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## Towards Improving System Functionality Through the Technical Analysis of Learning Management Systems

**Onwodi, G.**

Department of Computer Science,  
National Open University of Nigeria  
Abuja, FCT, Nigeria  
E-mails: gonwodi@noun.edu.ng

### ABSTRACT

At the moment, the online education system is taking on new dimensions. The need for a platform that will harmoniously combine modern functionality and ease of use is increasing. Creating electronic platforms using the latest technical developments allows you to organize high-quality online education. This research provides an overview of the platforms, namely: "Moodle", "Blackboard", "Canvas", "iSpring Learn" etc. All these platforms often provide similar features and users can hardly choose the most appropriate for them. Learning management systems have become increasingly attractive in recent times. These services have a large target audience and high demand in the field of online education. They can be used for both full-time and part-time training, storing course information, tests, and lectures, as well as monitoring training progress and maintaining reports. The research considered the advantages and disadvantages of each service, compare the platforms by a number of characteristics, namely: usability, mobility of the system (deployment system without the involvement of specialists), the presence of the built-in editor of the course, the availability of video conferencing, the availability of core functionality, additional functionality, support of various kinds of file extensions, the flexibility of the system, the availability of mobile applications, costs when using the platform. These aspects are the main ones when choosing a platform, as they are key when using online learning services. This theoretical research discusses several potential Learning Management Systems that can be utilized for teaching and learning processes in the context of institutions, organisations and businesses example Moodle, Canvas, Blackboard etc. The comparison is made based on literature reviews, analysis and interviews on the characteristics of the selected LMS providers. Among the characteristics considered are flexibility, ease of use, accessibility, and user-friendliness. This research also provides some recommendations on the selection of the platforms to be adopted.

**Keywords:** Learning, Mmanagement, Ssystems, Learning Management System, e-learning, Online Learning, Institutions, Businesses, Organisations, ICTs

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## 1. INTRODUCTION

In Nigeria and other countries, there are a plethora of learning management systems now currently in use. Because of its ease of use, it has become a veritable tool in the hands of educationist who have embraced it both locally and globally. Even though Nigeria has often been accused of being somewhat slow in embracing emerging technologies in the e-learning sector. There has been steady progress in recent years in the upsurge of educational institutions, businesses and organisations who have shown interest in incorporating learning management systems in the day-to-day interaction of students and staff and a clear example is National Open University of Nigeria. There has also been an increase in the number of indigenous technology companies who now cater to this new line of technology by developing, and sustaining, the technological infrastructure which powers this emerging sector.

Economic, social and technological forces are placing enormous demands on tertiary educational institutions, businesses and organisations call for increasingly flexible and diverse systems to cater to an ever growing range of learning needs. Flexible approaches aim to provide learners with greater choice over when, where and how they learn by adopting various flexible delivery strategies such as distance education, online learning, and mixed mode delivery, self paced or self directed learning strategies. Traditionally, tertiary institutions delivered their flexible teaching programs to students with the aid of print based course material and with limited information technology support such as email and electronic discussion lists. However, with recent advances in the digital technologies, institutions and organisations are increasingly seeking the potential use of information and communication technologies (ICT) to facilitate their flexible teaching and learning needs. In particular, with the emergence of internet and web technologies, tertiary institutions and organisations around the world have been seeking to exploit the use of e-learning technologies to support their distance teaching.

Among the diverse e-learning technologies, the learning management system (LMS) is a popular e-delivery medium within institutions and organisations. Assert that with response to growing needs of the student population, online education is increasingly common in tertiary education. Educators rarely have all the technological skills needed to develop custom web sites for online classes. Therefore, many educational institutions have adopted online course-building applications, or a LMS to facilitate online learning. The popular LMS systems in use are Blackboard, Canvas and Moodle applications. Two major functionalities associated with LMS are course administration and management and course pedagogy, teaching and learning. A learning management system is a software application that is used to organise and share electronic (or e-learning) materials, assignments, and assessments via an online platform for students to learn from. It also tracks and calculates grades, facilitating communication between students and teachers.

### **Statement Of The Problem**

A Learning Management System (LMS) can provide tremendous benefits both for the training department and for the organization in general. There are numerous choices for LMS providers, as well as functionalities, so an LMS implementation project can become quite confusing. Just what are the LMS basics and how can a system help your institution, business or organization? What are the best LMS to choose that best suit your organisational goals and what are the specific requirements needed to have a full functional LMS for effective service delivery?

### **Purpose of the Study**

The main purpose of this study is to present a wide-range comparative analysis of ten (10) electronic learning content management systems. Careful evaluation of LMS prior to purchase is required as there are many systems available to choose from in the main stream. All of them support the use of multimedia elements, creating and editing the lectures, exercises, and course assignments. The lack of communication support leads to using web forums and social networks out of the LMS. The contribution of this project presents an enriched modern trend of the software methodologies of the web-based oriented learning management systems from the perspective of design and development.

As the rest of the world embraces the digital benefits of online learning, Nigeria is not left out of the race. In many private schools, higher institutions, organisations, and businesses across the country, learning management system software are complimenting the traditional model of teacher- learner classroom interaction. SMEs and large-scale businesses as well as companies are integrating LMSs for online training and onboarding. As it offers opportunity for blended learning and e-learning to be rightly integrated into learning. While selecting a new learning management system (LMS) it is important completely vet the selected solution before purchasing; with implementation being an investment of time and money, one needs to utilize both in the most optimal way to get the maximum benefit and return on investment out of the new LMS.

### **Aims And Objectives**

This research seeks to investigate and analyse few LMS through which functionality can be improved for higher institutions, businesses and organisations.

### **Research Questions**

When consulting with a company or organization that decides to roll out a new Learning Management System (LMS), they typically should ask these questions. An LMS needs assessment is designed to answer the following questions (and many more).

1. Which LMS is right for our institution, organisation or business?
2. What resources do we need to implement the LMS system?
3. How will the LMS support our institution, business or organisational objectives?

## **2. REVIEW RELATED WORKS**

Many institutions, use Learning Management Systems as their platform to conduct fully online courses Kulshrestha, T., & Kant, A. R 2013. Examples of Learning Management Systems includes Moodle, Blackboard, Canvas, and a lot more. Moodle is a well known Course Management System (CMS) or LMS. Moodle, in fact, has become very popular among educators around the world because of its easiness and economy. Blackboard is a course management software application that is used in higher institutions of learning. It has quite a number of learning tools that includes online discussion board, a course calendar, information announcement, course content management, electronic mail, reviews, navigation tools, access control, grade maintenance and distribution, student progress tracking, auto marked quizzes and exams, etc. Sharma, A. &Vatta 2013, Duan, Y., He, Q., Feng, W., Li, D., & Fu, Z 2010.

According to Engelbrecht, E. 2003, a robust LMS should contain several functions such as automation of administrative activities, self-service and self-guided services, rapid assembly and delivery of learning content, a scalable web-based platform, portability and standard support, and knowledge reuse.

### 3. METHODOLOGY

The research methodology is a specific technique that is adapted in research procedures the collection, assemble and evaluation of data. It defines what kind of methods are used to gather relevant information in the specific study. Throughout this research process, several methods were applied such as observation from previous researchers that have conducted relatively similar research to succeed this research goals and provide relevant information. The process of research methodology started by reviewing relevant literature to gain more understanding the topic and clarify necessary aspects of the research. This research involves the collection of data through a review of relevant literature, the data collected is analysed compared and contrasted and the results were used to make recommendations. The main research method is based on quantitative research, search engines, data mining tools, analysis software and 5 point numerical rating scale where used to collect and analyse data for this research.

### 4. PRESENTATION OF RESEARCH FINDINGS

In order to analyse LMS systems, and to identify feature, strength and weaknesses on the critical success factors of LMS, a survey was conducted from LMS experts from different domains in literary works and different search engines. The tables below provide some ideas about which LMS may be the best option. There is a list of basic computer system requirements to use for the below listed LMS. It is always recommended to use the most up-to-date versions and better internet connections. These will still run with the minimum specifications, but you may experience slower loading times. All the below requirements will vary depending on specific hardware and software combinations as well as the type of use and load; busy sites may well require additional resources. For very large sites, you are much better starting with a small pilot and gaining some experience and insight. A "what hardware do I need for 50,000 users?"

**Table I. Features To Consider When Choosing An Lms**

ABILITY	Moodle	Canvas	Docebo	Black Board	Chami lo	Schoology	Sakai	alent LMS	iSpring Learn	360 Learn
Assessment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Authoring	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Certifications	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Chats	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Calendar	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

ABILITY	Moodle	Canvas	Docebo	Black Board	Chamilo	Schoology	Sakai	Talent LMS	iSpring Learn	360 Learn
Content Management	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Conferencing	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Customization	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Discussion Forums	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Dashboard	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gamification	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Integration	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Language	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes
Mobile	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Notifications	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Storage	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Support	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SCORM Compliance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

**TABLE II: DISPLAY OF COMPARISM OF FEATURES TO USER REQUIREMENT**

FEATURES	Moodle	Canvas	Docebo	Black - Board	Chamilo	Schoology	Sakai	Talent LMS	iSpring Learn	360 Learn
Content Management	5	4	5	5	4	5	3	5	4	5
Course Tracking	5	4	5	5	3	4	2	5	4	5
Integration	5	3	4	5	3	4	2	4	3	4
License	5	4	4	5	2	5	3	3	3	5
Communication	5	2	3	5	2	3	4	4	4	3
Virtual Classroom	3	4	3	4	4	4	3	3	4	4
Gamification	4	3	4	5	4	3	3	4	5	4
Mobile	4	4	4	5	2	3	2	3	4	3
Test	2	3	4	3	2	4	2	4	4	4
<b>MEAN SCORE</b>	<b>4.22</b>	<b>3.44</b>	<b>4.0</b>	<b>4.66</b>	<b>2.88</b>	<b>3.44</b>	<b>2.67</b>	<b>3.88</b>	<b>3.88</b>	<b>4.11</b>

The comparison analysis shows that more than 85% from presented Learning Management Systems have similarities in terms of functions. However, the focus of this research is to identify the most worldwide used LMS from the point of user-friendly, and easy to adapt with other add-ons applications. To succeed the process of analysis effectively, it is necessary to briefly explore a bit to the case company requirements and compare with trend features into the learning industry in order to have a better understanding of the core focus of the analysis. As discussed before, the case company wish to have the platform where main users such as platform admin, course instructors, and learners are able to communicate, store different format of course materials, and instructors wish to monitor learner's progress during the study time. With the help of Finances Online research regarding trends in eLearning industry were identified in relation to user experience of various features for LMS, author came to the conclusion that the following are the relevant features to use for comparison. Content management, Course tracking, Integrations, License, Communication, Virtual classroom, Gamification, and Mobile friendly.

Summarizing the table 5 above clarifies 9 features which are the most trend in the learning industry and there are more frequently requested with users. Furthermore, the comparison study of these features and case company requirements took place, they seem to be the perfect first phase of the development of the platform. Following the results of the comparison, it is clearly showing that Blackboard, Moodle, and 360 Learning are highly ranked with mean scores of 4.66, 4.22, and 4.11. The evaluation criteria were made by ranging 1 as a poor and 5 as a best based on the data collected from various researchers such as Finance Online (2019).

This research analysed the selected LMS platforms with the criteria proposed in the previous section. The part of their technical specification, taken from LMS' websites, is presented in subsequent Tables. The "N/A" is written in the place where information was not found. An interesting observation is that most of the studied LMS systems have an open source, such as Moodle, Chamilo, Sakai, Canvas. But other e-learning systems provide free versions of their limited-edition software, and multiple of them have paid versions. Almost all studied LMS platforms meet the requirements described in the "Sharable Content Object Reference Model" (SCORM) standard Rustici Software LLC (2019). Most of the modern LMS systems provide multilingual interface support, making it easier for users to use their native language. As an example, only 28% of the studied LMS platforms supported up to 10 different interface languages, and the remaining 72% of them support more than 10 interface languages.

## **5. DISCUSSION OF FINDINGS**

This research presents an empirical study of the qualities of ten (10) modern LMS platforms. The study was carried out in two stages. In the first step, the state-of-art literature was discussed, and the criteria for analysis of LMS systems were selected. In the second step, I focused on the choice of LMS platforms for investigation. I used specific keywords in Google and Bing search engines for the selection of such software, after much review several websites were used for data collection. As a result of this study, I can conclude that most LMS systems have similar features. All of them support the use of multimedia elements, creating and editing the lectures, exercises and course assignments. Out of all the LMS analysed 86% of the studied systems meet the SCORM standard, and no evaluating systems of the learners' knowledge are possible in 5% of them.

An interesting result that only 75% of all the systems provide chat support and only 68% of them have forum support. This result confirms the trend that the LMS platforms without any communication support for users are more suitable for a blending learning tool. The lack of communication support leads to using web forums and social networks out of the LMS, which contradicts to the concept of a unified learning environment system. Despite the significant advances in software development and the relatively long period of use of e-learning systems, they still do not meet all the criteria for an LMS, although their authors defined them as e-learning systems. This can further confuse the end-users, e.g., teachers, pupils/students and parents. As a future trend of LMS systems, we can point to the enhancement of real-time communication between individual users, the use of these systems as cloud services and the inclusion of added and virtual reality to their capabilities. This paper aims to help institutions in taking the right decision when it comes to choose one Learning Management System from the multitude of such systems on the market.

The chosen platform must meet the needs that a big institutions may have. The research focuses on a comparison of the main Learning Management Systems such as Blackboard, Moodle with other platforms (Docebo, Schoology, Canvas etc) and is based on different types of comparison. In the first part the researcher compare the systems based on their features and capabilities, and on the second part we take a look at the technical requirements. There should be a balance between those two parts, since technical requirements are translated from the university's point of view in budget. Based on the features and capabilities the researcher took in consideration in the first part of the study, decided that Blackboard is the best platform which would suit to a university, followed closely by Moodle. Blackboard has a total of 37 features and technical requirements out of forty, and Moodle missed only 4 of 40 criteria. The weakest product is sakai which has only 22 out of 40 features but this can be easily explained by the fact that is a platform freely available and it's evolving daily. The technical aspect show also Blackboard as the best choice and is also my general recommendation based on this study. There is a small difference between Blackboard and Moodle in the research conducted, but in the end the choice belongs to the user. Hence we recommend Blackboard as the best choice for higher education generally.

## 6. RECOMMENDATIONS

Choice of buying an LMS for your institution, organization or business is something that cannot be decided in a single day. Important points considered in LMS investment decision for achieving proficient business goals are ROI (return on investment), adaptive to the needs of the organization, usability, and effectiveness of the system, Total Cost of Ownership. If the software is Open-Source, that may or may not be free of cost and vice-versa for proprietary LMS. However, analysing global market for Open-source LMS software (Moodle), it is observed that they are freely available. On contrary, proprietary software (Blackboard, Litmos etc.) are paid. So, the choice of choosing the best LMS for you is not a decision driven by the absolute comparison but based on the relative comparison weighing in all technical and non-technical factors, including the Total Cost of Ownership (TCO). A long-term strategy and alignment of technology evaluation with that long-term strategy comes into play here. Based on the result from findings of the reviewed LMS systems and feedback provided on features there are some systems that are a better choice than others.

The recommendation would be to be provided down below with the highest preferred systems, provide a means for any institution, business or organisation saddled with the dilemma of making right decision of choosing an LMS system that best suit their needs towards improving functionality.

#### **Recommendation 1: Blackbaord**

Blackboard is a widely used Learning Management System all over the world by all educational institutes (schools, universities, schooling parents), but also by companies since the tool has a special version for trainings. Blackboard enriches the experience of learning with many plug-ins and tools that can be used to enhance traditional classroom tuition in the system of managed learning. It can scale back and forth from a single teacher to a more than 55.000-student University. From this study I discovered the most suitable LMS for institutions and organisations is Blackboard. The technical aspect show also Blackboard as the best choice and is also our general recommendation based on this study for institutions or organisations that have larger budgets and want to use an LMS that meets the all the requirements, Blackboard is recommended, it is the best choice generally.

#### **Recommendation 2: Moodle**

Open source platforms are becoming a choice for every institution, as they are beneficial to users in allowing platforms to be modified according to user requirements, and because of the low costs charged to get a better service, compared to a commercial platform that requires licensing fees per user, with an additional subscription and maintenance fee to make sure your LMS is kept up to date. Moodle is the recommended open source platform because it has a lot of features that meet the needs of students and it has had more than 80 million users. Reflecting a functionality point of view, Moodle seems to impress a lot of users based on the data collected from Google forums and YouTube. Most people say that the system has a great graphic user interface (GUI), including security standards. Furthermore, implementing the Moodle system will be the best choice for the case company because the system admin won't be facing unknown challenges due to the availability of data online to guide them in various processes.

### **7. CONCLUSION**

The study concluded, after assessing many LMS solutions are generalized. Their features are geared toward organizations at large, instead of fully investing in niche markets. However, finding an industry-specific LMS for your institution, organization or business is worth the added effort. And now you can even bypass hours or days of online shopping thanks to specialized software directories. The systems could each be an appropriate solution depending on the needs of an organization. By clearly understanding the differences, the core functionalities of each, and the benefits of combining or keeping applications separate, training and education professionals can help guide decision makers toward the best solution for the institution, business or organization. Matching the right solution to meet the needs will help institution, organizations or business effectively allocate their education naira through focused applications to manage the learning, administration, tracking, and reporting functions.

The research project was undertaken to compare Learning Management Systems and evaluate them to determine a relevant learning platform that can be used for educational purposes. This research present LMSs which has an incredible impact in the online learning industry. The relevance of LMSs is clearly supported by current findings during the research, most of the supportive findings are based on previous studies, LMS vendors, and experts. The present research has covered the most important topics in terms of the process for developing an accurate Learning Management System to reach user's needs. The research began with identifying the aim and objectives to support the process of detecting the requirements of the users. The platform users were identified as well as their main goals were discussed critically.

The assessment of understanding the requirements and it gave me a clear picture of what type of platform is required and what kind of features must be included in order to reach the case users needs. The evaluation findings have shown that there few requirements to give concern to while choosing the best LMS, such as functional suitability, performance efficiency, compatibility, security, portability, maintainability, and usability and all these requirements are presented well on the evaluation chapters. Keep in mind that finding the ideal LMS for your needs is the only way to truly reap the benefits of a Learning Management System. So, take advantage of free trials, and researchs like this state features and pricing options, and provides reviews from other e-Learning professionals who have had experience with the tool. This will allow you to get the most out of the Learning Management System and create successful e-Learning courses. You can also get an LMS quote tailored to your needs in as little as three minutes. This research will help you find the Learning Management System that works best for you towards improving functionality.

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