationships between concepts, knowledge and skills engaging both learners and instructors (Saad and Zaghloul 2002). In Condie and Livingston (2007), **blending** the traditional classroom based learning with online components is suggested for enhancing effective learning.

With respect to evaluating pedagogy specific aspects in enhancing the e-learning effectiveness Anderson (2003) in fact suggests that there is a positive correlation between supportive online environments through appropriate strategies and learning outcomes. Rourke and Anderson (2002) show that case-based learning is favourable for stimulating deep learning in distance learning. Alonso (2005) proposes a psycho-pedagogical e-learning model for taking into account the content structure, cognitive process and interaction. Draskovic (2004) examines the relationship between variables in learning mechanisms in collaborative learning. Or-Bach (2005) demonstrates that reflection activities can help learners better refine their understanding and reinterpreting capabilities in e-learning. All these above show that there is a positive correlation between adapting to cognitive preferences of learners and improved learning outcome (Aldridge et al. 2004; Dorman 2002).

The successful adoption of these strategies, however, requires appropriate technologies to implement these strategies. Various studies have examined the use of ICT to enhance e-learning (Reynolds et al. 2003; Wellington 2005). A number of ICT innovations such as broadband Internet access, weblog tools, RSS (Real Simple Syndication) facilities, Podcasting, ScreenCasting, Open source software (Moodle, SAKAI in learning management systems), Open source content (Wikiedia, MIT open source courseware), google scholar etc. have a great role to play in enhancing learner-centred active e-learning.

Several variations to the evaluation of technology-specific aspects of e-learning are dealt in Chandra et al. (2007), Kim et al. (2007), Landon, (2007), and others. For example, Chandra et al. (2007) ascertain a positive impact of information and communication technology (ICT) on improving student performance. The empirical study by Kim et al. (2007), appraises LMS using 81 validation items to help educators select a particular LMS. Landon (2007) evaluates various functions and features of LMS. Ng's (2007) investigation concerns with evaluating a synchronous e-learning system, namely Interwise. The work in Miah (2004) deals with identification of three critical factors in an education website, namely usability, learnability and technical functionality for an effective educational website. However, these evaluation models lack consideration into reusable learning resource management criteria which is intertwined with the learning strategies.

The true e-learning effectiveness transpires from effective management and reusability of these resources. LOM and ontologies are essential for effective reusability and interoperability of learning resources. The current state of the art technologies in LMS such as blackboard, WebCT are not effective (Hatem et al. 2005) in managing learning resources for reusability. To implement an effective management of learning resources enabling reusability and interoperability, it is important to identify and standardize metadata elements describing these resources. Towards this objective, there are several research and standardization efforts in identifying elements

to describe reusable learning objects. To facilitate standardization, various metadata standards have been developed for learning objects including Dublin Core, IEEE LOM, IMS Learning resource meta-data, SCORM (Shareable Content Object Reference Model) and Cancore for Canadian learning resources. Sicilia (2006) evaluates the usability of learning objects with specific characterization of the concept of learning object usability. However, these standards are confined to simple structure and lacks catering to specific context and do not take into account the relationship between concepts to fulfil the semantic web vision. Integrating ontologies (Gruber 1995) with metadata can enhance the reusability features and effective management of learning resources to realize the RLOR objective with semantic web technology. However, these general-purpose LOM do not take into account the interrelationship between concepts

Dealing with these issues, researchers like Jovanovic (2006), Stojanovic (2001), and Gasavic (2006) have identified and recommended ontology-based elements to describe learning resources. For instance, an ontology-based framework to represent context-specific metadata is presented in Jovanovic (2006). Stojanovic (2001) proposes an ontology-based metadata description of content, context and structure of the learning materials to enable flexible and personalized access to learning resources. Ontology-based mapping framework (Gasevic et al. 2006) is proposed to effective searching of learning resources using multiple ontologies. Delteil et al. (2001) propose semantic knowledge representation and Theodorakis et al. (2002) recommend context based approaches for accessing information on the Internet. Richards and Hatala (2005) suggest semantic relationship between concepts through ontology-based knowledge structure providing context specific access to information for effective e-learning. Researchers including Huang et al. (2003) have proposed ontology-based semantic web technology to facilitate and enhance management of e-learning resources.

However there are various limitations in directly applying these elements for effective management of RLOR. First, a phenomenal amount of effort and time is required to create, update and maintain RLOR along with LOM. There is a trade-off between a comprehensive coverage of elements to describe LO and the successful management of sustainable LOR. Sustainable LOR necessitates a simple and limited number of coverage of elements describing LO. To fulfil this objective, identification of a minimum number of critical elements describing learning objects as perceived by stakeholders of e-learning is essential. Second, these standards have a limited direct applicability in pedagogy-specific e-learning resources. Different attributes are required for describing different types of resources generated from different strategies. Towards overcoming these limitations, this study proposes inclusion of comprehensive critical pedagogy-specific elements for a sustainable RLOR.

To summarize, despite a lot of disparate studies on evaluating critical factors for effective e-learning factors and on management of learning objects, there is a paucity of research in the area of evaluating critical interrelated issues of pedagogical strategies, technology supporting various strategies and management of learning resources generated from various strategies. In this context, this study aims at assessing entwined aspects of these e-learning ecosystems to have a maximum positive impact on e-learning.

METHODOLOGY

This study aims to identify and evaluate the critical success factors based on the perceptions of key stakeholders in an e-learning environment. The three areas of investigation include identification of comprehensive pedagogy-based factors, technological factors to support each of those strategies and identification of comprehensive learning resource management factors including metadata and ontologies, to fulfil semantic web vision in an e-learning environment. Accordingly, the null hypothesis for this research is defined as follows: e-learning effectiveness is a function of effective adoption of various learning strategies, associated technologies and effective management of learning resources generated from various learning strategies for enhancing reusability.

The study consists of a systematic review of the literature on critical pedagogical approaches, technologies supporting those pedagogies and management of learning resources in an e-learning context. This review is supplemented by interviews with education providers in an e-learning context. The objectives of the interview are to identify whether the identified critical factors from literature are grounded in reality and to identify interrelated factors scaffolding pedagogies, technologies and management. The use of this qualitative approach to information gathering is to allow for triangulation of data and to increase the reliability and validity of the findings. The research design for this study is given in Figure 1.

The systematic literature review was conducted by searching various databases. The databases searched include Blackwell Synergy, IEEE Explore, Science Direct, Springer Link, Sage Publication, Wiley Interscience, Web of Science, Emerald, Proquest, e-books, various online educational journals such as International Review of Research in Distance Education, google scholar etc. The search strategy in this research includes “e-learning” or “online learning” or “web-based learning” limited by terms search such as “evaluation”, “empirical study”, “technology factors”, “pedagogy factors”, “management factors”, “effectiveness”, “critical factors”, “ontologies

factors” “metadata factors”, “learning object metadata” etc. In summary a total of 365 references were obtained. This clearly indicates the popularity of e-learning and significance of these issues in an e-learning context.

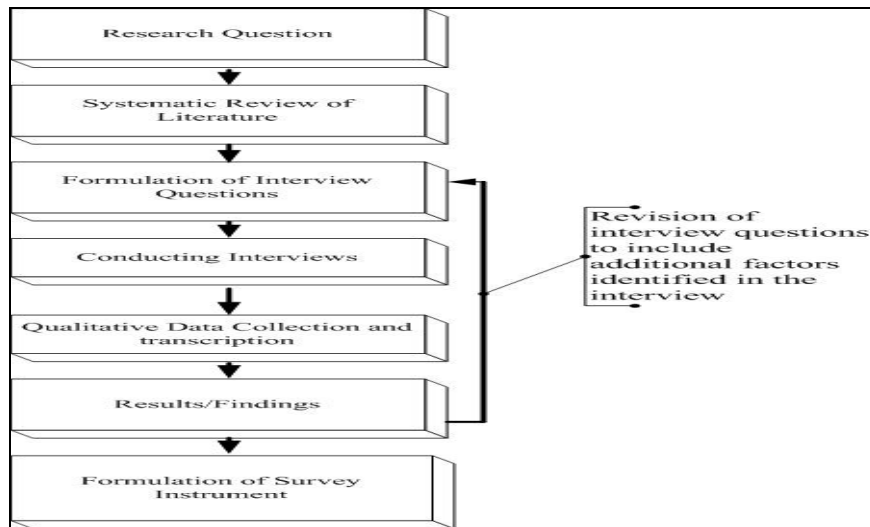


Figure 1: Research Design

An interview based approach was considered appropriate for this e study, as one of the objectives of this research was to get insight into the critical success factors in an e-learning environment as perceived by stakeholders. This method was identified as appropriate to ascertain the perceptions of the stakeholders in e-learning which can match with the factors identified through literature review. The sample in this study consisted of 29 interviewees. For this purpose, the experts were drawn from wide range of division namely strategy and policy division, library and learning resource management division, technology and media division and teaching experts in an e-learning environment. All interview participants were very knowledgeable in the e-learning area and aware of various types of e-learning such as blended learning, fully online, online supplementary etc. and a few are working in the area of RLOR. Interview representatives come from five universities and OUA representatives in Melbourne, Australia, offering higher education through distance learning mode. Identical interview protocol was followed for each interview. A summary of interview questions is given in Table 1.

Table 1. Summary of Identified Critical Factors

General	Strategy Related	Management Related
Role of the interviewee	Passive	Initiatives
General Perception	Interactive	Capture of knowledge and LOM
Use of LMS	Collaborative	Sharing of information
Technology Use	Adaptive	Organization of LO
Levels of courses taught	Explorative	Authentication of LO
Specialization area	Concept Mapping	Retrieval facilities
Institutions	Blended Learning	Distribution and reusability
Other	Other Strategies	Other
Impacts	Strategy Factors	Characteristics of LO
Retention rate	Type of Strategy	Metadata details
Learning outcome	Supporting Technology	Content details
Satisfaction	Types of LO	Context details
Motivation	Managing LO	Structure details
Communication	Other factors	Validation details
Career development		Learning Profile details
Other		Other

The interviews were comprised primarily of semi-structured and open ended questions tailored for follow-up interviews based on the response. The interviews lasted from 30 minutes to an hour. Each interview was

recorded in a digital recorder. These were supplemented by interview notes. Of the sample of five Universities, three of them are offering courses through the Open University Australia (OUA) program dedicated completely to distance education. Table 2 provides a more detailed account of the respondents. Three academic faculty members reviewed the interview questions to establish the validity and reliability of the measure.

Table 2. An Overview of Interview Participants

University	No. of Participants	OUA	Role of Participants
RMIT University	10	Yes	3 Policy/Decision making role, 2 library information management role, 1 media division, 4 teaching role
Monash University	10	Yes	1 Policy/Decision making role, 9 teaching role
Deakin University	4	No	1 Policy/Decision making role, 3 teaching role
Swinburne University	2	Yes	1 Policy/Decision making role, 1 teaching role
Victoria University	1	No	1 Policy/Decision making teaching role
Open University Australia (OUA)	2	-	2 Policy/Decision making role

RESEARCH FINDINGS

The objective of this study is to evaluate the critical success factors with respect to pedagogical strategies, associated technologies and management of learning resources as perceived by key stakeholders. Based on this, the critical success factors associated with key e-learning components can be identified for extending the information gathering and analysis process.

Based on the findings from literature review and interviews, the critical success factors associated with key components of e-learning are identified as shown in Figure 2.. The three major components identified for building a base for future research include general factors, strategy-specific factors, management factors and impact factors to assess the perceived effectiveness of e-learning. Strategy factors are assessed taking into account five strategies for effective e-learning. Within each, strategy-specific factors, including supporting technologies and generated learning resources, are identified to enhance its success. Comprehensive characteristics describing metadata and ontologies are covered under six sub-topics. They are basic details, content details, context details, structure details, validation details and learner profile details catering to different types of resources generated from different strategies.

The growing popularity of e-learning is evident from the concerted efforts taken towards improving the delivery of courses via e-learning mode. The interview shows that all five universities have some strategic plan towards enhancing e-learning facilities. For instance, a policy of minimum online presence has been introduced in one university. This necessitates online presence in each and every course offered in the university. Towards this objective, a strong move towards blended learning approach is recommended. One of the methods identified was the provision of online lectures through Podcasting and Lectoria to local students to enable learners to revisit the lecture for reinforcing the knowledge construction process. However, it was felt by a few interviewees that the resultant lack of attendance to lectures by students prevents them from providing such a facility. It was also felt the need for a mechanism whereby, the online lectures are available to only those who attended the lectures or genuinely missed due to valid reasons. Similarly a few interviewees mentioned the university's policy of integrating e-learning into curriculum through compulsory completion of at least one course via online delivery of education. Additionally, to overcome the lack of sense of belonging among e-learners, having a personal touch through phone calls and personalized feedback to learners are observed to be effective.

With respect to e-learning strategies the interviews corroborated the perceived effectiveness of student-centred strategies identified from literature to enhance e-learning effectiveness. All the interviewees recognised the value of using multiple strategies to enable meaningful learning to take place. However, various difficulties were identified towards implementing the same. One of the consistent drawbacks identified by the interviewees includes the ineffectiveness of LMS in incorporating multiple strategies to enhance student-centred active learning process. In this regard, four out of five universities use Blackboard as their course management system for online delivery of courses. Even though the interviewees appreciated the benefits of commercial LMS in terms of support system in case of emergency, having all components in a single package and the single interaction point, it had its own limitations. For example, it was felt that LMS is ineffective towards catering to differences in cognitive styles and preferences, encouraging active and interactive learner participation and use

of concept mapping techniques. Even though it supports collaborative learning environment, its effectiveness is limited towards catering to specific features such as automatic notification of postings, advanced search facilities based on certain attributes etc. To circumvent the LMS limitation, one interviewee mentioned incorporating the concept mapping technique using in-built road map tool within MS power point presentation. Another interviewee used strategies such as game-based learning, interactive learning with feedback mechanisms through provision these facilities outside the course LMS.

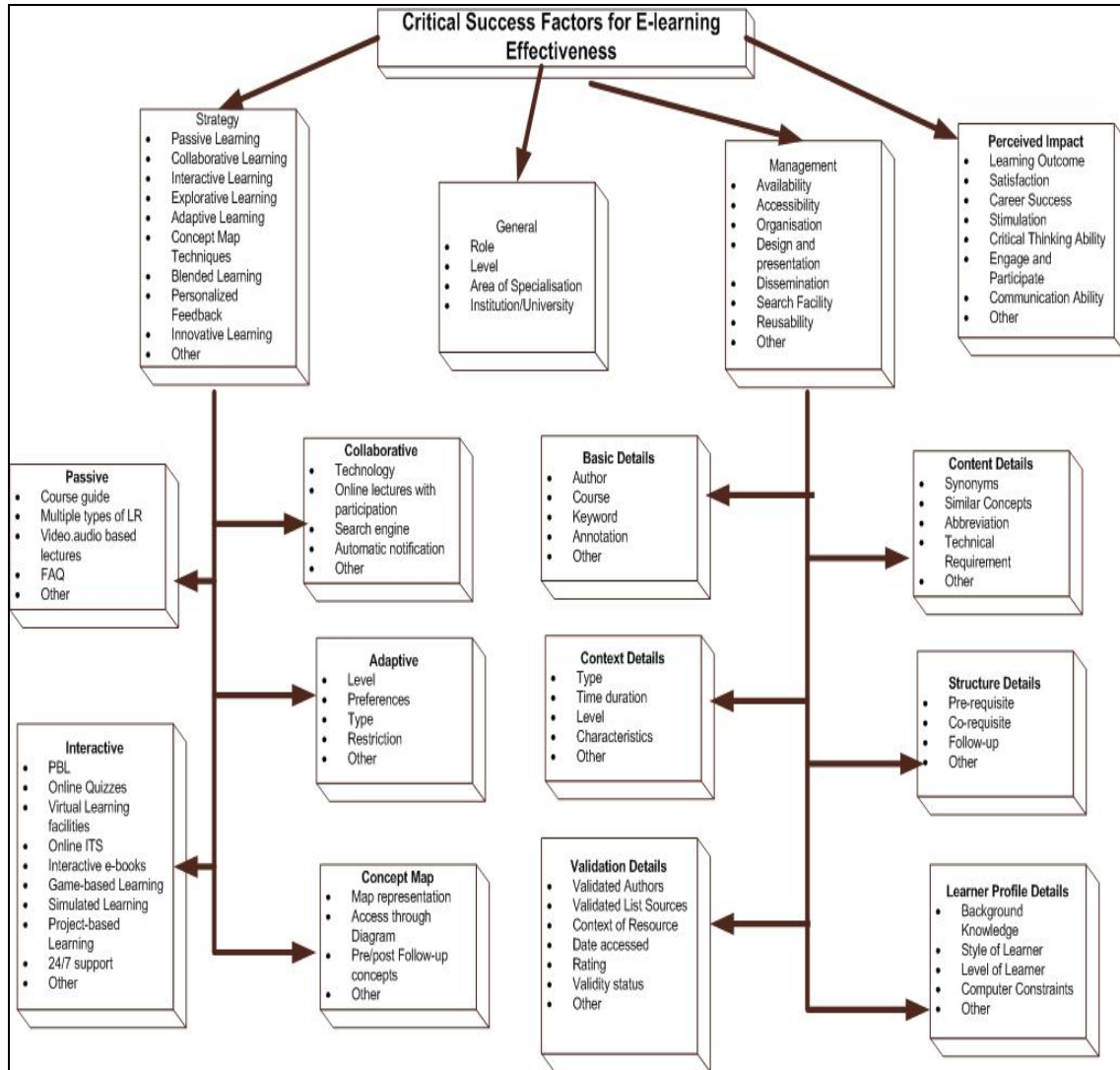


Figure 2: Comprehensive Critical Success Factors

According to one interviewee, effective e-learning should result in progress of learners from concept understanding to comprehension and finally to the learner's ability to apply in real world. To materialize this objective, it was felt that incorporation of various interactive teaching and learning approaches, such as simulated learning, case-based learning, problem-based learning, and scenario based learning etc, are crucial for e-learning success with or without the support of LMS. In essence, use of technology scaffolding active student-centred learning strategies in a given course can be seen as a peripheral activity but yet to become a mainstream reality. Another important barrier mentioned by some interviewees includes lack of adoption and embracement of e-learning and technological innovation, especially by senior teaching staff. This is perceived mainly due to resistance to change and inability to cope with the demands of the new digital generation of learners. It was felt that the provision of comprehensive training for both students and learners to proactively embrace new innovative technologies can overcome some of these barriers.

With regard to management of learning resources and associated LOM for interoperability and reusability, it was unanimously felt by interviewees that there is little support with respect to management and searching facilities within LMS for reusability of learning resources. It was strongly felt that the resources within LMS are

neither interoperable nor reusable. Any knowledge generated within a course environment can neither be transferred to a RLOR nor be reused by learners and teachers, unless special efforts are taken by individuals to store them in their own personal repository. In this regard, another key barrier identified for realizing the success of RLOR is knowledge sharing. Although all the interviewees acknowledged its importance, practical difficulties were identified in implementing the knowledge sharing culture. One of the main reasons was reluctance to share learning resources by a number of the teaching staff due to ownership issues. To circumvent this problem to an extent, some universities have a policy on ownership of resources. Accordingly, learning resources created by an employee during their association with the university belong to the university. Nevertheless, interviewees felt the difficulties in implementing without voluntary co-operation of the resource producer. To overcome this barrier and enable reusability, two of the five universities are in the process of integrating content management system (Equella) with LMS (Blackboard) where once learning resources are uploaded for a course, it will remain in the learning object repository for future reuse. Another important issue identified from the interviews were the quality of the resources, in terms of who is going to validate the resources and associated metadata details, which is a massive task. Granularity was another problem identified in the interviews in terms of where to stop a LO without losing the context and value of the resource. To sum up, the interview findings confirmed the literature findings with respect to identification of various strategies, associated technologies and adoption of multiple strategies to enhance e-learning effectiveness. However, policy measures need to be dealt with for effective implementation of identified factors and concerns for sustainable e-learning.

CONCLUSION AND FUTURE RESEARCH

Findings from the interviews provided a rich insight into the dynamics of various factors to enhance the effectiveness of e-learning. The perceptions of the interviewees with respect to the critical strategies factors and management factors are remarkably consistent with theory. However, this study reveals that there is a distressing gap between theory and practice with respect to adoption of various strategies to enhance e-learning effectiveness and the difficulties in creating reusable learning object repositories. Some of the barriers identified in the research include quality, sustainability of LOR, granularity of LO without losing the contextual value, barriers to sharing information and knowledge, copyright restrictions, version control and support from LMS to embed more pedagogical strategies. More concerted effort is required to adopt appropriate learning strategies and identification of possible ways to overcome the barriers to enhance e-learning success. A survey was developed based on the perceptions to include comprehensive strategies and comprehensive LOM to manage learning objects generated from the strategies.

This study is limited in a number of ways. The qualitative approach for information gathering from various stakeholders even though is appropriate for gathering the perceptions of stakeholders on what factors makes online learning effective comes with various limitations. First, due to small number of samples, sampling errors can arise. To some extent, efforts have been taken to reduce the sampling error through covering participants from different universities and wide range of participants. Second, the small sample size means that the observations can not be generalized. Interviews and literature based on the qualitative research has the limitation of lack of generalization. Third limitation includes exclusion of learners, an important stakeholder in the e-learning environment due to problems in obtaining ethics approval. However, instrument developed from this research will be used to expand the research to do a confirmatory research study. More in-depth studies will be needed to gain more insight into the factors influencing the effectiveness of e-learning environment. Future research in this area includes collection of information from larger samples through survey to provide a statistically supported generalization. Also, in order to compare ideal factors identified in this research with actual factors in reality, future study will explore into identification of the gap between potential and actual to enable effective policy decisions for enhancing effective e-learning.

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