

Compared Analysis of Representative Learning and Content Management Systems used in Education

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Online learning management systems used in universities do not fulfill entirely user requests. In order to optimize the activity of students and professors, an educational platform should provide both features of content learning management and features of content management. In this paper, we selected for analysis the most representative learning management systems (LMS) and content management systems (CMS) on the market. We analyzed both products that require paid license and free products in order to identify the essential features of a LMS and a CMS. Based on the results, we identified a series of features that such systems should provide and we conclude if the ideal system for an educational platform dedicated to superior learning may be represented by an existing product or by a hybrid system.

Keywords: CMS, LMS, compared analysis, instruction systems, educational platform

1 Introduction

Based on the way they are developed and their purpose, software products on the market can be classified in three different categories:

- In-house developed software products;
- Commercial software products;
- Free software products under GNU-GPL license (**General Public License**).

In house software products are developed by companies using its own resources and for its own use. The purpose of developing such software products is to simplify the management and the accomplishment of internal activities inside the company. The specifications of these products are fulfilling the needs of the company and are developed according to these needs. There are situations when such a company wants also to sell the software product. Still, because of the excessive personalization of the software, other companies or institutions may have serious difficulties in using it. Most of the cases, companies developed an in-house software product using financial investments and human resources for designing, building and implementing it during a time frame. Any change on the product for making it useable by other companies involves the increase of such investments. Thus, in-house developed products are, generally, designed exclusively for internal use. Still, there are

situations when the software product becomes a commercial one and the company that developed it commits to change the product in order to fulfill the requests of other users. If the product is provided for free and the source code is given to all interested users, then the latter may adapt the product to different request they may have.

Commercial software products are developed by companies that perceive a unique or a periodic tax for each license of the products. When a software product is already made, costs for developing a new version are, usually, lower than the costs for producing it. Thus, the users may consider the prices that developers perceive for such software products unreasonable high. Each sold license of a commercial software product aims a high income on a long time period, although, generally, there was a single production cost for developing the product.

Unlike commercial software products, *free software products*, under GNU-GPL license, may be used without paying any fee or tax. The source code for these products is also available for free. The main condition is that the product distributed under GNU-GPL license is not sold itself for money. These software products may be partially or totally modified and may be redistributed, also free of charge.

Programmers involved in developing free

software product often get involved also in paid projects. There are various modules and functions that need to be implemented and for which clients are willing to pay. This way, after a period of time from the moment they were developed and sold, such modules and functions are implemented and integrated into future versions of the free software products.

Limited budgets granted to education by governments, correlated with the economic crisis the society confronted with in the last few years, led to the orientation of the universities towards using free products. Thus, the development of such products and the increase of the community of those using products under GNU-GPL license were encouraged and favored.

We analyze three of the most representative learning management systems in order to identify the platform that best suits the requests of a product designed to help students in the instruction process. In order to optimally deploy the instruction process in higher education, the chosen system has to comply with both learning management requests and content management requests. For this reason, we analyze also content management systems (CMS).

2 Learning Management Systems

Learning management systems are web based software products that integrate applications designed for optimally deploying distance learning. These systems are also frequently used for campus-based learning as a method complementary to the activities in the class. Three of the most widely known learning management systems are **Moodle** and **aTutor** distributed under GNU-GPL license and **BlackBoard**, distributed commercially.

2.1 Background

Moodle - *Modular Object-Oriented Dynamic Learning Environment*, the most popular system dedicated to the educational field, is an open source collaborative platform based on social constructivism principles. These principles rely on the idea that students learn better when they have to create documents

and materials and when they have to explain the content to others. There are peoples than can understand a text by simply reading it and there are peoples than understand better when they explain to others.

Moodle provides tools like WYSIWYG (What You See Is What You Get) editors for content creation and also supports the communication between authors through its features of communication and collaboration like chat, forum and wiki. Also, in Moodle it is possible to import or export documents compliant to SCORM (Sharable Content Object Reference Model) and IMS (Instructional Management System) standards [1] [2].

A very important characteristic of Moodle is its modular structure which allows for enabling or disabling different options depending on the domain it is used for. Those who implemented Moodle generally first used the system at a small scale and, after testing its functionalities, they extended its scope.

Moodle is a PHP based collaborative system designed for a high level of interaction between instructors and learners. Due to its features and characteristics, Moodle is one of the leading courses management products in education area. The business area also manifests a growing interest towards using and implementing it for training of the employees. Learners in the business area want to acquire very fast the knowledge required for passing the tests at the end of the course, as they do not have the necessary time and patience to get through all the stages of a classical course. More, employers are not always willing to support classical courses as they prefer their employees to work [3].

Moodle learning environment was implemented in 2007 in 56 of the educational institutions from United Kingdom [4]. In 2007 there were over 20,000 installations of Moodle reported, with more than 8.3 million users from 169 countries. As an open source solution, Moodle knew a significant natural evolution, without being aggressively promoted on any market [5].

In January 2012, the number of websites developed through Moodle was more than 65000, with more than 57 million users from 218 countries, a significant growth compared to 2007. The total number of instructors was

more than 1.2 million.

Table 1 presents use statistics of Moodle platform as of January 2012 that highlight the popularity of the system among the actors involved in the instruction process.

Table 1. Moodle Statistics as of January 2012, adapted after [6]

Total number of sites recorded	65 940
Countries	218
Published courses	5 866 855
Registered users	57 064 214
Registered instructors	1 287 838
Page views	27 468 607
Messages published on forums	97 176 642
Resources loaded on the platform	52 563 498
Questions for evaluation tests	112 539 965

Even if Moodle is a free system, its implementation and, subsequently, its maintenance require time and money. Sometimes this represents a drawback in using the system. Still, Moodle was developed to improve the educational field and became the best free learning management system.

ATutor is another free web based learning management system. Due to its structure, it can be easily and quickly installed and configured and it allows the integration of different component like social networks or content management components. ATutor allows the users having the role of instructor to manage their courses online, to import or to create materials and to distribute them in the system [7]. ATutor is also compliant with IMS and SCORM standards [8].

This system provides the users and intuitive interface and communication tools like chat and e-mail. It also allows the integration with a videoconference module. The content of the courses may be imported from other sources or may be created using WYSIWYG tools available on the platform and predefined templates. For evaluation, aTutor provides tools for creating online test and it includes an online grade book.

BlackBoard is commercial content management software designed for the educational domain and used for activities of

teaching and instruction at distance. BlackBoard Learning System is a web server based platform which can either be installed on a local server or be hosted by BlackBoard ASP Solutions. The main purpose of this system is to add online elements to the traditional courses and to develop online courses. BlackBoard contains tools that allow social teaching and social learning like Vicarious learning, stimulating logical thinking and having an increased visual impact.

The administrative section of BlackBoard Learning System allows professors to create courses, publish articles, home works and videos for students. The instruction module is used for creating online courses and allows instructors to publish various lessons dedicated to students [9].

Professors may use the embedded calendar to let students know the deadlines for supplemental home works or the dates of evaluation tests. Also, there are dedicated sections where professors may publish announcements for students or where they can communicate through chat or forum. The communication between professors and students can be also done through e-mail, as another feature implemented in BlackBoard. The media library module allows the publishing of vide materials. The grade book section allows professor to set grades for

students as results of their evaluation.

The administrator or the professors can set read, write or delete rights to the other categories of users. Also, certain rights can be given to collaborators that are not registered on the system, for a limited period of time. They can access the platform in order to deploy collaborative activities through a secured virtual connection.

BlackBoard Learning System allows instructors to add educational content that was already created in BlackBoard System. Regardless the educational content was added to one or more sections it is stored in a single place and for each reference and use there is a virtual link created between sections. Subsequently, any change made on the educational object determines the automated update in each section where it was added [10].

The ease of use of tools for creating materials that BlackBoard provides allows the authors of educational content to have the freedom of focusing more on teaching techniques and on preparing the courses than on how to manage the platform.

2.2 Compared analysis of LMSs

The purposes for implementing a learning management system is to provide immediate access to instruction, to reduce the delivery costs per course, to let students learn at their own pace and to deliver knowledge with greater consistency [11].

Unlike the commercial BlackBoard, Moodle and aTutor are free systems which can be installed very fast and easy.

The navigation area on Moodle based websites is smaller than the navigation area on BlackBoard websites. Still, BlackBoard allows the personalization of each section of the webpage while Moodle does not allow changing the upper part of the pages. The functionalities that BlackBoard provides are far more intuitive for beginners than those provided by Moodle.

Moodle includes more tools, like vocabulary, lessons, journal and pools, and allows a faster integration of multimedia elements. Another feature of Moodle as a system used in

education is the possibility to track the activity of each learner in order to identify the sections of the courses he prefers. Moodle also embeds an evaluation tool which supplies the correct results and other details about the answers given by students at evaluation tests. Functionalities of Moodle are much better defined. Also, Moodle can be personalized by adding new modules.

BlackBoard includes a tool for conduction polls available just after the installation, and a *Resources* section where the user may quickly access external web sites.

Due to the global economic crisis started in 2009 and to high acquisition prices, BlackBoard lost a significant market share in a very short period of time. Being distributed under GNU-GPL license, open source products kept a relatively constant market share.

ATutor can be configured easier than Moodle which requires many options to be checked at the first installation. This process assume allocating a considerable long time interval for installing Moodle which can be shorten by using the default options to install Moodle in the basic configuration. Subsequently, after the installation was done, users may modify the standard settings.

Moodle and ATutor provide similar functionalities organized in a similar manner. Although aTutor interface has less functionality, it is more intuitive than the interface provided by Moodle. Still, the interface of Moodle looks more professional and provides more functionalities and options for personalizing the website compared to the one provided by aTutor [12].

All three learning management systems provide various means of synchronous and asynchronous communication and allow users to import templates or to load different types of files. As learning management systems, Moodle, aTutor and BlackBoard allow professors to create knowledge verification tests and students to access and visualize their results in the online grade book.

Unlike aTutor and Moodle, BlackBoard gives the user the possibility to create a

personal page and a more logic navigation structure, more intuitive for the user. Also, BlackBoard allows the detailed monitoring of user activity on the platform [13].

3 Content Management Systems

Content management systems are platforms designed to manage the content of the web sites through an intuitive and easy to use interface. According to [14], content management system is composed of **C**ontent **M**anagement **A**pplication - CMA and **C**ontent **D**elivery **A**pplication - CDA.

CMA allows the author to create, modify or delete content on a website without requiring programming and administration knowledge. Content created is taken by CDA, compiled and published on a website.

We analyze three of the most popular content management systems: Joomla and Drupal, distributed under GNU-GPL license, and Microsoft SharePoint, distributed commercially.

3.1 Background

Joomla is an easy to use CMS that does not require the developer of the web site to have programming aptitudes or technical knowledge. It is a relatively recent platform created by Andrew Eddie in 2005 and developed from Mambo. The platform became shortly one of the most popular open source content management systems under General Public License GNU-GPL.

Joomla provides support for fast development of web sites and of various online applications due to its ease of use and to the features it provides. The system keeps the evidence of all the pieces of content on the web site represented by text, images, music, videos or documents.

In 2011 there were more than 1.65 million installations of Joomla [15], representing presentation Web sites, online shops, e-commerce web sites, personal web pages or corporation web sites [16].

Drupal is an open source content management system, which can be also described as a content management framework - CMF. Unlike traditional content

management systems, Drupal provides a collection of predefined components that can be used as they are or can be reconfigured almost completely in order to meet user requirements. The way this system has been designed makes it very flexible and allows even those without any programming knowledge to make complex and professional sites. The most important characteristic of Drupal is that it is developed towards a "many to many" communication system model. The system allows each user to create a customized personal blog and generates links between these blogs and their rankings [17].

The collaborative platform proposed by Microsoft is based on some of company's reference products: Microsoft SharePoint Portal Server, SharePoint Team Services, Microsoft Office, Microsoft Exchange and Microsoft Content Management Server. The products in the SharePoint family may be independently used or may be combined together in order to achieve a complete solution for sharing information inside organizations of any kind and any size [18].

Microsoft SharePoint is a content management system that provides support for building collaborative websites. The installation and configuration of such a system implies a significant effort. In order to make a collaborative platform functional, SharePoint Server or SharePoint services must be installed, the web site must be configured and the users must be defined by an administrator. As a commercial product, both the installation and the configuration of a SharePoint platform benefit from Microsoft support. Thus, SharePoint is a solution for large organizations that desire to provide their employees an online collaborative environment.

SharePoint provides functionalities for document management, web content and business processes management. In order for the documents inside a library to be modified in a collaborative manner, the users of the platform with change rights on the documents must announce explicitly the operation of opening, respectively closing the

session of document editing. For each document that is collaboratively created by the users with editing/writing rights, a sub-site is created for hosting activities, discussions, announcement publication and web URLs of external sites about the content of the document, shared between the users working on that document [1].

3.2 Comparative analysis of content management systems

Free content management systems had a significant evolution in the past few years. They can be installed and configured pretty fast and easy without requiring the administrator or user to have advanced technical knowledge [19]. Content management systems embed tools for helping the user quickly update website with minimum technical effort, to adapt the structure of the website according to the content and to personalize the site in terms of graphics. Content management systems also provide an intuitive system of navigation through web pages.

Joomla and Drupal are two content management system developed in PHP and MySQL and there are no visible significant differences on the aspect of the websites built with either one of these. Both of them support the quick development of web sites and the differences are more visible on the administrative side [20].

Joomla! and **Drupal** are designed to work in shared hosting environments, the most accessible and used hosting solutions. Drupal is recommended for creating websites for virtual communities and Joomla is recommended for creating sites where the focus is on the management of the web pages and their content.

Installation of Joomla is quicker and does not require advanced technical knowledge as the installation of Drupal or SharePoint. Unlike these, Joomla has support for including new extensions and additional components programmed in PHP, provided for free or commercially. While Drupal also provides support of including other extensions after installation, all of them being free, extensions

available for Joomla are far more complex and more intuitive for users without technical knowledge. The disadvantage of integrating modules in Drupal is the lack of a good support for installing and using these modules. The community of Joomla users, which support the installation and the development of modules is much greater than the community of Drupal users.

Unlike Drupal, Joomla installation allows the deployment of a single website where roles and permissions granted to the users are limited. After a single installation, Drupal allows the creation of more websites and provides a more various range of users along with their customization.

Both Joomla and Drupal allow the simple editing of content. The administrative side is more intuitive and easier to use in Joomla than in Drupal. Unlike Drupal, Joomla embeds a WYSIWYG editor, TinyMCE, which is installed by default and which supports adding video files to webpages.

On content management side, Drupal provides complex services through unlimited levels of categories, labels and classifications. More types of content may be created, each with different characteristics, while in Joomla there are available only three content categories – Section > Category > Content.

On the internet, there are many free available templates for Joomla based websites in various domains. Although in a much smaller number, the free templates for Drupal are realized more professionally. Drupal also supports a greater flexibility in personalizing chosen templates.

The structure of a Drupal based website can be faster adapted to the content but setting up a visual theme requires more time and knowledge than for Joomla based websites. Drupal includes better tools for editing current pages by both users and web developers, without requiring changes directly in the code of the pages.

The average size of a Joomla page is smaller than the average size of a Drupal page. Still, because of using cache technology, web pages of Drupal based websites load faster

[21].

SharePoint is a complex system that supports the integration of Web Apps Office files and provides functionalities that are specific to social networks. Because it was designed for deploying collaborative activities in large size institutions, it has some disadvantages compared to Drupal and Joomla: the multi-linguistic content management is difficult, the time for accessing resources is longer, it doesn't support customization through templates. Installing SharePoint requires platform specific knowledge and cannot be done by users that don't have solid IT knowledge. Installation of Joomla and Drupal is intuitive and can be done by such users [22] [23].

4 Main characteristics of systems dedicated to education

In order to satisfy the requests of the actors implied in educational process in universities, based on the functionalities identified to be essential for an educational platform, institutions can choose between developing a new platform in-house or integrating a content management system and a learning management system. The integration will develop a hybrid platform which combines characteristics that are specific to learning management systems with characteristics that are specific to content management system, Fig. 1 .

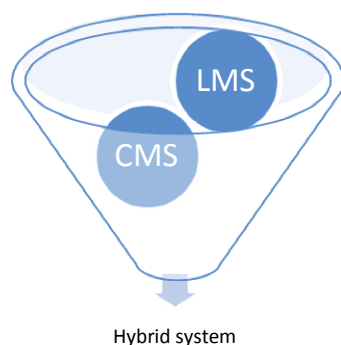


Fig. 1 - Integrating LMS and CMS into a hybrid system

Based on the features provided by analyzed LMSs and CMSs and on the pedagogical

practice we identified the essential features that an educational platform should provide:

- manageability by users that don't have strong IT knowledge;
- management of educational content from the front-end using WYSIWYG editors;
- management of document versions for collaborative activities;
- content import and export using different formats and possibility to embed multimedia content;
- file sharing;
- integration with e-mail client;
- user management and authentication;
- student tracking, online testing and grade book;
- intuitive interface;
- multi-linguistic interface and possibility to manage multiple site languages;
- integration with social networks (Facebook, Twitter);
- synchronous and asynchronous communication between users;
- detailed statistics about the activity on the platform;
- compliance with e-learning standards;
- integration with other components or systems.

The system that provides most of the essentials features of an assisted instruction platform that also ensures a collaborative environment and the commercial BlackBoard. As SharePoint is a content management system with great collaboration features, an integration of BlackBoard and SharePoint would respond to most of the requests of an ideal system dedicated to learning. Still, both of them being commercial products, this integration can be solely solved by their developers only.

As an open source solution, based on the analysis we took, in order to set up an education platform providing the essential functionalities, an institution may choose to integrate Moodle learning management system and Joomla content management system. Because both of them are open source management systems, the main advantage is that they can be fully integrated.

In order to access such an educational platform, only a web browser is required. The interface of the platform is managed by the CMS, due to the administrative features that this system provides. Regardless the user has professor/instructor rights, student/learner rights, or is simply an anonymous guest, he can browse the web pages from the public area of the CMS. Professors and students will have access to the private area based on username and password they are provided at the beginning of the courses, after signing up on the platform. Once authenticated, they can access information on both public and private area. The CMS menu will provide access to courses, seminar supports and calendar events from the LMS. The access will be fast due to Single-Sign-On, without requiring a supplemental authentication in LMS. Users can access the LMS content through the CMS interface in order to take advantage of the full functionalities of an educational platform.

5 Conclusions

As learning management systems are mainly oriented towards the achievement of the educational process and content management systems are mainly oriented towards interactivity and ease of use and administration, the integration between a LMS and a CMS would lead to a hybrid solution that would provide more of the essential functionalities of an educational platform than each one of them does. Still, most of the cases, the integration can be done only at module levels and not as a full integration.

Generally there is reluctance towards the use of open source systems. Those interested fear of lack of support or of the availability of an installation and use guide. The support for such systems is provided by members of open source user communities and not by a dedicated team ensuring functioning of the system and providing solutions to those asking for them. Considering though the price paid for the license of using a commercial product and administration and

maintenance costs, systems distributed for free remain a pertinent solution for those who wish to use them and do not have a long-term budget allocated for this purpose. Free systems are mainly used by superior education institution because these usually have it departments. The members of these departments are often involved in administration of systems designed for educational domain and even in their development.

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