DIGITALIZING HIGHER EDUCATION THROUGH LMSs: WHICH AND WHAT TO CHOOSE

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Abstract: About five years ago, prior the onset of Covid 19, higher education institutions used to carry out online learning activities somewhat as an alternative to the face-to-face classes. Now, more than ever, it's become widely accepted and highly imperative that any modern school needs a digital approach (and strategy) if it is to achieve its mainstream objectives; and universities are no exception. The opportunity arises from the perspective of using LMSs. With that in mind, there is a tough race out there on the market of LMSs that led to the optimization and refinement of many of them, and in a more rapid pace than before. From the users's point of view, choosing a viable and convenient solution has become more complex than ever, especially since each of the LMSs application offers some similarity regarding how it works and what it delivers. However, certain features such as price, learning curve, technical support, learning outcomes, etc. could stands out as key factors in choosing the implementation of one software platform over another. To identify the 'most complete' LMS, we utilized a rigorous methodology that involved evaluating a variety of LMS against a weighted set of features. Each LMS was assigned a score for each feature, and these scores were then used to calculate a product's total score, with a possible maximum score of five stars.
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Introduction

Organizations are constantly looking for ways to improve the skills of their workforce, while employees prefer companies that offer career growth opportunities (Vats, 2024). On the other hand, educational institutions constantly aim to improve teaching and assessment methods. So it can be said about the pandemic period that it had the role of accelerating what would have happened anyway: the increasing use of information technologies in the didactic activity. Thus, the increasing importance of e-learning platforms for academic

institutions in the post-pandemic era has reinforced digitization as a necessity, not just an option. In these circumstances, learning management systems (LMS) - currently less known as CMS (Course Management Systems) (Simonson, 2007, p.7) - being software platforms used for administration, tracking, reporting, automation and delivery of educational resources, training programs or learning and development programs. These are very useful in the classic educational system (schools, high schools, universities), in the corporate environment, non-profit organizations, professional associations, educators and independent tutors (Koblyakov, 2024), also in other areas, aiming to facilitate the process of learning and training, to provide online and personalized training to pupils, students, employees and so on. Even if Moodle it is perhaps one of the most popular LMS on the market (Sánchez, et al., 2023), especially in direct competition with other open-source platforms (Haan, 2024), the fact that there are plenty of such platforms on rise assumes that we are not talking about a monopoly.

If we step outside the box of LMSs, the importance of continuing the digitization of higher education could be based on the following aspects,:

provides access to educational resources from any place, at any time, therefore in a flexible manner, so that students no longer have to physically attend classes (Mondéjar-Jiménez, Mondéjar-Jiménez, Vargas-Vargas, & Meseguer-Santamaría , 2008, p.23);

promotes more fluid interaction between students and teachers, even at a distance, thus improving collaboration and team-working;

allow the adaptation of the courses according to the individual needs of the students, thus a personalization of the educational process.

The most popular LMS platforms are:

Moodle: flexible open-source system used by many institutions to customize courses.

Canvas: Known for its intuitive interface and easy integration with other tools.

Blackboard: Robust platform, popular for large-scale support and integrated assessment tools.

Google Classroom: Focused on collaboration and resource sharing, suitable for institutions using the Google tools.

Even if the most popular LMSs would seem enough to hold our attention, we have proposed to extend the area of research towards other similar solutions which are full LMSs or plays in a niche area. For example, initially, we had found that certain particularities of Microsoft Teams, Webex or Zoom could place them in the vicinity of the concept of LMS, but would be insufficient to put them together with the main actors on the market. At the same time, some analyzed platforms are not fully LMSs, but include quite a few specific or LMS-like features.

Defining aspects and essential functionalities of Learning Management Systems (LMS)

LMS is the core of eLearning solutions and is very important for the universities (Itmazi, Gea Megías, Paderewski, & Gutiérrez Vela, 2005, p.9). LMS platforms vary according to the specific size, complexity and features available, there are commercial solutions, by software manufacturers, but also open-source projects, each having advantages and disadvantages according to the needs of the organization or institution (Unal & Unal , 2011, p.20).

Characteristics of LMS platforms

Although we can talk about a multitude of particularities, given the large number of platforms that can be used in this way, we will point out some common features and functionalities:

1. Course administration can be considered the starting point of such online collaborative concept, by being able to upload and organize course materials (documents, presentations, videos and exercises, etc.);
2. Communication and collaboration using forums, internal messaging, and real-time chats that facilitate interaction between learners and teachers/instructors;
3. Assessment and tracking by creating and administering online tests and assessments so that learner progress can be tracked and reports generated for teachers/instructors;
4. Customization and Adaptation: Some LMSs allow the learning experience to be customized for each learner based on their knowledge level or interests.
5. Content suggestions based on past user behavior and performance;
6. User management, with administrators able to create and manage user accounts, enroll learners in courses and monitor their progress;
7. Security and privacy of sensitive data and course content, compliance with relevant regulations and standards through user authentication functions, content access control and data encryption.

Common Functions of LMSs

They derive from the previously mentioned characteristics and assume:

• Create and deliver online courses using a variety of formats such as text modules, videos, presentations and quizzes.
• Track student progress in courses, including test grades, assignments completed, and time spent in each module.
• Communication and collaboration between students and teachers through discussion forums, instant messaging and file sharing tools.
• Reporting and analysis on student progress and course performance, which can be used to improve instruction.

Considering these aspects, strategic guidelines can be identified for the optimal selection of a LMS, such as:

• analysis of the institution's needs: Type and number of courses, student profile, and available resources.
• testing several platforms: before making a final decision, it is useful to test several LMSs by implementing a pilot.
• involvement of the entire academic community: The decision must be made together with teachers, students, administrative staff to ensure that everyone's needs are covered.

The benefits of using a LMS

Certainly, the most obvious benefits is by intuition, if we think about the fact that we are talking about global and continuous access to educational resources, the automation of evaluation processes or the improvement of online interaction and communication.

• Improve learning efficiency: LMSs can help students learn more effectively by providing personalized and self-paced instruction, access to a variety of learning resources, and opportunities for practice and prompt feedback.

• Cost reduction: LMSs can help organizations reduce training costs by automating administrative tasks such as student enrollment, test scoring, and report generation.
• Increase engagement: LMSs can help increase student engagement by providing a more interactive and personalized learning experience.
• Improve performance: LMSs can help improve the performance of organizations by providing training that is aligned with their business goals and employee needs.
These benefits must also be moderated undet the light of certain impediments such as high costs for some platforms, the need to train staff and students for proper use, or security risks and privacy issues.

essential criteria in the selection of a learning management system (lms)
Choosing the suitable LMS for a higher education institution must be based on a detailed analysis of several factors, taking into account aspects such as (1) the specific needs of the organization that proposes to use such an application, (2) the size organization, (3) budget, (4) level of technical expertise available, (5) customization options. These can be integrated into comparison criteria that allow the evaluation of different platforms, such as:
a) Scalability - the ability of the LMS to adapt as the institution grows in size, with more users or courses. Platforms must support increases in the number of students, courses and teachers without affecting performance. For example Moodle and Canvas are recognized for their flexibility and scalability, while simpler solutions such as Google Classroom may be more suitable for smaller institutions.
b) Integration with other platforms - the ability of the LMS to connect and integrate with other applications and software systems already used by the institution (eg: videoconferencing platforms, student data management systems, or financial systems). It is important to see if the respective LMS allows easy integration with solutions such as Zoom, Google Meet, Microsoft Teams, or administrative systems such as educational ERPs. To that end, Blackboard and Canvas offer robust integration with many third-party systems, while simpler platforms may be limited to their own ecosystems (eg Google Classroom).
c) Costs, assuming the budget required to implement and use the LMS, including licenses, customization, maintenance and staff training. For example Moodle is a free open-source solution but requires costs for customization and hosting, while Canvas and Blackboard come with higher licensing costs but offer dedicated technical support. Therefore, it is important to correlate the total cost with the benefits and available resources of the institution.
d) Technical support and training, i.e. the availability and quality of technical support provided by the LMS provider and the need for staff training to use the platform effectively. It can be identified if the respectful LMS offers 24/7 support, accessibility to training resources (tutorials, webinars), and local language support. Here, we can mention Blackboard as known for its solid technical support, while Moodle may need in-house technical administrators for effective management.
e) Data security, the ability of the LMS to protect the personal and academic information of students and teachers, regarding the level of encryption, compliance with security standards (eg: GDPR for Europe), and data backup and restoration options. In this context, Canvas and Blackboard have rigorous security measures, but for open-source platforms such as Moodle, security may depend on how the platform is configured and administered.

f) User Experience (UX) - the interface and ease of use of the LMS for teachers and students, being able to analyze how intuitive the platform is, how quickly common activities can be performed (eg uploading materials, checking grades), and how easy the onboarding process is for new users. Canvas and Google Classroom have friendly and intuitive interfaces, while Moodle may require customization to optimize the UX.
g) Assessment and Feedback functionalities - the ability of the LMS to support student assessment through tests, quizzes and grade management. It can be tracked if the LMS offers automated test marking features, personalized reports, and immediate student feedback. Blackboard and Canvas have advanced grading systems, while Google Classroom offers a simpler approach without advanced reporting features.
h) Mobility and Accessibility refers to the compatibility of the LMS with mobile devices and access for users with special needs (eg support for screen readers). Canvas and Google Classroom have well-developed mobile apps, while Moodle requires additional configuration for optimal mobile experience.

Comparison of some LMS platforms

Analysing a LMS that meets our expectations must take into account several criteria, each of which has a significant impact on functionality, cost, and user experience. Therefore, we reproduce the criteria to which we will refer the comparison:
1. Open-source: Whether the platform is free and open-source, which means it can be freely customized and modified.
2. Course management: The ability to create and manage online courses (content creation, course materials, module organization, etc.).
3. Collaboration: Provides collaboration tools (forums, wikis, chat, etc.).
4. Accessibility: Meets accessibility standards for disabled users.
5. Assessments: Includes testing and assessment systems such as quizzes, exams, assignments.
6. Gamification: Using gamification techniques to increase engagement (badges, leaderboards, prizes).
7. Customization: The ability to modify the platform according to the specific needs of the user or institution.
8. Mobility: Support for mobile devices and mobile applications.
9. Technical Support: Provides technical support for users, either through a community or official support.

Table 1. Core and collaborative features

	Open-source	Course Mgmt.	Collaboration	Accesibility	Evaluation	Gamification
ATutor	☑	☑	☑	☑	☑	☐
Blackboard Learn	☐	☑	☑	☑	☑	☑
Canvas	☐	☑	☑	☑	☑	☑
Chamilo	☑	☑	☑	☑	☑	☑
Degreed	☐	☑	☑	☑	☑	☑
Docebo	☐	☑	☑	☑	☑	☑
EdCast	☐	☑	☑	☑	☑	☑
Edmodo	☐	☑	☑	☑	☑	☐

Forma LMS	☑	☑	☑	☑	☑	☐
Gibbon	☑	☑	☑	☑	☑	☐
Google Classroom	☐	☑	☑	☑	☑	☐
ILIAS	☑	☑	☑	☑	☑	☑
Moodle	☑	☑	☑	☑	☑	☐
RosarioSIS	☑	☑	☐	☑	☑	☐
Sakai	☑	☑	☑	☑	☑	☐
Schoology	☐	☑	☑	☑	☑	☑
TCExam	☑	☐	☐	☑	☑	☐

Table 2. Advanced features and technical support

	Customization	Mobility	Tech Support
ATutor	☑	☑	☑
Blackboard Learn	☑	☑	☑
Canvas	☑	☑	☑
Chamilo	☑	☑	☑
Degreed	☑	☑	☑
Docebo	☑	☑	☑
EdCast	☐	☑	☑
Edmodo	☐	☑	☑
Forma LMS	☑	☑	☑
Gibbon	☑	☐	☑
Google Classroom	☐	☑	☑
ILIAS	☑	☑	☑
Moodle	☑	☑	☑
RosarioSIS	☐	☐	☑
Sakai	☑	☑	☑
Schoology	☑	☑	☑
TCExam	☐	☐	☑

We mention that, in some LMSs, a certain feature either exists as full functionality, or can be assimilated as having that behavior. On some platforms, demo versions may not fully reproduce how certain features work.

The synergy between LMS and LXP

If it can be said that LXP (Learning Experience Program) begins where a LMS (Learning Management System) ends, in the sense of integrating other third party sources (playlists, videos, articles, etc.), but especially for that balances synchronized learning with asynchronous learning (Eduweb.ro, 2021), we can state that the relationship between a LMS and a LXP can be complementary and synergistic within an extended learning ecosystem. Thus, they can be integrated and used together to provide a more complete and personalized learning experience. LMSs are generally focused on the administration and structured delivery of courses, and are often used to manage formal education such as courses and degree programs. In contrast, LXPs focus on the personalized learning experience, encouraging self-directed learning and content exploration in a more flexible and adaptable way.

Although in the Table 3 we reproduce the characteristics of the two concepts in parallel, we mention again that they are not competing, but complementary. Thus, they can be used together to create a comprehensive learning and development strategy. For example, some organizations use LMS as their primary platform for delivering mandatory courses, and LXP to provide employees with additional learning and development options.

Table 3. LMS vs. LXP

	LMS	**LXP**
Complete Name	Learning Management System	Learning Experience Platform
Definition	A software application that allows you to create, deliver, manage, and track online learning content.	A software application that allows you to collect, curate, personalize, and recommend online learning content.
Main Purpose	Administer training Furnizarea și gestionarea conținutului de curs	Discover and deliver content Oferirea unei experiențe de învățare personalizată
Livrare	Cursuri liniare, secvențiale	Căi de învățare personalizate, bazate pe interese și nevoi
Key Features	Course creation Course delivery and assignment. Catalog management Content storage Progress and performance tracking. Scheduling Certification and accreditation	Content aggregation and curation. Content personalization and recommendation. Learner engagement and collaboration Learning analytics and insights. Consumer-grade user experience Internet access Recommendations Social media
Content Types	Training materials Compliance and onboarding Courses Instructional videos More rigid and longer form	Short "micro-learning" Interactive Skills-based 3rd party and user-generated Personalized formats depending on the learner
Strengths	Administration Assessment Certification Control	Content creation Flexibility Personalization Variety
Weaknesses	Flexibility Variety	Assessment Control
Drivers	Management/L&D Team	Learner/User
Collaboration	Limited features for social learning	Users post their own content leading to greater collaboration opportunities
Skills	In-depth structured courses to instill new skills	Personalized upskilling/reskilling programs
Analytics	Basic metrics	More in-depth use of data to track learner engagement and training effectiveness
Use Cases	Corporate training, education, non-profit.	Employee development, customer education, community learning.
Mode	Instructor-led.	Learner-led.
Socializare	Uneori limitată la forumuri de discuții	Accent pe colaborare, socializare și partajarea cunoștințelor
Examples	Moodle, Canvas LMS, Thinkific, etc.	Degreed, Absorb, 360Learning, EdApp, EdCast by Cornerstone etc.

Buget	Mai rentabile	Mai scumpe

Source: adaptation based on Feffer (2023), Kuzmina (2024), Bhatia (2024).

The future of the LMS-LXP relationship seems to be bright, complementing each other. While LMSs provide the necessary structure for compliance, monitoring and evaluation, LXPs will help create more flexible and personalized, user-centric learning experiences.

Conclusions

The digitization of education through LMSs can transform the educational experience of students and the effectiveness of teachers. Choosing a LMS is a complex process that depends on many variables. Each higher education institution must consider its specific needs and available resources. Thus, we can talk about robust solutions for higher education, such as Moodle, Canvas and Blackboard Learn, offering a balance between basic and advanced functionalities, but also open-source solutions (Sakai, ILIAS, Chamilo, etc.) for institutions with limited. Resources, which offer flexibility and low cost, but require technical knowledge for customization. At the same time, commercial platforms like Docebo or Degreed are recommended for universities that want to implement fast, guaranteed technical support and advanced functionality, but at a higher cost. Also, combining LMS with LXP can expand the scope of eLearning.

As a conclusion, each LMS has unique strengths and weaknesses. Choosing one platform over another depends on the specific needs of the institution or user, as well as the available budget. It is important to consider the specific needs and the specifics of the organization when it comes to choose a LMS platform, as well as the availability of resources for administration and technical support.

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