

## Leveraging open source portal technologies to create successful educative collaboration communities

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This paper presents the results of the EducaMadrid portal project sponsored by the *Consejería de Educación de la Comunidad de Madrid* which is being used by the educational community of Madrid (Spain). In order to adapt a standard portlets-based portal framework to the educational context, several enhancements have been made. First of all, a novel organisation model for virtual educational communities and an associated collaboration workflow have been defined. Secondly, several contributions have been made to portlet technology, such as the concept of community aware portlets and a personalised presentation system based on skins. Thirdly, specific user management functionalities have been incorporated. The article includes an evaluation of the system usage.

**Keywords:** collaboration; portal; portlet; virtual community; high school; LMS; SCORM; LOM; open source; free software

### 1. Introduction and educational context

The Internet and the technologies that have arisen around it have evolved enormously and now have the potential to be leveraged as a good complement to the formal education systems. The *Consejería de Educación de la Comunidad de Madrid* realized this and started a project within the context of the EducaMadrid initiative to create a portal that would allow teachers and students to be introduced the new information technologies and to be able to use them to improve their communication and participation possibilities. This paper presents the results, challenges, lessons learnt and an evaluation of the success of this ongoing project after the first three years since it was first made available.

The context of the project presented several challenges to the technical decisions on how to build the portal. One of the main challenges was the very wide number of potential users: When the project started there were around 1,500 public schools and 500,000 potential users of the portal. As the project evolved these numbers were increased. Another challenge was the need to integrate many distinct tools under a unified user interface. Since web technologies are constantly evolving, one of the main concerns was that the portal infrastructure should be able to respond to long-term technical necessities of the project, including incorporating future technologies that could be of use for the education community. In addition, the collaborative conception of the portal required distributed content creation and managing.

Several technologies were evaluated in order to find the one that provided the best solution for these challenges. At the end it was decided to use an emerging technology, Java EE based Portals, for providing a proven and robust solution which was highly flexible. Several proprietary solutions such as Websphere Portal, Weblogic Portal and Oracle Portal had been available for some time and were starting to achieve more widespread use. Also some Open Source alternatives were achieving a mature state.

The project was started a proprietary solutions to leverage the existing knowledge on the brand but short after, we found out that the product wasn't flexible enough at that time to meet all of our needs. For this reason it was decided to opt for an open source product: Liferay Portal [1], which offered the possibility to access the source code, providing the best flexibility possible. The next section explains the technical contributions that have been made during the project by extending this platform.

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The rest of the paper is organised as follows. Section 2 describes the pedagogical perspective that was used to determine the requirements of the portal. Section 3 describes the hierarchical organisation structure of the portal which is the foundation which allows it to support such a big community of users. Section 4 describes in depth the benefits of using the portal technologies but also its shortcomings and how they were addressed. Section 5 includes an evaluation of the portal during the three years of exploitation. Finally section 6 summarizes the conclusion and includes the guidelines for the future work.

## 2. Pedagogical perspective

From a pedagogical perspective, the portal also presented several challenges. It was meant since the beginning as a source of resources and information for teachers, students, parents and anyone interested. They are offered education-related news, pedagogical information, access to encyclopedias, calculus tools, on-line educational software organized by curricular area, links of interests, etc. But the portal wasn't meant to be a mere showcase or information point, for this reason it was seen as necessary to give the participants the right tools that allow them to have a very participative role.

EducaMadrid portal users, as happens with users from any other educational community, conform a wide, decentralized and heterogeneous community. These users experience very different realities on their daily work, both on a personal level (a child's environment is completely different from a teacher's) and on a group level (relevant events, contents, assets, and in general daily work, vary greatly among the different schools, even between different groups inside a particular school)

These specific user characteristics require a special kind of portal, one totally focused in the user, one that is not only an information showcase, but a collaborative work environment adapted to the user's reality, organization and activity, where the user is granted the demanded prominence and interactivity in order to perceive the portal as a work environment adapted to his real educational environment activity.

This prominence handover towards the users must be almost complete. Users must be promoted to be content authors, graphic designers and publishers. They must make the portal their own environment, using and combining the provided information and services according to their own taste and needs. All of this must be achieved keeping usability simple, and not demanding technical experience from the users. This concept is generally known as the webtop approach, since the idea is to transfer all user daily activities, traditionally handled within his local computer desktop, to the portal, where he should be able to complement his personal work with collaboration with the rest of the community [2].

Besides conveying to the users the idea of the portal as a personal experience, the portal must focus on collaboration, presenting it as its key value instead of information, which is relegated to a second class asset. The portal must enable not one but multiple web sites around collaboration groups, reflecting real educational groups (classes, schools, etc.) which conform the real educational community, therefore maintaining the educational community united in the web environment, through their interactivity and collaboration. This multi-site collaborative web environment is built on top of three main concepts:

- Personalization: existence of a personal environment for each user, adapted to his profile, age, environment, roles and privileges, which is also further configurable by the user. Personalization allows each user to have a personal and unique entry point to the portal, with applications, contents, usability and look & feel adapted for and by him.
- Virtual communities: collaborative web environments built around each work group inside the educational community, managed at all levels and even created by their own users. Virtual communities bring the portal closer to the specific reality of each educational environment inside the global community.
- Delegated role and permission management, based on a hierarchical structure: it would not be possible to maintain under control a decentralized open web environment as the one described without a powerful management capability, but it is also necessary to prevent administration bottlenecks. The solution is delegation, so that a central management team can delegate group roles and individual permissions on a granular or group basis, through a cascade-based hierarchy which exactly maps the organizational structure of the user community.

Key concepts of personalization and collaboration, complemented and controlled by a powerful, granular, and delegated permission management, are introduced in next section.

### 3. Organizational structure and workflow for large educational communities

EducaMadrid Collaboration Model is based on a novel Hierarchical Organization Model which follows the administrative organization of educational communities. At the top of the tree we would find global managers from the institutional Administration. Next level is conformed by territorial administrative units, which in turn branch to the different schools. Finally, the leaves of the hierarchy are reference groups within schools, representing a stable group of students guided by a single teacher. Virtual communities are created around the different classes and schools, and administrators for them are automatically assigned, according to this user structure. These are called *formal virtual communities*, since they map the organizational structure and conform the core of the collaboration environment.

This approach, although quite comprehensive, leaves some exceptions to be dealt with, since there are some cases that do not follow the previous approach but even so can take advantage of virtual communities. For all these exceptional cases, *ad hoc virtual communities* are used. They are dynamically created by users, which become their administrators and are able to invite other users in as members.

All registered users within the system are able to administer their own personal space (webtop), and they can also create contents and contribute with them to the different collaborative web spaces to which they belong, always following a content visibility control workflow described below.

According with these requirements, the following community roles have been defined in a community: *community member* (participate), a user that is member of a community; *community administrator*, which can be specialised in the roles administer community website, administer memberships and administer contents; *virtual community creator*, with permissions for creating ad hoc communities; *content owner*, the author of a content; and *content contributor*, a reviewer of a content.

To enforce granular control on such a large user community, and at the same time maximize efficiency and avoid bottlenecks, there are two basic delegation mechanisms:

- Permissions (user management, ad hoc community creation, personal web creation, etc.) may be delegated from one level to the next. This delegation is in cascade, so that a user can delegate permission only if he has it delegated from the upper level.
- Permissions are always scoped by the visibility of each node in the hierarchical organization (a school administrator with user management permission only manages users within his school).

A simple workflow mechanism is also used to limit content visibility to the proper user environment. Simplicity is a key issue for this process, since content contribution and publication takes place not only at institutional level, as is the case with most portals, but for every virtual community or collaborative web space within the portal. Each user is able to create contents in his personal web space, but only he views them there. If he considers a particular content worth to be shared with other users, he has to ask permission to the administrator of the hierarchical level (class, school, virtual community) where he wants his content to be visible. Request submission, analysis and approbation or rejection is an easy enough process to be comprehended and used by every user, even the younger ones.

This workflow process applies to all different levels of the previously described organizational structure, allowing different scenarios such as students requests to their teachers (for example for sharing a content within the School Class community), teachers request to the school admin (for example for publishing within the School website) or even teachers or the school administrator request to the administrators of global websites such as the Institutional Web Site.

There is also a special workflow process, slightly different than the one previously described, that allows teachers to push contents directly to their students, in order that they find them on their personal web space every time they log into the portal.

The described workflow system eases and rewards content creation, so that a global virtual educational content repository is created, maintained and continuously growing from the collaborative

effort of all users in the educational community, but at the same time the workflow rules enforce proper visibility of these contents so that they are not seen outside their proper environment of interest.

#### 4. Leveraging portal technology

The portal technology selected for EducaMadrid, Liferay [1], proved to be as highly extensible as it was needed for this project, to accommodate the requirements explained in the previous sections. The main methods to exercise this flexibility were, in order of less to more difficulty:

- Portlets: development of integrated web applications.
- Extensions: extensions points of the portal framework in order to perform integration with external systems such as LDAP and to extend the authorization system in order to conform with the organizational structure described in the previous section.
- Modifying the source code: extension of the portal framework itself, thanks to the availability of the source code, and communication with Liferay development team in order to contribute with these extensions.

In order to personalize portlets for each community, community aware portlets were defined and implemented. This concept of portlets is defined for applications which have different data stores depending on the community in which are used. The configuration of community-aware portlets includes a reference to the data store with relevant community data. For example, a community agenda has a separate data store for their own events. The portlets that were developed such as the chat or content publishing portlets were community aware. Some of the existing portlets distributed with Liferay were modified to support it and the changes contributed back.

A second important challenge we faced was the personalization requirements. The most significant one was the need to provide different personal desktops for teachers than for students. Even more, the students needed to have a different environment depending on their age and that environment needed to be able to accommodate as they grew older. The differences in the environment were two-folded: (1) the graphical scenario had to be adequate for the different ages of the students and functional for the teachers; and (2) the tools available had to be different for each user profile. To accomplish this requirement we extended Liferay to implement the concept of skins. A skin has full control of the appearance of the personal desktops and the community websites. Also it renders the top and bottom of the web page where the main links to the available tools are placed.

A final significant challenge was derived from the fact that the user base of the portal is very large and each year at the beginning of the course there were lots of changes to their profiles. In particular there were two kinds of changes that are described next. For both of them the use of a portlets architecture proved to be very useful because it was possible to develop a portlet [3] that extended the available user management functionality.

- Within a school a big percentage of students have to move to the next course. To support this we developed a tool that is available only to school administrators and allows him/her to execute a wizard that visits every school class and moves all the students of each of them to appropriate class in the next course.
- Many students and teachers changed of schools. To maintain the concept of self management we developed a second tool that allowed the administrators of one school to declare which members of the school were moving to a different school so that they were moved to an special area of users waiting for a final destination. Using the same tool they can search for the accounts of students and teachers that are new to their schools and come from other schools in the Madrid area. This tool allows those users to maintain their accounts (and their associated contents, memberships, information, etc.) when moving to a different school.

As a summary, the portal technology proved to be a good choice in terms of flexibility. It didn't solve all of our needs and presented some challenges but we were able to solve them in a satisfactory way.

## 6. Evaluation

The evaluation of the deployment and adoption of the EducaMadrid portal has been satisfactory both in terms of the amount of users and in terms of the usage of its resources, contents and provided services. The last statistics show an average of visits around 460,000 content views and 6 million pages per month. For a total of 70 million page views during the course 2005/2006.

The statistics were obtained using a variety of tools which has allowed us to obtain all the metrics desired and to confront results to verify their validity. Among those tools are Urwin [4], Awstats [5] and our own real time statistic tools written in PHP.

The usage of the portal has also seen a progressive increment in the number of schools and users registered. During the course 2005/2006 the number of users has increased by a 100% reaching 25,000 registrations to have access to email, personal website, contacts management, personal calendar, image gallery, content management, etc. The schools involvement has also improved significantly and currently there are around 900 schools which are self managing their user registrations. There has also been a big increase in the number of schools that have created and hosted their institutional website..

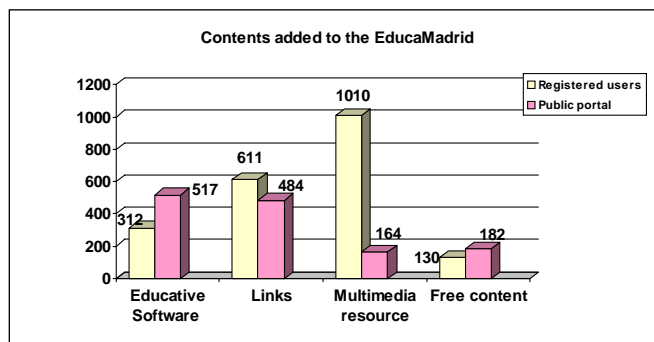


Fig 1. Number of contents incorporated by the *Consejería de Educación* (pink) and the registered users (yellow). It shows that users have made significant contributions specially in the multimedia area. Note: A selection of the most significant content types has been made.

## 6. Conclusions and future work

This article has presented how portlet technology can be successfully applied to the development of educational portals, and a hierarchical organisational model that promotes collaboration, as shown in the evaluation presented. In addition, the concept of community-aware portlets has been introduced to personalize portlets to the community space where they are used. The portal has won the prize to the best educational initiative of the Internet Day [6] in Latin America, competing with 900 proposals from 22 countries.

Current work is focused on integrating educative SCORM contents repository and improving the categorisation of contents based on IMS standards.

A mobile version of the digital magazine of EducaMadrid will be developed in the MyMobileWeb research project.

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