

## Learning Management Systems as a Tool for Learning in Higher Education

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### Abstract

*In recent years, Learning Management Systems (LMS) have become a major element of the technological transformation of education, providing educators and learners with a universal and effective environment for managing educational activities and resources.*

*The article presents the purpose of learning management systems, focusing on their main functionalities as well as their advantages and limitations. Several leading learning management systems are reviewed and compared. A set of indicators is used, based on which the comparison is made. A conclusion is made regarding the possibilities for application in higher educational institutions as well.*

*Keywords: Learning Management Systems (LMS), open source LMS, Moodle*

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### Introduction

In recent years, the integration of technology in education has had a significant impact on traditional teaching methods. With the application of distance learning and online learning during the COVID-19 pandemic, the needs of both educators and learners have changed. Needs have arisen to use interactive educational content in a suitable environment to manage the learning process, as more and more schoolchildren and students find it difficult to keep their attention and motivation. After the global pandemic, a preferred choice among students is distance learning, in which many technological solutions are integrated for its proper course.

Learning Management Systems have become a major element of the technological transformation of education, providing educators and learners with a versatile and efficient environment for managing educational resources.

The paper presents the purpose of learning management systems, focusing on their core functionalities as well as their advantages and limitations. Several leading learning management systems are reviewed and compared. A set of indicators is used, based on which the comparison is made.

### 1. Essence of Learning Management Systems

E-learning is a fast and efficient way to deliver and share knowledge with learners in different parts of the world. A learning management system is a global term for a computer system specifically designed to manage online courses, distribute learning materials, and enable collaboration between learners and instructors (Tadlaoui & Khaldi, 2020). According to Foreman (2017), a learning management system is a multi-user software platform, most commonly accessed through a web browser, designed to facilitate the management, delivery and tracking of educational content. LMS have become an integral part of the toolkit of modern education and company

training. They provide educators with a centralized and efficient platform where they organize and deliver learning materials to learners in an interactive manner. LMS platforms offer a wide range of functionality, including content management, course development, visual representation of learner progress, communication tools, and assessment methods. There are basically three types of users who work with LMS - teachers, learners (students, schoolchildren, employees) and administrators.

The main functions of learning management systems are the following (Öztürk & Gürler, 2020):

- ✓ registration and management of users (students and teachers);
- ✓ course management, online assessment (e.g., using a test and/or assignment);
- ✓ reports (site or course level reports).

Educators can upload a variety of learning materials, such as text documents, multimedia, and interactive resources, and organize them into courses and modules. Learners can access these materials regardless of their pace of work, allowing for self-directed and personalized learning. Learners' progress is tracked in real-time by tutors and thus problem areas are identified, and timely remedial measures can be provided. Communication tools integrated into LMS facilitate interaction and collaboration between learners and educators. Discussion channels, messaging systems, and virtual classrooms create a sense of community and belonging by encouraging knowledge sharing. Learner assessment tools in LMS allow educators to create tests, assignments, and exams that can be automatically graded. Learners receive instant feedback on their performance, allowing them to assess their understanding and track their progress.

According to Tadlaoui and Khaldi (2020), LMS platforms are flexible and accessible, allowing learners to access different types of e-learning materials from different devices with an Internet connection. This enables learners to take part in learning activities at a time convenient for them, regardless of their location.

From a technical perspective, a learning management system is a server software program that interacts with a database containing records of users, courses, content, and other information items. It is similar to other systems designed for e-commerce, payroll, human resources and others, but what makes it different is its educational nature. An LMS provides a venue for learning and teaching activities in a time- and location-agnostic environment. These systems can be used to enhance all three modes of teaching: face-to-face, online, and blended learning. They can also contribute to expanding the application of new methods in education (Vasilev, 2017).

LMS can be categorized into two main groups – paid (commercial) and open source (Turnbull, et al., 2023):

- **Open source LMS** – users have free access to modify the source code according to the requirements and needs of the specific organization. Open source LMS platforms are assumed to be free, but they may incur some costs for hosting, customization, adding functionalities, and management. An example of an open-source platform is Moodle.

- **Paid LMS Systems** – Commercial LMS systems are typically offered as a locally hosted product that resides on an organization's own servers or as a software-as-a-service (SaaS) offering that resides on a vendor's servers and is accessible from anywhere. The price for the product is usually negotiated according to the number of registered participants to the platform. An example of a paid platform is Blackboard Learn.

In summary, learning management systems are changing the traditional learning process by offering a comprehensive and efficient platform for delivering educational and training materials, promoting interactive and personalized learning approaches, and providing data-driven insights to optimize the learning process.

## **2. Basic functionalities of learning management systems**

In the use of learning management systems, three types of users are most often involved – teachers, learners and administrators. Functionalities differ for each type of user. In general, we can note the following main functionalities:

- *Content management* – e-learning platforms offer educators and administrators content management features, including uploading, organizing, and managing different types of learning materials (Turnbull, et al., 2023). These materials can include text documents, multimedia files (videos, audio), presentations, games and others. In some LMS systems, an HTML5 package is integrated, which allows the creation and uploading of various interactive content. Interactive content is known for holding users' attention.

- *Course Organization* – LMS allows instructors to structure and prepare courses in a systematic way. Courses can be organized in different formats - modules, lessons, weekly presentation, topics and more, thus providing learners with a clear curriculum for their learning and their progress can be tracked.

- *Student Enrollment and User Management* – LMS systems make student enrollment and user management easy. Administrators can create, enroll, and manage learner and teacher accounts, set roles and permissions, and control user access to specific courses. Most often, teachers have rights to enroll and unsubscribe learners from a course, and with them it is not possible to define a role other than a learner (schoolchildren, student), respectively, and they cannot define user rights.

- *Test administration and grading* – The platforms offer student assessment functionality, including creating tests, exams, and assignments. The LMS supports the collection and storage of graded assignments, as well as the assignment of grades and feedback to each learner (Turnbull, et al., 2023). Most often, grading is automatic, thus providing immediate feedback to learners. Student assessment information is usually stored in a digital log.

- *Progress Tracking and Reporting* – Educators and learners can track the progress and completion of a number of individual activities or resources and courses. Skill and certification tracking is one of the most important LMS features for almost all users. These features can track learned skills and track completed activities (Tadlaoui & Khaldi, 2020). The LMS records user interaction with the platform, including course completion, test scores and time spent on activities, and more. Administrators can generate different types of reports to gain insight into user engagement and performance.

- *Communication and Collaboration* – For communication purposes, LMS platforms have created forums where all enrolled course participants can post messages (Tadlaoui & Khaldi, 2020). There is also a chat where private messages are sent. From a collaborative perspective, educators can create assignments, tests, and discussions in which multiple participants work together in a group.

- *Mobile Devices Compatibility* – Because LMS are web-based, many are designed to be mobile-friendly, allowing learners to access learning content on smartphones and tablets with different resolutions and operating systems. At the same time, many LMS also provide their users with a mobile application. The use of mobile devices in the educational process increases learner engagement and enables learning on the go (Tadlaoui & Khaldi, 2020).

- *Gamification* – It is the process of adding games or game elements to activities and resources (for example, a task) to stimulate learner participation. E-learning platforms often include game elements to increase learner motivation and engagement. For example, the Moodle platform offers games such as Hangman, Millionaire, Crossword, and others that are tied to the material being studied. Adding game features to courses and training programs engages learners, accelerates their progress through modules, and increases their satisfaction (Tadlaoui & Khaldi, 2020). Gamification techniques add variety to learning and make it more enjoyable while encouraging competition among learners.

- *Integration with third-party tools* – LMSs support integration with various third-party tools known as plugins or add-ons. Öztürk & Gürler (2020) point out that plugins enable the use of new functionalities that are missing in the main system. Examples of the use of add-ons is LMS integration with video conferencing software, content creation tools, plagiarism detection services, and more.

- *Notifications and Alerts* – In an e-learning environment, it is essential that communication is immediate and timely to maintain a high level of engagement and participation of all enrolled users. Tadlaoui and Khaldi (2020) state that LMS platforms send notifications and alerts to learners and teachers about upcoming deadlines, new course activities and resources, new announcements, and other important updates, thereby improving communication and information sharing.

- *Multilingual support* – LMS offer multilingual support, meaning that learners from different language backgrounds have the option to change the look of the system to their preferred language. It is important to note that language packs do not apply to uploaded learning content, i.e., uploaded lectures, exercises, questions, and assignments are not translated when changing the language.

- *Security and Privacy* – Security and privacy are paramount to running an online course (Turnbull et al., 2023). Security features in the LMS include user authentication, access verification, and breach and intruder detection. Privacy controls are also an important component to ensure that sensitive information is accessible only to the people for whom it is intended.

In summary, we can state that learning management systems provide a large number of functionalities that support educational activity by increasing the engagement of learners and optimizing their learning outcomes.

### 3. A comparison of some learning management systems

Choosing an LMS system depends on a number of factors, one of the most important being the organization it will be used in and its requirements, followed by user interface, integration with other platforms and tools, usage fees, and more. We will look at LMS in higher education, since in this field more activities and resources are used on this variety of systems due to the large number of users. To better clarify the advantages and limitations of the systems, we will do a comparative analysis of some of them.

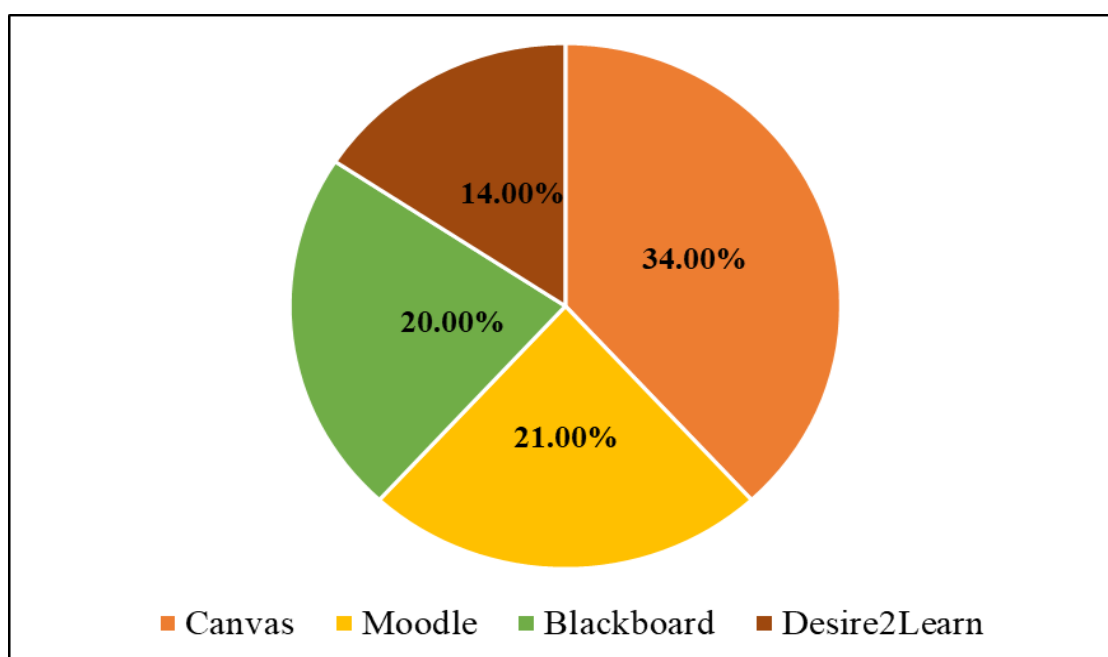


Figure 1. Proportion of learning management systems used

Source: Phil Hill & Associates (2022)

Figure 1. presents, using a pie chart, data from a statistical survey by Phil Hill & Associates (2022) on the relative share of LMS systems used by organizations, primarily in North America.

Regarding the LMS used in Europe, the data based on the researched more than 1,600 higher education institutions (albeit from 2016) show that the market is dominated by the Moodle system, whose share is estimated at 65%. The second place is taken by Blackboard with 11%, and the third by the Ilias system with 4% (Hill, 2016).

The research company Gartner (2023) published a ranking of LMSs in use in higher education, based on a rating formed by user opinions. The four metrics on which platforms are evaluated are:

- ✓ scalability;
- ✓ integration;
- ✓ customization capabilities;
- ✓ ease of deployment, administration, and support.

In the first three places are the Canvas, Moodle, and Blackboard systems with a rating of 4.4, 4.3 and 4.2 respectively (according to data as of the beginning of August 2023). The given data gives us a reason to compare these three systems.

### 3.1. Moodle

The learning management system Moodle is written in PHP and distributed under the General Public License (GNU). The first version Moodle 1.0 was uploaded to the Internet in 2002, and the current version is 4.2.1. (part of its interface is shown in Fig. 2.). It is used in nearly 240 countries, with over 154,000 Moodle-based sites and over 213 million users (Moodle, 2023).

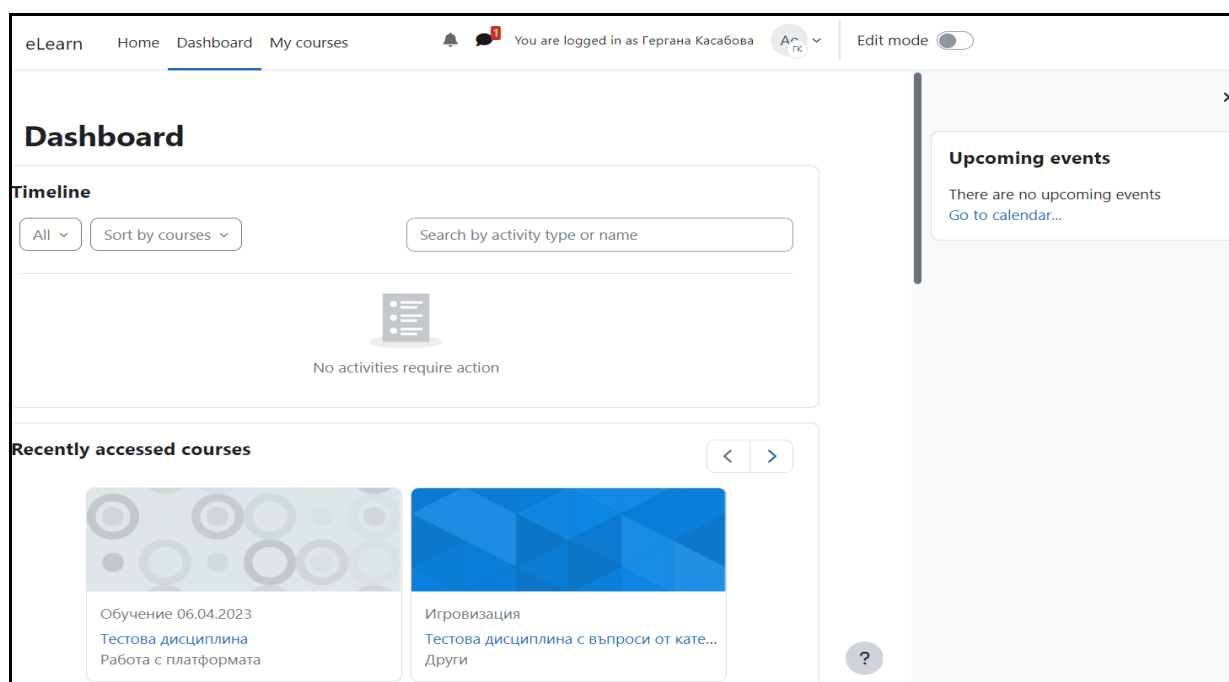


Figure 2. Moodle 4 interface 4.2.1.

Moodle can be used in all stages and forms of learning in educational institutions. At the same time, it is also suitable for corporate training of employees. Due to the worldwide reach of the system, 120 language packs are available and growing. Authors Pérez-Pérez, Serrano-Bedia and García-Piqueres (2019) state that Moodle provides a reliable, fast, stable, and accessible learning management system.

### 3.2. Canvas

Instructure Inc. officially launched the Canvas learning management system in 2011. Canvas LMS is used in both educational institutions and corporate units for employee training. Canvas is defined and distributed as open-source software. Globally, it has more than 30 million users and over 6 thousand customers (Instructure, 2023).

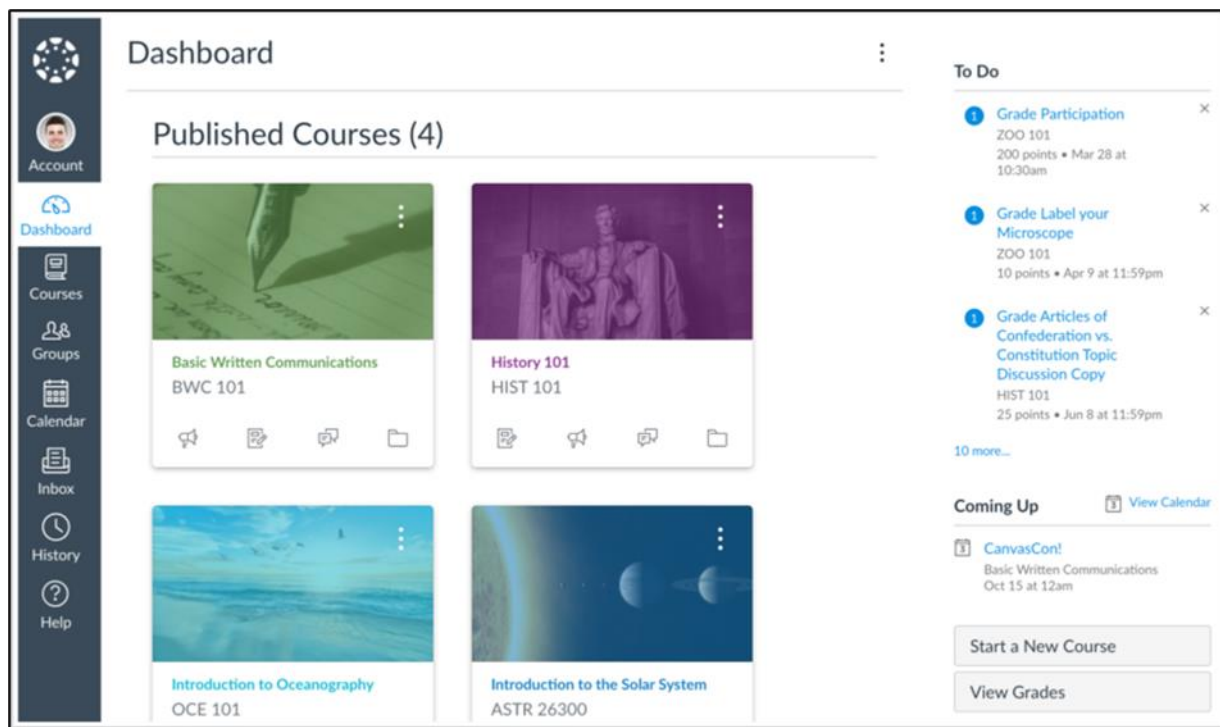


Figure 3. Canvas LMS interface

Authors emphasize the simplified functionality, intuitive user interface (see Fig. 3.) and reliable features of Canvas (John, 2021). The system offers feedback in the form of audio or video, which is defined as a unique opportunity to connect with learners and especially with the most motivated among them. Canvas can integrate with university information systems and data sources, as well as with third-party applications.

### 3.3. Blackboard Learn

Blackboard Learn is a platform developed by “Blackboard Inc.”. It was created by Michael Chasen and Matthew Pittinsky. It is available for a fee (according to online publications, the price starts at \$9,500 per year) and can be either self-hosted or software-as-a-service. Blackboard Learn is available at all stages of learning and is also suitable for on-the-job training. It is used globally in over 70 countries and has seamless integration with more than 200 technology partners (Anthology, 2023).

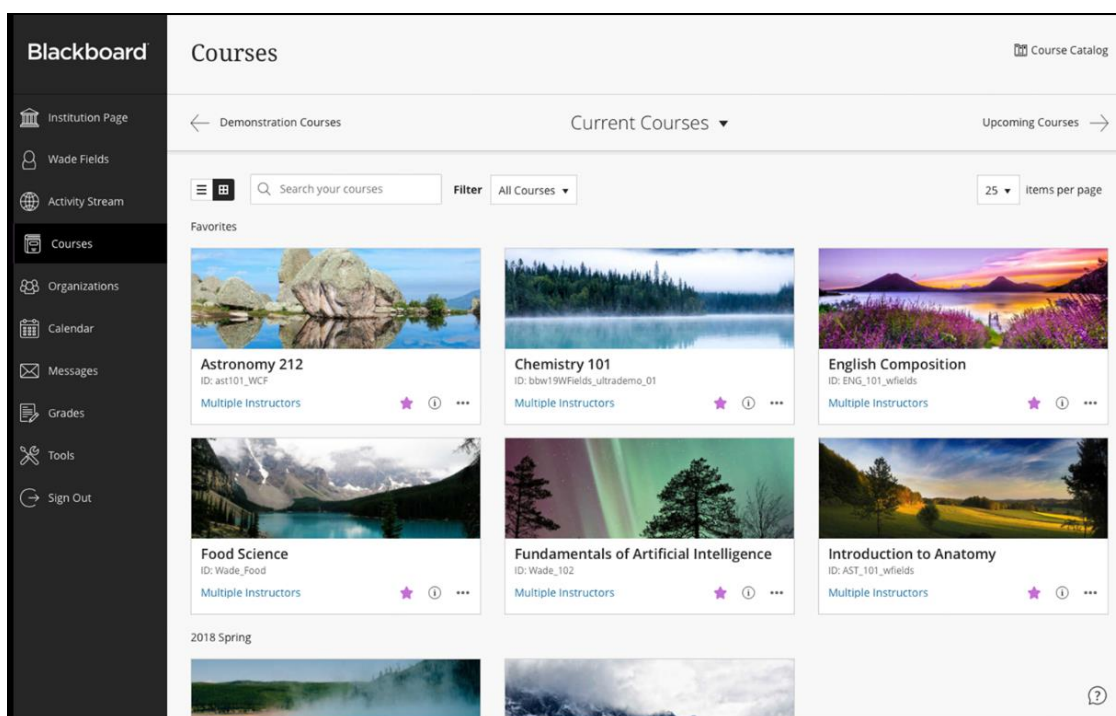


Figure 4. Blackboard Learn interface

The Blackboard Learn system is defined by some authors as the easiest and most effective way to connect learners with their teachers (Alturise, 2020). Added to this is a transparent and reliable grading system. Part of the interface of Blackboard Learn is shown in Fig. 4.

The main functionalities of the selected systems are presented in Table 1. It is important to note that both paid and open-source systems are considered. The overall comparison is made based on the documentation provided by the systems in question - Canvas Community (2023), Blackboard Learn Help (2023) and Moodle Docs (2023).

**Table 1. Main functionalities of the compared systems**

Main functionalities	Canvas	Blackboard	Moodle
Synchronous and asynchronous learning	Yes	Yes	Yes
Content creation	Yes	Yes	Yes
Video conferencing	Yes	Yes	Yes
Customer Support	Yes	Yes	Yes
Instructions for work	Yes	Yes	Yes
Upload files	Yes	Yes	Yes
Evaluation	Yes	Yes	Yes
Ease of use	Yes	Yes	Yes
Work in groups	Yes	Yes	Yes
Support for different languages	Yes	Yes	Yes

Gradebook	Yes	Yes	Yes
Attendance reporting	Yes	Yes	Yes
Plagiarism detection	It is possible to connect with a plugin	Yes	It is possible to connect with a plugin

In addition to the main functionalities presented in table 1., we will also consider some other specific characteristics of the systems - interface, communication, compatibility, personalization, prices, and others.

According to authors Öztürk and Gürler (2020), the interface of learning management systems should be intuitive, simple, and easy to use, so that learners and teachers can quickly get used to the system. When comparing the systems, Öztürk and Gürler note that Canvas and Moodle have an easy and user-friendly interface, while Blackboard Learn takes time to get used to and has no customization option. The administrative functions, course development, and assessment methods in the presented systems are rich and varied, with Blackboard and Canvas being more intuitive but lacking in detail. Moodle, on the other hand, has a high level of detail, but the tools are more complex to work with. All three platforms support a good level of communication between users by presenting similar features – chat, discussion forums and notifications.

The systems listed are compatible with major operating systems and devices. They also have mobile apps that allow for better learning flexibility and receiving timely notifications of upcoming activities. In terms of customization, Moodle and Canvas have the most options because they are open source and there are many add-ons to the systems, while Blackboard lacks customization. Blackboard Learn is paid and no pricing information has been officially announced, but it is clear that pricing depends on the number of users enrolled in the system. Moodle is an open-source system, but hosting and maintenance are associated with corresponding costs. In addition, there is and can be used cloud hosting Moodle Cloud, which is paid. Canvas LMS is a free and open-source cloud-based learning platform, but it comes with usage costs. A paid version is also available.

Progress tracking and detailed information on student activity is included across all three platforms. Gamification in the form of certificates, badges and points is available in the presented systems, and in Moodle there is an opportunity to learn through games (Dungeon, Crossword, Get Rich, etc.). In Canvas and Blackboard, the option to analyze data and predict is available, while it is not available in Moodle. Different types of reports and statistics about learner performance are available for teachers.

In summary, it can be stated that significant similarities are noticeable between the presented systems, and the differences in functionality are almost insignificant for users. A major difference and emphasis when choosing between the three systems would be the cost of using them. All three platforms have their advantages, and the choice between them depends on the specific needs, the available technical resources, and the preferences of the educational institution.

### **Conclusion**

Learning management systems are one of the main tools that help in the transformation from traditional face-to-face learning to online learning and at the same time have an important role as an accompanying element in face-to-face learning. Through an LMS, educators are able to successfully and efficiently deliver and manage their learning materials. Learners, for their part, could access their relevant materials (textbooks, aids, lectures/tutorials, tests and assignments) from any location and preferred device. The core functionalities of learning management systems provide administrators, teachers, and learners with everything they need to complete a complete learning cycle - from course enrollment to testing and assessment.



There are many LMS platforms that are suitable for teaching pupils, students and staff. In our comparison, we found strong similarities between Canvas LMS, Blackboard Learn and Moodle. These are some of the most used and highly rated learning management systems. They cover all the basic requirements for a smooth and at the same time effective learning process. All three platforms have their advantages and limitations, and the main difference between them is the cost of using them.

In summary, the choice between learning management systems mainly depends on the specific needs, technical resources, and preferences of the educational institution. Some intelligent techniques for data analysis, plagiarism detection and gamification exist in the systems considered, but as expectations for future development we can point to a higher degree of integration of business intelligence tools and artificial intelligence to study behavior and generate predictions for student success rate, as well as implementing more game elements in student learning.

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