Towards Selecting Effective Open Source Learning Management System/Software (OSLMS) for Higher Education Domain

Dr. Md Ajimuddin Sk[1]

Dr. Sibsankar Jana[2] **(Mentor)**

Samima Khatun[3]

[1]Librarian, Seth Soorajmull Jalan Girls College, Kolkata, West Bengal, India. Email-ajim.sk10@gmail.com

[2]Assistant Professor, Department of Library & Information Science, University of Kalyani, West Bengal, India. Email-sibs_jana@yahoo.com

[3]M.Phil. Scholar, Department of Library & Information Science, University of Kalyani, West Bengal, India. Email- samima88khatun@gmail.com

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Corresponding author:

Dr. Sibsankar Jana, Assistant Professor, Department of Library & Information Science, University of Kalyani, West Bengal, India. Email- sibs_jana@yahoo.com. Mob - +91-9433886928

Authors' Bio-sketch

Dr. Md Ajimuddin Sk is working as Librarian in the Seth Soorajmull Jalan Girls' College, Kolkata, West Bengal. He has completed his MA, MLIS and Ph.D form the Department of Library and Information Science, University of Kalyani. He has published research articles in various national/international journals and has presented papers in national/international conferences/seminars. His area of research includes e-learning, digital learning environment, digital library system, Bibliotherapy etc.

Dr. Jana is working as Assistant Professor in the Department of Library & Information Science, University of Kalyani, W.B. He has passed MLIS (Gold Medalist) from J.U. in 2001. Later he has also completed PGD in Digital Library Management (Standing 1st in merit list) and Ph.D. from J.U. Earlier he passed M.Sc (Geology) from C.U. and DPM, IR & LW from SLI, Govt. of W.B. Six research scholars have been awarded Ph. D. under his supervision. He has written three books and near about hundred research articles published in reputed journals, conference proceeding, book chapters etc. He has also delivered/presented invited lectures and papers in different LIS forums. His domains of interest are knowledge organization, scientometrics, digital resource management, scholarly communication, altmetrics etc.

Samima Khatun is at present a M.Phil Research Scholar in the Department of Library and Information Science, University of Kalyani. She has completed her MA, B.Ed. and MLIS from University of Kalyani. She has published research articles in various reputed journals and has presented papers in national/international conferences/seminars. Her area of research includes e-learning, bibliometrics etc.

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Abstract

We are in the age of Information and Communication Technology (ICT), where the learning communities (i.e. learners, teachers, scholars etc.) mainly in higher education domain are more technology depended. The stakeholders always handle advanced research, study, technologies and therefore they need some authentic and updated information to satisfy their daily needs. Simply they need some updated as well as real-time interactive digital learning platform that can give fast, authentic and updated information to satisfy their academic needs. This learning platform completely depends on the judicious designing methodologies and this designing methodology totally depends on the reliable and effective digital learning tools or Learning Management System (LMS).

The present study is an attempt to design the standard process towards selecting authentic, reliable and effective Open Source Learning Management Software/System (OSLMS) for the higher education platform. In this regards the study has been designed in the three layers for the selection of the popular and mostly downloaded OSLMS in the world. Later in the 3rd layer, comparative study of final six OSLMSs has been conducted based on the features under various criteria and parameters to select the right one. Lastly it is found that the Moodle fulfilled most of the criteria and selected as the most authentic, interactive, trustworthy OSLMS for the higher education system.

Keywords: Digital Learning Environment, Digital Learning Software, Learning Management System, OSLMS, Open Source Learning Management System, Moodle

0. Introduction

Today's learning environment in general and higher education domain in particular, is becoming more and more multifaceted than ever. Present days' researchers and learners always deal with some new concepts, theories and technologies. The research areas are interdisciplinary, complex in nature. The rate of obsolescence of the knowledge is becoming higher. Therefore, they need updated, real-time, expeditious, authentic knowledge to satisfy their needs. In this regard, the collaborative and interactive digital learning platform is required through which the stakeholders of the higher education domain may fulfil their needs. Besides the higher education stakeholders, the other learners in the society can also update themselves in their own pace, path and place also (Peters, 2000). Towards building the learning platform, various Open Source Digital Learning Management Software (OSLMS) are available in the public domain. All of these OSLMS have some strengths and weaknesses. Therefore, it is very difficult to select the right one. An authentic selection criterion is highly essential.

1. Literature Review

An LMS is the infrastructure that delivers and manages instructional content, identifies and assesses individual and organizational learning or training goals, tracks the progress towards meeting those goals, collects and presents data for supervising the learning process of organization as a whole (Watson & Watson, 2007). LMS is a pedagogical tool for educators to create and manage a course website and shares the course materials, discussions, chats, quizzes, surveys, gather and review assignments, and record grades (M.V & Swaroop, 2010). It is an environment with digital software which is designed to manage user learning interventions as well as deliver learning content and resources to students. (Adzharuddin &

Ling, 2013). The main focus of an LMS is to deliver online courses or training to students, while managing student rosters and keeping track of their progress and performance throughout all types of training activities (Benediktsson & Thorsteinsson, 2013). Virtual learning environment provides students not only a common platform where they can get the subject-wise tutorial online (or anytime), but also other administrative information, location of sessions, details of prerequisites and co-requisites, credit information, registration and tracking facilities are there (Lihitkar & Arora, 2013). Al-Ajlan in his study, measures the LMS on the basis of two kinds of comparison based on the features and capabilities of learning tools and the technical aspects of learning systems. Finally, he concluded that the most optimal learning platform is moodle. Moodle facilitates abundance of excellent tools which make the learning environment more interactive and collaborative (Al-Ajlan, 2012). In another study, Cavus and Zabadi have compared ATutor, Claroline, Dokeos, Ilias, Moodle and Sakai LMS. They compared the LMS by using the features of LMS identified by Al-Ajlan. Information is easily accessible on the Moodle and ATutor web pages, Ilias also makes information readily available to potential clients (Nadire & Teyang, 2014). During the past 15 years, the LMS has became important for creating of e-learning platform as well as designing of courses, content storage and delivery, assessments, administration, reporting etc (Karthik, 2018).

2. Objectives of the Study

The present study has made an attempt to study the Open Source Leaning Management System (OSLMS) for the following objectives:

a) To make comparison among the popular OSLMSs.
b) To design a framework for choosing right OSLMS through proper selection criteria.

3. Scope and Limitations of the Study

There are so many LMSs available in the commercial as well as in public domain. Only the Open Source Learning Management Software/System (OSLMS) have been taken into consideration for higher education domain.

4. Methodology

The present study has been done based on the three-layer model. In the first layer, a meta-list of OSLMs has been prepared by consulting various sources. In the second layer, the OSLMSs (of the First Layer) have been compared based on the monthly download statistics through the sourceforge.net. In the third layer, the selected OSLMSs have been compared based on the popularity criteria and through the final comparative study of the OSLMSs best one is selected.

The layer one is the Collection or making of a meta-list of OSLMS from different sources which is available in the public domain.

Table 1: Alphabetical List of OSLMS from Public Domain

OSLMS	aTutor
	Canvas, Chamilo, Claroline, CourseSites by Blackboard
	Dokeos
	eFront, Eliademy, ELMSLN
	Fedena, Forma LMS
	Ganesha LMS
	ILIAS
	.LRN's LMS, LAMS LON-CAPA, LatitudeLearning
	Moodle, Metastudy

	OLAT, OpenOLAT, Opigno, Open edX LMS
	Sakai, SWAD, Schoology
	Totara LMS
	WeBWorK

In the second layer, OSLMSs have been selected on the basis of the monthly download statistics in the SouceForge.net website. The developers create and manage more than 500,000 projects, they have more than 33 million monthly users and 4 million downloads per day. It provides daily, weekly, monthly as well as yearly download statistics. It also provides detailed downloaded country and used operating System in the download statistics.) (About SourceForge, 2018)

Table 2: Monthly Download Statistics of OSLMS from SouceForge.net

	OSLMS									
Year	ATutor	Claroline	Docebo	Dokeos	eFront	Forma LMS	ILIAS	Moodle	Open ELms	OpenUSS
July, 2018	580	281	25	203	263	902	601	3,555	15	05
August, 2018	689	214	31	189	268	832	103	3,353	29	02
Septe., 2018	718	259	25	133	288	861	100	4,638	10	0
Octo., 2018	877	519	25	223	346	881	97	6,034	9	16
Nove., 2018	954	252	27	134	335	713	71	6,564	17	03
Dece., 2018	738	280	19	136	243	716	68	5,067	26	5
January, 2019	806	388	20	149	343	931	254	4,493	23	28
Feb., 2019	1,015	394	23	148	288	1,138	163	3,544	10	05
March, 2019	1,249	735	34	243	266	1,106	78	4,200	12	03
April, 2019	911	558	16	215	221	1,075	74	3,132	19	03
May, 2019	953	460	15	206	256	1183	113	3,977	16	00
June, 2019	748	256	7	82	154	927	79	3,400	04	00
July, 2019	654	225	16	62	294	940	60	3,638	10	02

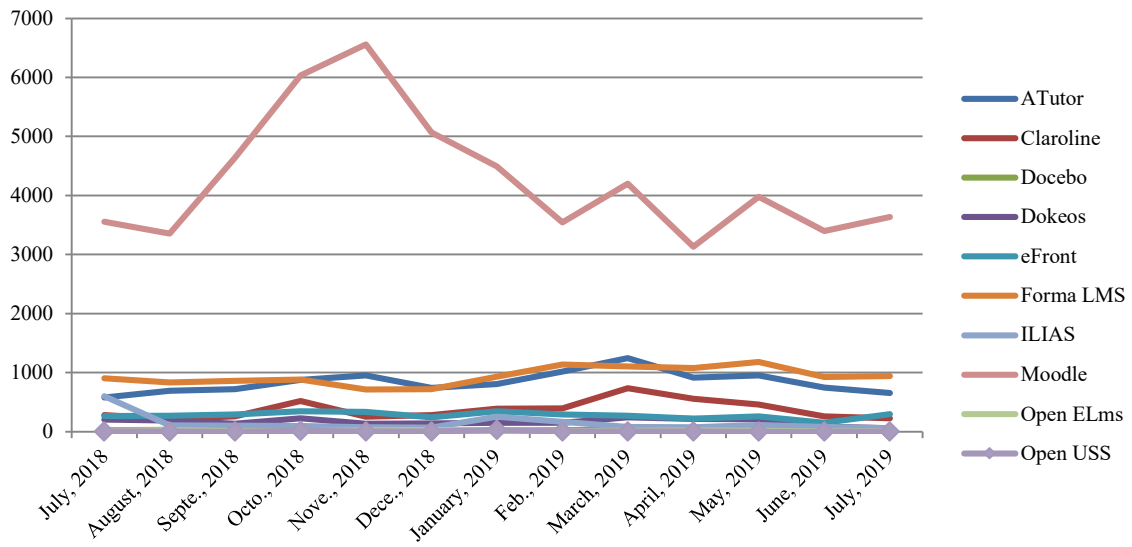

Figure 1: Monthly Download Statistics of OSLMS from SouceForge.net

Here the Ten OSLMS have been considered for the layer 3, based on the monthly download statistics in the SouceForge.net.

In the layer 3 or final layer the 10 OSLMS has been analyzed on the basis of the popularity criteria of the software. These are as follows:

Table 3: Popularity criteria of 10 OSLMS

LMS	Usage statics				OS	Language Capability	Documentation	Standards Support	Latest Version
	Institution	Courses	Country	Enrolment					
Claroline	NA	NA	80	NA	WindowsUnix	Multilingual	Yes (Multilingual)	SCORM IMS/ QTI	1.11.10 28/02/2014
Docebo	1100	ND	80	300,000	Linux	Multilingual	Yes (Multilingual)	SCORM AICC and XAPI	7.0 16/03/217

Dokeos	6,000	122,000	60	1297 775	Windows, Linux, Mac OS X and UNIX servers	Multilingual	Yes (Eng)	SCORM	2.1.1 22/01/2012
eFront	NA	600000	180	10000000	Linux, Windows macOS	Multilingual	Yes (Multilingual)	SCORM XAPI	3.6.15.5 15/05/2015
Forma LMS	NA	NA	NA	NA	Linux, Window, Mac	English	Yes	SCORM	1.4.2 12/05/2016
ILIAS	103	NA	53	963885	Linux MAC	Multilingual	Yes (Eng & Spanish)	SCORM, LOM, IMS LTI	5.2.5 09/06/2017
Moodle	80,896	12,071,930	234	356,463,131	Linux MAC Solaris Windows	Multilingual	Yes (Multilingual)	IMS, AICC and SCORM XAPI	3.3 15/05/2017
Open Elms	NA	NA	156	NA	Linux MAC Solaris Windows	Multilingual	Yes (Multilingual)	IMS, AICC and SCORM XAPI	3.3 15/05/2017
Open USS	NA	NA	NA	NA	Windows, Linux macOS	English	Yes (Eng)		4.0.1 16/02/2008

Based on the data given in the table 3 as well as availability of the popularity data, six LMS have been taken into consideration for the final comparative study to fulfill the above-mentioned objectives.

5. Comparative study of the selected OSLMSs

The final comparative study has been conducted on the basis of the basic features of the OSLMS. These features have been categorized into five broad categories i.e. System administration, Communication, Teaching-learning and Evaluation, Software Support System (SSS) and Domain Standard Support. These features have also been categorized into some criteria and parameters. These are as follows:

5.1 System Administration

System administration is the key part of every LMS that plays a pivotal role and make the LMS more reliable and user friendly in the higher educational platform. It includes the creating, configuring, designing, populating and running the courses in the digital environment. It also includes the creating new and managing the existing courses, user management, student evaluation management etc.

Table 4: Comparative study on the basis of the System Administration

Criteria	Parameters	ATutor	Docebo	Dokeos	eFront	ILIAS	Moodle
Authentication	Manual accounts	Yes	Yes	Yes	Yes	Yes	Yes
	Email-based self-registration	Yes	Yes	No	Yes	Yes	Yes
	Single ID based authentication support	No	Yes	No	No	No	Yes
	External database authentication	Yes	Yes	No	No	Yes	Yes
	Network authentication	Yes	No	Yes	Yes	Yes	Yes
	NNTP authentication	Yes	No	Yes	No	Yes	Yes
	Pluggable Authentication Modules (PAM)	No	No	No	No	No	Yes
	POP3 server authentication	No	Yes	Yes	Yes	Yes	Yes
	RADIUS authentication	No	No	No	No	Yes	Yes
	CAS Authentication	No	Yes	Yes	No	Yes	Yes
	SOAP Authentication	NO	Yes	No	No	Yes	Yes
	LDAP Authentication	Yes	Yes	Yes	Yes	Yes	Yes
	Shibboleth Authentication	Yes	Yes	No	No	Yes	Yes
	Unique login authentication	No	No	No	No	No	Yes
	Web services authentication	Yes	Yes	No	Yes	Yes	Yes
Structuring course curricula at top level		No	No	No	No	No	Yes
Course authorization		Yes	Yes	No	Yes	No	Yes
Enrolment and Registration	Manual enrollment	Yes	Yes	Yes	Yes	Yes	Yes
	Self enrolment	Yes	Yes	Yes	Yes	Yes	Yes
	Guest access	No	No	No	No	Yes	Yes
	Course meta link	No	No	No	No	No	Yes
	PayPal enrolment	No	Yes	No	No	No	Yes
Tracking System	Progress bar	Yes	Yes	Yes	Yes	Yes	Yes
	Lesson objectives	No	No	No	No	No	Yes
	My Progress	No	Yes	No	No	Yes	Yes
	Mycourse Status	Yes	No	No	No	No	Yes
	Attendance Register	No	No	No	No	No	Yes
	Engagement analytics report	No	No	No	No	No	Yes
	Individual Learning Plans	No	No	No	No	No	Yes
	Course Status Tracker	No	Yes	No	No	No	Yes
Statistical Reports of Students Progress	Grades	No	Yes	No	Yes	Yes	Yes
	Conditional Activities	No	No	No	No	No	Yes
	Activity Completion	No	No	No	No	No	Yes
	Course Completion	No	Yes	No	No	No	Yes
	Open Badges	No	No	No	No	Yes	Yes

	Course Reports	No	Yes	No	No	No	Yes
	Progress Bar	Yes	Yes	Yes	Yes	Yes	Yes
Log-in Analysis		No	Yes	No	Yes	No	Yes
Calendar	Course	Yes	Yes	Yes	Yes	Yes	Yes
	Group/ User	Yes	Yes	Yes	No	Yes	Yes
	Events	Yes	Yes	Yes	No	Yes	Yes
User experience capturing	Functionality	No	Yes	No	Yes	No	Yes
	Reliable	No	Yes	No	No	No	Yes
	Useable	No	Yes	No	Yes	No	Yes
	Pleasurable	No	Yes	No	No	No	Yes
	Personal	No	Yes	No	No	No	Yes
Course Backup and restore		Yes	Yes	Yes	Yes	Yes	Yes
Site Security		Yes	Yes	No	Yes	Yes	Yes
Regular security updates		Yes	Yes	Yes	Yes	Yes	Yes
Delegation of authority		No	No	No	No	Yes	Yes
Multilingual Capability		Yes	Yes	Yes	Yes	Yes	Yes
Plugin management		Yes	Yes	Yes	Yes	Yes	Yes
Interoperability management		Yes	Yes	No	Yes	No	Yes
webDAV support		No	No	No	No	Yes	Yes
Total Criteria and Parameters 54		Yes 23 No 31	Yes 38 No 16	Yes17 No 37	Yes 22 No 32	Yes 30 No 24	Yes 54 No 00

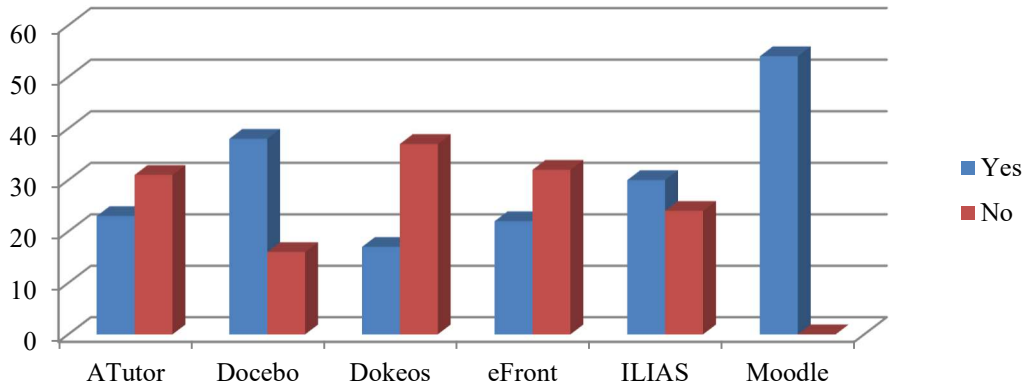

Figure 2: Parameters and criteria under System Administration

The table 4 and figure 2 represent the overall administrative capabilities of the OSLMS. There are 57 criteria under 17 parameters, moodle has covered 54 out of 54 criteria under all the parameters, and Docebo covered 38 criteria out of 54. So, on the basis of the system

administration Moodle is the highly strong and service oriented LMS than others. It can serve all the required functionalities for the learning community.

7.2 Communication

In the digital learning environment, the instructors share the learning resources and other activities with the learners and the learners give feedback to their instructors. They can also discuss a topic in the discussion forum and can do chat each other in the chat room and even they can evaluate each other in the workshop environment, which make the learning environment more interactive and collaborative. Therefore, communication is one of the most important features of the OSLMS.

Table 5: Comparative Study on the basis of the Number of parameters on different criteria under Communication

Criteria	Parameters	ATutor	Docebo	Dokeos	eFront	ILIAS	Moodle
Discussion Forums	Standard Discussion Forum	No	Yes	No	No	No	Yes
	Single Simple Discussion Forum	Yes	Yes	Yes	Yes	Yes	Yes
	Each Person Post One Discussion	No	Yes	No	No	No	Yes
	Q&A Discussion Forum	No	Yes	No	No	No	Yes
	Standard Forum in a Blog-like Format	No	No	No	No	No	Yes
Real-time Chat Service		Yes	Yes	Yes	Yes	Yes	Yes
Internal mail Service		Yes	Yes	Yes	Yes	Yes	Yes
File upload/online submission of assignment		Yes	Yes	Yes	Yes	Yes	Yes
Audio/Video Conference		Yes	Yes	Yes	Yes	Yes	Yes
Whiteboard		Yes	No	No	Yes	No	Yes
Online Journal		Yes	Yes	No	Yes	Yes	Yes
Wiki		Yes	Yes	Yes	Yes	Yes	Yes
Glossary		Yes	Yes	Yes	Yes	Yes	Yes
Blog		Yes	Yes	Yes	Yes	Yes	Yes
Workshop		No	Yes	No	No	No	Yes
Dashboard		No	No	No	Yes	No	Yes
Feedback survey	Attitudes Toward Thinking and Learning Survey (ATTLS)	Yes	No	No	Yes	No	Yes
	critical incidents survey	No	No	No	No	Yes	Yes
	Constructive On-Line Learning Environment Survey (COLLES)	No	Yes	Yes	No	Yes	Yes
Messaging and alerts	Assignment notifications	Yes	Yes	Yes	Yes	Yes	Yes
	Available update notifications	Yes	Yes	No	Yes	No	Yes
	Backup notifications	No	No	No	No	No	Yes
	Course creation request notification	Yes	Yes	No	No	No	Yes
	Course creation request approval notification	No	Yes	No	No	No	Yes
	Course creation request rejection notification	No	Yes	No	No	No	Yes
	Course completion notification	Yes	Yes	Yes	Yes	Yes	Yes
	Important errors with the site	No	Yes	No	Yes	No	Yes
	Manual enrolment expiry notifications	No	Yes	No	Yes	No	Yes
	Self enrolment expiry notifications	No	Yes	No	No	No	Yes
	Personal messages between users	Yes	Yes	No	No	Yes	Yes
	Feedback reminder	Yes	Yes	Yes	No	Yes	Yes
	Notices about minor problems	Yes	Yes	No	No	No	Yes
	Feedback notifications	Yes	Yes	Yes	Yes	Yes	Yes

	Notification of quiz submissions	Yes	Yes	Yes	Yes	Yes	Yes
Total No Criteria and Parameters = 34		Yes 20 No 14	Yes 28 No 06	Yes 14 No 20	Yes 19 No 15	Yes 17 No 17	Yes 34 No 00

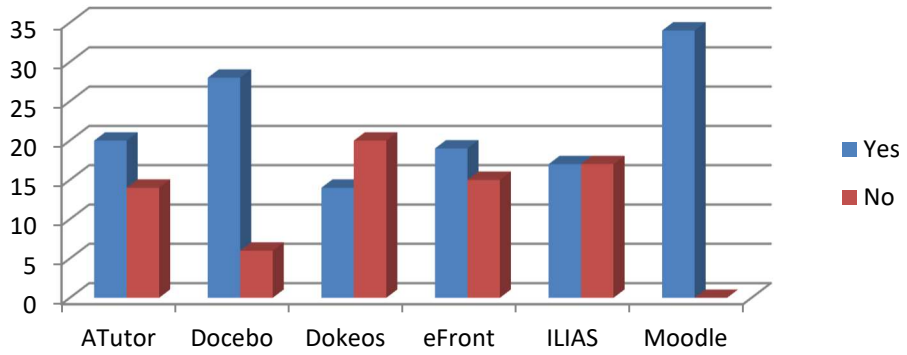

Figure 3: Parameters and criteria under Communication

On the basis of the data in table 5 and figure 3, the Moodle is in the top position that fulfills all the criteria and parameters (i.e. 34 out of 34) and Docebo is in the second position that covers 28 out of 34 criteria.

7.3 Teaching-learning and Evaluation

7.3.1 Teaching-learning

Teaching-learning is another significant part of the educational system. Simply the success of the education system merely depends on the good teaching-learning process. A good teaching-learning process includes the curriculum development to interactive classroom practice, online or offline training and other interactive practices, which enhance the engagement of the learners as well as motivational level in their learning process. Now we can follow the criteria and the parameters related to teaching-learning to compare the LMS.

Table 6: Comparative Study on the basis of the No. of parameters on different criteria under Teaching-Learning

Criteria	ATutor	Docebo	Dokeos	eFront	ILIAS	Moodle
Curriculum Development	Yes	Yes	Yes	Yes	Yes	Yes
Content Management	Yes	Yes	Yes	Yes	Yes	Yes
Resource Sharing and reuse	Yes	Yes	Yes	Yes	Yes	Yes
Instructor Help Desk	No	Yes	Yes	No	No	Yes
Online training	Yes	Yes	Yes	Yes	Yes	Yes
offline training	Yes	Yes	Yes	Yes	Yes	Yes
Multimedia Integration	Yes	Yes	Yes	Yes	Yes	Yes
Course Structuring/ Restructuring	Yes	No	No	Yes	Yes	Yes
Learning Object management	Yes	Yes	No	Yes	Yes	Yes
FAQ Management	Yes	Yes	Yes	Yes	Yes	Yes
Interactive report charts	No	Yes	No	Yes	No	Yes
Integrated Badges	Yes	Yes	No	No	Yes	Yes
Total No Criteria and Parameters = 12	Yes 09 No 03	Yes 11 No 01	Yes 08 No 04	Yes 10 No 02	Yes 10 No 02	Yes 12 No 00

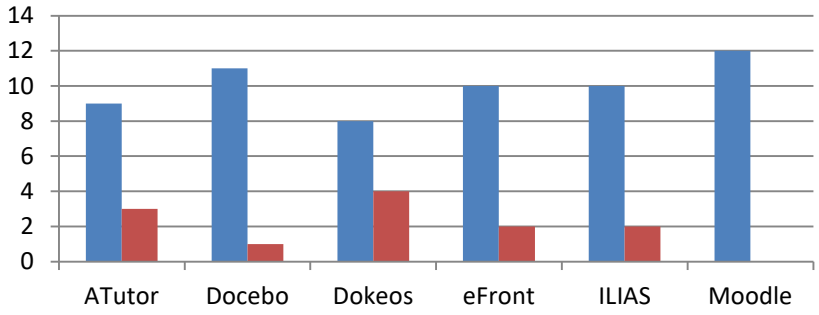

Figure 4: Criteria under Teaching-Learning

The data in the Table 6 and Figure 4 are very clearly showing again moodle is the only LMS that has fulfills all the features (12 out of 12) related to the teaching-learning parameters and criterion. In this section the others LMS are also in good position i.e. Docebo covered 11, eFront and ILIAS covered 10 features.

7.3.2 Evaluation

The learners use to come in the educational institution to learn something and achieving a degree as well as certificate after completion of the course. In this connection, the institution uses some evaluation process to judge their knowledge. In the digital learning environment, this evaluation process includes online test (Single-answer MCQ, multiple-answer MCQ, true/false question, matching question, short answer question, numerical question answer etc.), online or offline assignment, peer and self assessment etc. Now we can compare the LMS on the basis of the evaluation criteria.

Table 7: Comparative study on the basis of the No. of parameters on different criteria under Evaluation

Criteria	Parameters	ATutor	Docebo	Dokeos	eFront	ILIAS	Moodle
Online Grading		No	Yes	No	Yes	No	Yes
Peer and self assessment		No	Yes	No	No	No	Yes
Online Quiz	Single-answer MCQ	Yes	Yes	Yes	Yes	Yes	Yes
	Multiple-answer MCQ	Yes	Yes	Yes	Yes	Yes	Yes
	True/False Question	Yes	Yes	Yes	Yes	Yes	Yes
	Matching Question	Yes	Yes	Yes	Yes	Yes	Yes
	Short Answer question	Yes	Yes	Yes	Yes	Yes	Yes
	Numerical question	Yes	Yes	Yes	No	Yes	Yes
	Calculated Simple Question	Yes	Yes	Yes	No	Yes	Yes
	Essay Question	Yes	Yes	Yes	Yes	Yes	Yes
Online Quiz Editor		Yes	No	No	Yes	No	Yes
Automated Testing and Scoring		Yes	Yes	No	Yes	Yes	Yes
Total Parameters under different Criteria = 12		Yes 10 No 02	Yes 11 No 01	Yes 08 No 04	Yes 09 No 03	Yes 09 No 03	Yes 12 No 00

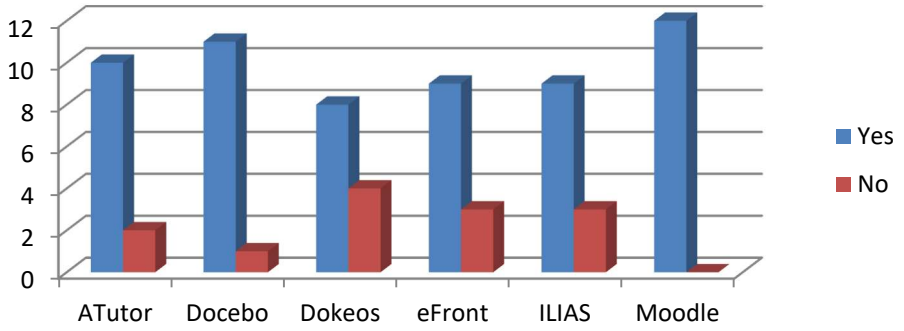

Figure 5: Parameters and criteria under Evaluation

The evaluation statistics viz. table 7 and figure 5 are clearly expressing that the moodle is the best LMS. In this section, the moodle again has covered all the 12 criteria followed by Docebo and ATutor.

7.4 Software Support System (SSS)

The SSS includes developer forum, technical support forum, community forum, demo site etc. In the digital learning environment, the teaching-learning process depends on the accuracy and effectiveness of the LMS. Therefore, for the smooth running the LMS, we need some technical and non-technical support from the developers. Now it is essential to measure the software support system before selecting the LMS.

Table 8: Comparative study on the basis of Software Support System

Criteria	ATutor	Docebo	Dokeos	eFront	ILIAS	Moodle
Developer Forum	Yes	Yes	No	No	Yes	Yes
Technical support Forum	Yes	Yes	Yes	No	Yes	Yes
Community Forum	Yes	Yes	No	No	Yes	Yes
Bug Reporting facility (Bugzilla)	Yes	Yes	No	Yes	Yes	Yes
Features Request Facility	Yes	Yes	No	No	Yes	Yes
Availability of demo site	Yes	Yes	Yes	Yes	No	Yes
Availability of demo courses	Yes	Yes	Yes	Yes	No	Yes
Availability of Themes	Yes	Yes	No	Yes	Yes	Yes
Availability of Translations	Yes	Yes	Yes	Yes	Yes	Yes
Total No Criteria and Parameters 09	Yes 09 No 00	Yes 09 No 00	Yes 04 No 05	Yes 05 No 04	Yes 07 No 02	Yes 09 No 00

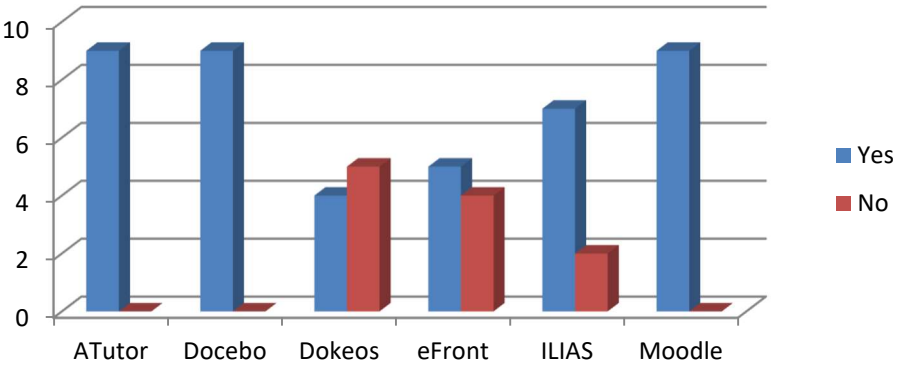

Figure 6: Criteria under Software Support System

The table 8 and the figure 6 highlight that the ATutor, Docebo and Moodle have fulfilled all the criteria and parameters of software support system.

7.5. Domain Standard Support

The domain standards are like a vehicle that makes the learning objects as well as learning infrastructure flexible that represent more sensible and coherent way to manage and repackaging of learning objects or resources for the learning community. The main advantages of domain specific standard development and use are: Durability, Interoperability, Accessibility and Reusability.

Table 9: Comparative study on the basis of domain standard support.

Criteria	ATutor	Docebo	Dokeos	eFront	ILIAS	Moodle
SCORM	Yes	Yes	Yes	Yes	Yes	Yes
IMS LTI	Yes	No	No	No	Yes	Yes
AICC HACP	No	No	No	No	No	Yes
LRMI	No	No	No	No	No	No
LOM	No	No	No	No	Yes	Yes
GEMS	No	No	No	No	No	No
Total No Criteria and Parameters 06	Yes 02 No 04	Yes 01 No 05	Yes 01 No 05	Yes 01 No 05	Yes 03 No 03	Yes 04 No 02

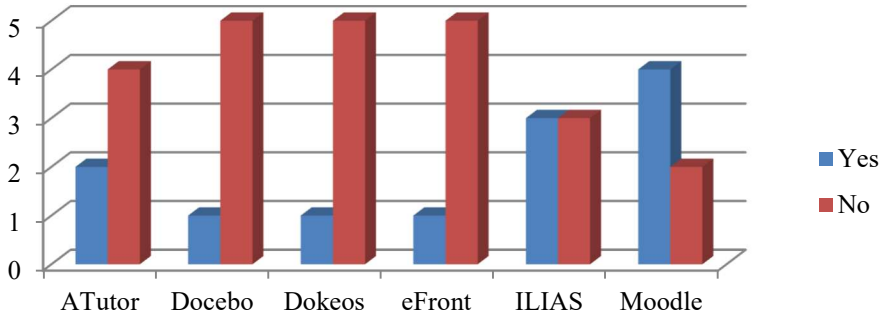

Figure 7: Criteria under Domain Standard Support

The data in the table 9 and the figure 7, is expressing the status of using domain standards in the LMS. The data shows that the Moodle support 4 standards, ILIAS 3, ATutor is 2 and other three LMS support 1 domain standard each. Hence, we can say that the Moodle is the best LMS in this category.

6. Final Report and conclusion

Based on the comparative study in the previous section, we can now highlights the final result as well as final selection of the right LMS.

Table 10: Final Report of the Study

Features		Total No Criteria and Parameters	ATutor		Docebo		Dokeos		eFront		ILIAS		Moodle	
			Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1. System Administration		54	23	31	38	16	17	37	22	32	30	24	54	00
2. Communication		34	20	14	28	06	14	20	19	15	17	17	34	00
3. Teaching-learning and Evaluation	Teaching-learning	12	09	03	11	01	08	04	10	02	10	02	12	00
	Evaluation	12	10	02	11	01	08	04	09	03	09	03	12	00
4. Software Support System		09	09	00	09	00	04	05	05	04	07	02	09	00
5. Domain Standard Support.		06	02	04	04	02	01	05	01	05	03	03	04	02
Total		127	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
			73	54	101	26	52	75	66	61	76	51	125	02

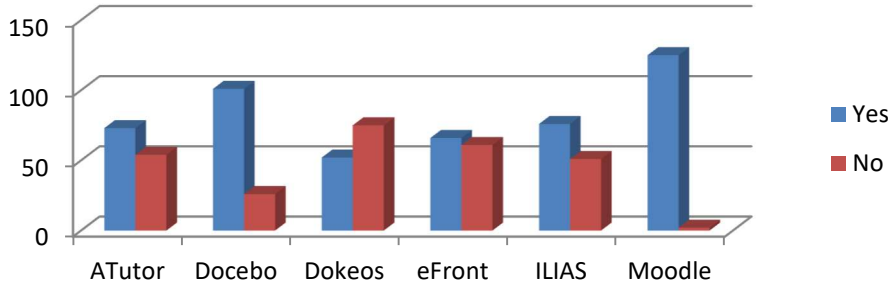

Figure 8: Final Report of the study

The present comparative study has made an attempt to design a selection process or to select the right LMS. The present study clearly represent that the Moodle is one of the most efficient, effective, popular and highly used LMS throughout world. In the final result (Table 10 and Figure 8), we clearly find that there are total 127 criteria and parameters under five key features of the LMS. The moodle has covered 125 parameters out of 127 and missed only 2 parameters in the whole study. Moodle facilitates to design, manage and track the learning resources. It gives access to the learners from anywhere and anytime. It supports wide variety of social and collaborative tools (blogs, forum, wiki etc.) to make the learning environment more interactive, where the learning community can participate in the live session and share their views and resources. Moodle has a wide range of plug-in facility to add the additional features from other sources to enrich the existing system. Due to the availability of the source code, anyone can modify moodle as per their requirements.

In the concluding remarks, it may be stated that though it a comparative study of digital learning software, however it may be used as a model guidelines for studying a number of software systems on a particular discipline.

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