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Learning Management Systems for higher education - an overview of available options for Higher Education Organizations

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Abstract

This paper presents an overview, based on a theoretical research, of the Learning Management Systems (LMSs) options available for the Higher Education Organizations (HEOs). The first part of this paper is presenting the main challenges which have to be faced by HEOs when select and implement a LMS as well as the second part of the paper it is dedicated to a rundown of the main alternatives available for HEOs from the main families of LMSs. Also, this paper is looking to provide a more clear picture of the challenges and alternatives in the domain taking into consideration the differences existing between cultures, countries, and ultimately between HEOs.

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Keywords: cloud-based LMS; Higher Education Organizations; Learning Management Systems; open-source LMS; proprietary LMS.

1. Introduction

In the late 1990s when the boom of the ICT was impacting significantly the society in all its aspects the specialists from various domains have decided to take the advantage from this evolution of the software and hardware resources. This happen in all domains of activity, from oil & gas industry up to automotive industry, in fact being impossible to name a single domain of activity which has not being touched by the ICT boom. Even more important, the ICT development has impacted and irreversible influenced the education of all grades as well.

Nowadays the Higher Education Organizations (HEOs) have to face more challenges, and more complex issues, starting from an increase number of students enrolled in their educational programs up to the limitations imposed by

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the infrastructure available to accommodate the students and the curriculum classes. During the past two decade a hope to solve, at least partially, the challenges face by HEO was brought by the developments achieved by the Information and Communication Technology (ICT). The HEOs have totally changed their position towards the use of technologies and equipment made available to the masses of user by ICT, and here have to be mentioned the boom recorded by the mobile devices development. Based on the ICT developments, and on the large and easy access facilitated to these developments, the HEOs have got the time and the possibility to look to a variety of solutions for managing the learning, giving a more substantial attention to LMSs use within their educational programs. However, in the opinion of the author of this paper, there is still a lack of information about LMSs in terms of which types of LMSs are available, which the challenges to select and implement a LMS are etc. It is sufficient to consider a simple answer to a possible question, why the HEOs do need using a LMS, and answer which is given in same simplicity by the ultimate goal of any HEO, that being the achievement of the customer satisfaction. Considering as main customer the student, the ultimate goal will be a successful student, which is nevertheless, the student who not only graduate a faculty but who is able to be employed immediately with an employment package considered satisfactory for the junior grade.

According to Davis, Carmean, & Wagner (2009), end of 1990s represents the border between traditional and future in education. At that time, the learning management has been transferred from the classroom as we all know and which is still existing at present, to a new level of development. As per the same researchers, at that time, the "*traditional classroom experiences were being "ported" online, redesigned (or at least reconfigured) for computer-mediated delivery, and distributed via the Internet*." (Davis, Carmean, & Wagner, 2009, page 4). At the beginning the learning management experience in the new form, computer assisted and via Internet, was reduced to the management of messages sent and received. But, Davis, Carmean, & Wagner (2009) shown that, in 1997, the first leading companies in LMS development, which were at the time, Blackboard and Saba have developed LMSs fit to be used at enterprise level and server-based, these being at the time the most advanced proprietary LMSs. Known also as commercial LMSs, the purpose of those early proprietary systems was to create digital materials for teaching and learning, to distribute these materials to the users, to manage the teaching materials and the users data and ultimately to assess the users knowledge achieved at the end of the teaching-learning process.

In fact, among all definitions given to LMSs by various researchers and specialists into the domain, the one provided by Berking, & Gallagher (2013) was defining the scope of the LMSs as "*...a key enabling technology for "anytime, anywhere" access to learning content and administration*" (Berking, & Gallagher, 2013, page 6). In the author's opinion, the LMSs could be defined as a set of software platforms, delivered to users by instructors through internet and by the use of various hardware means, having as purpose the delivery in the shortest time possible a high level of knowledge into a domain assuring in the same time a full management of the entire educational cycle, including data and information.

HEOs have been involved since the beginning in the use of the proprietary LMSs, and, in fact, the HEOs played and are also playing at present a very important role from this point of view. Why is that? Just simple, because of the fact that the students are mostly teenagers in the age range of 18 to 29.

2. HEOs, Teenagers, ICT Technologies and LMSs Connections

The research performed by the author has revealed several important aspects which could be considered as causes or contributive factors to the development of a direct and very tide connection between HEOs, students (teenagers), ICT technologies and LMSs. The various types of LMSs could be split in three main families and these families are: open-source LMSs, proprietary LMSs, and cloud-based LMSs. Regardless the type of LMS in use by a HEO, the interfacing between people and system is done through electronic (computer/tablet/mobile/smartphone/networks) and virtual means (Internet, Cloud computing etc.). This involves the use of ICT technologies. Below, the author is presenting several statistical data and graphs which are deemed to bring a clarification in terms of available ICT technologies and especially of the mobile ones and the penetration/use of these by the people.

In 2013, a study has been carried out by a team of researchers from USA (Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013), with the purpose to understand where the spread and use of Internet is and also, where the smartphones adoption have arrived. The conclusion the researchers arrived should not be at any surprise looking to the development of ICT technologies, "*Smartphone adoption among American teens has increased substantially and*

mobile access to the internet is pervasive. One in four teens are "cell-mostly" internet users, who say they mostly go online using their phone and not using some other device such as a desktop or laptop computer" (Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013, page 2).

The figure 1 is presenting a graphical statistic cited from Madden, Lenhart, Duggan, Cortesi, & Gasser (2013, page 3) which shows an incredible level reached in terms of Internet access which, according to example given for USA, has reached a 95% even for 12 to 17 years age range teens. The range of interest for the present paper, 18 to 29 years old shows the same very high level of Internet use. In other words, the teens between 12 and 17 years old, once arrived to the moment when they go to the University they are already prepared to use Internet, they have already sufficient knowledge and also poses the means (mobile technology) to access, get familiar in a very short time and use any kind of system Internet based, including here a LMS.

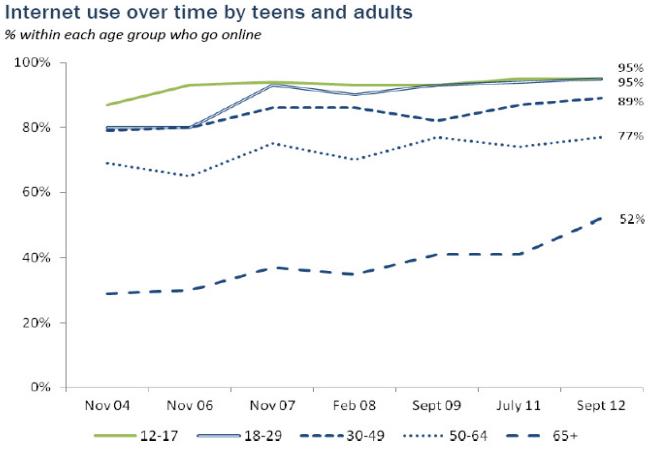

Fig. 1. Statistic presenting the internet use during period 2004-2012, by age groups. Graphical statistic as presented in Madden, Lenhart, Duggan, Cortesi, & Gasser (2013). Source according to Madden, Lenhart, Duggan, Cortesi, & Gasser (2013): The Pew Research Center's Internet & American Life Project surveys. All teen data comes from separate surveys of teens and their parents (Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013, page 3)

Mobile Phone Internet User Penetration Worldwide, by Region, 2012-2017
% of internet users

	2012	2013	2014	2015	2016	2017
Middle East & Africa	88.9%	92.7%	94.0%	94.0%	95.0%	96.0%
Asia-Pacific	80.6%	83.9%	87.4%	90.0%	92.6%	93.9%
Central & Eastern Europe	47.8%	59.4%	72.4%	80.6%	86.6%	91.7%
North America	51.7%	57.9%	64.3%	69.8%	74.4%	79.2%
Western Europe	46.1%	57.2%	67.8%	78.2%	85.0%	90.6%
Latin America	41.2%	51.8%	58.5%	65.0%	70.1%	75.2%
Worldwide	**66.8%**	**73.4%**	**79.1%**	**83.6%**	**87.3%**	**90.1%**

Note: mobile phone users of any age who access the internet from a mobile browser or an installed application at least once per month; use of SMS/MMS is not considered mobile internet access
Source: eMarketer, Dec 2013
167151 www.eMarketer.com

Fig. 2. Statistic for mobile phone internet user penetration worldwide, by region, 2012-2017, as presented on MobiThinking$_{TM}$ White Papers Web page (2014), source cited by MobiThinking$_{TM}$: www.eMarketer.com, January 2014 (MobiThinking$_{TM}$, 2014, http://mobithinking.com/blog/mobile-web-penetration).

Moreover, a simple research of the statistical data available shows the future trend of ICT technologies at worldwide level. Figure 2 quoted from MobiThinking$_{TM}$ (2014, http://mobithinking.com/blog/mobile-web-

penetration) is presenting the near past, present and near future clarifying even better the Internet use from mobile phones at global level. It is very clear that the present and the future belongs to ICT technologies, and especially to mobile technologies. As per statistic presented in figure 2 (MobiThinking$_{TM}$ (2014, http://mobithinking.com/blog/mobile-web-penetration), all global regions shows to have an increase appetite for ICT technologies and use of Internet.

According to same MobiThinking$_{TM}$ (2013, http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats/a#topsmartphonecountries) the smartphones sales will increase from a 1,013.2 millions of units in 2013 to an estimated 1,733.9 millions of units in 2017, which means an increase of the sales of smartphones with approximate 71% within four year time. In same period of time, same source (MobiThinking$_{TM}$, 2013, http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats/a#topsmartphonecountries) is stating that is expected a growth of the tablets sales from 227.3 millions of units in 2013 to 406.6 millions of units by 2017. Even, the portable PCs and desktop PCs sales statistics shows a depletion of the users interest these type of items will be still securing an important segment of the market. In fact, according to Heggestuen, today "*one in every 5 people in the world own a smartphone, one in every 17 own a tablet*" (Heggestuen, 2013).

As a partial conclusion, the tools are available and already well known by all parties involved in higher education and this is a fact. But what about the LMSs offer? Is the LMSs market enough developed? Could the offer allow the users to select and implement a system according to their needs? The answer, again based on the research of the statistical data available, shows that the market offers three main categories of LMSs, as follows:

- Proprietary LMSs (or commercial LMSs)
- Open-source LMSs
- Cloud-base LMSs
- Hybrid LMSs (usually developed in house)

3. A Brief Look on the Use and Spread of the LMSs

Probably the most advanced in terms of education, USA, offers again a driving example in terms of the LMSs use. As per statistics presented by Edutechnica (2014, http://edutechnica.com/2014/05/26/lms-by-the-numbers-spring-2014-updates/) and which are presented in figure 3, quoted from Edutechnica, an impressive number of HEOs from USA have already in use one LMS. Still present and used in the highest number of USA HEOs, Blackboard Learn (a proprietary LMS) has started to face since 2002 a very strong competition especially from other proprietary LMSs (Canvas, Desire2Learn) as well as from open-source LMSs (i.e., Moodle and Sakai).

	ANGEL	BbLearn	Canvas	D2L	Moodle	Sakai	Other
Institutions	180	1030	258	272	566	116	413
	6.3%	35.8%	9.0%	9.5%	19.7%	4.0%	14.4%
Enrollments	989,922	7,619,598	2,204,231	2,154,285	2,820,549	1,114,403	2,135,602
	5.8%	44.6%	12.9%	12.6%	16.5%	6.5%	12.5%
Average Size	5500	7398	8577	7920	4983	9607	5171
Median Size	3735	4336	4709	5027	2352	4885	1986

Fig. 3. Statistic presenting detailed LMS usage data for USA higher education organizations with more than 2,000 enrollments, as presented in Edutechnica (2014, http://edutechnica.com/2014/05/26/lms-by-the-numbers-spring-2014-updates/). BbLearn = Blackboard Learn; D2L = Desire2Learn; Other = Learning Studio/eCollege, Jenzabar's e-Racer, SharePoint, WebStudy, OpenClass, Scholar360/Edvance, other commercial LMSs, other open source LMSs, and LMSs developed in-house (Edutechnica, 2014, http://edutechnica.com/2014/05/26/lms-by-the-numbers-spring-2014-updates/)

Considering the business strategy of Blackboard Inc. to improve its market footprint by acquiring specific business (i.e., in 2009 ANGEL has been acquired by Blackboard Inc.) looks that at least on the proprietary LMSs market there will be at least one very strong player for the near future.

Still present and used in the highest number of HEOs from USA, Blackboard Learn (a proprietary LMS) has started to face since 2002 a very strong competition especially from other proprietary LMSs (Canvas, Desire2Learn) as well as from open-source LMSs (i.e., Moodle and Sakai). Figure 3, quoted from Edutechnica (2013, http://edutechnica.com/2013/10/15/data-driven-campus-lms-strategy/), shows that the Blackboard Learn is still the most common use LMS not only in USA but in other regions which are considered as pioneers and in the same drivers in higher education development. Even more, the market has been bridged not long time ago by another outstanding achievement of the virtual world specialists these being the Cloud computing. A sample of the impact of the newest achievement is given by Docebo®, "*a disruptive Cloud E-Learning solutions provider*" (Docebo®, 2014, page 2) which claims that has 28,000 customers in 26 countries. Docebo® has published in March 2014 an impressive report which considers a growth of the E-Learning market (including LMSs market) at an annual average rate of 7.9% during period 2012-2016, leading to a worldwide business financial value of the specialized market in 2016 of $51.5 billions (Docebo®, 2014).

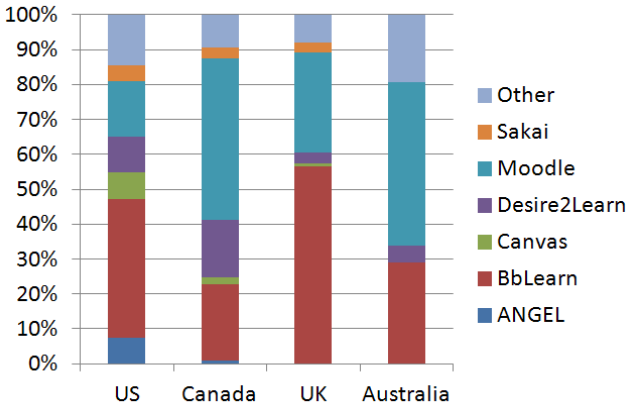

Fig. 4. Statistic presenting the higher education organizations usage by North America, UK and Australia regions as percentages from total, as presented in (Edutechnica, 2013, http://edutechnica.com/2013/10/15/data-driven-campus-lms-strategy/).

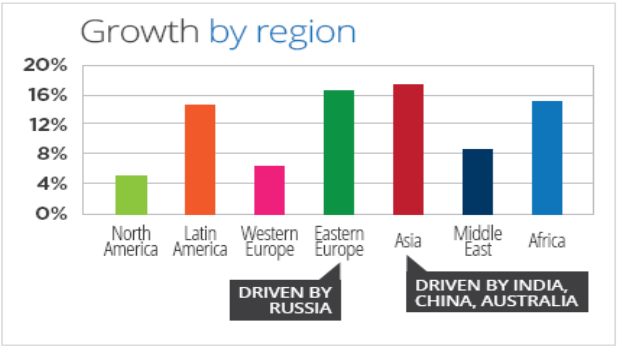

Fig. 5. Statistic presenting the 2011-2016 growth rates for E-Learning market (including LMSs market) by geographical region, as presented in Docebo® (2014). Data source quoted by Docebo®: Ambient Insight 2012 (Docebo®, 2014, http://www.docebo.com/landing/contactform/elearning-market-trends-and-forecast-2014-2016-docebo-report.pdf).

From the incredible value E-Learning market will worth by 2016, according to the source cited by Docebo® (2014), Ambient Insight, the LMSs market will worth by 2016 no less than $38.3 billions, having like this the lion's cut of 75% from the specific business. The statistic presented in figure 5, quoted from Docebo® (2014), shows that the growth rates are lower for regions like Western Europe and North America then in other regions, this mainly due to the advancements which these regions have achieved comparing with the others, so the markets in Western Europe and North America have reached a saturation point. In author's opinion, the driving regions, from LMSs viewpoint, will open the gate for significant growth only when large scale moving from existing LMSs type to other types more developed will be visible and/or for the growth based on the future important achievements into domain which could add more value to the HEO performances. However, according to Docebo® report (2014), and the source cited by Docebo® report, Bersin & Associates, in 2012 were "*...some 500 providers in the LMS market and only five of them have more than a 4% market share.*" (Docebo®, 2014, page 8).

4. LMSs Main Categories

Below, the author will briefly refer to the main categories of LMSs, considering these categories of LMSs from the point of applicability within the HEOs and also, considering that the purpose of the LMSs, regardless the type (category) is the same. So, from the purpose point of view it was assumed that all LMSs from all main categories are deemed to manage the educational cycle and the students' data as minimum.

4.1. Proprietary LMSs

The proprietary LMSs represent the beginning. These systems are called proprietary because have been licensed by their developers under exclusivity of the legal rights belonging to the copyrights owner/s. The proprietary LMSs require the existence of a developed infrastructure (buildings fitted with labs, networks, computers etc.) and also involve the installation of the platforms on the HEOs servers and computers.

In case the HEO do not have a sufficient developed infrastructure and the servers can't be accessed by students from external sources (for example using Juniper interface) than the LMS has to be interfaced through internal infrastructure which could be a disadvantage. The most known and used at present proprietary LMS is Blackboard Learn and previously the author has cited statistics proving the spread of this LMS. Some other important proprietary LMSs to be mentioned are: Design2Leran, ANGEL (property of Blackboard Inc.). However, due to the strong competition of the open-source LMSs and of the new incomers, the Cloud-based LMSs, the proprietary LMS developers have looked to different possible customers than HEOs.

The new trend in sales is to cover the needs for training and development of the human resources employed by medium and big size enterprises. Also, because the enterprises activating in various industrial domains, for example, have to have fixed infrastructure and have to have a well developed ICT network in order to be competitive on their targeted markets. However, there are still involved costs, these costs being dependent on the number of users, the number of licenses needed, the number of upgrades required, the level of maintenance necessary to be done etc. In order to become cost effective, a proprietary LMS has to be purchased if the number of students is higher than 2,000 (Edutechnica, 2014, http://edutechnica.com/2014/05/26/lms-by-the-numbers-spring-2014-updates/) and the use of the LMS is targeted for at least three years. Today, from HEOs point of view, the proprietary LMSs are not anymore a viable and cost effective solution.

4.2. Open-Source LMSs

Differently than the previous category, the open-source LMSs are learning management platforms which made available the source code under a public free license, this giving to the user the rights to use, to change, to study, to create and to distribute the results, free of charge, to anyone and for any purpose. This is equal to a donation done by developer/s to the public for the public interest. The open-source LMSs were developed as an option to the proprietary ones being a better solution from financial point of view, involving less costs related to software licenses and maintenance/upgrades, requiring not a well developed infrastructure and, most important, offering the liberty to develop own LMS, based on own goals, own requirements and adapted to own necessities.

In fact, the major advantages offered by open-source LMSs are simply enumerated by Davis, Carmean, & Wagner (2009): "*…. in higher education, institutions are interested in selecting software they can modify to serve their particular needs and systems, and the university can make its own decision about whether or when to upgrade to a new version*" (Davis, Carmean, & Wagner, 2009, page 11).

The present leader on the open-source LMSs market is Moodle (Edutechnica, 2014, http://edutechnica.com/2014/05/26/lms-by-the-numbers-spring-2014-updates/, Moodle, 2014, http://moodle.net/stats/). According to Moodle statistics, presented on Moodle developer Web page, at date of 31st of August, 2014, Moodle had 76,465,411 users, from 241 countries (Moodle, 2014, http://moodle.net/stats/). Some other open-source LMSs considered by the author important to be cited are: Sakai, eFront LMS, Dokeos LMS. The open-source LMSs are considered a very good solution for small and medium size HEOs.

4.3. Cloud-based LMSs

The Cloud-based LMS have emerged on the specialized market as a matter of course. Was sufficient that the developers brought together the Cloud computing features with Internet available options and use all these to deliver the education online to any student, at anytime and anywhere around the world, the only must requirements to be fulfilled being the existence of an Internet connection and of a tool (i.e., computer, tablet, smartphone).

According to Bhatia (2014), the Cloud-based LMSs are a low cost solution which "*are able to take advantage of the convenience and flexible aspects of the technology*" (Bhatia, 2014). The statement just quoted could be translated easily by highlighting the advantages offered by this category of LMSs. From all advantages the author of this paper considers as major and significantly important the following:

- Do not require installation of LMS platform
- Could be accessed directly through an Internet connection
- The management (ie., create, upload, change, communicate etc.) could be done through the internet browser
- Low cost solution, as are not required costly infrastructure, specialized software licenses, no maintenance involved from user side
- Extremely mobile solution as do not require a face-to-face interface
- Possible to personalize the education as required and as necessary and also capable to provide personalized and instant feedback to users

The above major advantages make the Cloud-based LMSs to be a suitable solution for small and medium size HEO and especially for those HEO which do not have proper and sufficient infrastructure and also, facing an increase of the number of students (enrollments). The list of Cloud-based LMSs is long at present and is increasing and will increase even in the near future. From most known systems could be enumerated the following: DigitalChalk, Docebo SaaS LMS, TalentLMS, Firmwater LMS, Litmos LMS etc.

4.4. LMSs Trends

The present trends point out on the open-source LMSs. According to Davis, Carmean, & Wagner (2009), and as an example, in 2009, 20.1% of the responders were using Moodle, while 13.1% from the responders were using Blackboard LMS (Davis, Carmean, & Wagner, 2009, page 9). There is a battle in progress, and that is carried out between the open-source LMSs versus the proprietary ones. However, citing the title of an article published in 2011 by Ted Curran, "*Open source or proprietary LMS? Your answer, my friend, is floating in the Cloud*" (Curran, 2011). In other words, considering the advantages offered by Cloud-based LMSs, there is a high possibility that the battle between open-source and proprietary LMSs to be won by the Cloud-based systems.

Apart, of the above the author of this paper believes that other important trends are referring to the availability of a deployment system which could make things easier and faster for users being able to offer the possibility to interface the system from any mobile device fitted with a Wi-Fi connection, a screen and a keyboard, and from any place where an Internet connection is available. Another trend which the author considers, is that in the future, the LMS developers will focus on the use of software as a service (SaaS) defined as the software which is not hosted by

the user server but is stored in a third party (supplier) system, the software being rented from the third party. The license of the software is retained by the third party.

5. Conclusions

The main scope of this paper was to try clarifying as much as possible within a short publishing space the actual status of the Learning Management Systems in the context of ICT technologies outstanding achievements recorded in the past two decades.

As stated since the introductory section, the purpose of the paper was not to debate or to point out that a LMS is better than another one. However, is to be highlighted as conclusions, that the future will belong to those systems which will be able to take the advantage of the latest achievements made available by the ICT technologies developments and also which will prove sufficient flexibility from the point of view of resources involved (hardware, software, human, financial) keeping those to the lowest level possible.

Nevertheless, the size of the HEO like number of students, variety of specialties as well as the budget for various resources will dictate ultimately the type of LMS to be used. Also, the author would like to highlight that the future belongs to LMSs, considering that the modern higher education demands the fulfillment of some critical requirements in order to be successful. Here are to be mentioned the need of better organized courses, a very accurate records management and archiving, better, fast and flexible communication, modern assessment tools for both, teachers and students as well as for system itself looking to the continuous improvement side and not the last, the need to optimize the educational cycle. This is what LMSs can do, offering at the end one place for everything.

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