

# An enterprise e-learning solution:

## The practical case of the UNED in the EHEA

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**Abstract**—In this paper, the European Higher Education Area (EHEA) adapted technological model is presented, developed in order to provide the e-learning solution for the new grades of the Spanish University for Distance Education (UNED). The transition of UNED's e-learning users to a new platform must focus on user experiences, so WebCT (used in the university from the beginning as its e-learning platform) and Moodle (open source e-learning platform with numerous implementations in other universities) were analyzed from a user's point of view. This analysis allowed a set of interfaces/tools to be defined in order to fulfil the user requirements for the UNED enterprise e-learning system, called aLF (active Learning Framework). Actually, the new version of aLF has implemented the new improvements in order to start a successful transition.

**Keywords**—user experience; e-learning platforms; enterprise e-learning system; adaptation; customization

### I. INTRODUCTION

The Spanish University for Distance Education, UNED [1], is the largest public distance education university in Spain with over 200,000 students, 1400 lecturers and 2000 administrative staff. It has been in existence for more than 30 years. Since it is a distance education university students do not come to a central campus to receive their teaching. They attend regional study centres. There are currently over 60 of these study centres distributed throughout Spain and Europe. As well as the lecturers the university also has 6900 tutors working in these study centres. The tutors are an important figure in the teaching process because quite often they are the main contact the student has with the university. They provide the students with support in many ways, for example, giving taught classes, leading laboratory sessions, and helping to resolve any problems the students may have with the subject being studied.

One of the key features that sets the UNED apart from other distance universities is its consistent commitment to innovation, both methodological and technological. As such, it is evident that ICT (Information and Communication Technologies) has always had an important role within the UNED. Over the years its use has grown and currently forms an important part of the university's activities. As well as the online teaching activities it is also used as part of the administration process (where the UNED is moving towards the position of being a paperless university), admissions (where more than 90% of student admissions are being undertaken via Internet), and examinations (where the exams are no longer

transported to the local study centres on paper but as encrypted electronic files). However, without a doubt the most important application of ICT in the university has been the development of our own online community-based learning platform, aLF [2], for use in our virtual campus.

When the UNED's virtual campus was started in the year 2000, a commercial e-learning platform was initially used. This e-learning platform was WebCT [3]. With time it became evident that this system was not sufficiently flexible for the university's needs, and hence the platform aLF (active Learning Framework, a system being developed by researchers in the School of Computer Science) was gradually introduced as a substitute. With the appearance of the EHEA (European Higher Education Area), modifications were required for aLF, but represented only a part of ongoing development activities, and did not by any means imply a drastic restructuring or rebuild of the platform or its tools.

These days it is very common for standard face-to-face universities, and other academic institutions, to offer forms of e-learning. As such, they are able with very little work, to configure existing online systems to provide the technological infrastructure for these taught courses. Since the student numbers in these cases are typically very small, and the online teaching is typically complementary to their main teaching activities, it does not matter that the underlying technological infrastructure is used or not enterprise by nature. In the UNED, however, due to its very distance education-based nature, all ICT used has to be EIS (Enterprise Information Systems). Any EIS should by definition be robust, scalable, OS portable, and interoperable with other systems. The currently popular PHP-based e-learning platforms (Moodle [4] is the most popular solution in the open software area) do not fulfil these requirements, and hence, any application for large student numbers requires custom ad hoc solutions, which is far from perfect. Since aLF is built over dotLRN [5], which is an EIS, it is inherently robust, scalable, etc., as any system of this type should be.

However, in the UNED, all the e-learning users are accustomed to working with the WebCT environment so the portlet based interface of aLF (the standard view in web applications) was not easy for them to use. Focusing on the UNED user's experience, a new interface has been developed adding some icons/tools functionalities of WebCT 4.x. Furthermore, the influence of Moodle users in the

methodological approach of the UNED lead to the development of a new planning tool that behaves like the Moodle tool. With this tool, the UNED Moodle users will be more at ease with the e-learning platform. Additionally, more improvements based on the WebCT and Moodle experiences were added. In the following sections the EHEA fundamentals and their importance for the UNED, and its need for a robust enterprise learning management system, will be presented. Subsequently, the tools developed in order to get a full new interface and tools oriented to the EHEA specifications, and based upon best practices taken from WebCT (the UNED's Learning Management System before 2009) and Moodle (a lot of users have been working with it), will be detailed.

## II. EHEA SPECIFICACIONES

The EHEA directives present the evaluation of personal and group activity as the main feature of an EHEA e-learning space. So, a lecturer must build a planning model of a course based on autonomous tasks and collaborative activities between students. The first feature consists of providing an organizer tool to define the course structure, so from this organizer the student has a clear view of his/her objectives and who is going to undertake collaborative work in order to achieve good academic performance. In aLF this feature is provided by the planning tool (a Moodle-like tool). The planning tool has a user-friendly interface for thematic or weekly blocks that presents an organized view of the different resources of the e-learning platform.

Another problem is how to provide a unified view of content (like the content table of WebCT) and activities, avoiding the use of hyperlinks (created by professors, so mistakes are common) from content to activities. The idea is to have a navigation model using didactic units (like e-books) easy to define and use. These didactic units have activity sections in order to add platform resources, so for a lecturer it is easy to declare the planning of a course and add his/her own content integrated together with the platform resources (activities, assessments, forums, chats and so on). In order to provide this feature, a new tool called Content was developed to fulfill the requirements. In the following sections these tools will be explained.

## III. WHY ENTERPRISE E-LEARNING?

The UNED has nearly 200,000 e-learning users in almost 5,700 learning communities (courses and working communities). So, the performance of the e-learning solution is very important for the university and its users. In Table 1, some important statistics are detailed in order to get an idea of the requirements the need to be taken into account for the e-learning platform. aLF is based on the OpenACS/LRN [5] framework toolkit, and open source solution for enterprise systems which fulfill these requirements [6],[7] & [8]. Also, the toolkit has the property of clustering in order to provide a 24 hours service with no down time, so it is easy to add new front-ends in order to achieve the performance and availability of the solution.

As an example, a snapshot from Google Analytics is shown in Figure 1. The e-learning platform (November 2009) has

been around 700,000 pages served (as peak) and 25,844 users viewing learning pages (as peak) during that period.

## IV. ALF SERVICES AND USABILITY ISSUES

In order to provide a customized solution for the university, the development of aLF has been focused on two aspects: the addition of collaborative interaction tools (first problem) and to provide several workspaces where to share information from different groups, classes or communities (second problem). So, from the user's viewpoint, aLF provides a large variety of tools organized around three clearly distinguished workspaces: a personal one, the communities (to which the user belongs) and the courses (being undertaken by the user). The services offered, therefore, depend on the environment in which the user's interaction takes place:

- **Communities:** the organization of different types of work groups (teaching teams, research projects, various associations, departments, faculties, etc.) is made possible. To this end, several communication tools are offered (forums with notification services in e-mail and news), work management (documents shared with version and access right control, links of interest to the group and surveys) and task sequencing (agenda with appointments and weekly task planning).
- **Courses:** apart from the general services already mentioned for the communities, the following are included: document management (tasks, summaries, notes, course guides, and frequently asked questions), activity planning (weekly planning integrated with the course tasks) and several resources (links and shared course files, inclusion and edition of web pages with the course contents, exams, management of students and marks, etc.).

TABLE I. SOME DATA FROM OCTOBER 2009

Statistics Item	Value
Hits per day	2,000,000
Hits per month	50,000,000
Page views per day	550,000
Page views per month	15,000,000
Daily single users	15,000
Average users connected	400
Average response time per hour (in seconds)	2 s
Peak of connected users & hits	900 users & 3,200,000 hits/day
Number of communities (either subiste, or dotlrn classes, sub groups and/or communities)	5,700
Number of registered users	210,000
Number of active users per year	115,000 last year   50,000 last mont

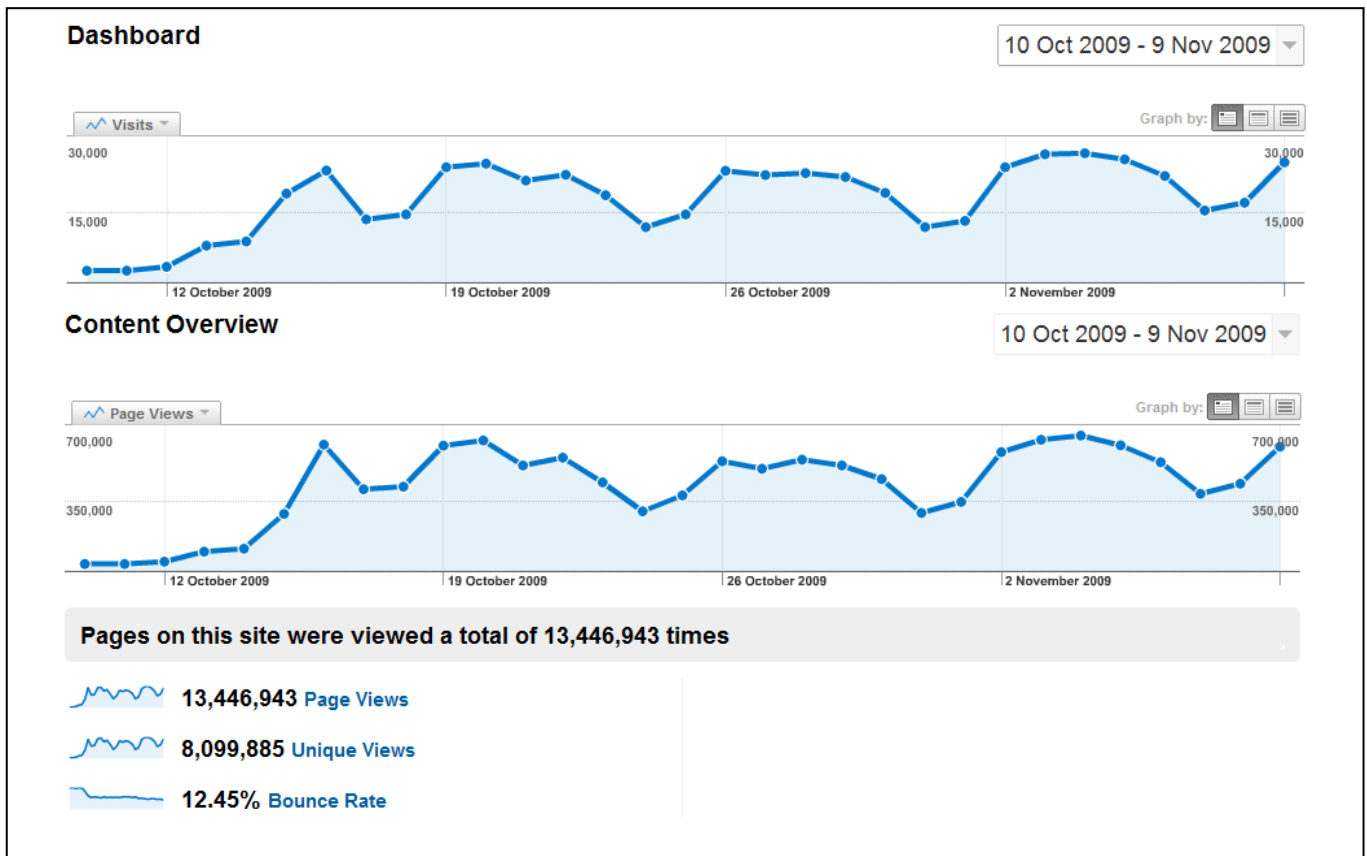


Figure 1. Snapshot from Google Analytics

- Users: all aLF users have an agenda, a space for documents, links of interest and personal pages in the work area of any user/teacher/student which integrates with the rest of the services offered in the different communities or courses to which the user belongs. Furthermore, tools are offered for different types of users. Hence, the administrators and teachers have specific tools for following the work undertaken by each user and for each type of user. For example, statistics can be accessed by value and by user in each community or course.

In each case, when a user enters aLF, he first accesses his personal workspace (“my portal”), from which he can efficiently access all the novelties that have taken place in any of the communities and courses to which he may belong. In fact, one of the most highly valued aspects by users is the possibility of efficiently accessing any novelty, i.e., a new file added in such groups, the new lines in the agenda, the messages in the forums, the tasks and notes in the courses, the news, etc. Another question related to the management of novelties is the fact that the aLF forums can be managed through automatic response notification services. This allows user to be warned of any novelty appearing in a forum, without the need to be connected to the platform. Furthermore, the user can choose whether to receive news sent by a specific

user (e.g., the teacher) about a certain subject and/or to receive an instant warning or report of the novelties that have taken place in the last few days.

Finally, aLF facilitates the organization of the interconnections between the different workspaces, both those related to the personal and collaborative work in the different communities and courses, and those related to the groups and subgroups defined in such communities and courses.

As has been seen above, aLF provides several advantages: customization adapted to the UNED methodological model; a robust and scalable solution focused on corporative environments; and an integrated portal environment for virtual communities (classes and work groups). There are several systems used in different institutions. Maybe two are the most referenced: WebCT [3] and Moodle [4]. The UNED has been using WebCT since the year 2000. WebCT supports big institutions (like the UNED) and it is a consolidated solution for enterprise environment. Moodle is an open software solution which has a great projection, but it does not have implementations on big systems (the UNED has nearly 200,000 users). Furthermore, both of these solutions are based upon the concept of course with no interaction between courses and group works, and no sharing of educational services between courses. aLF provides these features, sharing all the objects available in the groups (calendar entries, tasks,

assessments, news and so on) publishing them in different group targets (for example, from a personal space it is possible to share, not to copy, owned documents to a class, allowing to rich the learning environment [9]).

So, aLF is oriented to users but the interface used it was not pleasant for users and it was necessary to get “best practices” from two well know platforms (WebCT, implanted in UNED, and Moodle, due to its impact in the open source e-learning platform world) in order to assure a smooth management change.

## V. WEBCT BEST PRACTICES

WebCT was implanted in the year 2000 (when the UNED started to work with Learning Management Systems), so a lot of practices and experience has been gained using it. In 2008, an exhaustive work of requirements analysis was undertaken to get all the mayor functionalities that university lecturers wanted to be in a new platform (and not present in aLF). The main features were:

- A simple content table. aLF did not have a tool similar to the WebCT Content Table tool.
- Icon based interface. All the users are used to work with the icon interface provided by WebCT so a first section on courses was developed to provide a smooth user interface change for UNED’s professors.
- Simple panel control. aLF’s panel control is difficult to manage because it has a lot of options. This ammount of options makes the course/community configuration complicated.

All these tools and their aLF implementation will be show in the following subsections.

### A. The content tool

The Content tool [10] is a simple and easy tool for content creation in an educational context. It focuses on the teacher that wants to create the content of a course in a simple way with a navigation and presentation that will be easy for the student to use. This tool helps the user focus only in the content and text rather than in the presentation, order and navigation that is already done and organized.

The Content tool is fully integrated with the e-learning platform template (see Figure 2), so the navigation menu is always present for the user. This provides an easy layout focused on the didactic unit defined for an EHEA course space. The content tool has several functionalities, so the four most important are detailed here.

**The integration of activities:** A course in .LRN has many tools available to be linked to the content base. In order to simplify the process of linking activities, a new interface was created to guide the teacher with the process. The process of linking activities has several steps, which is why this new interface was designed to guide the user through those steps, since a multi-step process can confuse the user. This interface works mostly with javascript using visual effects for each step in order to improve usability.

The functionality of the interface, see Figure 3, is divided into two main steps with the option to go back and forth between them, when possible. The first step is selecting the activity (there is a section with the information about all the activity types), after selecting “select the activity type”, the current activities of that type along with the option to create a new activity of that type are shown in an emerging section, after an existing or new activity is selected, the third sections appears with the OK option to confirm the selection and continue to the next step. If another activity type is selected after the third section is open then the third step is closed. This will force the user to select an activity from the type selected (the current selection is not lost but simply not shown until the same activity type is selected again).

The second step, see Figure 4, is to set the details of that activity, a location for the page (where the activity is going to showed) and an optional description for that activity to be displayed in the page. If the selection was an existing activity the interface will add a link to the activity selected. If however, the selection is to create a new activity, then the interface will redirect to the activity type context in order to create the new item, after which, the item is created and automatically added to the content page (but the user will remain within the new activity context in order to be able to configure the activity).

The use of these steps gives the user the option to go back one step without having to start all over again. In this interface the user always knows how long the process is going and can focus only on the current action.

Each activity is displayed inside the content of a page, where the title of that page is the same as that of the activity created (and the optional text is shown above the activity link). The link for the activity shows a message according to the type of the activity, and some validations are done before presenting the link, to be sure that the activity is published (if it is not the case, the message has no link).

**Navigation issues and group template:** The Content tool displays the content of every course with a template that is dynamically generated. Multiple templates for content sections are an additional option for the teachers to change the way in which the content is displayed to the users in each course; there is a set of templates available to choose.

The whole template is divided into the following parts:

- Sections: an unordered list with links to the first page of each section.
- Sub-sections: an unordered list with links to the first page of each subsection.
- Units: a combo-box with all the units available.
- Navigation: three links with an image to navigate left, right or to go to the unit's first page.
- Order section: two links with an image to move the page up or down in the list.

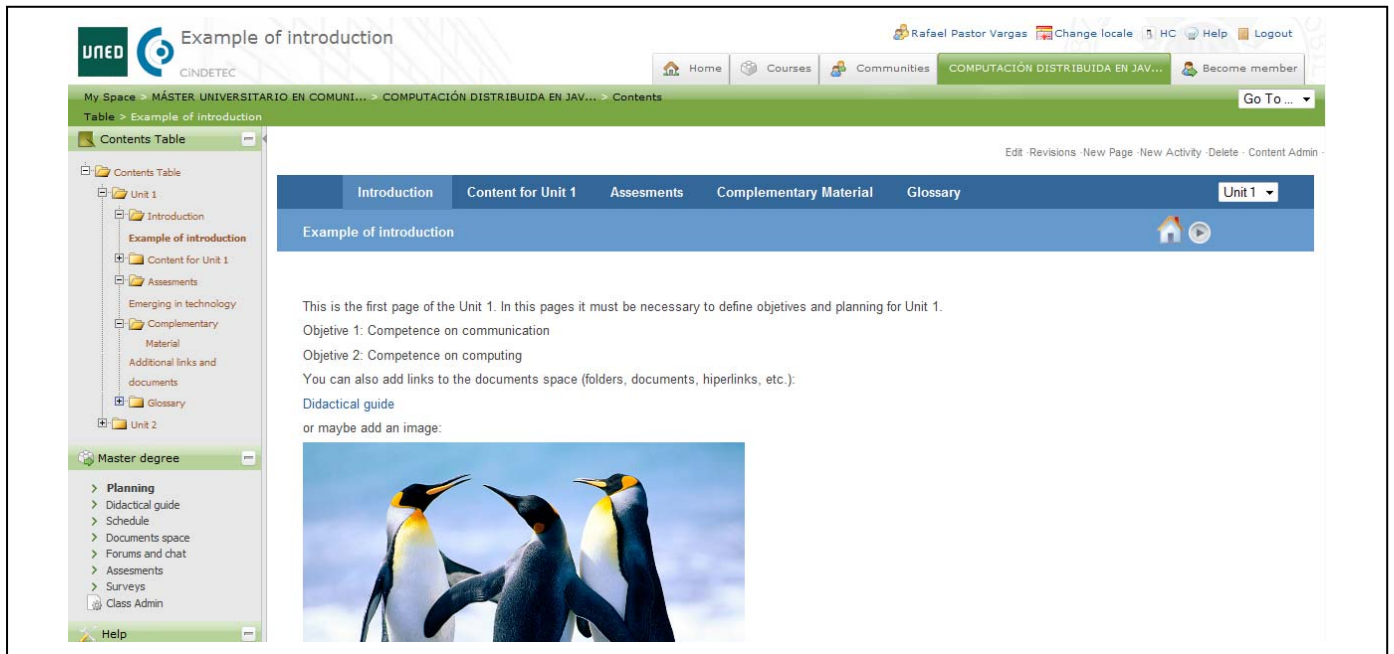


Figure 2. Content tool: Activities section of a didactic unit.

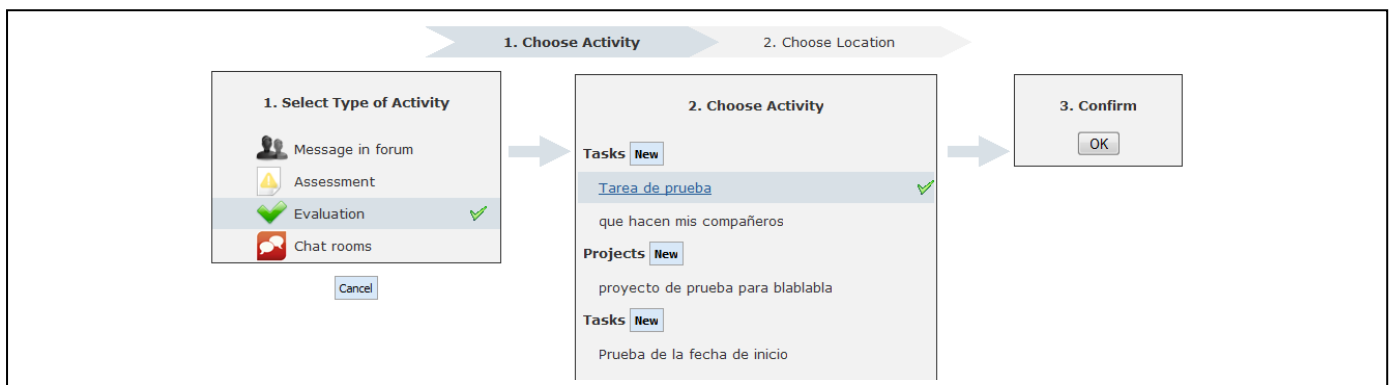


Figure 3. Step one of the linking activities process.

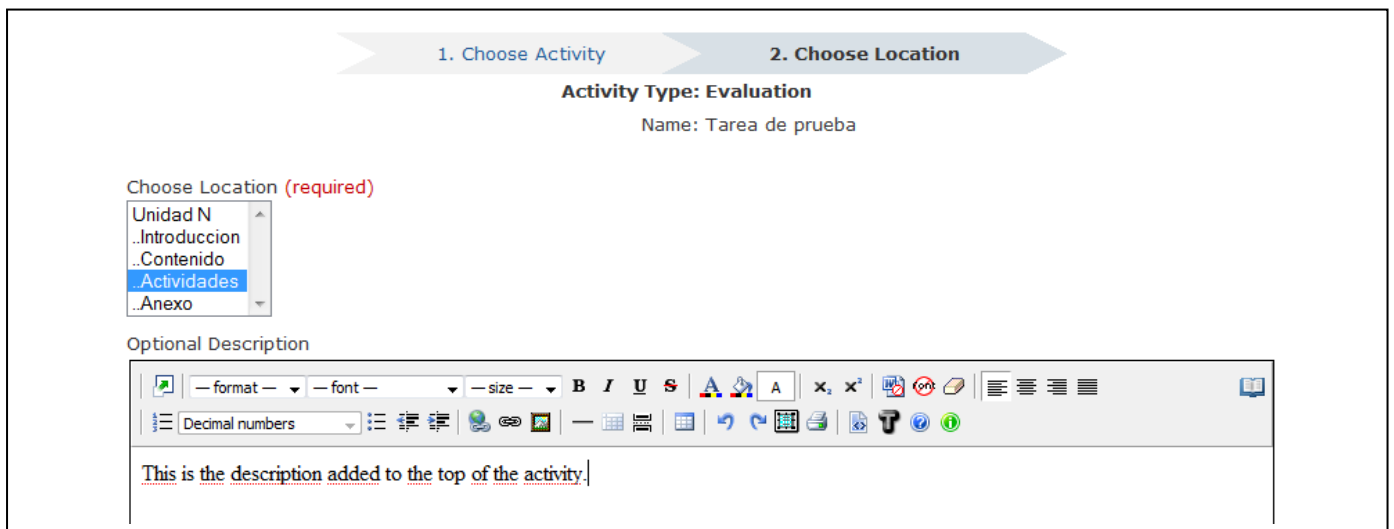


Figure 4. Step two of the linking activities process.

**Content Glossary:** A glossary is a very useful tool for lecturers to provide a better learning experience to the students. In every page of the content, words can be marked to have a glossary definition by an interface provided inside the rich text editor. A plug-in for the Xinha rich text editor was created to provide an interface where the terms and definitions are inserted, updated or removed. This plug-in has a main javascript file which handles the startup of the plugin and related validations, a dialog is open when the plugin is activated, the dialog has three areas, the term, the definition and the existing words. The plugin works by selecting a portion of text to add a definition to, and a dialog opens with the text selected in the term field in editable mode. A definition needs to be added for that text and all the current definitions in the course are shown in the interface, where, depending upon the selected text for the term, the definitions are ordered as being related or not related.

In every page the glossary words are links with different color and a tooltip property. If the mouse is placed over a word, the definition is shown in a popup. If the link is clicked it will take the user to the glossary page with all the terms.

In the content interface there is an entry for the glossary as an extra section in each unit. This glossary section has one page that shows all the glossary entries, and each entry has a counter that shows how many times the word is being used in all the pages. There is also an option to edit the word on a separate page and an option to delete individually or by group. This page is related to the unit where it was opened from. The navigation tree is focused on the glossary of that unit and the template shows all the sections of that unit.

**Automated Copy of Content between Courses:** In the content tool there is an automated option to import/export group (course/community) content pages (activities are

course-based and are not exportable). The export is done by taking care of the sections/subsections related to the content and the files inside the content pages. The import is undertaken normally, following which, the import of each page is mapped to the sections/subsections, and for each activity page a new empty entry is added to the activities table. This will allow the system to treat the pages as if they were activities and link a new activity to them (the glossary word count entries are also added for the target content instance).

### B. Icon based entry in a course

A WebCT user is used to have an initial view of the course based on icons in an organizational page, see Figure 5. In aLF this feature (organizational page) is not possible due to the portlet view provide as default. However, in this case a new section in the initial page of a course (joined to the planning tool which will describe later) have been added in order to add navigation icons to the most common tool provides by aLF (and WebCT): forums, study guide, content table, assessments, evaluations, glossary, tutoring (special work subgroups in UNED), news, frequently asked questions, previous exams, chat, File storage (Documents administrators) and so on. In Figure 6, it shows the default configuration on the icons navigation sections. In order to add more icons, the edition mode must be activated and then, from the select box it can be chosen from the list of available (as seen in Figure 7). Also, it is possible to move the icons using drag and drop capabilities of the section, and removed pressing the “forbidden” small icon.

Using these new features the “WebCT users” are more comfortable with the initial configuration of course, because it is similar to what they already know how to use.



Figure 5. The initial icon-based page for a WebCT course.

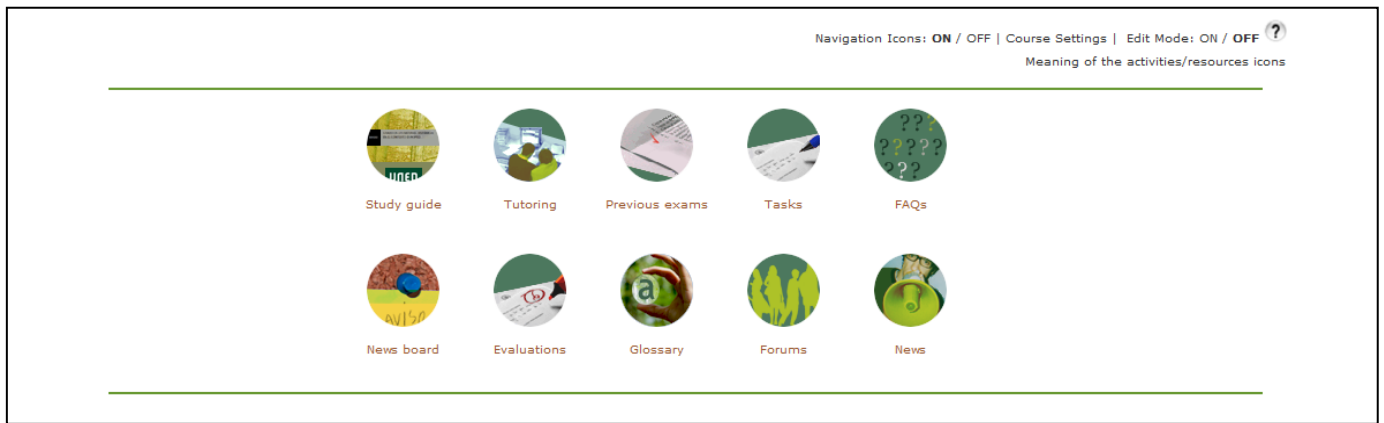


Figure 6. The initial icon-based page for an aLF course.

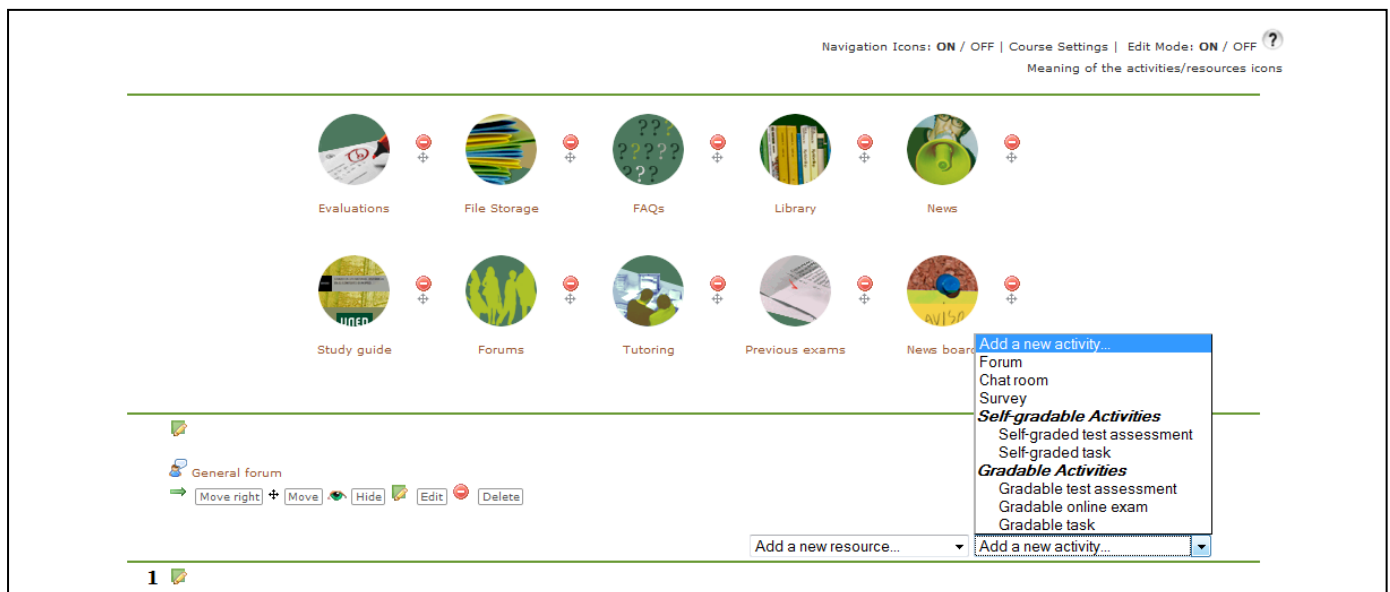


Figure 7. The tool for adding new icons to an aLF course.

### C. Simple panel control

Another important feature for a lecturer is the use of a control panel in order to configure the main tools of a course. In the case of aLF, all the tools are configured in the same page (based on portlet properties for the tool) so for a WebCT user it seems complicated to find the correct portlet configuration tool and the use of scrolls and clicks are usual in order to get the correct configuration. Like WebCT provides (see Figure 8), a simplified view of the panel control was developed to have a similar interface for “WebCT users”. In this case, there are four sections which provide most common administrative actions:

- User’s management. Located in the upper left part of simple panel control (see Figure 9).
- Course properties. Located in the upper central part of panel. Provides features about changing of course name, description, left menu organization, etc.

- Tools configuration. Located in the upper right part of panel. Provides quick access to the configuration portlet view for the tool. Also allows the installation of new tools.
- Working subgroups list. Located in the lower left part of the panel. Provides quick access to the working subgroups and the creation of new subgroups.

## VI. MOODLE BEST PRACTICES

Moodle provides an excellent tool in order to have a visual representation of didactic guide (temporal or module based) so in order to facilitate to UNED professor the definition of the course plan, a similar tool from Moodle was developed to satisfied the actual “Moodle users” from the university. In the next subsection it will be detailed.

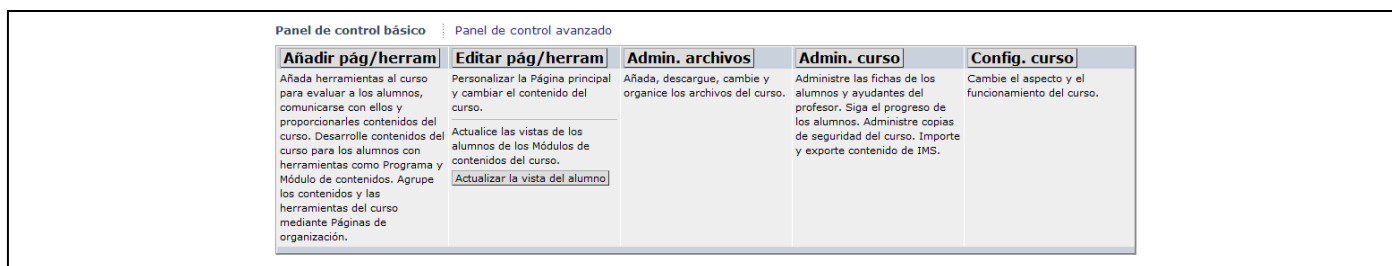


Figure 8. The simple panel control for a WebCT course.

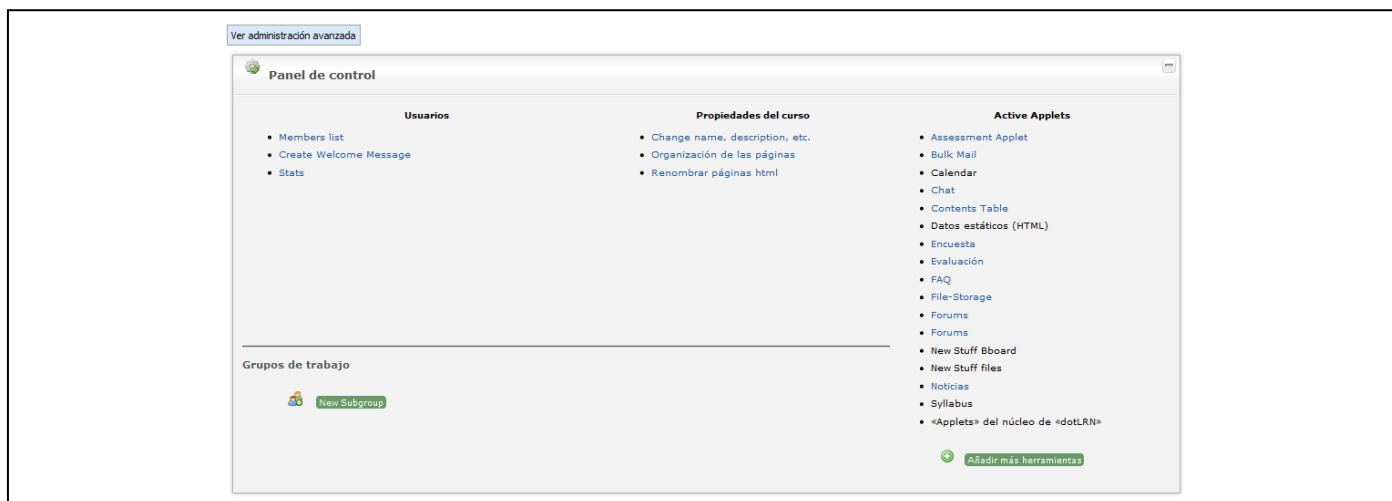


Figure 9. The simple panel control for an aLF course

### A. The planning tool

In order to achieve the EHEA requirements, a didactic guide based on activity items (assessments, tasks, forums discussion, etc.) must be produced by teachers in order to describe the overall work that students have to do in the course. To support that, it has been created an organization and planning system by blocks where information (resources and activities) can be added by teachers from many sources and ordered in any way.

The blocks (organizational unit) [11] can have a topic or weekly format, and a summary is available for each block to describe the contents on that topic or week. For each block new and already created resources and activities can be included, so reusable activities can be defined in order to help teachers in every term (one planning, several terms).

The planning interface [10], see figure 10, becomes the Community/Course home and is organized in blocks. There are currently two formats for the blocks:

- Weekly Format: each block represents a week, the week start the day the community starts, this value is set in the Course Settings of the Blocks View. The current week is highlighted.
- Topics Format: each block represents a topic, all the activities and resources in this block are related to the topic (in this format the start date of the community is not relevant). This format lets the teacher select the current topic and highlights that topic automatically until the teachers mark it as not selected or another

topic is selected, only one topic can be selected at a time.

This option is available for all communities inside the admin panel, there's a link to enable/disable this view, when the view is enabled a default empty block is created inside the community (this initial block it is always shown on top with no format), it adds the navigation bar to the master section inside that community and it automatically mounts the resources needed (evaluation, assessment, forums, content, pages, chat, etc.) on the community.

Each course has many available tools; inside each block there is an option to add a resource/activity, the supported packages are: evaluation, assessment, forums, file-storage, content, pages and chat. All the location actions are drag-n-drop based, so all the items in a block can me moved over the same block or others.

## VII. CONCLUSIONS AND FUTURE WORK

In this article the way in which the UNED's e-learning platform aLF, an EIS, has been developed to support virtual communities, adapted to the EHEA, has been presented. It has been argued that any e-learning platform that underlies these communities in such a fundamental way, has by its very nature to be an enterprise system, due to its robust nature, scalability, etc.





Figure 10. The planning tool based on organizational units called “blocks”.

While other types of architecture (not EIS) such as the currently popular PHP e-learning platform can be made to support high student numbers (using imaginative clustering techniques), their inherent lack of scalability and other EIS characteristics, unnecessarily complicates their overall performance.

It has been noted that for the EHEA, a practical study of best practices implemented in WebCT (tools based) have been included in the development of aLF in order to minimize the transition to the new platform. Also, a planning tool like that of Moodle has been incorporated to provide a natural way for the course organization defined by the didactical guides elaborated for the EHEA. The advantage of this way of presenting a course to students is that they can see easily what work has to be done and what the sources they have at their disposition to undertake the work. The fundamentally sequential nature of each block provides a sequencing of activities for the students. For example, a student can see that initially they have to read a text, enter into a forum to discuss it, undertake a practical activity based upon it, and finally, undertake some kind of online evaluation.

As was noted at the beginning of this article, innovation is a standard ongoing activity within the UNED. As such, the development of aLF over the next few years will continue in the current direction, expanding the possibilities of online distance education, making it more ubiquitous. In basic market terms, as traditional face-to-face universities are increasing their use of virtual communities on online teaching, the UNED must extend its online teaching model to become more “face to face”, in the sense of using both the synchronous and asynchronous capabilities of aLF and its tools to shorten distances and enable students to access the tools and educational resources they need to undertake their studies. As such, the future work being contemplated at present, is envisaged to focus on providing a better user

experience: copying items and organizing sections, automatic show/hide functions for temporal planning, integration of didactic guides elaborated by professors from other scenarios, SCORM (Sharable Content Object Reference Model) support for the content tool (allowing users to publish and author SCORM objects) and marking up content pages for users (to provide visual tracking of content views).

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