

An e-Learning Environment Based on the Moodle Platform for Iraq Universities

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Abstract

This paper proposes the deployment of learning management systems to provide virtual environment to higher education in Iraq. In this paper we show that implementing a learning management system (LMS) to manage learning process is within reach even with little material and human resources. This paper proposes an open source popular and free of charge platform called Moodle. We also show that other solutions such as web-based alternatives to LMS are completely unaffordable given the limited financial resources of our universities. The system is aimed for use by university level students and educators (teachers and instructors). Further, a deployment plan is given in this paper to provide a guidance and reference for the implementation requirements and steps of this LMS operation.

Keywords: eLearning, Computer Networks, Computer Servers, Web Servers, Databases, Communications, Moodle, Learning Management System,

بيئة تعليم الكتروني للجامعات العراقية مبنية على منصة موودل

الخلاصة:

تقترح هذه الورقة نشر نظام ادارة التعليم لتوفير بيئة افتراضية للتعليم العالي في العراق. في هذه الورقة نظهر ان تنفيذ نظام ادارة التعليم لأتمته العملية التعليمية هو ضمن الامكانيات المتاحة حتى مع محدودية الموارد المادية والموارد البشرية. هذه الورقة تقترح استخدام منصة مفتوحة المصدر تتميز بالشيوع بين المؤسسات التعليمية العالمية بالإضافة الى كونها متاحة للاستخدام بدون مقابل تدعى موودل. كذلك نستعرض حلول اخرى بديلة عن نظام ادارة التعليم كتلك المستندة الى الويب ونوضح انها بالكامل خارج امكانيات الجامعات العراقية بسبب محدودية الموارد المادية لهذه الجامعات. النظام المقترح يستهدف الطلبة على المستوى الجامعي بالإضافة الى التدريسيين. بعد ذلك يتم عرض خطة عمل لنشر نظام ادارة التعليم لتوفير التوجيه وكذلك كمرجع تقني لمتطلبات التنفيذ وخطوات العمل.



1. Introduction

Electronic educational technology, commonly known as e-learning, has evolved to constitute an irreplaceable part of modern education system. It is formed of a huge set of mainly digital systems to provide services and functionalities [1]. As professions like computer engineering, information technology and data communications continue to deliver better performance, topics such as e-learning become even more attractive. e-Learning comprises many sorts of media that provide text, audio, images, animation, and streaming video, it also contains a wide range of applications such as audio or video tape, satellite TV, CD-ROM, and computer-based learning. Furthermore, intranet/extranet, web-based learning, Information and communication systems are involved in e-learning process [2].

The history of e-learning starts around early 1960s when the University of Illinois established a classroom system equipped with linked computer terminals. Students could access informational resources on a particular course while listening to the lectures [3]. The 1970s and 1980s saw notable contributions in computer-based learning by researchers at the New Jersey Institute of Technology as well as developments at the University of Guelph in Canada. In 1976, Bernard Luskin established Coastline Community College as a "college without walls" by using television station KOCE-TV as a medium of delivery. In the UK the Council for Educational Technology encouraged the employment of educational technology, thus, utilizing the National Development Program in (Computer Aided Learning) in the period (1973–1977), and the (Microelectronics Education Program) between (1980–1986). By the mid-1980s course materials became accessible via the libraries at many colleges.

With the emergence of World Wide Web into the public domain in the 1990s, academics started using newly introduced technologies to employ multi-object oriented sites (which are text-based online virtual reality systems) to create course websites along with simple sets of instructions for their students. Improved Internet functionality and speed enabled new methods of communication involving multimedia, interactive material or webcams [4].

The American National Center for Education Statistics estimated the number of high school students registered on online learning courses increased by 65 percent from 2002 to 2005, due to the greater flexibility, ease of communication between teacher and student, and quick lecture and assignment feedback [4]. A study in 2008 by the U.S Department of Education estimates that during the (2006-2007) academic year about 66% of postsecondary schools offered some distance learning courses. The study also shows 77% of enrollment in courses with an online component. In 2008, the Council of Europe passed a statement endorsing e-learning's potential to drive equality and education improvements across the EU [5].

In modern days, it is no longer sufficient to operate an education/training system under an "Industrial Model" that simply teaches the 3 R's:- reading, writing and arithmetic. Students/Trainees today need to develop creative thinking, digital literacy, collaboration and teamwork skills, with the ability to evaluate and apply knowledge in the rapidly changing information-rich digital work and community environments [6].

LMSs are by default the tool of choice in educational institutions and hence the target group expected to use the tools and features are normally of medium to high levels of education and mental skills such as university professors and instructors as well as students. Furthermore, non-educational institutions such as private companies and organizations are adopting these systems to increase productivity and enhance evaluation of training programs.



Fig. (1) Learning cycle by using LMS [6]

The configuration shown in Fig.(1), gives an ideal learning environment built upon an efficient infrastructure of communication systems and information technology. The figure also represents a complete cycle of services that enables the learners to keep track of the material and learn on their own pace.

E-Learning, generally, adopts different principles and criteria to what is common to traditional education. These differences stem from the fact that this new approach is based on digital computers and communication lines rather than on timely physical existence in a class. Therefore, a student and an instructor can be thousands of kilometers apart from each other and they can still have productive exchange of interactions. Furthermore, this approach ensures that even time is not an important factor in the process where recorded materials, email and messaging services ensures that recorded lecture viewed on a time later can be as useful as fresh ones. Table 1 provides a useful comparison between the two approaches [7].

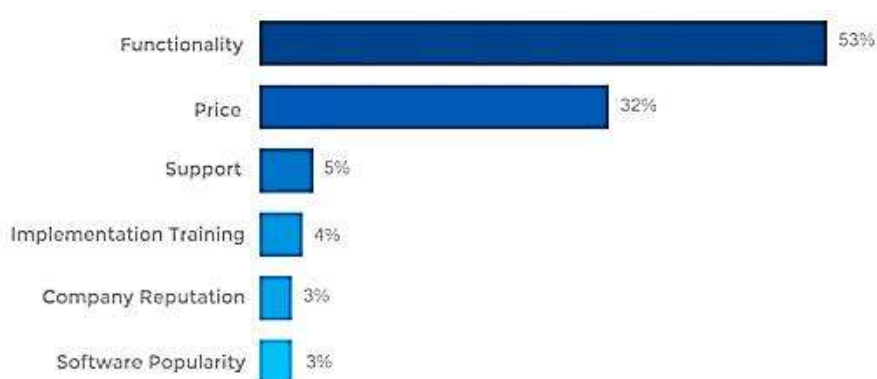
This paper proposes the deployment of e-Learning approaches in Iraqi universities with an emphasis on implementation perspectives, that's the computer engineering and information technology aspects of the e-Learning system. The paper proposes the use of an open source LMS as the platform for implementing the e-learning system. In the subsequent sections, various principles and technologies are explored in order to provide the necessary knowledge and know how to those interested in adopting the e-Learning approach.

Table 1. Comparison between traditional and e-Learning approaches.[7]

	Traditional Classroom	e-Learning
Classroom	<ul style="list-style-type: none"> • Physical – limited size. • Synchronous. 	<ul style="list-style-type: none"> • Unlimited. • Anytime, anywhere.
Content	<ul style="list-style-type: none"> • PowerPoint/Impress/etc. • Textbooks/library. • Video. • Collaboration. 	<ul style="list-style-type: none"> • Multimedia/simulation. • Digital library. • On demand. • Sync. & Async. Communication.
Personalization	<ul style="list-style-type: none"> • One learning path. 	<ul style="list-style-type: none"> • Learning path and pace determined by learner.

2. eLearning Considerations:-

The adoption of e-learning is sometimes considered risky with the lack of knowledge and necessary funds to implement the required changes. This is particularly true because e-learning requires a detailed knowledge of the underlying technology from computer systems to communications and IT. The following factors determine the success or failure of the transition to a digital system [7] & [8]:-

**Fig. (2) Factors that influence the choice of e-learning platforms [9]**

- a- **Functionality:-** this is the most important factor in adopting a particular platform as most institutions have particular demands. Fig.(2) shows the high rank customers give to this factor when purchasing an e-learning system.
- b- **Cost:-** this is the second most important factor when choosing a platform, in fact, this factor lost its prime position as more and more open source platforms are made available with all the necessary functionality (see Fig. (2)).
- c- **Focus:-** various institutions have different requirements, with that come the variation in the offerings of different platforms, such offerings include (as shown in Fig.(3-a)) whether the platform is Web-based or On-premise. Fig.(3-b) shows the five main industries that employ some sort of digital platform.
- d- **Sustainability:-** this includes the availability of support either from the vendor or an active community. It also includes the training.
- e- **Software & Standards:-** this has to do with the technology used in implementing the platform (see Fig. (2)). Although this factor is very technical it is an issue of compatibility and integration.

The above mentioned factors are directly related to the selection of a particular platform and thus the entire technology used to implement it. It has implications for those who are intended to use the new educational technologies, namely, the lecturers and students.

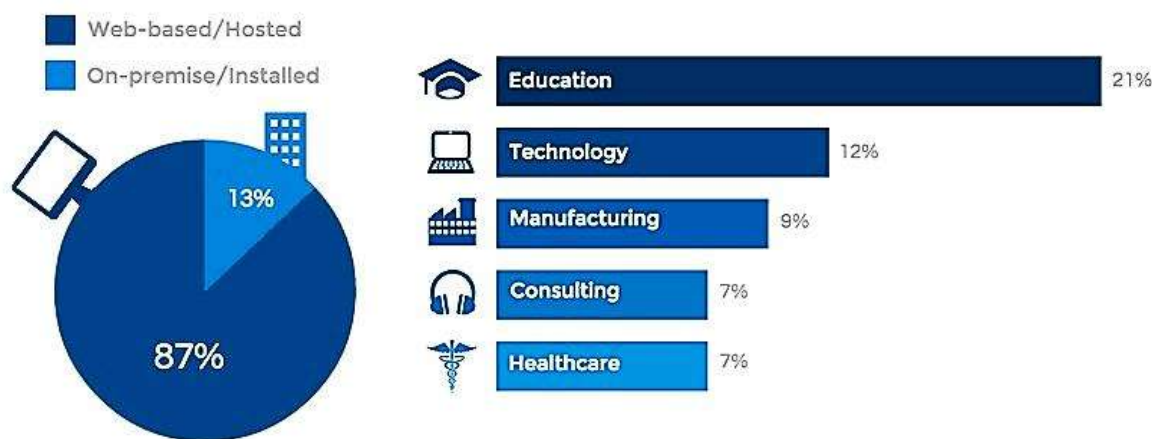


Fig. (3) a) Deployment methods-left, and b) Industries using e-learning platforms-right [9]

3. Learning Management System:-

A learning management system (LMS) is a software application that provides a comprehensive set of tools for educators to manage learning resources, administrative functions, assessments, and grading [10]. In open distributed systems, independent components of the software cooperate to achieve individual and shared goals. Both individual components and the system as a whole are designed to cope with change and evolution in the number and nature of the participating entities. Such systems are important in many contexts, from large scientific collaborations to enterprise systems and sensor networks [11].

LMSs provide electronic platforms that can be used to launch and track e-learning courses and enhance face-to-face instruction with online components. Primarily, they automate the administration of learning by facilitating and then recording learner's activity. As systems have evolved, some modern LMSs have added extra features such as e-commerce, communications tools, and etc. [12].

The best way to describe an LMS platform is to consider filtering the entire content of the internet for a particular resource or webpage (see Figure 4). Another approach would be to apply an agent (software program) specifically designed with a set of criteria to search for the content.

In the original internet search model, people interpret filtered results (web pages, products) retrieved from the web. In the second agent-based model, software agents perform these searches and filter functions, while providing higher-level services to people in a conversation requiring mutual learning [13].

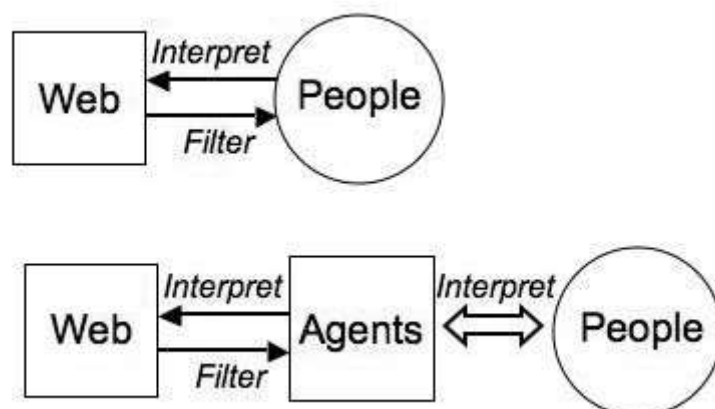


Fig. (4) Direct versus agent-based search approaches [13]

An agent (see Fig. (4)), is an encapsulated computer system that is situated in some environment, and that is capable of flexible, autonomous action in that environment in order to meet its design objectives [11]. By employing this specification of an agent-oriented view of the problem, the management of learning material and the administration of students' records becomes smart and autonomous.

It is straightforward to conclude that most applications require or utilize multiple agents in order to reflect the distributed behavior of the application, the distribution of control, and intersecting requirements. Furthermore, such intersecting agents may decide to interact, for achieving their individual objectives or because of their dependencies.

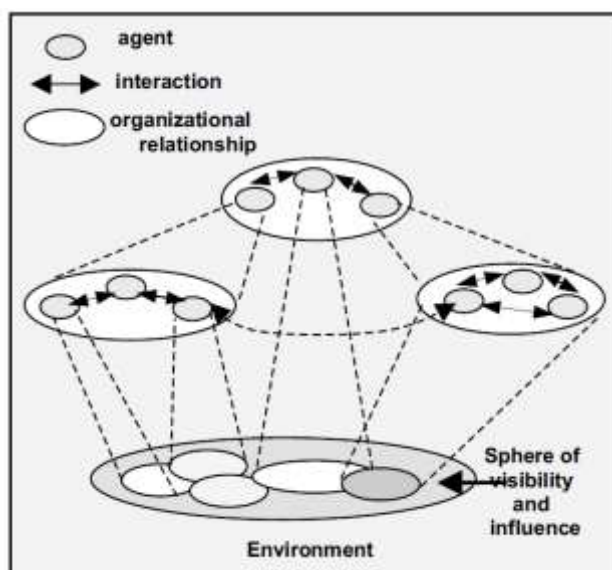


Fig. (5) Canonical view of a multi-agent system [11]

A meaningful model can be obtained by realizing the above mentioned facts. Fig.(5) shows that using an agent-oriented technique in system implementation requires decomposing the application into multiple, interacting, autonomous parts that have different goals to achieve and are able of fulfilling certain functions.

A more technical description to the implementation of an LMS is given in Fig.(6-a) where there is at the bottom the set of infrastructure components, these include the basic services provided by the operating system of the computer network which utilizes the hardware of connected network of computers. Next, the system implements a set of general or common services which are used by the next layer to generate a layer of applications in the form of services. The top layer is the application layer which is interface with which a user interacts.

This organization allows both standalone deployment of this system because of the presence of a user interface and, also, it allows the integration of the system with other systems by accessing the APIs of the services of the application layer directly without going through the interface.



A functional view of the LMS is given in Fig.(6-b), in which, the system is divided into layers of functions. The bottom layer provides the interface with the hardware that forms the network and terminals. On top of that there is the layer of all the databases of material, students, categories, rules, administrative structures, and etc. After that there is a layer that generates a set of common services, this layer is an intermediate layer. The next layer is a one that provides the services that can be classified as e-learning services in a basic form. This layer can be accessed from other agents or application for the purpose of synchronization and integration via a set of APIs.

The basic services are then used to form more sophisticated tools in the next layer. The top layer in this hierarchy of functions is the agent. This layer is designed in order to make the use of the underlying services and function as easy and accessible by the user as possible.

Also, because there are different types of users that use the same LMS there should be different types of agents in the top layer. Furthermore, same users sometimes have the choice to switch roles and therefore the implementation of the LMS must be flexible to accommodate these requirements.

Fig.(6-c) provides some examples of services included in an agent of LMS together with examples of services in the layers below. The figure shows the interaction of these layers to provide the functionality of the agent.

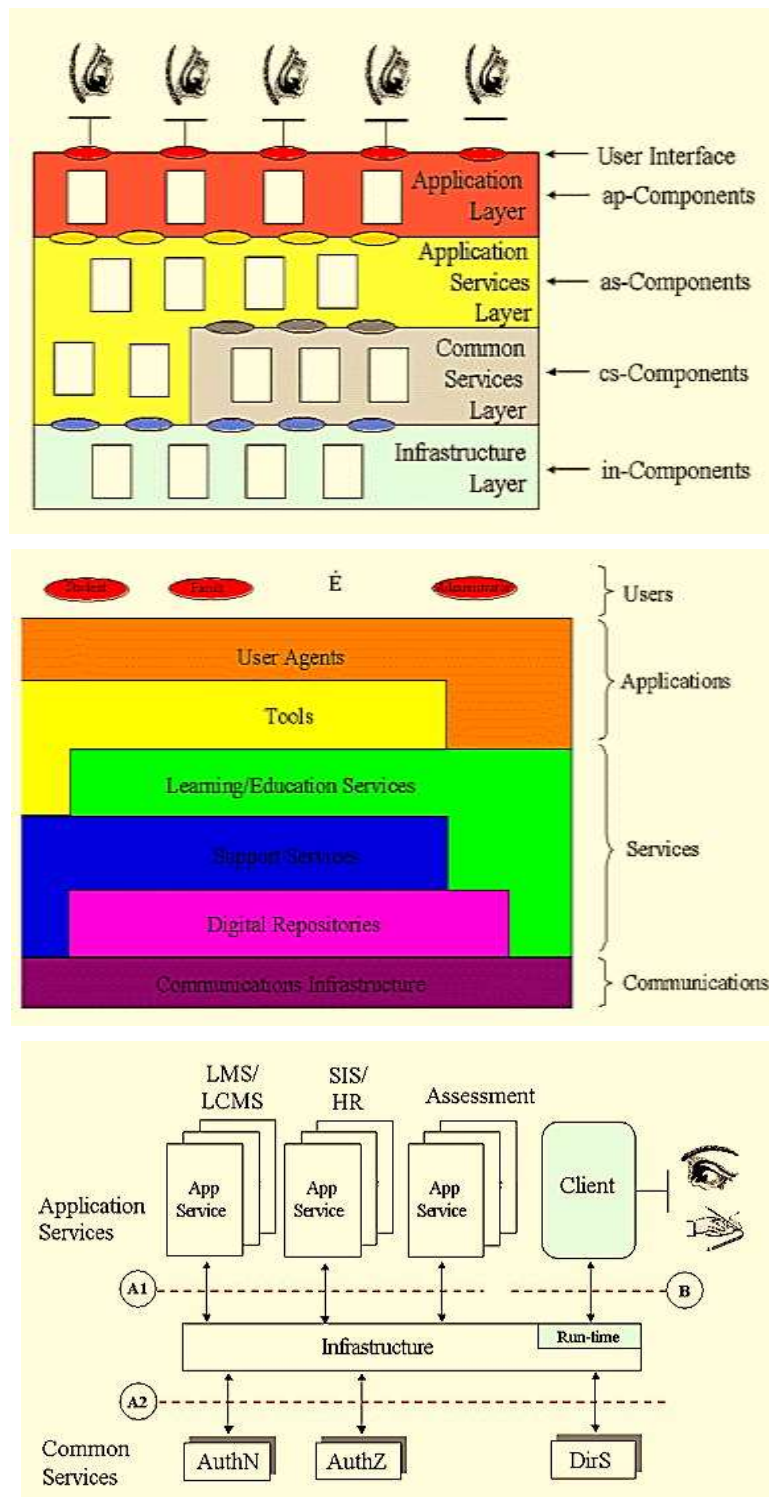


Fig.(6) Layered view of LMS a) components-top, b) functions-middle and c) example services-bottom [14]

The specifications and technical implementations mentioned above have evolved over decades and for that the current state of LMS market is very diverse with dozens of platforms available. Many of these platforms have been in service for decades; this, however, doesn't mean the door is closed for new LMSs. In fact, new platforms are seen as strong competitors in this field as they offer fresh and dynamic environment, example of that is the Canvas LMS by Instructure.

A recent survey of the most influential LMS platforms is provided in Fig.(7). This list shows the ranking of LMS platforms according to four factors:- the number of customer institutions, the number of users (mostly students), the popularity of social media and the size of the vendor organizations.

From this survey we notice that Moodle is been chosen by the most users although most institutions prefer paid services of Edmodo and Connect EDU. This is in part because these institutions opt for outsourcing which means that the provider will be responsible for both installation and maintenance. This figure also shows the size of the organizations providing Moodle is the biggest. It is interesting that a platform like Blackboard is in the fourth place although many of the top ranked universities use it as the LMS of choice.

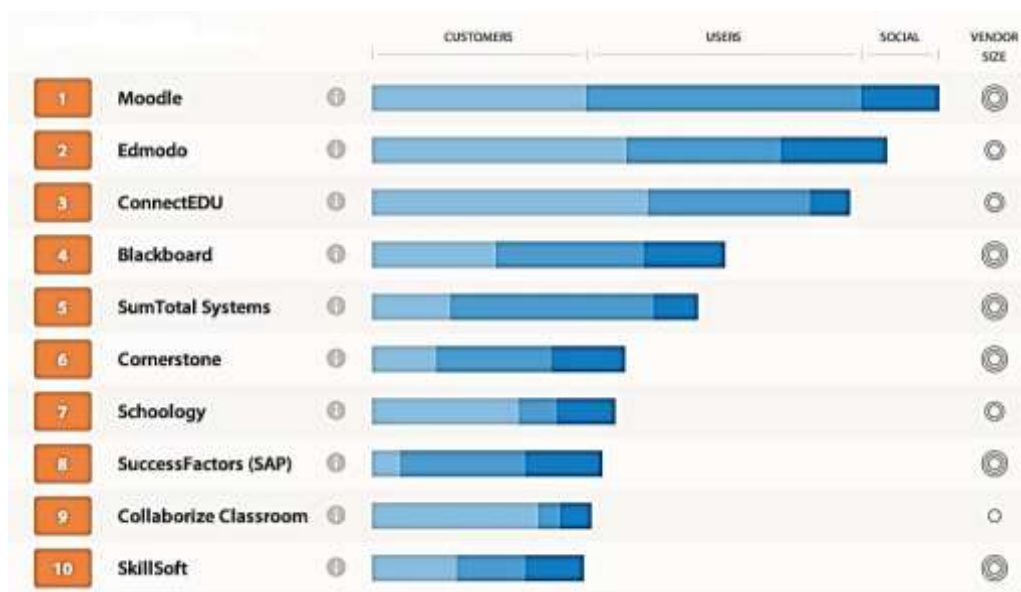


Fig.(7) Top 10 LMS platforms [15]

3.1 Services of LMS:-

Well-designed LMSs normally offer a set of standard services. These range from material management to administrative functionalities. A common set of such services should include the following [12]: -



- Course development tools for uploading resources (text, multimedia, simulation programs, etc.).
- Course syllabus development tools with the ability to structure learning units.
- Content management tools to enable reuse of course on subsequent years.
- Quiz/survey tool for creating tests, course evaluation, etc.
- Grade book to enable educators put weights on different activities.
- Administrative tools to help instructors and departments track student activity both as individuals and in groups.
- Password protected accounts to give students controlled access to course materials.
- Personal webpage publishing to enable students interact with other scientific communities and other learners.
- E-commerce tools for sale of courses in private universities (optional).
- Streaming audio and video of educational material (important but also optional).
- Virtual classrooms to create webinars, video conferences and virtual labs.
- Access to electronic libraries.

In addition to these services LMS platforms can provide an important feature which is collaboration as shown in Fig.(8). In which the education service can be provided by teachers from other institutions or even from people from outside the academic institutions.

The best example for the above case is the time when there is no enough qualified teachers for a certain topic such as in medicine or in nuclear physics and etc. This is achieved by paying the teacher or his institution for the service he/she provides and allowing them access to the LMS remotely. This way, these institutions can share valuable human resources efficiently.

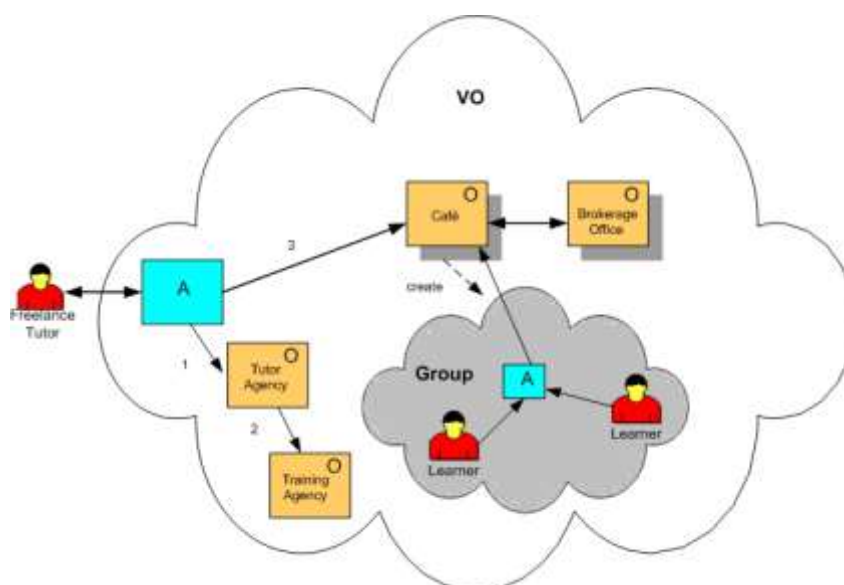


Fig.(8) Collaboration across various institutions [16]

3.2 LMS Alternatives:-

Some researchers and educators suggested the employment of a set of web based tools to replace a dedicated LMS platform. The main motive for such suggestion is that there is an abundance of such tools that rely mainly on an advanced search and categorization tools least to mention is google engines. Furthermore, the expansion of cloud computing as a provider of infrastructure and services (taking in consideration the sharp fall of cost of such services) gives this approach an important boost.

A) *Advantages of LMS alternatives:*

- i. Tools in cloud do not exist in LMS that can help collaboration and content creation such as VoiceThread and Diigo, as well as the ignition of a peer review process as the content will become available on the web [10].
- ii. It is thought that web based tools help students to learn faster and hence make them judge the best tools, also, the process of feedback and improvement of those tools is much faster than in LMS.
- iii. Portability of web based tools and reliability of service.

B) *Drawbacks of LMS alternatives:-*

- i. The uptake of such tools is a slow process for both learners and educators as both sides need to learn new tools every time a new service is needed.
- ii. Most useful cloud services are not free of charge which is not sustainable for many institutions especially in developing and poor countries.
- iii. Cloud based services are still struggling with the questions of security [10].



- iv. There is no fallback procedure in case of breakdown/stoppage from the providers or interruption of internet service, therefore the entire system will be off and nothing can be done on the side of the educational institution.

3.3 Moodle LMS:-

Moodle is an open source web application used to create interactive online learning sites. It started as a PhD project by Martin Dougiamas. The first operational version was released in 2002 [17].

"MOODLE" stands for "modular object-oriented dynamic learning environment". As the name refers, it uses some of the best practices of software engineering that is the modular design of software components which makes it adaptive, customizable, and interoperable. Also, it is based on OOP approach which gives it a natural-like cycle of upgrade and maintenance.

As seen in Fig.(7), Moodle is one of the most popular platforms. This is mainly because it is free and open-source software. But also because it is easy to install on any computer system that has web server as it is written in PHP as seen in Fig.(9). It employs the use of a database like MySQL, Microsoft SQL Server or Oracle as the back-end data store [17]. Furthermore, it can be used on mobile devices.

Moodle offers some important features that differentiate it from other LMSs:-

- It is easy to create courses from existing resources.
- It is easy to import courses from other platforms such as Blackboard, WebCT and etc.
- It has a simple and secure enrolment system.
- Its online management is simple for both students and lecturers.
- It uses plugins to add new functionality. These are developed by independent programmer.
- It has the feature of themes where the look and functionality of the site can be changed by installing a new theme.
- It is available in over 70 languages including Arabic.
- There is a large community of users and developers which ensure good support as well as the addition of new features.
- It is Free.

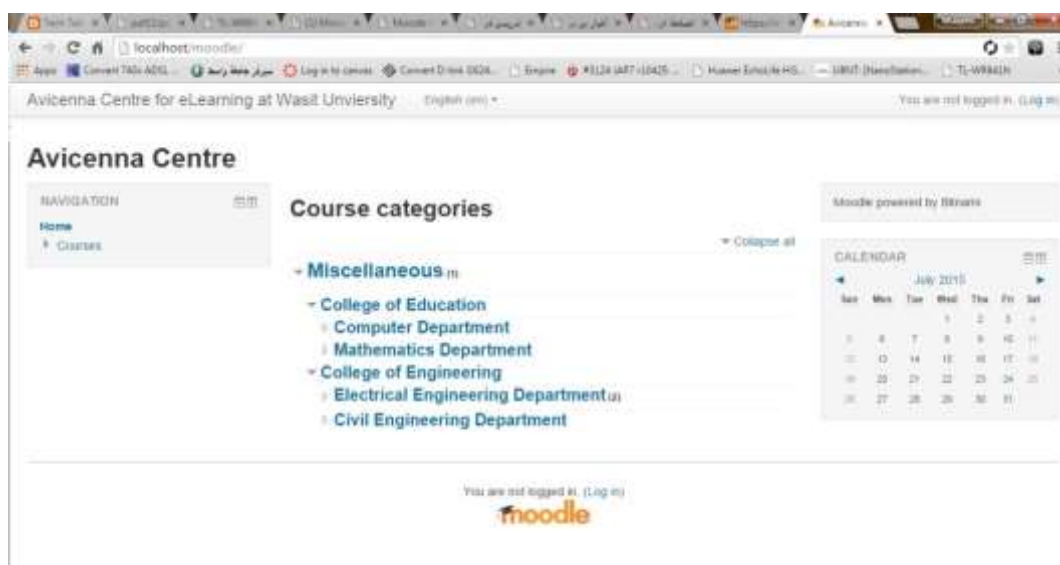


Fig. (9) Moodle (eLearning platform) of Wasit University accessed via Chrome

Due to these features this paper proposes the use of Moodle as the main platform for providing e-Learning in Iraqi educational institutions. This adoption on large scale will help to create a large base of specialists who can integrate the platform with other existing systems and also help to connect the units of these institutions together.

The projected curve for such adoption process is not as steep because the platform is of open source and can be connected to other systems easily which means the possibility of creating a large system of connected components that span many institutions very quickly.

4. Deployment plan:-

The proposed deployment plan involves two conceptually related aspects, namely, the hardware/network aspect and the software/platform aspect. Initially, the physical layout of the campus where the system is intended for deployment is analyzed to draw conclusions regarding the best practices in implementing a reliable and cost effective network coverage. After that the platform (Moodle) is installed, then, the learning management tree is created.

In the first step a network server is installed in secure room with reliable source of power by using a good uninterruptable power supply (UPS) unit. The server then is connected to a router or switch which in turn is connected to a set of backbone links. This should create an intranet within the campus with the possibility of connection to internet for access from off campus (see Fig.(10)).

Backbone links are connected to telecommunications closets or racks situated in each floor or building section of the campus [18]. The telecommunications closets contain LAN switches or even hubs. From those switches originates set of horizontal lines that end each in a wireless access point (AP).

The distribution of those access points must be studied and planned carefully in order to cover any possible blind spot and also cope with the number of students using the network in a particular place on campus. For example in places near a lecture room or a lab there should be at least more than two access points to provide the necessary bitrate and also to give enough backup in case of failure of one or more APs. Also, these APs must be provided with reliable source of power from UPSs. In less inhabited places such as walks and gardens the number of APs can be reduced significantly.

In order to achieve high performance, the media of backbone links are preferably fiber optics (FO). This requires also that the router in the server room as well as the switches in the telecommunications closet both support FOs. The use of FOs also has the benefit of having distances of more than 500m between the router and the switches. If FO is not available due to cost issues, UTP can still be used to provide Gigabit Ethernet, but the distance that a cable can travel before having to repeat the signal reduces to 100m.

As for horizontal links, UTP cables are the preferred choice in order to keep both cost and complexity down. This however requires following the standard rules of cabling (provided in details in [18]) in order not to degrade the bitrate of the network which is a crucial factor in the successful deployment of the entire LMS.

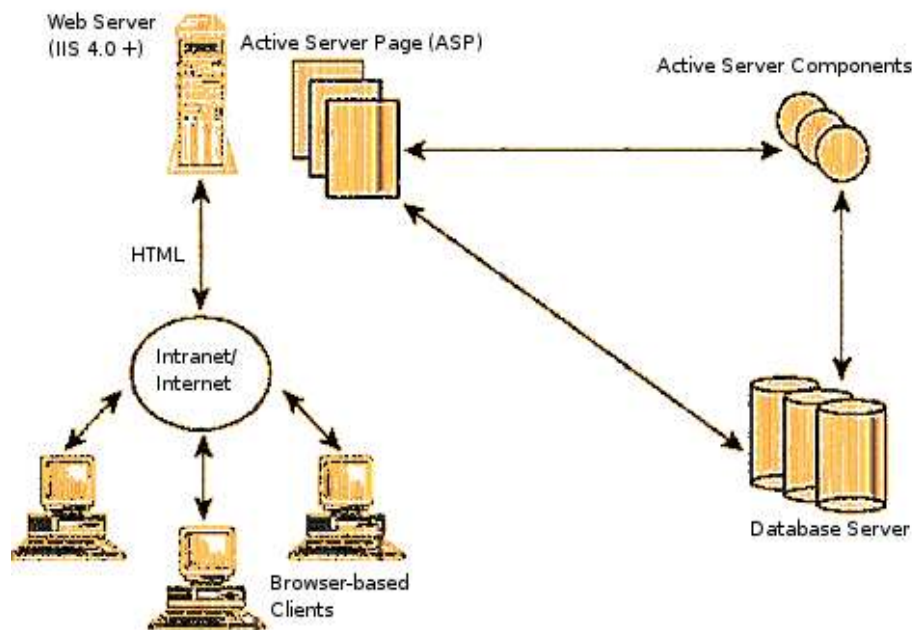


Fig.(10) Server based network to support Moodle LMS platform [19]



The second step of establishing the LMS is the installation of the Moodle platform on the network server. This step requires that the server support a recent version of IIS webserver, this depends on the particular version on Moodle being installed. For example, Moodle 2.5 requires IIS version 8, PHP version 5.3.3 or above, database such as MySQL version 5.1.3 or above.

After installing the platform, the institution (college/university) virtual tree must be created (see Fig.(9)). This includes establishing the hierarchy of the divisions of the institution. A college for example is divided into departments which in turn are divided into stages or years. The stages are then filled with the individual course. For each course a set of standard features is created such as the weekly events, the calendar, quizzes, chat room, forum, attendance list, gradebook, course resources, assignments and many others (see Fig.(11) for example).

After the creation of the virtual tree, the control of each course is transferred to the academic staff which can then use the system to customize and upload course material and also to enroll their class students on that course. Moodle platform allows a high degree of customizability and personalization as well as its support for most spoken languages.

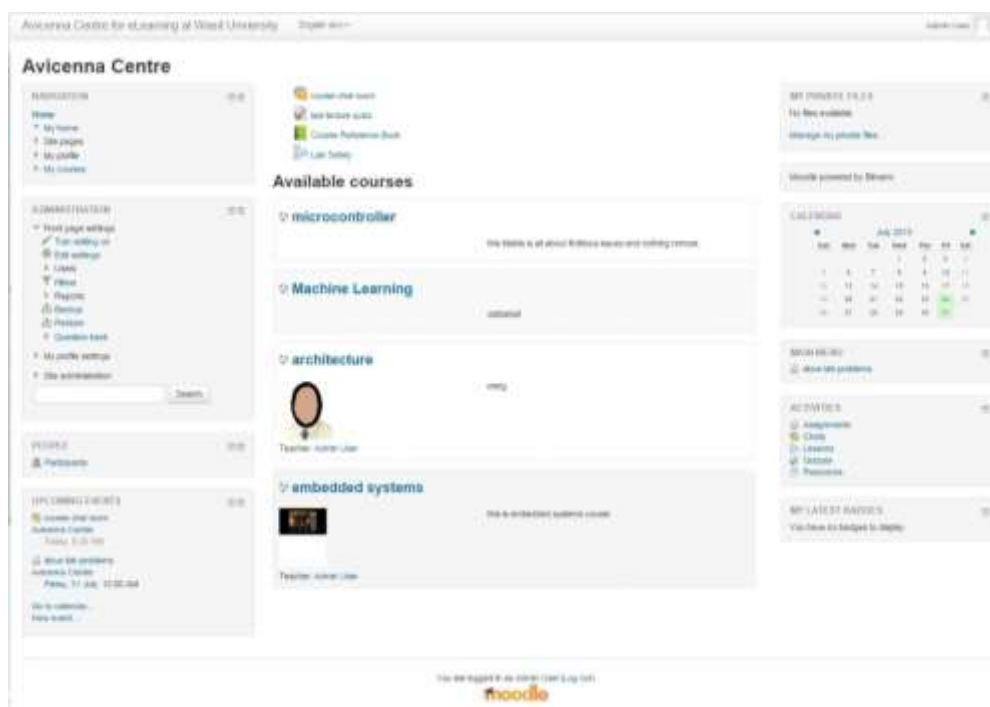


Fig.(11):- An example course page taken from the Avicenna center for eLearning of Wasit University



5. Conclusions

This paper proposed the employment of e-Learning approach in the modernization of higher education in Iraq. The set of gains achieved by employing e-learning and e-governance in general is beyond dispute. However, choosing the suitable time, place and tools is what needs to be studied and scrutinized.

In this paper the authors have shown that using an LMS to manage virtual environment of learning is possible within the limited resources of most Iraqi higher education institutions. By adopting an open source easy to implement platform, such as Moodle, many hurdles have been cleared. These hurdles includes either the development of native LMS from scratch with requires a huge base of knowledge, time and resources, or the employment of vendor platforms provided by one of the companies, the pitfalls with this approach is immediately obvious which are the unaffordable cost as well as the difficulty of importing technology in the current time.

This paper have also demonstrated that alternatives to LMS are not very suitable learning environment in Iraq due to the inherent problems associated with the lack or weak infrastructure as well as the technical difficulties associated with that approach.

Finally this paper exhibited the relative straightforwardness of implementing a Moodle based LMS by giving a deployment plan to cover both hardware and software aspects of the implementation process.

As a continuation to this study further work and reporting needs to be done on the adoption and acceptance rate of both academic staff and students for the newly implemented system in Wasit university, and also, pinpointing the most problematic issues that affect a successful utilization of this system such as the limitation to Intranets due in part to the lack of fiber optics based broadband service in Iraqi institutions and to security concerns in another part. Finally, the prospects of interoperability of this platform across multiple colleges to form a centrally managed virtual university must be investigated.



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