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Original Article

Comparative Study between Open Source LMS Platforms: Choice of the Moodle e-Learning Platform

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Abstract *- In this work, we propose a comparative study between six open sources LMS platforms based on the report of the forum of digital training actors (FFFOD) published in 2020. The work concerns comparing the most widely used open source LMSs in the French-speaking world to remove hesitation, to promote a reasoned choice of an LMS platform, by emphasizing the educational, administrative and technical functionalities of open source platforms.*

Keywords *- Comparative study, LMS platform, Open source, Canvas, Chamilo, Claroline Connect, Ilias, Moodle and WordPress.*

I. INTRODUCTION

We can classify LMSs, according to their basic architecture, according to their mode of distribution (open source or proprietary), according to the computer language they use, according to the learning philosophy that structured their construction, according to the types of markets for which they are intended (school, business), etc. We thus find LMS with a content vs competence orientation, LMS with an autonomy vs collaboration orientation and LMS with an individualization vs massification orientation.

However, hundreds of e-learning platforms (Learning Management System) are present on the world market. They can be classified into two categories: Open Source platforms and proprietary platforms.

- Open Source LMS platforms As their name suggests, they are free and readily available. These platforms like for example Moodle [1] and Claroline Connect [2], are efficient but require a big administrative effort.
- Proprietary (paid) LMS platforms are tools created by private companies. These platforms go further than Open Source LMS platforms and are easier to administer, we cite as examples Coursera [3] and Udacity [4].

In this work, we propose a comparative study between six open source LMS platforms based on the report of the forum of digital training actors (FFFOD) published in 2020. The report which referred to the study launched and produced by Stratice since 2012 concerning the Benchmark of open source LMS [5]. This benchmark is the result of collaboration between groups of actors of the digital training: experts LMS administrators of one or more platforms or simple formers. All brought their personal experience with the greatest possible objectivity in order to compare the open source LMSs most used in the French-speaking world. The benchmark aims to remove hesitation and promote a reasoned choice, with an emphasis on educational features of course, but also administrative and technical features of open source platforms.

Because it is mainly used in educational and training institutions, education managers or teacher trainers, it emphasizes specific educational functions. Thanks to specific examples of use, readers will be able to represent this functionality of this tool. All the functions required for the study of a criterion have been tested in a real situation. Authors can be helped by available documentation and / or existing online communities. In some cases, the advertisement function cannot be implemented. This is the subject of the commentary. All platforms are used according to the different user profiles available.

Thus, through this comparison, taking into consideration the eight criteria and their sub-criteria, we can choose the most robust platform.

II. CRITERIA FOR CHOOSING A PLATFORM

The choice of an e-learning platform is always complex, because it is an institutional choice formulated in specifications drawn up from strategic orientations, an organizational context, technical and educational functionalities expected. In this search, we will use six criteria [6]:

A. At the level of Pedagogy

With regard to the theory of teaching, there is no good or bad LMS, but the LMS can correspond to such or such pedagogical strategy. If we do not deploy mandatory training like assessment tools, then the possibility of personalized courses will not generate much interest. Likewise, if our trainers are developing content, this is more important than using our outsourced product production and having built-in authoring tools. Finally, if peer learning is at the center of our strategy, we will of course attach great importance to communication and collaboration tools.

B. At the level of Monitoring and Reporting

Depending on the nature of the establishment (education, vocational training) or the company, the traceability of the learners' activities and the importance of restoring and formatting the data collected will not be the same nature. Since the requirements of sponsors or funders vary widely, it is important to ensure that you can configure the LMS to meet them.

C. At the level of Design and Ergonomy

As we seek to develop or strengthen our image with learners or customers, the potential for personalization of the LMS will become even more important. Having a responsive design interface and / or having a mobile application is particularly important, because the share of Internet access via smartphones or tablets in 2018 exceeds that of fixed access.

D. At the Deploying

Whether it's time or cost, deployment must be related to the volume to be properly evaluated. In fact, if only a few dozen learners are enrolled each year, we will be looking for fewer ways to connect LMS to HRIS. For the same reason, installation and configuration costs will be easier to determine for large organizations.

E. At the Technical level

If the characteristics of the LMS can meet our needs at time T, it takes 2 to 3 years to check its adaptability according to the technological evolution of the industry and the number of learners. Besides the technical characteristics of the platform, we also have to ask ourselves what skills we need to maintain the LMS and support the users.

F. At the level of Offers and Services

When comparing subscription types, fixed rates or types per user, the volume of transactions in the analysis increased again. Then, we must try to determine the total cost of each user in order to compare the prices at time T and according to the evolution of uses. Whether the LMS is proprietary or open source, we need to be careful with existing services (and can check with other customers). Provided by the publisher or the service company and must be adapted to the critical level that we define.

Based on these different criteria, we will apply them between six Open Source platforms to draw a conclusion from the choice of platform. So we chose the Canvas platform, Chamilo platform Claroline Connect platform, the platform Ilias, Moodle platform and the platform WordPress.

III. COMPARATIVE STUDY OF OPEN SOURCE LMS PLATFORMS

In this part, we will practice choosing a better e-learning platform, using the criteria adopted by the FFFOD in 2020; and through the comparison between six examples LMS open source [6] :

- Canvas was created in 2011 by the company Instructure (UTAH, USA), and distributed from 2012 in universities and schools of UTAH. The open source solution coexists with the Instructure offer in SaaS mode [7].

- Chamilo is created in 2010 and developed under the aegis of the Chamilo Association. It is a fork of Dokeos which is itself a fork of Claroline. The association organizes and coordinates the community of developers [8].

- Claroline Connect was created in 2014, it is the result of the merger of the LMSs and the Claroline and Spiral Connect teams. The open source solution coexist with an offer in SaaS mode [9].

- Ilias founded in 1997, and born at the University of Cologne. Its development is today coordinated by the company ILIAS (Cologne). There are several user communities, including one in France [10].

- Moodle was created in 2001, and its development is supervised by the Moodle HQ team funded by a network of Moodle Partners. An annual French-speaking conference is organized every year: the MoodleMoot [11].

- WordPress was created in 2003 and used by 34.7% of websites in the world. Associated with the LearnDash plugin, the famous CMS turns into an LMS. LearnDash is sed mainly in the English-speaking world, in higher education, in vocational training and by independent entrepreneurs [12].

We have chosen these six LMSs because they are the most commonly used, best known, and best suited to the needs of learners, teachers, and administrators. Indeed, according to the FFFOD 2020 report, we have found that although the number of LMSs around the world has started to increase in recent years, the number of open source code tends to decrease. This is the reason why we will not find an LMS this year, although some organizations still use LMS, they will not continue to evolve and therefore will disappear. The number of open source LMS installations and the number of users continues to increase. These LMSs are now favored by companies after having crossed university walls to be deployed in many training organizations of different sizes and categories [6].

The methodology that we are going to adopt is that of scoring. Indeed, this method is especially used in direct marketing to determine the value of different customers contained in a file. Scoring is a technique that uses scores to assess potential customers. For example, the criteria used are: response to emails, number of reminders, number of orders placed, average order amount, payment terms and times, sensitivity to promotions, etc. The enrichment of the economic and financial vocabulary of February 18, 1987 in France suggested the use of the term "scoring" or "evaluation by score" [13]. In our case, the method consists in trying by the use of criteria and sub-criteria to retain the LMS which has the best overall scores.

The scoring method first involves determining the selection criteria. These criteria include sub-criteria, for which a score is assigned between 0 and 5. Then, the scores corresponding to the sub-criteria are added together to determine the scores of the criteria which make up the whole. The sum of the standard scores constitutes the total score obtained by the LMS. Finally, compare it with the overall scores of other LMSs to keep the LMS with the best overall score. This is what we will see and demonstrate with the following examples:

The following table Table 1 offers us the comparative results according to the first criterion which concerns the creation and organization of training courses and its five sub-criteria (training management, catalog management, course management, presence of Authors tools and diversity and interactivity).

Table 1. Comparative table according to the first criterion

Criteria and sub-criteria \ Platform		Canvas	Chamilo	Claroline Connect	Ilias	Moodle	WordPress LearnDash
Criteria	**Sub-criteria**	**Notes**					
1 Creation and organization of training	Training management	4	5	4	5	5	3
	Creation of catalogs	4	5	4	4	4	4
	Course creation	2	5	3	5	3	2
	Presence of authoring tools	2	4	4	5	3	Abs
	Diversity and interactivity	3	4	4	4	5	2
Subtotal		15	23	19	23	20	11

The comparative results of the first criterion concerning the creation and organization of training courses show that are platforms Chamilo and Ilias are classifieds first with a total of 23 points with a performance (the maximum score 5) in three sub criteria (training management, creation of catalogs and course creation for Chamilo and training management, course creation and presence of authoring tools for Ilias) followed by the Moodle platform with 20 points with a performance in two sub criteria (training management and diversity and interactivity). The Claroline Connect platform is placed in third place with 19 points without any performance followed by the Canvas platform with 15 points without any similar performance. The WordPress platform is placed last with 11 points with the absence of the sub-criterion presence of authoring tools and without any performance.

The following table offers us the comparative results according to the second criterion which concerns individualization and communication and its four sub-criteria (the positioning tool, individualization of courses, individualization of content and communication and tutoring).

Table 2. Comparative table according to the second criterion

Criteria and sub-criteria / Platform		Canvas	Chamilo	Claroline Connect	Ilias	Moodle	WordPress LearnDash
Criteria	**Sub-criteria**	**Notes**					
2 Individualization and Communication	Positioning tool	Abs	Abs	Abs	Abs	Abs	Abs
	Individualization of courses	2	4	4	2	3	4
	Individualization of content	2	1	4	1	5	Abs
	Communication and tutoring	3	4	3	4	5	3
Subtotal		7	9	11	7	13	7

The comparative results of the second criterion which concerns individualization and communication show that the Moodle platform is ranked first with a total of 13 points with a performance in two sub criteria (individualization of content and communication and tutoring) followed by the Claroline platform Connect with 11 points without any performance. The Chamilo platform is classified in third place with 7 points no performance. The other three platforms are ranked last with a total of 7 points each without any performance

Table 3. Comparative table according to the third criterion

Criteria and sub-criteria / Platform		Canvas	Chamilo	Claroline Connect	Ilias	Moodle	WordPress LearnDash
Criteria	**Sub criteria**	**Notes**					
3 Learning Collaborative	Workgroups	5	5	5	2	2	Abs
	Collaborative production	5	5	5	2	2	Abs
	Social networks	3	5	1	1	3	3
	Portfolios	5	Abs	5	5	5	Abs
Subtotal		18	15	16	10	12	3

The following table offers us the comparative results according to the third criterion, which concerns collaborative learning and its four sub-criteria (the work group, collaborative production, social networks and portfolios).

Table 4. Comparative table according to the fourth criterion

Criteria and sub-criteria / Platform		Canvas	Chamilo	Claroline Connect	Ilias	Moodle	WordPress LearnDash
Criteria	**Sub-criteria**	**Notes**					
4 Skills and badges	Skills repositories	5	5	Abs	5	5	Abs
	Automatic skills validation	1	5	Abs	3	5	Abs
	Allocations of badges	5	5	5	5	5	4
	Open Badges compatibility	5	4	5	3	5	4
Subtotal		16	19	10	16	20	8

The comparative results of the fourth criterion concerning skills and badges show that the Moodle platform is ranked first with a total of 20 points with a performance in all the sub criteria followed by the Chamilo platform with 19 points with a performance in three sub criteria (skills repositories, automatic validation of skills and awarding of badges). In third place, we find the Canvas and Ilias platforms with 16 points with a performance in three sub-criteria for Canvas (skills benchmarks, awarding of badges and open badges compatibility) and a performance in two sub-criteria for Ilias (skills benchmarks, automatic validation of skills and allocation of badges). Fourth place is assigned to the Claroline Connect platform with a total of 10 points with a performance in two sub-criteria (awarding of badges and open badge compatibility) and an absence of two sub-criteria (skills benchmarks and automatic validation of skills). As for the third criterion, the WordPress platform is placed last with 8 points without any performance and one absence for the same sub-criteria as the Claroline Connect platform (skills benchmarks, automatic skills validation).

The following table provides the comparative results according to the fifth criterion which concerns tracking and reporting (monitoring and reporting) and its four sub-criteria (individual tracking, statistical tracking, data export and SCORM / XAPI standards) .

Moodle platform with 12 points with only one performance for the portfolios sub-criterion. The penultimate place is assigned to the Ilias platform with 10 points with only one performance for the portfolios sub-criterion. The WordPress platform is placed last with only a total of 3 points, to note that there is an absence for this platform of three sub criteria (working groups, collaborative production and portfolios).

The following table offers us the comparative results according to the fourth criterion which concerns skills and badges and its four sub-criteria (skills benchmarks, automatic validation of skills, awarding of badges and Open Badges compatibility).

Table 5. Comparative table according to the fifth criterion

Criteria and sub-criteria / Platform		Canvas	Chamilo	Claroline Connect	Ilias	Moodle	WordPress LearnDash
Criteria	**Sub-criteria**	**Notes**					
5 Traking and Reporting	Individual tracking	4	5	4	3	5	4
	Statistical tracking	3	3	3	3	5	3
	Data export	3	3	3	3	4	4
	SCORM/ XAPI standars	Abs	3	3	4	4	3
Subtotal		10	14	13	13	18	14

The comparative results of the fifth criterion concerning tracking and reporting show that the Moodle platform is still ranked first with a total of 18 points with a performance in two sub-criteria (individual tracking and statistical tracking) followed by the two platforms of the two platforms. Chamilo and WordPress with 14 points each without any performance. The Ilias and Claroline Connect platforms come next with 13 points each without any performance. The Canvas platform is placed last with 10 points without any performance and an absence for the SCORM / XAPI standard sub-criterion.

The following table gives us the comparative results according to the sixth criterion which concerns user management and its three sub-criteria (registration and authentication, registration in training and GDPR compliance).

Table 6. Comparative table according to the sixth criterion

Criteria and sub-criteria / Platform		Canvas	Chamilo	Claroline Connect	Ilias	Moodle	WordPress Learn Dash
Criteria	**Sub-criteria**	**Notes**					
6 Management users	Registration and authentication	4	5	4	5	5	2
	Registration in training	3	4	3	3	5	3
	GDPR compliance (General Data Protection Regulation)	Abs	3	Abs	Abs	5	5
Subtotal		7	12		8	15	10

The comparative results of the sixth criterion concerning user management show that the Moodle platform is still ranked first with a total of 15 points with a performance in all the sub criteria, followed by the Chamilo platform with 12 points and a performance in one. only sub-criterion (registration and authentication). The WordPress platform takes third place with 10 points and a performance in a single sub-criterion (GDPR compliance). Fourth place is occupied by the Ilias platform with 8 points with a performance in a single sub-criterion (registration and authentication) and an absence of a sub-criterion (GDPR compliance). In last, located the platforms Canvas and Claroline Connect with 7 points without any performance and lack of compliance under RGPD criterion.

The following table offers us the comparative results according to the seventh criterion which concerns design and ergonomics and its four sub-criteria (graphic personalization, linguistic personalization, responsive design and the IOS and Android Apps).

Table 7. Comparative table according to the seventh criterion

Criteria and sub-criteria / Platform		Canvas	Chamilo	Claroline Connect	Ilias	Moodle	WordPress Learn Dash
Criteria	**Sub-criteria**	**Notes**					
7 Design and ergonomics	Graphic customization	2	3	2	2	5	4
	Linguistic customization	3	4	2	5	5	4
	Responsive design	3	5	5	3	4	4
	Apps IOS and Android	Abs	Abs	Abs	Abs	5	5
Sous-total		8	12	9	10	19	17

The comparative results of the seventh criterion concerning user management show that the Moodle platform is still ranked first with a total of 19 points with a performance in three sub-criteria (graphic customization, linguistic customization and IOS and Android Apps), followed by the WordPress platform with 17 points and a performance for the Apps IOS and Android sub-criterion. The Chamilo platform is placed in third place with a total of 12 points with a performance for the responsive design sub-criterion and an absence of the IOS and Android Apps sub-criterion. The Ilias platform is ranked in fourth place with 10 points with a performance for a single sub-criterion (linguistic customization) and an absence of the IOS and Android Apps sub-criterion. In fifth place, we will find the Claroline Connect platform with 9 points with a performance for the responsive design sub-criterion and an absence of the IOS and Android Apps sub-criterion such as Chamilo. Last is the Canvas platform with only 8 points without performance and an absence of the IOS and Android Apps sub-criterion.

The following table offers us the comparative results according to the eighth criterion which concerns installation and handling and its four sub-criteria (ease of installation, modularity, available documentation and user community).

Table 8. Comparative table according to the eighth criterion

Criteria sub-criteria / Platform		Canvas	Chamilo	Claroline Connect	Ilias	Moodle	WordPress LearnDash
Criteria	**Sub-criteria**	**Notes**					
8 Installation and grip	Ease of installation	1	5	1	4	4	5
	Modularity	5	4	3	4	5	5
	Documentation available	4	4	2	3	5	3
	User community	4	3	2	3	5	3
Subtotal		14	16	8	14	19	16

The comparative results of the eighth criterion, which concerns installation and handling, show that the Moodle platform is still ranked first with a total of 19 points with a performance in three sub-criteria (modularity, available documentation and user community) followed by art platforms Chamilo and WordPress with 16 points with a performance for the two sub criteria for WordPress (ease of installation and scalability) and performance for a single criterion under (easy installation) to Chamilo. In third place are ranked at the same time the Canvas and Ilias platforms with 14 points with no performance and in last the Claroline Connect platform is placed with 8 points with no performance.

The following table gives us the sum of the comparative results of the eight criteria of the three platforms chosen for this study.

Table 9. Scoring table / Summary table of the best platform

Criteria / Platform		Canvas	Chamilo	Claroline Connect	Ilias	Moodle	WordPress LearnDash
Criteria	**Sub-criteria**	**Notes**					
1-Creation and organization of training		15	23	19	23	20	11
2-Individualization and Communication		7	9	11	7	13	7
3-Learning Collaborative		18	15	16	10	12	3
4-Skills And badges		16	19	10	16	20	8
5-Tracking And reporting		10	14	13	13	18	14
6-Management users		7	12	7	8	15	10
7-Design and ergonomics		8	12	9	10	19	17
8- Installation and grip		14	16	8	14	19	16
Total		95	120	93	101	136	86

The comparative results of the different criteria show that the Moodle platform is ranked first with a total of 136 points with a performance in 20 sub criteria and without any absence of sub criteria, followed in second position by the Chamilo platform with a total of 120 points with a performance in 13 sub criteria and an absence for 3 sub criteria. The Ilias platform is ranked in third place with a total of 101 points with a performance in 8 sub criteria and an absence for 3 sub criteria. We rank the Canvas platform in fourth place with a total of 95 points with a performance in 7 sub criteria and an absence for 3 sub criteria like Ilias. Fifth place is assigned to the Claroline Connect platform with a total of 93 points with a performance in 6 sub criteria and an absence for 4 sub criteria. In sixth and last position, we will find the WordPress platform with a total of 86 points with a performance in 4 sub criteria and an absence for 8 sub criteria.

IV. CONCLUSION

As a conclusion of this comparative study for the choice of the best e-learning platform based on the criteria adopted by the FFFOD in 2020 concerning the six platforms chosen: Canvas, Chamilo, Claroline Connect, Ilias, Moodle and WordPress [6], we note that the Moodle platform obtained the best score which is 136 points and is positioned in first place, against 120 points for Chamilo placed in second place. With 101 points Ilias which was classified in third spot and Canvas with 95 points is placed fourth. Fifth place is assigned to Claroline Connect with 93 points and last, WordPress is classified in sixth position with 86 points.

In analyzing the various results, we find that the majority of these criteria (6), Moodle won first place, with the exception of two criteria, namely the creation and the organization of training (criterion 1) and the collaborative learning (criterion 3) where it is classified third to the first criterion and the fourth position to the third criterion. Likewise, it has a performance (maximum scores = 5) for 13 sub criteria which is equal to 37.14% of all the sub criteria, but it only has an absence in "three sub criteria which is equal to 8.57% of all the sub-criteria".

Therefore, based on these different results, the e-learning platform that we will choose will be the Moodle platform, which is the most effective at all levels. Please note that when the situation changes and the needs of the users of the e-learning platform are different, the selection criteria and sub-criteria are arbitrary. Likewise, there are non-quantifiable qualitative standards that entered into the selection of LMSs and increased the difficulty of selection. In the final analysis, every choice is a choice, only in this way we should measure the effectiveness and performance of the choice, in order to try to make improvements to achieve the previously determined goals.

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