Evaluating learning management systems for University medical education

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Evaluating Learning Management Systems for University Medical Education

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Abstract- Student is becoming the key focus of the educational process, where students' creativity and interactions are strongly encouraged. Student role changed to be knowledge and information hunter rather than receiver, and teaching, meanwhile, is becoming a peripheral activity. Several interactive and new methods of learning has evolved in the last two decades aimed to utilizing the information and communication technology tools to improve the educational process availability and accessibility. The learning management system (LMS) is the system responsible for integrating all learning services and managing teaching and learning activities. It provides a collection of tools and functions to support teaching and learning processes, usually including course management tools, online group discussion, homework collections and grading, and course evaluation. This study was conducted to evaluate different open source learning management systems that were under consideration to be implemented by the College of Medicine, King Saud University (CMKSU), Riyadh, Saudi Arabia. The study reviewed open source and commercial LMS systems as a future strategy.

Objectives: the main objective of the current study was to assess the open source LMS systems based on conducting literature review and practical evaluation. The study included a literature review on LMS including commercial and open source systems.

The study focused on evaluating three open source LMS systems, Jusur, Sakai, and Moodle. Jusur is the LMS adopted by the National E-learning center in Saudi Arabia, and the other two LMS systems are considered as the principal open source LMS systems implemented worldwide.

Methodology: this study depended on published technical reports, LMS systems official websites, and industry reviews, as well as examining the products features and evaluating how they meet CMKSU needs and requirements.

Results: All the three LMS systems provide excellent tools including discussion boards, chat sessions, and other collaboration tools. Jusur has a strong localization features and technical support and training. On the other hand Sakai and Moodel were ranked better for the user interface and other content and course management features. Sakai is having the advantage of being developed in Java platform. Moodle and Sakai support integration with other systems, while Jusur support the integration in the offline mode only.

Conclusion: Open source LMS systems is more recommended because of its popularity among reputable universities, and the benefits of such systems including exchange of experience and e-courses if the development efforts are guaranteed, as well as the availability of the skills required for the development. In the current study, the evaluation focused on the features of LMS systems and a combination of several frameworks to enhance the evaluation process. All three LMS systems provide excellent tools for student interactions and activities. Standards and integration that make these systems able to communicate with other students and hospitals systems are critical features. In addition, the LMS system should be able as well to mange and accommodate a huge amount of information that needed among medical and educational content, including different subjects, lecture notes, lecture videos, text books, videos of surgeries, and radiology images.

I. INTRODUCTION

The continuous and rapid advancement and development in information and communication technology (ICT) have led to dramatic changes in learning methodologies, and creation of new learning environments. The development of the e-learning concept aimed at utilizing ICT tools to improve the educational process and its availability and accessibility. [1] In addition, the Internet has radically and dramatically changed the way we access information, it emerged as one of the most important tools in e-learning [2].

Several studies were conducted to assess the benefits of e-learning and web-enhanced education for students, in addition to its great importance in educating and training on job workforce [3]. Furthermore these studies revealed that students involved in web-enhanced learning showed better performance than students with no such involvement [4] [5]. Undergraduate student surveys showed that students considered web-enhanced learning beneficial to their learning process [6].

Learning Management Systems (LMS) provide a collection of tools and functions to support teaching and learning processes, usually including course management tools, online group chat and discussion, homework collections and grading, and course evaluation. LMS systems evolved from just a tool to manage courses and publish syllabus on the Internet to systems offering a high degree of interaction between students and instructors [7]. As most LMS systems appeared to utilize the Internet to provide a structured web-enhanced learning process [8]. Furthermore,

some LMS features are technically sophisticated, such as virtual classrooms, deadlines, and dividing students into groups for online tasks [9].

The College of Medicine in King Saud University (CMKSU) decided to build a complete medical e-learning system to facilitate medical education and problem based learning. An assessment of students' information technology skills was conducted [10] [11], in addition to a study to assess using e-learning in patients' education [12]. Moreover a study to assess the family physicians skills and attitude towards online education in Saudi Arabia was conducted and revealed a positive attitude towards online education [13]. Based on the result of previous studies and other published studies and reports from the literature, an e-learning system design was completed [14] where integration between e-learning system and other hospital information systems was an important part [15].

As a part of this e-learning system plan, the Computer and Information Systems Department (CIS) in College of Medicine started the process to implement a LMS system; the CIS is responsible for information systems, information technologies infrastructures, and applications in College of Medicine, Dental College, and University Hospitals in King Saud University. As part of the assessment process, this study was conducted late 2008.

During the last decade, many comparisons between LMS systems were performed. These comparisons varied from simple comparisons between few LMS features to complex comparisons [16]. The aim of this study was to assess the open source LMS systems based on conducting literature review and practical evaluation. The study included a literature review on LMS including commercial and open source systems.

II.   COMMERCIAL AND OPEN SOURCE LMS SYSTEMS

An early strategic decision to be taken regarding the selection of the appropriate LMS system in any organization is to decide whether to go for an open source or a commercial LMS system. Both types of LMS have their advantages and disadvantages [17]. Commercial LMS systems have many advantages including being developed by a single company with unified development methodology and approach, the LMS is thoroughly tested for bugs and errors, upgrades for the system can be automatically installed, the customization can be done by the company relieving the organization from this burden. Furthermore commercial LMS systems would include the latest tools and modules to support faculty staff and students.

On the other hand, commercial LMS systems have some drawbacks including [18] out of box functionality which means that once the product is installed, the organization will not be able to modify or add major functions and features to the system; customization difficulty; inflexible data models and architectures; and surprisingly, poor vendor support and services.

For Open source LMS systems, most of the drawbacks of commercial LMS systems are overcome, they protect the organization from being bounded to one vendor, and customization is easier. In addition, open source

communities quickly find bugs and issue fixes for them, support from communities with large number of developers is always at hand, and security patches are released more quickly. However, there are some risks exist with open source LMS systems including [16] being developed by a large number of independent developers which may complicate the development and customization process, and the management of security patches and bug fixes which will be the responsibility of the information technology team within the organization instead of the vendor.

The most important point here is the customization and development freedom, which encouraged most reputable universities to go for open source LMS systems.

To make the choice of whether to go for open source or commercial LMS systems, CMKSU has to be able to provide a skillful and permanent development team. This is essential for the success of deploying an open source LMS, because although there are active communities developing open source LMS systems that can help in the development, however the tailoring and customization of the LMS should be delivered by CMKSU especially for specific requirements including the localization and the integration with current student information system and other hospital information systems.

It should be noticed that, having a skillful development team is not enough, but it is so vital to have a permanent team, which means that such a team should be always there and in any circumstances to be replaced only with trained and qualified new developers. This can be probably and partly achieved by recruiting the students of the information technology faculty in KSU as part of their placements and graduation projects. This will help to keep the development process going, and at the same time will give the students a unique opportunity to cooperate with international development communities and improve their experience.

Instead, to hire a qualified development company to do the customization, but this solution is only recommended when it is not possible to get the development team.

Open source LMS systems is more recommended because of the popularity of this choice among reputable universities, and the benefits of such systems including transfer of experience and e-courses if the development efforts are guaranteed, as well as the availability of the skills required for the development.

III.   METHODOLOGY

In order to evaluate features and tools in modern LMS systems, an evaluation framework needs to be set. Several evaluation frameworks were developed including frameworks for pedagogical evaluation [19] where the main concern is the evaluation of student capability to use the LMS, frameworks of evaluating LMS systems based on standards such as SCORM [20], and general evaluation frameworks [21] [22]. However, these commonly used evaluation criteria do not fully help in evaluating the three open source LMS systems. Most modern LMS systems do not work as a standalone system but are integrated with other systems such as student information systems (SIS). In addition, localization is very critical factor in evaluation,

since Arabic is the main language in Saudi Arabia, and LMS systems should fully support Arabic language. The development environment for each LMS systems is one key factor to be considered as well as having a skilled development team, is crucial when deploying an open source LMS system.

In the current study, the evaluation focused on the features of LMS systems and a combination of several frameworks to enhance the evaluation process.

The categories that were evaluated in this study can be divided into:

- Content Management: including content adding, importing, and other functions
- Curriculum mapping and planning: including accessibility, lesson adding, and personalization, assignments and assessment
- Learner engagement and administration: including different administration and tracking tools for the learners and their behavior
- Tools and services: including discussion forums, email, messaging

These criteria were applied to three of the mostly used LMS systems in Saudi Arabia and the world:

- Jusur:

Jusur is an LMS designed and operated by the National Center of E-learning and Distance Learning (ELC) for E-Learning process management of the higher education in the Kingdom of Saudi Arabia [23]. It is fully localized, arabized, and implemented by most of the Saudi Universities. ELC is putting great efforts to continuously develop Jusur LMS and to provide the necessary support to KSA universities to help them in implementing and maintaining this system.

- Moodle:

Moodle emerged in 1999 from the Australian higher education community. [24] Much of its rise to fame has been in the last few years, and as of September 2007 there were 69 Moodle installations with 20,000 or more users. The Moodle Trust hires core programmers and covers project expenses. Moodle is perceived as high value in the education community, particularly higher education and further education.

- Sakai:

Sakai began life with a grant from the Mellon Foundation. [25] Five founding institutions merged elements of their existing home-brew course management systems, the largest contribution came from University of Michigan followed by Indiana University, MIT, Stanford University and the Open Knowledge Initiative. Big business moved in during 2005 as IBM, Sun and Unisys all came on board. Fast forward to 2007 and there are now over 100 Sakai Partners.

IV. RESULTS

In Table 1, it is clear that Sakai provides the easiest user interface for the content management part. Although Jusur provides an easy to use interface, however, its set of functions is relatively small compared to Sakai and Moodle systems. Moodle provides a comprehensive set of curriculum mapping and management tools. This is probably due to the long development history of Moodle compared to Sakai.

For the learner engagement and administration tools, Jusur lacks some important features, especially the statistics module that enables instructors to track the students' activities with respect to the course content. Both Sakai and Moodle provide excellent tools.

All three LMS systems provide excellent tools including discussion boards, chat sessions, and other collaboration tools. However Moodle, has several add on tools exist that extend these tools to include virtual classrooms, and face to face communications.

As long as integration is considered, Sakai represents an excellent choice since it is known for its integration capabilities. Moodle also represents a good integration environment, and it is already integrated with SIS systems in many universities. Jusur on the other hand is limited with regard to integration, and can only exchange data with other systems in offline mode rather than real time mode.

Jusur has excellent localization features as it was developed mainly to be an Arabic LMS system and therefore, it has superb localization features. Moodle Arabic version is also there but with limited features compared to Jusur

Sakai has a great advantage of being fully developed in Java, while Moodle and Jusur are developed using php and mysql database. Java development tools are more common and preferred in Saudi Arabia than PHP development and are supported on more systems. For example, PHP systems are best used on Linux systems, and not recommended for Windows based servers as the performance of PHP and mysql falls when Windows servers are used [26]. In addition Java qualified developers are easier to find than PHP developers in Saudi Arabia.

Both Moodle and Sakai are served by a large community with continuous efforts for development and support. Jusur is highly supported both technically and for users by the National Center of E-learning and Distance Learning in Saudi Arabia. The National Center of E-learning and Distance Learning is continuously holding training courses and workshops for users around the Kingdom. Besides the continuous efforts by the ELC for development of Jusur and the user feedback development process [27].

Table 1 shows the result of the evaluation based on study criteria (insert here)

V. DISCUSSION

Learning management systems are becoming an essential element of any e-learning system. Several factors have to be considered and carefully studied before deciding on the LMS implementation. For any e-learning system to be successful, it must have some features including flexibility, which allows the system to adapt to the capabilities and goals of

every student [28]; ease of use, to allow learners to focus on the material itself rather than focusing on how to use the system [28]; interactivity [29], where the learners can interact with each other and with their teachers through video conferencing or discussion boards.

Student (learner) is becoming the key focus of the educational process, and teaching, meanwhile, is becoming a peripheral activity. Several interactive and new methods of learning have evolved in the last two decades aimed to utilizing the information and communication technology tools to improve the educational process availability and accessibility [30]. The continuous advancement in ICT has led to a creation of new learning environments such as distance learning, online learning on Internet, self paced learning, and integrated (blended) learning [31]. E-learning systems have greatly expanded in recent years. In 2005, about 3.2 million students had one or more online course in the United States [32]

The common factors in the new learning methods are the utilization of ICT and the changes in students and teachers roles. Students are becoming more independent and active rather than being passive and relying on teachers. Students are becoming learner and information and knowledge hunter. On the other hand teacher's role is becoming more of facilitators. All three LMS systems provide excellent tools for students' interactions and activities including discussion boards, chat sessions, and other collaboration tools.

The practical and sensitive nature of medical education increases the importance of e-learning. E-learning can be used in teaching basic sciences, pre-clinical, and clinical subjects. Furthermore, practical subjects like anatomy, and clinical training require high level of interaction to enable students to get the most out of it. The e-learning model designed and adopted by CMKSU is a modern approach that satisfies the special requirements of medical education through the integration between different hospital information systems, and students' information systems. This integration is indeed required for the success of e-learning in medical environments.

All three LMS have the standards that make these systems are able to communicate with other students and hospitals systems. However, Jusur LMS is limited with regard to integration, and can only exchange data with other systems in offline mode rather than real time mode. The results of this study agree with other studies which show that Jusur lacks some essential functionality in LMs systems, and with studies showing the maturity and advanced features in both Moodle and Sakai. [27]

The nature of medical education however adds more challenges and requirements to the LMS [12]. Some subjects like those involving practical medicine require the students to identify symptoms, and examine the history of patients. It is not enough to provide the learner with text books or lecture materials. The learners should have access to more details in order to understand medical subjects well. Therefore, medical LMS should be able to provide students with the tools to clearly identify and describe different parts of the body including videos and detailed figures; it also must interact with other medical systems to provide students with the medical history of patients, including X-ray images, and prescribed medication. Medical e-learning systems require a higher degree of interactivity than other types of e-learning system.

The LMS system should be able as well to manage and accommodate a huge amount of information that needed to be included in the content. The content should include different materials, the lecture notes, lecture videos, text books, videos of surgeries, etc. This huge content is expensive in terms of both cost and effort, and it needs several servers with storage capacities enough to keep such content.

VI. CONCLUSION

Student is becoming the key focus of the educational process, and teaching, meanwhile, is becoming a peripheral activity. The Internet has radically and dramatically changed the way we access information, and is becoming an important educational tool. In addition the continuous advancement in ICT has led to a creation of new learning environments such as distance learning, online learning, self paced learning, and integrated (blended) learning. These new educational environments encourage students to become learners and knowledge hunters rather than being receivers. Such environments support students to be more self dependent and active rather than being passive and relying on teachers. On the other hand teachers' role is becoming more of being facilitators and moderators.

Open source LMS systems are more recommended because of its popularity among reputable universities, and the benefits of such systems including exchange of experience, content and e-courses if the development efforts are guaranteed, as well as the availability of the qualified developers for the development. In the current study, the evaluation focused on the features of LMS systems and a combination of several frameworks to enhance the evaluation process. All three LMS systems provide excellent tools for student interactions and activities including discussion boards, chat sessions, and other collaboration tools. The practical and sensitive nature of medical education increases the importance of e-learning in teaching basic sciences, pre-clinical, and clinical subjects. Standards and integration that make these systems are able to communicate with other students and hospitals systems are essential features. In addition, the LMS system should be able as well to mange and accommodate a huge amount of information that needed to be included from medical and educational content, including different subjects and materials, lecture notes, lecture videos, text books, videos of surgeries, and radiology images.

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TABLE 1.   RESULTS OF OPEN SOURCE LMS EVALUATION

Criteria	Jusur	Moodle	Sakai
Content management	provides good content management capabilities including adding content and integrating it in the system, and other essential content management functionality	Provides good content management capabilities, it exceeds Jusur in the simplicity of adding new content to the system.	Good content management capabilities, with excellent user interface for the faculty member to add the content
Curriculum mapping and planning	Weak in this point, it only allows access for the whole enrolled students in the course; however it also allows dividing students into groups. Its interface is difficult for the students and many features are missing in the interface. Only the assignments are mapped into the grade book	Provides excellent curriculum mapping and planning functionality. It allows one-to-one discussions, excellent grade book and personalization capabilities. Its interface however is more complicated and difficult	Excellent capabilities and nice user interface for the students and faculty members. It grade book is not as good as Moodle

	while the assessments and tests are not.	to use than Sakai.	
Learner engagement and administration	Has simple tools including discussion boards, chatting, and email. Its calendar is not really useful. Collaboration tools include file sharing. It has no statistics as to how the student is using the content which is essential in all modern LMS systems. Students are not able to organize their courseware according to their exact needs.	Moodle provides excellent learner engagement and administration tools	Provides excellent tools for the learner.
Tools and services	Includes most necessary tools.	Includes most necessary tools.	Includes most necessary tools.
Standards	SCORM compliant	SCORM compliant	SCORM compliant
Localization	Fully Arabic LMS except in few places which are not localized yet.	Has Arabic version that can be added	Has partial Arabic support
Integration with student information systems	Integration will be hard, and currently information can only be exchanged with SIS offline (using text files) and not online	Difficult to integrate	Uses web services and can be easily integrated with current SIS in KSU.
Deployment environment	PHP programmed and will work best on Linux platform, uses mysql database. It is not recommended to run on Windows servers.	PHP programmed and will work best on Linux platform, uses mysql database. It is not recommended to run on Windows servers.	Java programmed and it can run on either Linux or Windows OS. It can use either Oracle 9i or higher DB or mysql database.
Support and development	Supported by the National e-learning center in KSA	Has a large community for support and development all over the world including major universities Europe.	Has a large community of support and development all over the world including major universities in USA