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Investigation and Analysis on the Development Trends of Learning Management System over the Past Five Years (From 2005 to 2009)

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Abstract: The booming of information technology has influenced the evolution of learning patterns and the integration of information technology into teaching has became one of the mainstream methods. The teaching and delivery of knowledge are no longer restricted to traditional lectures. As Learning Management System (LMS) at the present stage can accommodate a diversity of learning requirements and functions, there are many literatures to study on the application of the LMS. However, as the development of relevant industries and technologies, users' requirements on the LMS may be influenced and changed. How will these changes affect the development of the LMS? What are the changes and developments of the LMS required for addressing the current and future requirements of the users? To address these questions this study aims to perform a comprehensive investigation on the technologies, applications, and analysis of the LMS to realize the developments of the LMS.

Keywords: E-Learning, Learning Management System (LMS), Information and communication technology (ICT)

1. Introduction

In recent years, the rapid development of Information and Communication Technology (ICT) has created impacts on traditional education [18]. In this context, the role of the teachers can change from a knowledge provider to a facilitator and the role of the students can also changed from a knowledge receiver to a knowledge provider [4]. In the web-based environment, administrators, instructors, and students can apply a learning management system (LMS) to manage individual resources conveniently. Moreover, through computer technologies, the students' learning behaviors can be real-time recorded that can assist the teachers in tracking and realizing the students' learning status immediately. Kirschner and Paas [13] suggested that such an environment can bring new experience to the users.

The LMS can leverage interactivity, multimedia, knowledge management, and customized learning [7][9][10][16]. By using internet, the users can take teaching and learning on the learning platforms without the restrictions of time and space. Therefore, so far, many organizations have invested a lot of time and fund in the development of LMS [1]. Nevertheless, as the advances of ICT, users may change their requirements on using the LMS and the development of the LMS may be influenced from human and technology

aspects. Therefore, this study intends to conduct a thorough investigation and analysis to realize the development of the LMS from an academic view.

2. Methodology

The purpose of this study is to investigate and analyze the development of LMS in depth. Hence, to conduct this work, this study collated, analyzed, and summarized relevant articles published by five SSCI (Social Sciences Citation Index) journals in the field of E-Learning from January 2005 to October 2009. The five journals are Computers & Education (C&E), Journal of Computer Assisted Learning (JCAL), Journal of Educational Technology & Society (ETS), Innovations in Education and Teaching International (IETI), Educational Technology Research and Development (ETR&D).

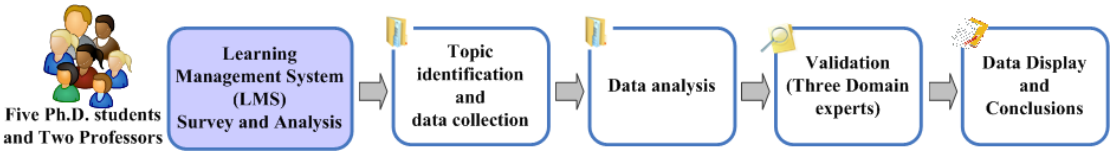

Figure 1. Research framework and process

As shown in Figure 1, this study was administered by five Ph.D. students and two professors who defined aims, collected data, surveyed articles, analyzed data, validated results, and summarized investigations. Each stage of this process was began with an open-ended discussion and ended in a convergent thought. The results were produced by detailed assessments, clarification, and validation. In order to ensure the investigation is correct, three domain experts were invited for examining the results during the process.
In this study, a total of 1,545 articles were sampled from the five journals in SSCI database. To screen these articles, a definition of LMS was identified in this study. According to Hall [9], Hall [10], and Ellis and Ryann [7], a LMS is served for the functions of learning management, process recording, issue discussions and online learning. Based on the definition, a total of 90 articles were selected for further investigation. The detailed results are summarized in Table 1.

Table 1. Number of articles related to the study of learning management system in each year (from 2005 to 2009) and journal

	C&E	JCAL	IETI	ETS	ETR&D	Total
2005	1/48 (2.08%)	3/38 (7.89%)	9/29 (31.03%)	3/69 (4.35%)	1/37 (2.7%)	17/221 (7.69%)
2006	2/56 (3.57%)	2/36 (5.56%)	3/33 (9.09%)	2/86 (2.33%)	1/43 (2.33%)	10/254 (3.94%)
2007	6/123 (4.88%)	2/41 (4.88%)	3/32 (9.38%)	2/83 (2.41%)	2/37 (5.41%)	15/316 (4.75%)
2008	9/228 (3.95%)	3/45 (6.67%)	6/38 (15.79%)	7/85 (8.24%)	0/35 (0.0%)	25/431 (5.8%)
2009	17/178 (9.55%)	5/35 (14.29%)	1/27 (3.7%)	0/44 (0.0%)	0/39 (0.0%)	23/323 (7.12%)
Total	35/633 (5.53%)	15/195 (7.69%)	22/159 (13.84%)	14/367 (3.81%)	4/191 (2.09%)	90/1,545 (5.783%)

3. Results

Based on the research issues of the 90 articles, four categories were classified that are technology development, educational application, analysis of user intention, and analysis of system development.

3.1 Technology Development

To enhance LMS performance, many studies applied novel approaches to develop an innovative service for the LMS, such as the Data mining technique analyze learners' behaviors and provide feedbacks [20]. Some studies utilized proxy technique to develop a diagnostic and learning system for analyzing and evaluating online learning status of learners. Additionally, in order to achieve interoperability of LMS, Wang and Hsu [23] proposed a system based on SCORM (Sharable Content Object Reference Model) and ontology technique to restructure curriculum that can reduce teachers' burden and empower the curriculum with interoperability over internet.

Many users adopted open source software to develop their LMS. The users can amend original functions or add new functions based on their requirements in order to improve the performance of the LMS, for instance Moodle, blog and Wiki.

A general LMS may not be able to serve all teaching purposes or facilitate special learning. To address this problem, therefore, a new LMS was developed. Chen, Ko, Kinshuk, and Lin [5] developed an online simultaneous learning system to enhance learners' conversation skills and improve peers' interactions. Méndez, Casadesús and Ciurana [17] proposed a virtual company that allows fresh graduates to learn how to cope with a problem in real life.

3.2 Educational Application

By definition, digital learning is an application of ICT to improve learning. The use of ICT in teaching activities on LMS can eliminate the gap between cities and rural areas and break the traditional boundary between teachers and students, as well as facilitate the cooperation, communication, and knowledge sharing of learners [14][15].

Interactive services on LMS can encourage self-learning and active learning, as well as facilitate knowledge sharing. In this way, learning environments can integrate teaching strategies with activities to allow cooperative learning [11], such as Cortez et al. [6] used a face-to-face computer supported collaborative learning system to enable teachers and students to share learning contents and take a dynamic teaching and learning on a real-time basis.

Diverse presentations and functions of teaching material prompt teachers to introduce their conventional curriculum into LMS. Rich functionality can also be used to enhance teaching and learning performances. In 2005, Peat, Taylor, and Franklin introduced natural science curricula into a virtual learning environment [19]. The sharing, both real-time and non-real-time, on the platform can enhance verbal and written communication skills of learners to reduce cultural differences and barriers by leveraging the relevance mechanism of high interactivity [25].

3.3 Analysis of User Intention

Good learning methods and teaching strategies can effectively improve learning outcomes and encourage learning intents. Many scholars studied the theoretical structures, learning models or teaching strategies of LMS, such as Alexander and Golja [2] evaluated the experiences of teachers and students on using LMS to analyze the usability and application purpose of the system.

Innovative technologies have resulted in constant evolution of technical tools on LMS. A number of literatures have researched and analyzed the two dimensions to investigate the transformations and impacts. Schaik, Barker, and Moukadem [21] developed a virtual university system and applied TAM to examine learners' intention to use. Eynon [8] examined whether the integration of ICT into LMS is beneficial to improve teaching and learning performances.

When using LMS, different contexts would be bring about different intentions and effectiveness. Weller, Pegler, and Mason [22] evaluated users' experiences from two virtual learning environments and investigated the integration methods and relevant components for the two learning environments.

3.4 Analysis of System Development

LMS can be benefited certainly if the LMS can fully incorporate the advantages of teaching theories. In case of cooperative learning, Wang [24] designed a test item analysis system and discussed how the system, cognitive patters, and learners' attitudes influence the system effectiveness. Blin and Munro [3] applied the activity theory to analyze virtual learning environments. Furthermore, the changes of external environments are also one of the key factors to influence system effectiveness. The empirical analysis found that better interactivity between teachers and students, curriculum structure, system support, and system flexibility would improve the users' satisfaction [26].

If systems can achieve interoperability effectively, users can work with the systems better. When the roles of main users are different, learning systems have to take corresponding developments. In 2005, Kim and Santiago analyzed the E-Learning development and digital content management of nowadays and future in Korea [12]. They indicated that many learning systems lack dynamic feedback mechanisms.

4. Conclusions

The investigation results of this study provide insights for educators and researchers into research trends and patterns of the development of the LMS in the field of E-Learning. A well LMS should be developed based on the features of technologies and the requirements of users. Moreover, it is also necessary to examine how to integrate pedagogies into the LMS to improve teaching and learning performances. The following points concern the development directions and research issues for the LMS in the next 2 to 3 years.

- Designers and educators have to attend to plan supporting measures according to the use of LMS in real educational contexts.
- The development of LMS has to tend towards learner-oriented environments and satisfy users' requirements, rather than only focus on applying novel techniques to the LMS.
- The development of LMS should consider how to provide personalized learning and adaptive feedback mechanisms to improve students' learning outcomes.
- A LMS needs more suitable educational activities and rich interactions to support enterprise applications and personalized learning.

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