

# PROPOSAL OF A WEB APPLICATION TO SUPPORT TEACHERS IN ACADEMIC MANAGEMENT ACTIVITIES

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## Abstract

The objective of this work was to develop a web application that would serve as a support tool for teachers in some of their academic management activities, as a result of monitoring the courses taught at Higher Education level. Specifically, this application focuses on the teachers of the Higher School of Computing “Escuela Superior de Cómputo” (ESCOM). The construction of this web application took into account all the teacher’s needs from a random sample of teachers from the same institution, referred to as academic management activities carried out by teachers and how much time they invest in them. The results show that the proposed application helped teachers to better manage their time dedicated to their teaching.

## Keywords:

Learning management systems, educational technology, teaching.

## 1. Introduction

The emergence of internet and the development of online tools have allowed the development of new opportunities in the educational field, significantly impacting the way it is taught, and will be taught for years to come. Although these tools cannot yet fully replace face-to-face teaching, they can be a great help to promote, develop and complement the teaching-learning process within the classroom [1].

Despite the digital divide that currently exists [2], a high percentage of Higher-Level education teachers [3] use online tools to support themselves in the academic and management tasks involved in teaching their courses.

Currently, a large number of teachers have found on the Internet a new way to complement the courses taught in the classrooms, making use of the tools that are available on the Internet or publishing their own websites with information, activities and practices of each one of those courses. Although these types of tools are not new, from 2002 with the launch of Moodle [4], more teachers began to use educational tools to support their academic management activities.

There are tools focused on the educational field which have a series of characteristics depending on their purpose, which range from simple management applications that allow control of grades, attendance or activities, to very complex systems which belong to their own categories such as they are; learning management system (LMS), content management system (CMS) and learning content management system (LCMS). Nowadays, most universities and educational institutions are using educational support tools as a complement to face-to-face classes taught in classrooms.

The ESCOM does not have its own tool to support academic management activities for teachers, such as in the control of grades, reception and publication of activities, organization of content and generation of questionnaires for the mentioned courses. The purpose of the application that has been developed, called ADAGA, was to support ESCOM teachers by satisfying some of the specific needs that they expressed through the field study that was carried out on campus.

For some years, face-to-face courses began to be supported by digital tools, although not all teachers have made the change. Some of these tools are Moodle Gradebook, Google Classroom, Teacher's Notebook, and Additio. On the other hand, web services have appeared to be used by some of the teachers in order to maintain contact with students (social networks), collaborating in the writing or in the debate of an academic topics (Google drive apps): Twitter, Facebook, Blogs, among others.

Despite having the tools described above, in general, a series of situations predominate, such as: a) the dispersion of information, b) the complexity of monitoring evaluations (evaluating multiple groups even from different units of learning), c) the difficulty of reusing previously developed content. Another situation that arises is the complexity inherent in the use of some of these tools, which causes users to give up using them due to the learning curve they require.

The ESCOM of the National Polytechnic Institute has mostly teachers with training and computer knowledge at a high level [5]. Despite this, many of the situations described above are common within the institution, which currently does not have its own application that supports academic management activities and to allows teachers to carry out their work activities in a better

way. Some ESCOM teachers have made isolated efforts implementing their own applications, using existing applications or making use of other types of web services to complement their face-to-face courses.

The problem that arises in this work is that the ESCOM professor has to carry out multiple teaching activities, which causes the teacher to be overloaded with work, even more when the teacher must attend between 3 and 5 groups per semester, with 30 or more students per group, involving various tasks both academic and management such as: designing exams and marking them, reviewing tasks and projects, often in physical format, generating written documents for their students, as well as organizing the information that will provide them, among other. As mentioned, the overload of work that the ESCOM teacher has to develop, is the problem that arises in this terminal work.

It is also important to note that, due to this work overload, some situations may arise in the teaching work environment that may cause high levels of stress in teachers, when teachers are exposed for a long time to stressful situations and events. when chronic work stress appears, which causes burnout syndrome [6][7]. This causes the aforementioned problems to become even more acute, wearing down the performance of teachers when giving classes.

Due to the problems described in the previous paragraph and the current need [8], to make better use of web resources and technology for education, it is necessary to design a teacher support tool that centralizes some of their activities of academic management in order to complement the ESCOM's courses, allowing it to adapt to most of the forms of teachers work and to be able to provide a tentative solution to the aforementioned problems and homogenize the way the school relies on technology.

With the implementation of the ADAGA System, the aim is to support the ESCOM teaching staff, reducing stress factors related to the organizational variables of the job, preventing these factors from generating situations that affect the teacher's job performance as well as the teacher's quality of life. Tools should be provided that allow teachers to carry out their functions with best practices, such as the organization of exams, projects, activities and assignments and their evaluation, thus avoiding the stress caused by the lack of time to review and serve all students enrolled in the courses taught [6][7].

The aim was to unify the most outstanding characteristics of the support tools used by teachers, in an application that allows the interaction between teachers and their students, taking into account that the digital resources that the application will contain will be shared by teachers and consumed by students.

The use of the application can increase academic activity by having more effective assessment methods instead of using only conventional methods, thus improving the use of the teacher's time and the way of teaching their classes, in addition to providing a set of characteristics for this purpose.

## 2. Study of the Current Situation

Due to the fact that the ADAGA application was implemented online and the accessibility that we have today to internet resources, being possible to make use of it through mobile devices and computers, whether they are both portable and desktop, this thanks to responsive design [9][10][11]. It is important to know the systems that currently exist and how the functions of the application will be adapted to the specific needs of ESCOM teachers.

## 3. Theoretical framework

The Learning Management System (LMS) are learning management systems that allow the administration, distribution, monitoring and support of the different activities developed within a training process that can be completely virtual or blended [12][13].

The characteristics that most LMS [14] are:

- ❖ Centralization and automation of learning management. It provides a platform on which courses can be developed, integrated, managed and monitored remotely with minimal resources over a wide geographic range.
- ❖ Flexibility. The platform can be adapted both to the study plans of the institution, as well as to the contents and pedagogical style of the organization. It also allows you to organize courses with great ease and speed.
- ❖ Interactivity. The person becomes the protagonist of their own learning through self-service and self-guided services.
- ❖ Standardization. This feature allows the use of courses carried out by third parties, personalizing the content and reusing the knowledge.
- ❖ Scalability. These resources can work with a variable number of users depending on the needs of the organization.

- ❖ **Functionality.** Features and characteristics that make each platform adequate (functional), according to the requirements and needs of the users.
- ❖ **Usability.** Ease with which people can use the platform in order to achieve a specific goal.
- ❖ **Ubiquity.** Capacity of a platform to generate peace of mind for the user and make him feel certain that he will find everything he needs in said virtual environment.
- ❖ **Integration.** LMS platforms must be able to be integrated with other business applications used by human resources and accounting, which makes it possible to measure the impact, effectiveness, and above all, the cost of training activities [15].

A Content Management System (CMS) is basically designed to easily conceive, edit, index and publish content. However, it can also be used to support educational or academic courses [16][17]. These systems manage various forms of content, including files, images, electronic documents, audio and video files [18][19], without the need to convert them to a web format or encode them. This requires few specialized skills, so a CMS is tailored to the teachers' way of working, which also efficiently supports distance learning and education [20].

Some of the characteristics of the CMS are: a) Access to data, based on user roles. b) Collect and share information; c) Data storage assistance; d) Verification of content redundancy; e) Reports; f) The use of the tool is intuitive and easy for the user; g) Customize configuration through multiple options.

Security is an important factor with content approval properties granted by the administrator, email verification, access to the system through login or user registration, among others. It allows users and administrators to decide what content is displayed privately or publicly.

A Learning Content Management System (LCMS) has the main function of creating and organizing content focused on learning, many LCMS also have the ability to store and deliver previous versions of courses, with teachers who use this type of software to develop, manage, publish and reuse educational content [21][13].

An LCMS has particular characteristics [22] that all LCMS must have as stated by Greenberg (2002) and Williams (2002), which are:

- a) Repository of learning objects (LOs).
- b) Publishing tools
- c) Authoring tools;
- d) Collaboration tools;
- e) Dynamic interface;
- f) Administrative application.

#### **4. Methods and materials**

For the construction of the ADAGA application, the Metric Version 3 methodology was used. Figure 1 shows the technological architecture of the developed application, in which the interaction of the 3 different user roles with the multiple functions of the structure and the repository.

The system will allow three types of users: Students, Teachers and Administrators, the system will allow to load content that can be consumed by students, this being; Activities, Publications, Materials, Questionnaires. There will also be a notification system via email as well as within the same system to be able to communicate to students and teachers of any change or situation.

The application will send a confirmation email when a new user is registered, as well as each user will be assigned a unique identifier, which will be used to identify him in all subsequent processes carried out on him.

The system will also have the possibility of being able to generate evaluation frameworks for the activities and questionnaires that are uploaded to the system, in addition to being able to monitor the evaluation per student of the activities or exercises that are delivered.

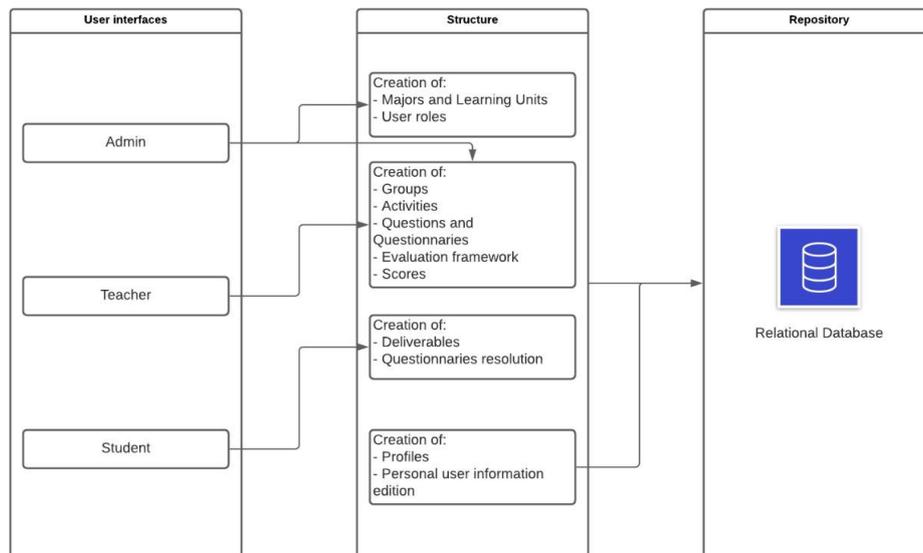


Figure 1 Technological architecture of the system

#### 4.1. Integration of Analysis Subsystems

This section explains the subsystems belonging to the application that was developed.

##### **Users**

In the user's module there is the system implemented to register users who enter the application for the first time, as well as the assignment of roles (student, teacher or professor) of the same; it also contains the login for any occasion in which the user wishes to enter their account.

Also, in this module is the display of the list of users who have an account and who are associated with a group, although it is only visible to certain users depending on their role in the application, the permissions are specified in the following sections.

##### **Courses and groups**

For this module, the visualization, creation, edition and elimination of data both in courses and in groups are contemplated; courses will only be created by administrators, groups will have the possibility of being created by administrators and teachers. The additional actions that the administrator, the teacher and the student can take depend on the permissions that have been previously established in the requirements analysis.

##### **Publications and activities**

For this module, the visualization, creation, edition and elimination of publications and activities for the roles of teacher and administrator are contemplated. Regarding the student role, there will be a specific option that will be the delivery of the activities and only visualization for publications.

In the same way, both publications and activities will have functionalities for the use of multimedia resources to generate them.

##### **Exams and Questions**

This is one of the most complex modules, in this case the generation of questions and the association of these with an exam are specific to the teacher, the questions belong to the teachers who create them and can be public or private.

For the student, the panorama is very different, since he is only allowed to view and answer the exam if he is associated with a group in which he is enrolled, otherwise he will not have access to the information in this module.

##### **Evaluations and control of grades**

This module is designed specifically to meet the needs of teachers, they will be able to generate evaluation matrices and associate them with their groups, which have activities, publications and exams associated with them, as well as registered students. By having all these interactions, the control of grades is generated since when evaluating the deliveries and exams of the students, the grades are automatically registered in the sheet of the control of grades. The student is only allowed to have access to the grade sheet to consult the evaluation of the deliveries made. The

following graphic shows the levels or layers of the architecture designed for the ADAGA application, with the physical partitioning of the information system, see Figure 2.

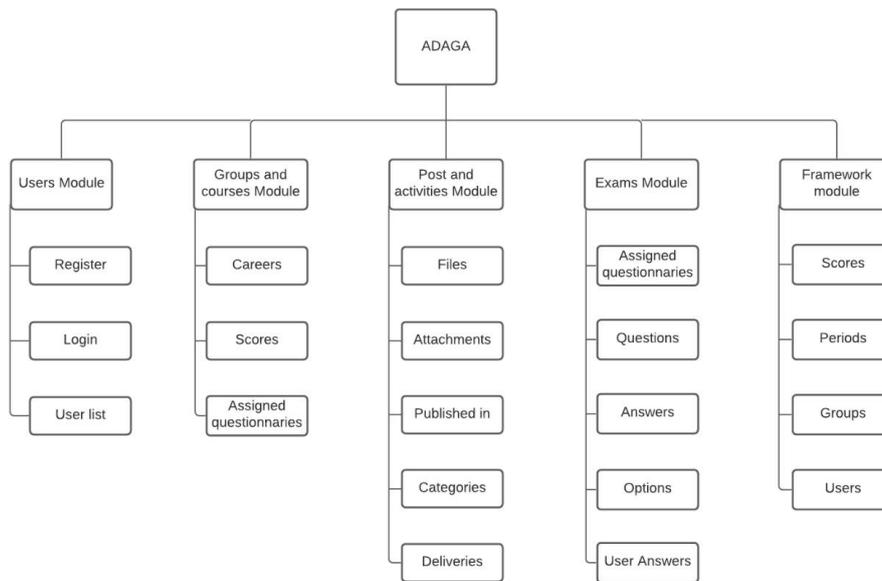


Figure 2. WEB application architecture (ADAGA)

This is a modular decomposition of the subsystems or modules specifically identified previously in the design subsystem identification task, all based on the previously designed process model, see Figure 3.

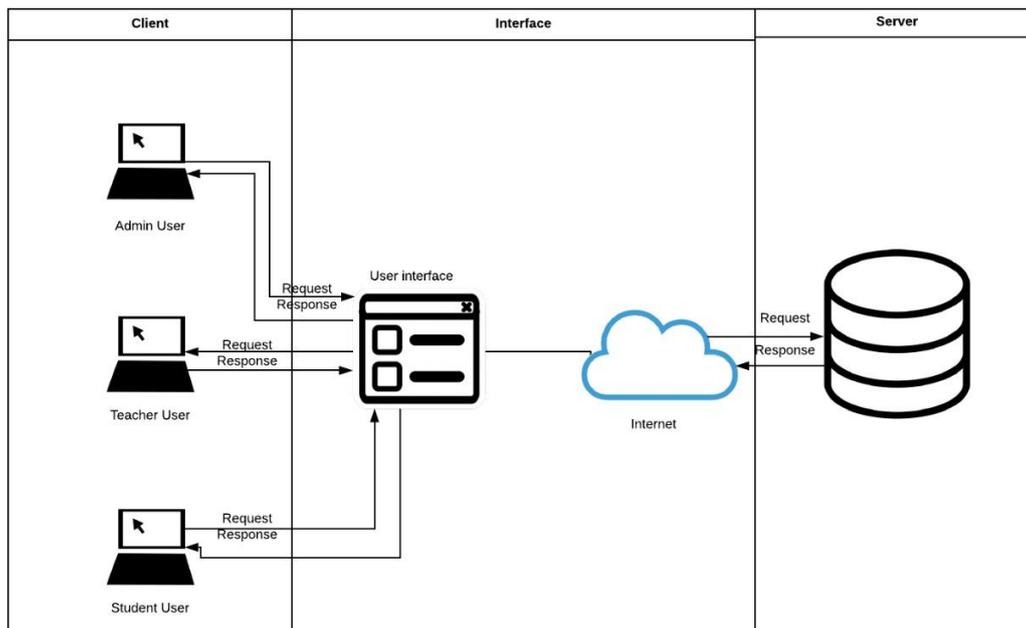


Figure 3. Module diagram

On the server, the requirements are the following:

- a. PHP >= 7.2.5
- b. BCMath PHP Extension
- c. CType PHP Extension
- d. Fileinfo PHP Extension
- e. JSON PHP Extension
- f. Mbstring PHP Extension
- g. OpenSSL PHP Extension
- h. PDO PHP Extension
- i. Tokenizer PHP Extension
- j. XML PHP Extension

Some interfaces are shown in Figures 4, 5 and 6. Figure 4 shows the interface that refers to the user entry. In figure 5 you can see the list of courses offered by the application. Figure 6 shows what corresponds to the functionality of the application in relation to the teaching resources.

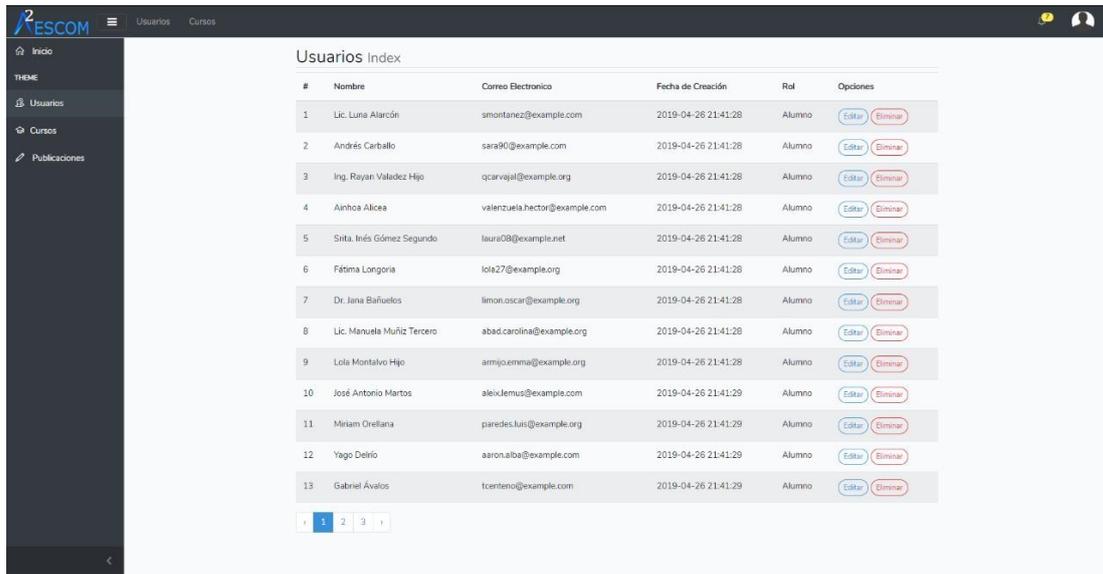


Figure 4. Graphical user list interface



Figure 5. Graphical interface for course creation

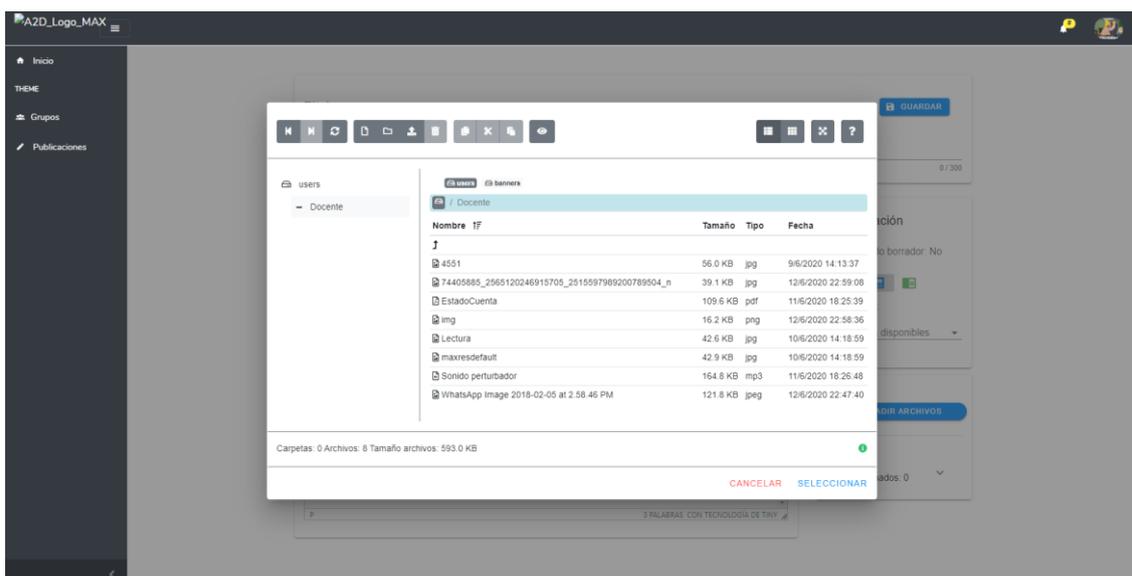


Figure 6. Graphical interface for adding resources

## 5. Results

Application testing. The purpose of unit testing is to be able to verify that the operation of each module, as a unit of code, works correctly separately. Thus, these tests will be carried out locally, without having a connection to the cloud or servers. Other tests, similarly, will be performed locally with automated insertion of data generated with seeder queries.

Taking into account the research presented in the theoretical framework on educational support tools and the classification of them as LMS, CMS, LCMS, in addition, considering the general idea of the Web application that has been developed, it has similarities with the LMS, CMS and LCMS. See Table 1. However, it is not being classified in any of the three categories, as it does not fully have the characteristics and elements of each one of them.

Table 1. Common characteristics of ADAGA with the different education support tools.

	Features	ADAGA
LMS	Centralization and automation of learning management.	✓
	Flexibility	✓
	Interactivity	□
	Standardization	□
	Scalability	✓
	Functionality	✓
	Usability	✓
	Ubiquity	□
	Integration	□
CMS	Data access, based on user roles	✓
	Collect and share information.	✓
	Data storage assistance.	✓
	Content redundancy check.	□
	Reports	□
	Using the tool is intuitive and easy for the user.	✓
	Customize settings through multiple options	✓
	Allows users and administrators to decide which content is displayed privately or publicly	✓
Supports users to help them resolve questions and issues	✓	
LCMS	Learning Object Repository (OAs)	□
	Publishing tools	□
	Authoring tools	□
	Collaboration tools	□
	Dynamic interface	✓
	Administrative application	✓

Therefore, ADAGA works as a support tool for the teacher, with regard to the academic management activities that they must carry out. For this reason, pedagogical issues were not strictly considered, since the design of educational resources was not considered, thus leaving it outside the classification of an LMS. In summary, various aspects of the three systems (LMS, CMS and LCMS) were retaken for the development of ADAGA, in order to adapt its design to meet the requirements of the teachers of the Higher School of Computing.

The advantages that the application offers to the user and that the competition does not have, are the following: the learning curve is short because the handling of the tool was quite empirical, the use of the application is completely free for all users ( teachers, students and administrator), it is flexible to complement the schooled courses allowing it to adapt to most of the ways of working of teachers and it is capable of homogenizing the way in which the school relies on technology.

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## References

1. "Análisis de internet como herramienta educativa", 2018. [Online]. Available: <https://www.feandalucia.ccoo.es/docu/p5sd5030.pdf>. [Accessed: 13- Jun- 2018].
2. "La brecha digital y sus repercusiones en los países miembros de la Aladi", Aladi.org, 2018.[Online].Available: [http://www.aladi.org/nsfaladi/estudios.nsf/decd25d818bod76c032567da0062fec1/169f2e26bfc7a23c03256d74004d6c5f/\\$FILE/157Rev1.pdf](http://www.aladi.org/nsfaladi/estudios.nsf/decd25d818bod76c032567da0062fec1/169f2e26bfc7a23c03256d74004d6c5f/$FILE/157Rev1.pdf). [Accessed: 14- Jun- 2018].
3. L. Santuario Parra, O. Soria Zuñiga and E. Ruiz Ledesma, La educación en línea: herramientas de aprendizaje y su impacto en la enseñanza de las matemáticas. Ciudad de México, 2018.
4. "History - MoodleDocs", Docs.moodle.org, 2020. [Online]. Available: <https://docs.moodle.org/38/en/History> . [Accessed: 17- Feb- 2020].
5. L. Ortigoza Campos, "Informe anual de actividades académicas y Administrativas 2017", Escom.ipn.mx, 2018. [Online]. Available: <http://www.escom.ipn.mx/docs/slider/informeAnual2017.pdf> . [Accessed: 08- Aug- 2018].
6. M. Cárdenas y L. Mendez, "Evaluación del desempeño docente, estrés y burnout en profesores universitarios", Revista: Actualidades investigativas en educación, 2015. [Online]. Available: <http://www.revista.inie.ucr.ac.cr> . [Accessed: 25- Jun- 2019].
7. L. Urquidí y J. Rodríguez, "Estrés en profesorado universitario mexicano", Revista: Actualidades investigativas en educación, 2014. [Online]. Available: <http://www.revista.inie.ucr.ac.cr> . [Accessed: 25- Jun- 2019].
8. [G. Molnár, Teaching and learning in modern digital environment. Herlany, Slovakia: IEEE, 2015.
9. "Use of Technology in Teaching and Learning | U.S. Department of Education", Ed.gov, 2018. [Online]. Available: <https://www.ed.gov/oii-news/use-technology-teaching-and-learning>. [Accessed: 13- Jun- 2018].
10. M. Laguna Segovia, "Estudio sobre el uso de Internet y sus aplicaciones en el alumnado de último año de carrera de la Universidad de Alicante", Hdl.handle.net, 2018. [Online]. Available: <http://hdl.handle.net/10045/35701>. [Accessed: 13- Jun- 2018].
11. W. Us and E. Marcotte, "Responsive Web Design", A List Apart, 2019. [Online]. Available: <http://alistapart.com/article/responsive-web-design/> . [Accessed: 01- May- 2019].
12. [L. Enríquez Vázquez, "LCMS y objetos de aprendizaje", Revista.unam.mx, 2019. [Online]. Available: [http://www.revista.unam.mx/vol.5/num10/art66/nov\\_art66.pdf](http://www.revista.unam.mx/vol.5/num10/art66/nov_art66.pdf). [Accessed: 01- May- 2019].
13. "LMS y LCMS: Funcionalidades y beneficios", Centrocp.com, 2019. [Online]. Available: <http://www.centrocp.com/lms-y-lcms-funcionalidades-y-beneficios/> . [Accessed: 01- May- 2019].
14. "Characteristics of a Learning Management System", Custom E-learning and Online Training Blogs - CommLab India, 2019. [Online]. Available: <https://blog.commlabindia.com/elearning-development/characteristics-of-lms>. [Accessed: 01- May- 2019].
15. B. Brockbank. "Learning Management System for e-learning", en el libro "The AMA handbook of e-learning: Effective design, implementation, and technology solutions". Piskurich, G. (Editor). AMACON, American Management Association.2003, New Cork. USA.
16. H. Use and W. Craig, "Tips for Evaluating Which CMS to Use", WebFX Blog, 2019. [Online]. Available:<https://www.webfx.com/blog/web-design/how-to-evaluate-what-cms->

- [touse/?utm\\_source=feedburner&utm\\_medium=feed&utm\\_campaign=Feed%253A+SixRevisions+%2528Six+Revisions%2529&utm\\_content=Google+Reader](#). [Accessed: 01- May- 2019].
17. "Las 8 características que todo CMS debería tener o porqué Wordpress es el CMS más adecuado. | Prestigia", Prestigia.es, 2019. [Online]. Available: <https://www.prestigia.es/blog/las-8-caracteristicas-que-todo-cms-deberia-tener-o-porque-wordpress-es-el-cms-mas-adecuado/>. [Accessed: 01- May- 2019].
  18. B. Boiko, "Content Management Bible", Hungry Minds, New York, 2002. pp.83,84,104,105,507,508,889 [[http://www.unex.es/didactica/RELATEC/sumario\\_5\\_1.htm](http://www.unex.es/didactica/RELATEC/sumario_5_1.htm)]. [Accessed: 26 - Mar - 2019].
  19. S. McKeever, "Understanding Web content management systems: evolution, lifecycle and market", 2003.
  20. [Online]. Available: <http://hdl.handle.net/10045/35701>. [Accessed: 26 - Mar - 2018].
  21. C. Benevolo y S. Negri, "Evaluation of Content Management Systems (CMS): a Supply Analysis", 2015.
  22. [Online]. Available: <http://www.ejise.com>. [Accessed: 26 - Mar - 2018].
  23. C. Belloch, "Entornos virtuales del aprendizaje", 2016. Unidad Tecnológica Educativa – Universidad de Valencia [Online]. Available: [https://mimateriaenlinea.unid.edu.mx/dts\\_cursos\\_md/pos/ED/AV/AM/07/Entornos.pdf](https://mimateriaenlinea.unid.edu.mx/dts_cursos_md/pos/ED/AV/AM/07/Entornos.pdf) [Accessed: - 31-Ene- 2019].
  24. "LCMS: la evolución de los LMS", Revista.unam.mx, 2019. [Online]. Available: <http://www.revista.unam.mx/vol.5/num10/art66/art66-5.htm>. [Accessed: 01- May- 2019].