What Makes an LMS Effective
A Synthesis of Current Literature

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Abstract: There is a growing number of organizations and universities now utilising e-learning practices in their teaching and learning programs. These systems have allowed for knowledge sharing and provide opportunities for users to have access to learning materials regardless of time and place. However, while the uptake of these systems is quite high, there is little research into the effectiveness of such systems, particularly in higher education. This paper investigates the methods that are used to study the effectiveness of e-learning systems and the factors that are critical for the success of a learning management system (LMS). Five major success categories are identified in this study and explained in depth. These are the teacher, student, LMS design, learning materials and external support.

1 INTRODUCTION

Providing an environment for e-learning (electronic learning) and more recently the notion of blended learning in the Higher Education sector has increased the need for these institutions to invest in learning management systems (LMS) to support teaching and learning. This can be viewed as an attempt to be more competitive by attracting a larger market share of students (Turner and Stylianou, 2004). At first, e-learning systems were mostly used to provide external and distance education modalities and to offer more flexibility for external students (Mason, 2006; Allen and Seaman, 2007). However, e-learning has been considered an essential part of the teaching and learning process for many Higher Education Institutions (HEI) and many of these institutions are further adopting a combination of face-to-face (F2F) learning and e-learning (Keengwe and Kidd, 2010; Palloff and Pratt, 2001), which is referred to as blended learning. Rapidly growing developments in information and communications technologies (ICT) provide an opportunity for students to learn in a more flexible environment where access to learning materials and resources is available at all times regardless of the time and place.

However, many users stop using virtual learning tools such as those embedded within an LMS after first practices (Sun et al., 2008). The continued use of the available tools is not high (Chiu et al., 2007) and the discontinuation of e-learning tools after the first adoption, occurs frequently. While initial adoption is an important success factor of using an e-learning system, continuous use is still required to achieve tangible success. Initial e-learning adoption and continued use of LMS tools are two significant concerns in this area.

In an attempt to further explore the LMS critical success factors, this paper reviews and synthesizes different approaches that have been used to study the effectiveness of e-learning systems and discusses the significant factors that help an LMS to be used most efficiently.

2 APPLYING A FRAMEWORK

In analysing and understanding the effectiveness of a particular system frameworks or models are often developed and applied to a body of work. It is within this context that computer human interaction, self regulated learning, collaborative learning, and e-learning acceptance studies, can aid in a deeper understanding of the critical issues that entice users to actively contribute within virtual learning environments. To study the behaviour of LMS users, an overview of seven of the most relevant studies is presented in this section.

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2.1 Technology Acceptance Model

The technology acceptance model (TAM) is a framework that has been applied in many technology adoption studies. Its focus is to predict and assess user willingness to accept technology. TAM investigates the relationships between perceived ease of use (PEU), perceived usefulness (PU), and attitudes and intention in adoption. User perception and attitudes toward the system is influenced by both these factors.

This framework can be used as a tool to predict learning satisfaction in virtual learning environments and show the perceived ease of use and perceived usefulness of the LMS that significantly affects student satisfaction (Pituch and Lee, 2006). The application of TAM in relation to LMS's identifies the *perceived ease of use* in student perception of using an e-learning system and the *perceived usefulness* in the perception of the learning enhancement level as a result of the adoption of the system. Perceived usefulness has more impact on intention to e-learning adoption than perceived ease of use which means if students find e-learning objects difficult to use they will rate them as less useful.

2.2 Unified Theory of Acceptance and use of Technology

Venkatesh and Davis (2000) extended the TAM framework and introduced cognitive instrumental processes and social influence as effective factors on perceived usefulness and usage intention and as a result introduced the Unified Theory of Acceptance and Use of Technology (UTAUT) model (Venkatesh and Davies, 2000). This framework was based on the findings of eight models in Information System (IS) adoption area. It hypothesized three factors that directly predict the intention to use an invention which are:

- *Effort expectancy* or perceived ease of use
- *Performance expectancy* or short term perceived usefulness and
- *Social influence*

It also argues that intention and facilitating conditions were direct predictors of usage behaviour.

2.3 Perceptions of Innovation Characteristics

The Perceptions of Innovation Characteristics (PCI) is yet another model that can be applied in e-learning acceptance studies. This model explains the key innovation attributes that impact on the user acceptance. Critical innovation attributes identified in this model are (Rogers, 1995):

- *Compatibility* which refers to the degree a system is consistent with the learner current requirements, values and previous experiences
- *Trialability* which specifies the user perception of a chance to try the system prior to using it on commitment
- *Relative advantage* which is the level of enhancement a system offers in comparison to previous tools for accomplishing the same task
- *Complexity* which is the level of perceived complexity to learn and use the system
- *Observability* which shows the result visibility of adopting the system

Moore and Benbasat (1991) extended the model to seven constructs including:

- *Compatibility*
- *Trialability*
- *Relative advantage*
- *Ease of use*
- *Result demonstrability* which explains how much the outcomes of using the system are tangible
- *Visibility* which is defined as "the extent to which potential adaptors see the innovation as being visible in the adoption context" and finally
- *Image* which is the feeling that using a system can enhance user social status

2.4 Expectation Confirmation Model

Expectation Confirmation Model (ECM) is a framework that has been applied to study the intention to continue using innovations. This model defines five constructs to explain the consumers level of satisfaction (Oliver, 1980). These steps are:

1. Customers form a preliminary expectation of a particular service or product before purchasing it.
2. Then they accept and make use of that service or product.
3. After a period of first consumption, users form conceptions about the service or product efficiency.
4. Then, consumers determine the level of confirmation of expectations by comparing their perceptions of the service or product performance with their initial expectation. Accordingly, based on the confirmation level, a dissatisfaction or satisfaction feeling is formed.
5. Finally, satisfied users decide to continue using the service or product in the future, whereas dissatisfied consumers stop its later use.

Marketing studies have indicated that consumer level of satisfaction is the main reason to repurchase intention (Szymanski and Henard, 2001). Bhattacherjee suggested to apply ECM in IT acceptance and continued use intention because of the similarity between the user intention to keep using IT products and the consumer intention to repurchase a service or product (Bhattacherjee, 2001). This model hypothesizes that a user decision to continue using Information technology is affected by three factors:

- *Satisfaction*
- *Expectations confirmation* and
- *Post-acceptance expectations*

2.5 Flow Experience Theory

Flow experience theory is a tool that can be used to explain the e-learning adoption. This theory explains the holistic experience that individuals perceive when they are totally engaged in performing a task (Csikszentmihalyi, 1997). In this case, people become so involved in their ongoing activities that they are unable to identify any variation in their surroundings. From the perspective of motivating people to use information technology, Flow experience can be considered as an intrinsic motivation construct in comparison with perceived usefulness, which reflects user extrinsic incentive (Lee, 2010). Its different constructs such as:

- *Concentration and focus* (Lee, 2010), (Li and Browne, 2006)
- *Enjoyment* (Lee, 2010),
- *Attention*
- *Control*
- *Curiosity*

are variables that have been used to measure Flow experience.

2.6 Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) is also a framework that can be applied in e-learning acceptance studies. Based on this model, the factors that influence behavioural intention are (Ajzen, 1991):

- *Perceived behavioural control* which refers to the availability of required skills and resources as well as the user perception of the necessity of getting the results.
- *Subjective norm* which reflects the perceived social demands to show the behaviour and is related to social normative beliefs about the expectation and
- *Behavioural attitude* which refers to how favourite a person evaluates the behaviour

A number of studies have examined these three variables and found them valid to explain a persons decision to use IT (Liao et al., 1999). Applying TPB to the e-learning field, perceived behavioural control explains the role of users basic internet skills and the subjective norm argues the impact of peers attitude on a student to uptake using an LMS (Lee, 2010).

2.7 Media Richness Theory

The last applicable framework, Media Richness Theory (MRT) aims to explain the characteristics of technologies that decrease hesitancy and ambiguity in different business settings and can reveal another aspect of appropriate e-learning systems. Researchers showed that the media with more communication channels was more efficient for presenting materials that require less analysis. However, to present materials that need more analysis, lean media, like text, was more effective than rich media, like video. The concepts of selecting appropriate media has also been investigated in education (Liu et al., 2009).

3 E-LEARNING ADOPTION AND CONTINUED USE FACTORS

Researchers (Sun et al., 2008) have adopted these models individually or as a combination, to investigate success factors of e-learning acceptance and continued use. Five main critical success factors can be synthesised from the findings. These are identified as teacher attitude and skills, student attitude and skills, LMS design, Learning materials characteristics and external support. This section explains each factor in further detail.

3.1 Teacher Attitude and Skills

Instructor behaviour toward virtual learning environments (Sun et al., 2008) as well as the technical capabilities (Benson Soong et al., 2001) has an important role in student behaviour towards an LMS system. In a survey conducted on 900 students, Selim (2007) showed that the instructor's interactive learning attitude is one of the most critical factors that can entice students to actively interact on an e-learning system.

3.2 Student Attitude and Skills

The computer knowledge and previous experiences of students are also significant factors that influence adoption and acceptance of an e-learning system. Researchers have identified the self efficiency and experience of students using the technology as a significant factor (Chiu and Wang, 2008) while anxiety can be identified through a lack of knowledge and skill and can cause a major negative outcome (Sun et al., 2008).

3.3 LMS Design

One of the most important factors that impacts on using an LMS is how the system is designed. Different characteristics have been highlighted by researchers that can affect the intention to use an e-learning system which are:

- *Perceived ease of use* which is sometimes called effort expectancy (Chiu and Wang, 2008) or perceived behavioural control (Lee, 2010).
- *The interactivity of the system* (Pituch and Lee, 2006)
- *User friendly interface design* (Selim, 2007)
- *Complete and easy to understand information of the system*

3.4 Learning Materials Characteristics

The learning content that is delivered through an LMS system and the pedagogical approaches that are followed in a unit should also support e-learning. Effective learning content should consider the following criteria:

- *Perceived usefulness*
- *Accuracy and completeness*
- *Performance expectancy* which is referred to the level of short term perceived usefulness
- *Intrinsic value* which is referred to the degree an activity is delightful
- *Utility value* which is the relevance of a system to future career objectives or long term usefulness
- *The collaboration level of learning materials*
- *The compatibility between learning objects and student requirements*
- *Relative advantage*

3.5 External Support

Support from the institute and the peer impact are also important factors to be considered in the use and implementation of an LMS. The educational organization should provide:

- *Computer labs*
- *Reliable networks*
- *Technical troubleshooting*
- *Information accessibility*

Subjective norms or the peer impact also proved to motivate individual intention to continue using an e-learning system (Lee, 2010).

4 DISCUSSION

A synthesis of the literature and frameworks presented here allows for the identification of a three-phase timeline explaining student behaviour. Although the important components in each phase overlap the factors in the other phase, this classification gives a better understanding of the required steps that lead to the effective implementation and use of an LMS (see figure 1). The timeline and the relevant critical factors in each phase are discussed in this section with more details.

The first phase deals with the essential factors that need to be considered before the use of the LMS. Previous student computer skills and knowledge of ICT is one of the most important pre-requisites of a successful LMS experience (Chiu and Wang, 2008). The more a student is ICT competent, the less effort that is required for the student to adopt and use the e-learning system. However, more experienced users may expect more advanced features in the system.

The second phase of an LMS acceptance occurs while students start using the system. In this phase, the LMS design, the quality of learning materials, teacher attitude and external support plays a significant role in encouraging students to continue using the e-learning system. In terms of LMS design, the richness of the media used in presenting the learning martials (Liu et al., 2009), the response time, the interactivity of the system (Pituch and Lee, 2006,), a logical navigation structure, easy and good access (Sun et al., 2008) and the design of the interface all impact on the students intention to continue participating in an e-learning environment.

The Learning materials must be compatible with the virtual learning environment (Papp, 2000), have a level of joyfulness (Chiu et al., 2005), be accurate and comprehensive. Consequently, the design and use of teaching experiences that enhance the sense of equality and community among students can encourage students to be more active in virtual learning environments. While the design of the

teaching experiences is quite important the assessment model used must also be supportive of this. The assessment can play a large factor in student attitude toward the use of the LMS (Sun et al., 2008)

In this phase, the behaviour of peers is also seen as an external motivation and may change how a student interacts with the LMS since social influence is proved to be effective on an individuals attitude (Lee, 2010). The availability of computer labs, the network reliability, troubleshooting support and information accessibility are other required external supports that are vital in the success of an e-learning program (Selim, 2007).

Considering the ECM model discussed earlier, the users first experiences of the system forms their ongoing approach and continued use which is the third phase of the timeline (see figure 1).

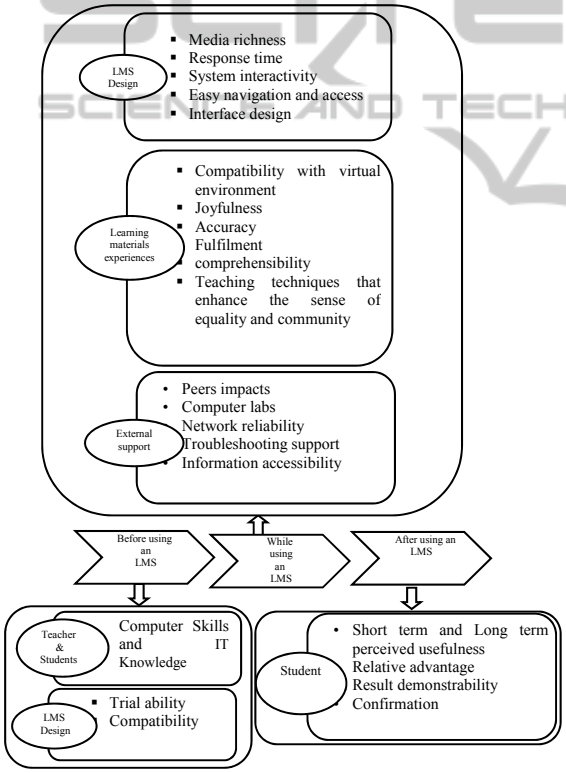

Figure 1: LMS adoption and Acceptance Timeline.

The users short term and long term perceived usefulness of the system (Lee, 2010), (Pituch and Lee, 2006), and the feeling of relative advantage in using an LMS (Liao and Lu, 2008), as well as the tangibility of the results and the level of confirmation of initial expectances create a level of user satisfaction that forms continued use behaviour.

5 CONCLUSIONS

E-learning and more recently blended learning is used significantly in higher education teaching and learning, however, it is critically important to use it in ways that support and promote positive learning experiences for students. The existence of learning tools in an LMS does not automatically result in them being used for positive or effective teaching and learning experiences. The synthesis of literature presented here highlights the critical factors that affect the success of an LMS and how to plan for success. The five factors involving teachers, students, learning materials and pedagogical approaches, LMS features and design, and external supports need to form an essential component of a successful LMS implementation. An LMS implementation needs to be planned and teaching staff need to be aware of the factors that can lead to its successful use as an essential component of teaching and learning within higher education.

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