OER State-of-the-Art and Outlook: A TERENA-OER Preliminary Report

Contents

Introduction

The continued growth in the scope of learning resources available in on-line repositories has contributed to the trend of increased sharing and use of these learning resources. This underscores the open nature of the materials and their accessibility on the web. Open Educational Resources (OER) are defined as "digital learning resources offered online (although sometimes in print) freely and openly to teachers, educators, students, and independent learners in order to be used, shared, combined, adapted, and expanded in teaching, learning and research," (Hylén et al, 2012, p.18). The U.S. Department of Education considers OER "an important element of an infrastructure for learning. OER come in forms ranging from podcasts to digital libraries to textbooks, games, and courses. They are freely available to anyone over the web." OER are perceived to be part of a larger trend toward open sources in higher education, including more well-known and established phenomena such as open source software (OSS) and open access (OA).

OER "offer the prospect of an innovative and powerful approach to the development, dissemination and utilization of knowledge," (Hylén et al., 2012, p.18). Kortemeyer (2013) pointed out that there are four major obstacles to OER adaptation in higher education: discoverability, quality control, unordered resources ("last mile") and acquisition. He noted that "many of the repositories, even inside of unified efforts like the Open Education Consortium, remain disconnected from each other". Sabadie and colleagues (2014) wrote that OER in Europe (with some exceptions) are not as well-received as in other parts of the world (e.g. the U.S.) for similar reasons, as well as language barriers. Well-managed OER repositories that aggregate high quality content offer a solution to some of these challenges by assuring the high quality of aggregated OER to make discovery easier. By leveraging these resources, institutions worldwide can overcome local challenges and use OER for course development, faculty training and tutorials as well as teaching strategies and effective classroom management. OER can help facilitate a new, less hierarchical pedagogical model where learners are responsible for their learning choices and progress. As the European population is aging, the demand for learning materials for lifelong learning increases and with this, the importance of OER repositories.

Every day, universities and educational organizations generate new educational content for teaching, learning, research and assessment. This content is stored on websites and in repositories. However, generic search engines have difficulty locating this content and retrieving it. The TERENA task force TF-Media (2010-2013) proposed a plan to implement a European-level OER metadata repository service for the benefit of the Research and Education community gathered under TERENA/GÉANT. The current project, titled TERENA-OER, was established with the task of making searching, using and reusing educational content more manageable.

Repositories/referatories and their functionalities

Learning objects (LOs) are often defined as digital entities that can be used and reused in the process of learning and education and are considered by many to be the cornerstones for the widespread development and adoption of e-learning initiatives (Cechinel, Sanchez-Alonso & Garcia-Barriocanal, 2011). LOs should be large enough to have educational value, but small enough to be reused easily. They are stored in Learning Object Repositories (LOR). LORs store learning objects and their metadata, either at the same place or separately, while making them

appear as a single unit for end users' sake (Neven & Duval, 2002). LO repositories are a shared, open and public space.

The purpose of a digital repository is not only to store catalogued LOs and distribute them, but to allow sharing and reuse (Duncan, 2003). A referatory, on the other hand, does not store LOs but only metadata (structured data about data). LOs are stored elsewhere, usually on servers at higher education institutions. Metadata is descriptive information about the resource, which describes the LO, and is critical for sharing and reuse. Therefore, it is essential that each LO has consistent metadata fields so that different metadata aggregators can exchange information. The two best known metadata schemes are the Dublin Core and the IEEE Learning Object Metadata (LOM). The ability to find learning materials which are accompanied by metadata facilitates the reuse and reconstruction of learning materials. Thus, a variety of learning processes can be created, with adaptations geared toward meeting the needs of students learning and the learning objective.

The LOM (Learning Object Metadata) standard

TERENA-OER will use the IEEE metadata standard, titled the LOM. Published in 2002, the IEEE Learning Object Metadata standard (LOM) is a common metadata scheme. The LOM is a hierarchical scheme: nine major categories (General, Lifecycle, Meta-Metadata, Technical, Educational, Rights, Relation, Annotation and Classification) which together include about 50 metadata elements (Ochoa et al., 2011). The LOM has a controlled, predefined vocabulary for every metadata element. The number of elements allows the LOM flexibility in adaptation to various application profiles. This is a rather large number, especially in comparison with the Dublin Core standard which only has 15 elements. Considering the diversity of sources that will be aggregated by TERENA-OER, the LOM is the ideal metadata standard for our needs. There will be a low common threshold of 8-12 mandatory fields, some of them generated automatically, and optional elements can be added as parts of application profiles defined for specific groups.

Table 1: TERENA-OER suggested metadata field

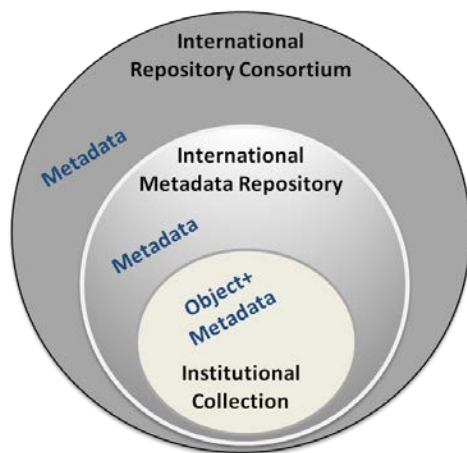|	Element	Mandatory	Optional
1	Title	✓	
2	Language	✓	
3	Subject	✓	
4	Keywords	✓	
5	Format		✓
6	URL	✓	
7	Description		✓
8	Location	✓	
9	Learning Resource Type	✓	
10	Copyrights (creative commons)	✓	
11	Date	✓	
12	Creator	✓	
13	Relation		✓

Figure 1. Material distribution and sharing levels

Paradata

Beyond metadata, certain OER repositories and referatories store paradata as well. Paradata are records of user activity related to a learning object. Paradata can record the number of times a resource was accessed and downloaded, the tags it was given by users, whether it was commented upon, what was the content of the comments and so forth. Paradata also record user-specific activity, for example course enrollment and preferred language, so the system can improve the users' experience by fine-tuning to their needs.

Legal and rights issues (intellectual property)

A significant challenge in using and reusing OER is the issue of copyrights. This makes the "open" in OER somewhat ambiguous. "Open" can be content that can be used without cost, or content that is openly licensed for distribution, reuse, etc. Given that the creation of an OER often is expensive and time-consuming, every reuse makes the OER more cost effective. Therefore, appropriate licensing of an OER can considerably lower costs in relation to the frequency of use.

The Creative Commons (CC) licenses are designed to answer these copyright challenges and are used by MERLOT, Connexions, MIT OCW and many other OER repositories. Creative Commons is a non-profit organization with the goal of making sharing and using of resources easier from a legal perspective. The CC licenses simplify the OER sharing by assisting copyright holders to enable others to copy, distribute, remix and make other use of the copyright holders' materials. There are six major CC licenses. The most restrictive (BY-NC-ND) only allows downloading and sharing with credit to the copyright holder, allowing no changes. The most liberal license (BY) allows any use of the work, including commercial use, as long as credit is given to the copyright holder. The use of CC licenses in TERENA-OER will ensure that the LOs presented to the users will be truly open and not just free for individual use.

Repository strategies and policies: National, European and global initiatives

There is an ample number of OER repository and referatory initiatives worldwide, which assist users in finding, using and reusing LOs. These repositories can store the LO and its metadata or the metadata only, with the objects themselves stored in a different location. Those initiatives can be national or international.

Connexions (http://cnx.org/)– Connexions is a learning objects repository founded by Rice University in 1999. It includes a large collection of educational materials, organized in units called

modules, and free tools for creating, sharing and adaptation the modules. Users are encouraged to donate the modified modules they have created back to Connexions, resulting in a fast-growing and constantly updated LOR (Ochoa, 2010).

MIT OCW (http://ocw.mit.edu/) – The MIT OpenCourseWare is another early (2002) LO initiative, designed to open educational materials. It was founded by the Massachusetts Institute of Technology (MIT) and offers LOs by MIT at no cost and under a Creative Commons license. Today there are over 2,150 open MIT courses and courses have been translated into Chinese, Spanish, Portuguese and other languages.

MERLOT (http://www.merlot.org/) –The Multimedia Educational Resource for Learning and Online Teaching is an international consortium of academic institutions and other partners involved with the development, organization and review of LOs in higher education. It was founded and is sustained by the California State University System and has partners worldwide (e.g. OER Africa, The University of Lucknow, India). Some of the MERLOT LOs go through an internal peer-review process in which reviewers assess the material's quality, potential effectiveness for teaching and learning and ease of use.

MAOR (http://maor.iucc.ac.il/) - The Israeli Metadata And Objects Repository was created in collaboration with MERLOT and supports the case for repositories created by and for the community. The learners' community, i.e., content developers, institutions, organisations and individuals, create a shared collection of digital objects that will serve the entire community at any place and time.

Europeana (http://www.europeana.eu/) – Launched in 2008, Europeana is a central metadata referatory and a portal of European culture. It has over 2,000 contributors, including the Louvre and the British library. In addition, the Europeana Group runs a large number of projects for the preservation of European heritage (e.g. HOPE, Heritage of the People's Europe).

LACLO (http://www.laclo.org/)– the Latin-American Community of Learning Objects maintains the LAFLOR (Latin American Federation of Learning Object Repositories) repository federation. This is a referatory of LOs in Spanish, Portuguese and English.

OER Africa (www.oerafrica.org) **–** OER Africa was established in 2008 by the South African Institute for Distance Education (SAIDE) with the goal to promote OER use across Africa and to support regional educational networks by enabling OER sharing and collaboration between institutions.

JOCW (http://www.jocw.jp/) – The Japan Open Courseware Consortium (JOCW), a consortium of Japanese universities created in 2004 with the assistance of the MIT OCW to provide open-access university courses, first in Japanese and later in English.

On the international level, we have seen several international initiatives to create repository federations, significantly expanding the sharing of LOs on a worldwide scale. These repository federations include MERLOT, The Open Education Consortium and the GLOBE.

ARIADNE (http://www.ariadne-eu.org/) – ARIADNE is a global network of institutions (of European origin) whose objective is to assist in the exploitation, sharing, use and reuse of digital resources in education. The ARIADNE Foundation builds infrastructure designed to facilitate the sharing and reuse of e-learning materials.

Open Education Consortium (http://www.oeconsortium.org/about-oec/) – The Open Education Consortium (formerly the OpenCourseWare Consortium) is a global partnership in which hundreds of institutes of higher education and associated organizations collaborate. The consortium's website indexes a large amount of university-level courses by topic in various languages. Beyond its referatory capacities, the OEC is a place for the exchange of knowledge and acts as a coordinator of the global OCW movement and its efforts.

GLOBE (http://globe-info.org/) – The Global Learning Objects Brokered Exchange is a worldwide alliance of organizations that manage and/or federate one OER repository or more. It is a large, diverse referatory which aggregates metadata from its members. GLOBE founding members are the ARIADNE Foundation in Europe, Education Network Australia (EdNA Online) in Australia, eduSourceCanada in Canada, MERLOT, and the National Institute of Multimedia Education (NIME) in Japan.

The TERENA – OER pilot project

TERENA-OER will create a European level, open source, metadata aggregation broker/portal that will harvest the metadata of OER from the national level of universities and NRENs up to the pan-European level. The portal will be hosted and operated by one or more TERENA member organizations. It will be a European metadata aggregation portal for Open Educational Resources (primarily audiovisual contents, recorded lectures) collected and maintained by institutional and national content repositories. It will offer a forum to collaborate, innovate and share knowledge in order to foster the development of Internet technology, infrastructure and services to be used by the research and education community. It will allow users to share at the highest level of materials developed through public funding and will encourage adoption of flexible licenses which enable adoption, integration and reconstruction of LOs.

The pilot project will begin by collecting metadata from national repositories and make them available via the TERENA portal, bridging the gap between the repositories. TERENA-OER will become a one-stop-shop (broker) for national learning resource organizations, each of them managing and/or federating one or more learning object repositories within each country.
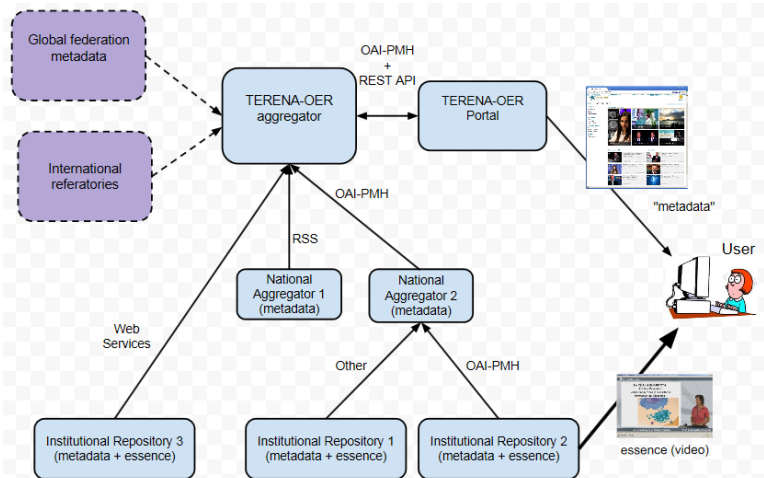

Figure 2. The suggested TERENA-OER architecture

The project's objectives

The primary aim of the TERENA-OER project is to develop the first working prototype of the OER service (including the metadata aggregation engine and the web portal front-end) and pilot a service for the broader TERENA/GÉANT Community in 2014. The OER referatory is not the service that the NREN community intents to build on its own but it is a task that we believe TERENA has to take the lead on in order to facilitate the development of future value-added services on top (including MOOCs and others)

The first part of the project consists of three steps

1. Defining the essential metadata and vocabulary for the TERENA-OER community. The number of metadata field will have to be large enough to facilitate effective communication between systems, but small enough so that systems aggregating metadata from different disciplines (e.g. medicine and astronomy) will have them in common.
2. Design and implementation of the portal's infrastructure. This portal will be one level above the national repository (NREN or University), and will be able to pull the Metadata to the central TERNEA-OER by harvesting, web services, OAI repository or batch upload.
3. Connecting with content providers across Europe. TERENA-OER will allow users federated searches in different European digital libraries and OER repositories, using the common metadata set defined in step one.

The TERENA-OER project was designed by a team of several European organizations and institutions that have been working together as part of the TF-media taskforce. This group has been active in promoting the TERENA-OER project while keeping the NRENs role in mind. The solution this project offers can assist aggregating resources and efficient use of existing European LOs originating in higher education institutes.

The development and promotion of such a project will increase collaboration between European NRENs and higher education institutes and will allow exchange of knowledge and content. Expert workgroups will be able to collaborate using the project's platform. Other than that, we believe that promoting TERENA-OER and similar other projects will broaden the services NRENs can offer their members (HEI) and establish a different level of application that will support e-learning technologies. The NRENs' cooperation is essential for the project's success.

Expected benefits for the users

The project will present a new model of learning object repositories guided by the ideas of sharing, openness and community suited for the social media era, with public involvement in the processes of creation, evaluation and distribution. The growing trend toward openness and collaboration in international consortiums that facilitate connections among portals and allow for an expanded search between repositories, enable a near unlimited flexibility of educational possibilities suited to varied users and needs. For example, lecturers might integrate objects according to specific pedagogical demands and construct a new learning process tailored to the needs of different target audiences. As a result, learners and international content providers will be able to form communities that share learning materials. Openness from institutions and organizations for the distribution of information will contribute to the international trend toward information sharing and the creation of collaborative learners' communities. The project will help the HEI to provide faculty with a larger variety of suitable learning objects for their pedagogical needs.

The portal's characterizations

Homepage – For the users' convenience, we suggest a simple, intuitive and up-to-date interface. The main components of the portal could be broadly classified into four categories: metadata, paradata, connectivity (federated search) and social media. The metadata scheme, defined earlier, is the first component and is very much needed for interoperability with repositories. The basic paradata components (e.g. rating, favorites) will be developed in the first phase and the more complex components (e.g. peer review) will be added in the second phase. Figure 4 presents the main components of the portal.
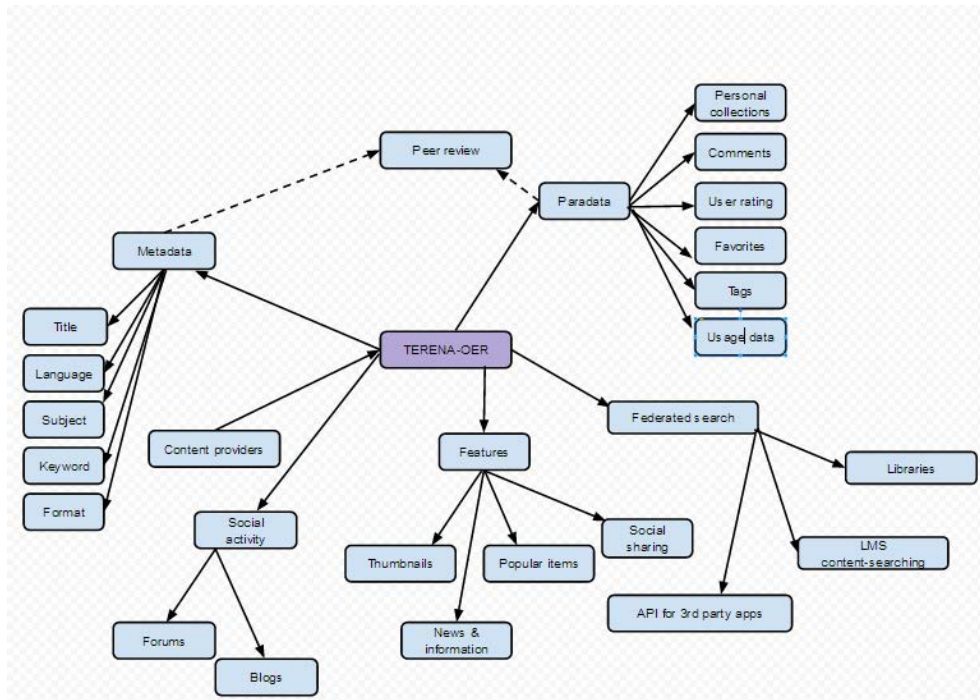

Figure 3. The four components of the TERENA-OER portal

Phase I

In the first phase, we will develop the following:

- Basic search
- Advanced search
- News and information
- About us
- Terms and policies
- Dynamic tag cloud
- Popular items (by ranking, favorites, downloads, views, etc.)
- Thumbnails
- Categories
- Language
- Rating
- The usage of learning objects
- Comments
- Social media sharing

- Help
- RSS
- Alerts
- Web access for the disabled
- Responsive Web Design
- Dashboard for content providers and usage statistics

Search - The highest priorities are the portal's search and browse mechanisms. Today, the difficulty of finding of OER content matching specific context is one of the main barriers in use and reuse of OER. TERENA-OER will offer basic and advanced search of OER from its own metadata collection, as well as federated search in European and global repositories. Being a referatory specific for metadata in higher education, TERENA-OER will be more effective in retrieval of relevant OER than all-purpose search engines and will base its search function mainly on the common OER metadata fields, which were defined earlier in this report. The user will start the basic search in a simple search box, with more optional filters added in the search process to narrow the search and increase its precision.

In the advanced search, items will be searched by language, discipline and sub-discipline, target audience, type (e.g. video, audio, text), year, technical format, author, contributor, user rating, license, platform (e.g. mobile) and tags and so forth. Users will be able to sort the search results by relevancy, title, date and ranking.

News and information – This section will report any new developments of public interest in TERENA-OER, such as new partners, new contributed materials, software updates and so forth. The project will publish a newsletter with items of special interest.

About us – a short explanation about TERENA-OER's goals, the partners involved and a list of content contributors. The section will also include contact information for potential content contributors: universities, NRENs, other higher education institutes and content providers. There will be further information regarding the technical details involved in contributing content to the project.

Terms & policies – The section will give an overview of TERENA-OER's policies. It will provide the terms for searching the portal and using the retrieved items, using the API, licensing issues, accessibility, contributions and so forth.

Dynamic Tag Cloud – TERENA-OER's users will be able to freely tag resources. The tags will be aggregated and visually represented as a tag cloud, with Better-used tags having a larger, more centralized visual representation. The tag cloud will assist users in easy retrieval of relevant content by indicating other users' preferences.

Popular items – The homepage will present popular items. A general "popular" item could be defined as an item that received high ratings from users, that have been downloaded often, etc. Another possibility is to present specific popular items (e.g. from a certain category) according to the users preferences, as indicated in their profile.

Thumbnails – A visual representation of the LO. They will be presented as a reduced size version of the item or as a sample of larger LOs, such as presentations or videos. Thumbnails will be generated automatically as part of the preview of learning objects in TERENA-OER, in order to support visual-based selection.

Categories – OER contributed to the project will be indexed using a pre-defined classification scheme based on knowledge disciplines. Users will be able to browse materials according to category, making the retrieval of discipline-relevant materials more efficient.

Language – Being a European project, TERENA-OER should be translated into major European languages (e.g. English, Spanish, French and German), although we expect the prominent language in most LOs will be English.

Rating – Members will be able to assign a rating of 1-5 stars to an OER as a measurement of its perceived quality in their eyes. The average result will be part of each OER's display in TERENA-OER.

The usage of learning objects - TERENA-OER will collect data of users' activity at the individual level and the overall referatory level. We will extract the data to study the users' preferences and types of usage. We will be able to, for example, study the download frequency of different LOs, the time each user spent looking at her or his chosen LOs, or the number of times a LO has been added to personal collections.

Comments – members will be able to personally reflect on the quality of the OER in the portal's collection using the comments mechanism. Commenting, unlike formal peer review, will be open to any TERENA-OER member and will complement the assessment of the quality of OER.

Social media sharing – Users will be able to share relevant items on Twitter, Facebook and other web-based social media outlets, increasing the OER exposure and outreach and engaging a wider audience. In addition to general social networks and sites, users will be able to share items in scientist-designated networks such as Mendeley and Academia.edu

Help – The portal's "Help" part will deal with several topics: detailed explanations of the site's policies and licensing; information about each of the portal's functionalities and services; contact information; a list of Frequently Asked Questions (FAQ).

RSS - The portal will syndicate its news and materials through RSS (Rich Site Summary) feeds. The feeds will be tailored for the users' requirements, with the option of subscribing, for example, to an RSS of all new materials in a certain discipline in the last 30 days, or an RSS of the top ranking OER in a discipline. In addition, any search results could be converted to XML format and read by an RSS reader.

Alert – Members could receive updates about subjects they defined in advance, such as new items in a discipline or new comments for certain LOs, directly to their email box.

Web access for the disabled – TERENA-OER will be navigable for all users, in accordance with the WC3 Web Content Accessibility Guidelines Version 1.0.

Responsive Web Design – The TERENA-OER website will be designed to adapt its layout and content based on the size of the screen it is presented on. This will ensures that the website could be viewed properly on mobile devices.

Dashboard – A dashboard will allow content providers to contribute new materials easily and view data about OER they have already contributed to TERENA-OER. The content provider institutes could, for example, use this dashboard to determine their most popular OER.

Figure 4. The future portal's main parts, as they appear in the MAOR portal (step 2)

Phase II

Beyond the basic features of phase I, in phase II we intend to start building a community of practice, as well as add more technological features.

- Personal collection
- Suggested items
- Quality issues (peer review)
- Membership
- Social media outlets
- API
- Mobile applications
- Federated search

Personal collection – Members will be able to create and annotate a private collection of LOs for easy access and use. Personal collections could be shared publically or privately between users. The LOs in personal collections could be organized under the user's interests (e.g. in topics). Aggregated results from personal collections could become a possible indicator of LOs popularity.

Suggested items – the portal will have present the user with related items to the one retrieved. The items could be those viewed by other users who viewed the current items, or items with similar keywords or tags.

Quality issues – The challenge of ensuring open educational resources' quality is well known, and will be addressed by TERENA-OER using the following mechanisms: First, the content providers will be universities and NRENs of good standing, known for creating high-quality OER. Second, the project will rely upon input from average users, as well as expert reviewers, in assessing the quality of individual OER.

Peer review – Formal peer review in TERENA-OER will be a structured process, in which at least two experts in the relevant field will submit professional opinions about every LO which will be up for review. The reviews will include a description of the material's learning goals, its targeted population and recommended uses. The reviews will be visible for the TERENA-OER users.

Membership – for individuals, there will be a "Become a member" link in the portal's home page that will enable them to join the portal and create personal profiles and collections. The profiles will be searchable for the portal's visitors and will present the members' skills, disciplines and other details they would choose to publish. The portal will adapt itself to the users' preferences, as indicated in their profiles.

Social media – The project will employ social media outlets (e.g. blogs, YouTube, Pinterest) for rapid communication and engagement of users. These resources will have to be frequently updated in order to keep the users' interest.

Application interface (API) – An import/export API will make TERENA-OER's data and functionalities accessible to other sites, third-party applications and content providers.

Mobile applications – TERENA-OER will create mobile search applications for iOS and Android-based devices. The mobile applications will encourage learning anywhere, anytime, in alignment with the lifelong learning ideals.

Federated search (connectivity)

Users will be able to search through TERENA-OER in a network, or federation, of OER repositories. Although the repositories will remain geographically distributed and located on different servers, a common metadata scheme (suggested earlier in this report) will allow users to retrieve LOs that general search engines normally cannot retrieve.

The federated search will enrich the variety of high-quality learning objects offered to faculty by academic libraries and increase the chances of faculty implementing existing OER in class materials. For example, TERENA-OER could support the MOOC concept by supplying already available OER for the development of new MOOCs.

TERENA-OER will allow Learning Management Systems (LMS), such as Moodle and Blackboard, access to its system via web services (APIs). LMS vendors will be able to integrate TERENA-OER services in their interfaces, resulting in, for example, a plugin for search in TERENA-OER from an LMS. Collaborations of this kind can expose TERENA-OER to a large number of users and encourage additional NRENs to contribute their metadata to the project.
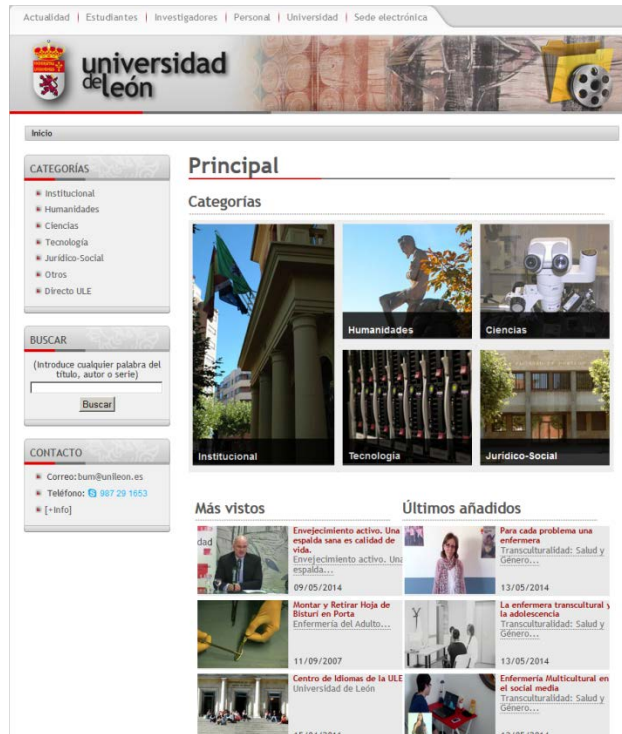
Figure 5. The Universidad de Leon website is an example of best practice in educational web design

Summary

TERENA-OER will be a state-of-the-art central referatory of European learning objects for higher education. The project has four parts: the suggested metadata scheme, the information collected as a result of users' activity (paradata), connectivity (federated search) and social media. The project will be built in two stages; in the first stage we will develop the basic components of the portal, such as search, notifications, rating, comments, etc. In the second stage we will build a community of practice using social media and implement formal peer review. This is a pilot project meant to gain us a critical mass (in terms of participants, support, interest, etc.) for the development of a sustainable service.

The portal's target audiences are teachers and students in higher education, who will use its materials for studying and teaching. Teachers will be able to find and reuse existing free OER that they have not been able to locate using general search engines, with an assurance of high quality. Reuse of available OER will contribute to the sustainability of learning objects produced by European NRENs and universities and to their cost-effectiveness. TERENA-OER will support current e-learning trends such as MOOCs and will connect with OpenCourseWare projects in Europe and worldwide. The project will increase the quality and quantity of free teaching materials available in European high education, as well as expand the services the NRENs offer higher education institutes into the new territories of e-learning and learning technology.

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