

Comparing LMS and CMS Platforms Supporting Social e-Learning in Higher Education

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Abstract— Content and learning management systems (CMSs/LMSs) exist in abundance, providing a software platform for supporting web-based applications in an easy-to-use way. In educational contexts, the exploitation of these platforms offers integrated solutions on the distribution of course material, student management and interaction between stakeholders. This paper evaluates the use of representative LMS/CMS platforms for supporting social e-learning systems in higher education, in terms of technical and educational perspective. To this direction, respective prototypes were developed using the LMS platforms: Schoology, Moodle and Atutor, and the CMS ones: Drupal, Joomla and Wordpress, and a comparative analysis was conducted. One major conclusion is that these platforms facilitate the development of e-learning environments with social features through a user-friendly dashboard and a variety of education-oriented services.

Keywords—Social e-learning, CMS, LMS, comparative analysis

I. INTRODUCTION

In recent years, the rapid evolution of Information and Communications Technology (ICT) and the proliferation of Web 2.0 have led to many changes in education, by introducing innovative technologies in the teaching and learning process [1]. A representative example of these changes is the advancement of e-learning with social features. E-learning provides an educational environment where learners can have access to the educational curriculum, without time and place restrictions [2]. Social e-learning enables, in addition, the learning through the interaction between participants in the educational process. One of the technological innovations is the emergence of web-based platforms for developing integrated web applications, namely Content Management System (CMS) and Learning Management System (LMS).

CMS is a system that facilitates the creation and modification of digital content, including files, images, electronic documents, audio files, and many more, in real time or as needed. It is designed to enable the deployment and publishing of any kind of websites. On the other hand, LMS is software platform for managing course material, student

interactions, and assessments. It provides an integrated solution for developing web-based educational systems [3].

This study focuses on the evaluation of the use of the most popular LMS and CMS platforms in higher education, regarding technical and educational features provided, and the comparison between these two system types. Hence, three LMSs: Schoology, Moodle and Atutor, and three CMSs: Drupal, Joomla and Wordpress, were chosen in this review. Afterwards, respective prototypes were developed in order to evaluate the usability, flexibility and capabilities of platforms for supporting e-learning systems with social features. The course selected for learning through these systems is a programming language being taught in an abundance of Universities, with the intention of analyzing their exploitation in higher education. The major conclusions are that these platforms facilitate the distribution of learning content, course management, student tracking and assessment, communication and collaboration, and their functionality has been remarkably extended incorporating social features in order to follow the evolution of technology. Moreover, they enable the development of integrated systems, even by those who lack programming skills, and reduce implementation cost, time and effort needed.

The remaining sections of this paper present the related work, the LMS/CMS platforms reviewed and their prototypes developed, the research methodology followed, describing also the evaluation criteria, the comparative analysis conducted, and finally the conclusions and future work.

II. RELATED WORK

Several studies on the review of LMSs are available in the related scientific literature. In [3], the authors discuss several LMSs, namely Moodle, Atutor, Blackboard and SuccessFactors and compare them based on several characteristics, such as flexibility, ease of use, accessibility, users interaction, integration with other systems etc. The aim of their study is to provide useful information to Higher Education Institutions to take the proper decision when choosing an LMS platform regarding their needs. In a similar context, the chapter in [4] provides comparisons among the most similar LMSs, for instance ATutor – eFront – Moodle, Blackboard – Moodle, Blackboard – eFront – Sakai, etc, to

allow universities to choose the proper system for their distance education activities. In [5], the authors propose a framework on the analysis of LMSs' potentiality and admissibility focusing on their usefulness and quality in use. This model has two aspects: i) the classification of the LMSs into categories according to specific objectives, and ii) the survey of the usability of these systems. In [6], it is reported the results of a comparative usability study conducted in 2008-2009 on two different LMSs: BlackBoard and Moodle.

Approaches that utilize CMS platforms in educational field have been studied by [7] where a Joomla-based online course was developed to carry out hybrid learning. This tool is a powerful open-source CMS and, according to this paper, it provided flexible class organization and learning ways, flexible instructor-learner interaction, flexible sharing of educational material and flexible assessment methods. Likewise, in [8], the authors present the capabilities of the above CMS and its exploitation in education, schools and universities. In [9], the authors describe the use of Drupal CMS in educational context for creating a learning environment where students and teachers have completed control over the content they shared. Moreover, in [10], the authors developed the SNAP Platform, a purpose-built, cloud-hosted e-learning environment for student learning support, built with Drupal. Finally, researchers have also studied the educational use of the Wordpress CMS. In [11], a thorough study of this tool for supporting the teaching and learning process is shown. While, in [12], the authors developed a LMS using Wordpress and this implementation had a major impact on their students learning experience.

The above literature overview confirms that the decision of the best LMS/CMS platform for supporting online learning is a crucial procedure where many features should be considered. Thus, an evaluation of these platforms is essential for developing high quality software that meets our requirements. The present comparative analysis is substantially different to others, concerning the purpose of this research, the platforms reviewed and the evaluation criteria.

III. LMS/CMS PLATFORMS REVIEWED

In this section, we describe the LMS and CMS platforms selected for review and, in addition, display screenshots of developed prototypes.

A. Schoology

Schoology¹ is a cloud based LMS that supports course management, increased access to curriculum and supplemental content, communication and collaboration in a social networking context.

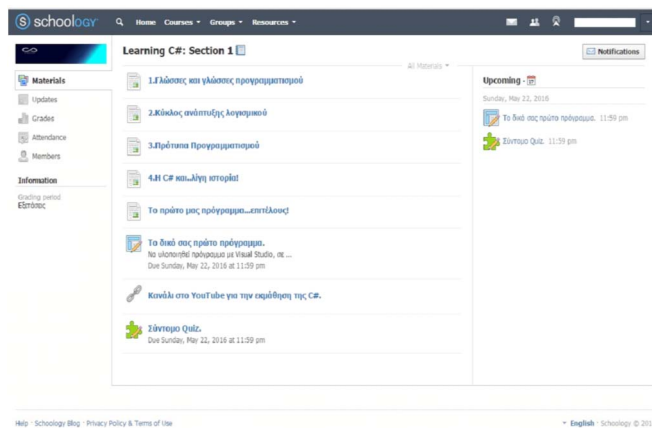


Fig. 1. Learning using Schoology

B. Moodle

Moodle² is a LMS designed to provide educators, administrators and learners with a single, robust, secure and integrated system to create personalized learning environments. It has a wide range of standard and innovative features for supporting teaching and learning process. Moreover, it allows for extending system functionality using community sourced plugins.

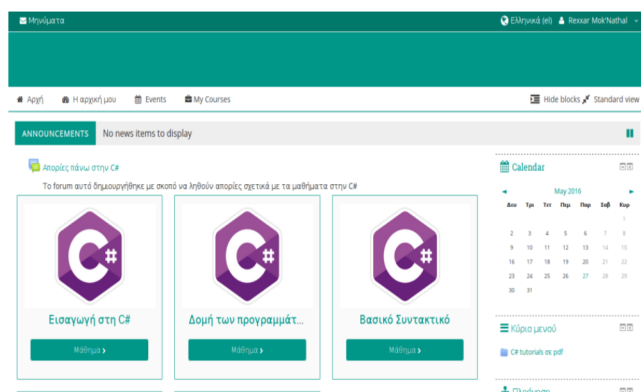


Fig. 2. Moodle-based online course

C. Atutor

ATutor³ is an open source web-based LMS used to develop and deliver online courses. Administrators can install or update it in a simple way, customize themes, and easily extend its functionality with feature modules. Educators can quickly conduct their courses online and manage the web-based instructional content. Students learn in an accessible, adaptive, social learning environment.

¹ <https://www.schoology.com/>

² <https://moodle.org/>

³ <http://www.atutor.ca/>

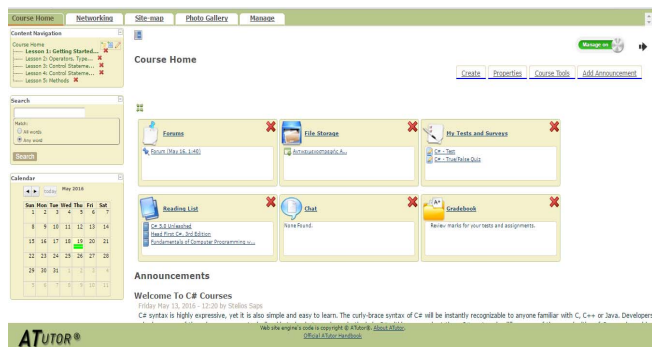


Fig. 3. Course management in Atutor

D. Drupal

Drupal⁴ is a content management software with great standard features, like easy content authoring, reliable performance, and excellent security and no programming skills required for developing professional websites. It includes free modules that extend and customize its functionality.

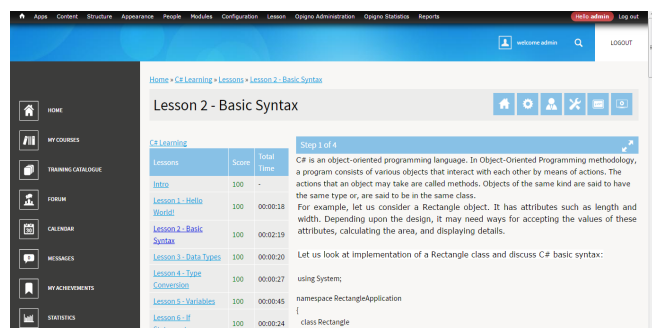


Fig. 4. Online course in Drupal

E. Joomla

Joomla⁵ is an award-winning CMS for publishing powerful online applications. It has an intuitive management interface to control all the features and functionality possessed. Furthermore, there are a variety of free extensions that allows users to extend its functionality and customize it to their own objectives.

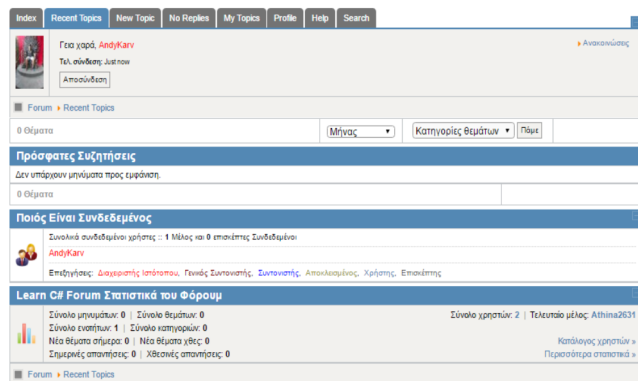


Fig. 5. Developing a LMS using Joomla

F. Wordpress

WordPress⁶ is reportedly the most popular website management or blogging system in use on the Web, supporting more than 60 million websites. It has over 50,316 plugins available, each of which offers custom functions and features enabling users to tailor their sites to their specific needs.

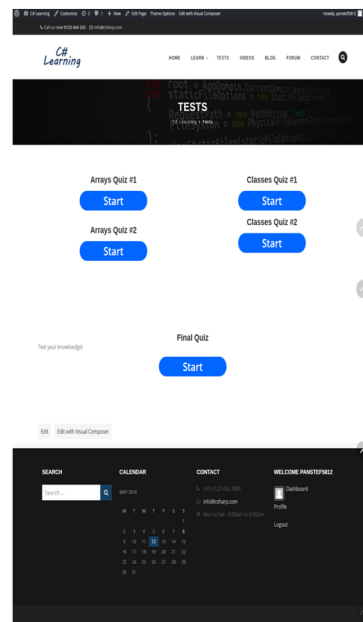


Fig. 6. E-learning developed in Wordpress

IV. RESEARCH METHODOLOGY

A. Steps of methodology

The aim of this study is to discuss the way potential LMS/CMS platforms can be used in higher education as an e-learning environment with social features, and to compare the selected platforms in terms of several characteristics.

Initially, we conducted a thorough investigation of research area, focusing on the exploitation of LMS/CMS platforms in the teaching and learning process and surveys concerning LMS/CMS capabilities. Subsequently, we developed prototypes of selected LMS/CMS platforms for evaluation. The course that has been chosen for teaching was the programming language C# (C Sharp), which constitutes a lesson of Computer Science Departments in a huge range of Universities. Finally, we evaluated the LMS/CMS platforms based on technical and educational characteristics and analyzed the results.

Fig. 7 illustrates the steps of evaluation followed in this study.

B. Evaluation criteria

In order to evaluate the LMS/CMS platforms, several characteristics were chosen, achieving a more reliable comparative analysis. These characteristics cover the main technical requirements and the fundamental educational

⁴ <https://www.drupal.org/>

⁵ <https://www.joomla.org/>

⁶ <https://wordpress.org/>

features, essential for the development of efficient and effective social e-learning systems [5, 13].

From a technical perspective, the characteristics used in the evaluation are:

- Core functionality: It refers to the type of application the platform mainly has designed to support.
- Open source: If the platform can be freely used, changed and shared.
- Extension modules: If the platform has several modules that can be added on to the site to extend its functionality.

- Customizable: If the platform provides an easy way to customize the site with many widely available configuration options.
- Easy to use: If the platform can be used by users who have no technical experience.

From an educational perspective, the selected characteristics concern the teaching-learning modules and social interaction, and are:

- Course management: If the instructor is able to create course content, organize it and manage materials distribution.
- Conducting tests: If the platform provides tools for conducting online assessments for student evaluation.
- Tracking student: If the platform has the capability to track student activity and participation.
- Gradebook: If the student grades can be stored and managed by instructor, and reports about learner performance is provided.
- Synchronous and asynchronous interaction: Synchronous learning offers face-to-face interaction, while asynchronous technologies support peer-to-peer one. Examples of synchronous interaction include videoconferencing, webcasts and interactive learning models. On the other hand, asynchronous learning can be carry out even the student is offline and involves coursework delivered via web, e-mail and message boards.
- Social publishing/ Communities: If the platform provides the capability of creating communities with common interests or characteristics, where the users can communicate and collaborate effectively through a social interaction, and publishing content by all members, not only by the site's operator (user-generated content).

V. COMPARATIVE ANALYSIS & DISCUSSION

The development of effective and efficient social e-learning systems is a challenging process, as they should handle the enormous volume of information being exchanged between the participants in the learning process (instructors-learners) along with their interactions, by providing a high-quality learning experience. The use of LMS/CMS platforms facilitates the development of such systems.

All the LMS/CMS platforms, evaluated in this study, provide a pleasure and user-friendly environment for developing web-based systems, requiring no technical and programming skills. Thus, the deployment of an integrated web-based learning system is accomplished in a simplest way, and without spending a lot of time and effort. Moreover, these platforms incorporate social networking services supporting, thus, both formal and informal learning.

From a technical perspective, CMS platforms provide a variety of customization options, due to the fact that their core functionality is to support general scope web-based systems. They have an abundance of available modules which can be

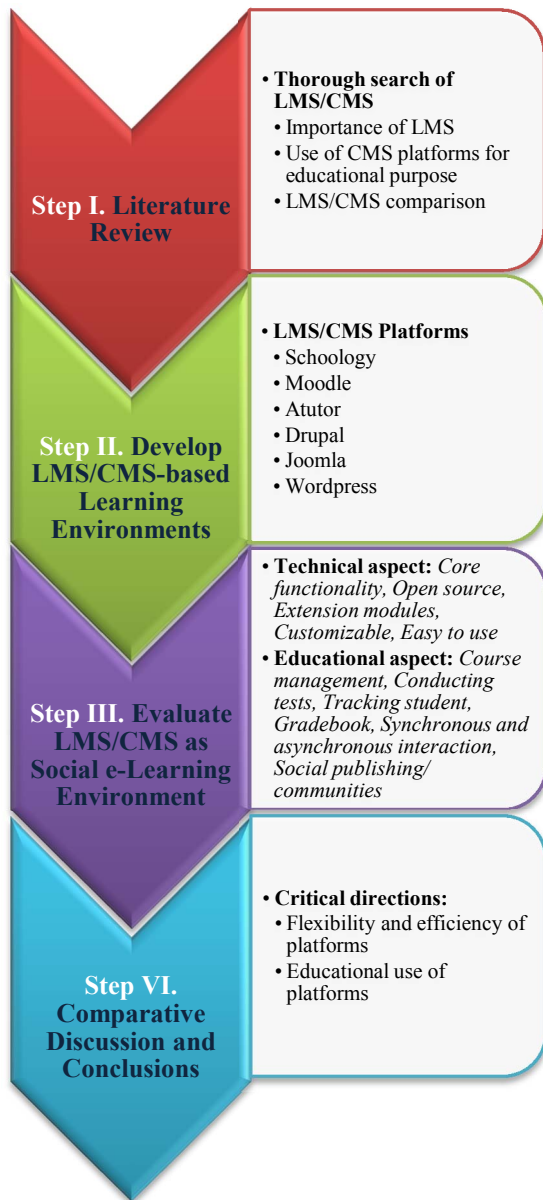


Fig. 7. Evaluation Steps

installed in order to extend system capabilities. Using a CMS platform, professional websites can be developed. On the contrary, giving that LMS platforms are education-oriented, they lack many extensions and customizable interfaces.

From an educational perspective, LMS platforms provide all the necessary modules for supporting the learning process by default. Hence, the instructors do not need to search and install the proper modules, as required in CMS platforms. However, in CMS platforms, there is a huge amount of modules, and so the instructors can choose the ones which align better to their requirements. On the other hand, due to the predefined modules of LMS platforms, they provide certain capabilities and limited configuration options.

Table I and II illustrates a comparison between LMS/CMS platforms reviewed based on technical and educational criteria.

TABLE I. EVALUATION OF LMS PLATFORMS

Evaluation aspect	LMS Platforms		
	<i>Schoology</i>	<i>Moodle</i>	<i>Atutor</i>
Core functionality	LMS	LMS	LMS
Open source	No	Yes	Yes
Extension modules	It is supported by enterprise version.	It provides the capability to install and disable plugins within a single admin interface, freely integrate external applications and content or create your own plugin for custom integrations.	There is a central module repository with few modules, integrated feature extensions, or third party add-on software. Developers can create integrated and third party feature modules to extend its functionality.
Customizable	Limitations on customization.	Customizable site design and functionality through themes and plugins and their easily configuration.	Easily create a custom version by importing themes, modifying them, or creating a new one. Except from this, it offers a variety of configurations in modules.
Easy to use	It has a simple and easy-to-use interface.	It offers a modern and userfriendly interface, easy to navigate on both desktop and mobile devices.	It is easy to install, create a system and manage it.
Educational			
Course management	It gives the capability to build diverse materials designed to engage students	Instructors can selectively release course content and assessments based on	Instructors can link discussions to specific dates or course events. The system can

	on all levels, set up and organize courses in many different ways.	specific start and end dates.	synchronize course dates defined by the institutional calendar.
Conducting tests	A basic assessment tool is provided.	A tool with huge variety of test options.	An integrated system for assessments.
Tracking student	It displays student course activity information.	Reports for whole student activities	Reports showing student activities
Gradebook	It is provided.	It is provided.	The system provides test analysis data for individual test items
Synchronous and asynchronous interaction	Instant messaging.	Whiteboard. Real-time chats, where chat logs are created and can be shared. Instant messaging.	Students can compile selected course content into a downloadable content package for viewing offline. Chatting is supported. It can also be used as an accessible instant messaging and white board tool, AComm.
Social publishing/Communities	There are groups and discussion features.	It provides discussion forums and groupwork.	Group functionality is available through the ACollab. Students have personal and public folders which can be shared. Students can create study groups, send e-mail to their groups, use a shared chat space and notice board, and share material privately within the group.

TABLE II. EVALUATION OF CMS PLATFORMS

Evaluation aspect	CMS Platforms		
	<i>Drupal</i>	<i>Joomla</i>	<i>Wordpress</i>
Core functionality	CMS	CMS	CMS
Open source	Yes	Yes	Yes
Extension modules	Its functionality can be extended with any one of thousands of add-ons and modules.	It is a completely object-oriented software design which allows Joomla! users to write their own extensions and	There are over 38,000 plugins in the WordPress Plugins Repository that helps in adding new and

		share them with the community. The extensions are divided into plugins, components, and modules.	enhanced features in a WP site.
Customizable	It provides many widely available plugins, themes and other configurations.	It offers many customization possibilities for website design and adding functionalities.	Due to its widespread popularity, there is a huge variety of customizations, such as plugins, themes, etc
Easy to use	It has a user-friendly interface, so there is no need having programming skills to manage it.	It is an intuitive and easy to manage tool without needing technical knowledge.	It is easy to install and provides a user-friendly interface.
Educational			
Course management	There are appropriate modules.	Extension to integrate Joomla and Moodle. LMS plugins.	A variety of related plugins.
Conducting tests	Through corresponding modules.	Many test/quiz plugins.	A lot of plugins, provided this capability.
Tracking student	No	No	No
Gradebook	Through course and quiz modules.	Through test/quiz plugins.	Through plugins.
Synchronous and asynchronous interaction	Primate messaging, chatrooms	Online Virtual Classroom plugin. Chatting.	Live chatting, Messaging
Social publishing/ Communities	Forums, Groups	Forums, Groups	Forum, Groups, Commentpress (which allows readers to comment paragraph by paragraph in the margins of a text), Wiki

VI. CONCLUSIONS & FUTURE WORK

The emergence of Web 2.0 has transmuted the Internet into a tool of sharing, collaborating and communicating. To this direction, e-learning systems need to enrich their functionality by embedding social features. Using a LMS/CMS platform, this can be achieved, as nowadays these tools provide social modules. Therefore, innovative e-learning systems are developed easily through a user-friendly interface and without spending a lot of time and effort, or needing programming skills.

The future directions of our research deals with the use of developed systems in practice, supporting the undergraduate course titled "Object-Oriented Programming" in the Department of Informatics of the University of Piraeus and the analysis of the participants' feedback.

ACKNOWLEDGMENT

The authors of this paper would like to thank the University of Piraeus Research Center for the financial support of this research paper.

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