

Digital Educational Resources Repositories in Lower and Middle Education in Portugal: Quality Criteria in the International Context

Cornélia Castro¹, Sérgio André Ferreira¹ and António Andrade²

¹School of Education and Psychology, Portuguese Catholic University, Oporto, Portugal

²School of Economics and Management, Portuguese Catholic University, Oporto, Portugal

corneliacaastro@gmail.com

sergioandreferreira@gmail.com

aandrade@porto.ucp.pt

Abstract: The thematic of Digital Educational Resources (DER) and digital educational repositories at primary and secondary education levels is of growing centrality in the educational themes in the international debate. In order to make it easier for teachers and students to find the best and relevant learning resources and to encourage teachers' uptake of innovative materials and learning styles, authorities and/or companies in European countries have launched web based educational repositories. Following this trend, about two years ago, three major institutions in Portugal have launched their repositories: *Portal das Escolas* (ME), *Casa das Ciências* (FCG) and *BOA* (INESC-ID). After examining the state of the art of educational repositories in Europe, it was found that those three Portuguese repositories are not mentioned in recent European reports and so the study here presented seemed to be very relevant. This work aims to develop a descriptive and comparative study, in order to characterize the reality of the Portuguese repositories and compare it with European examples of good practices. To guide this investigation, the following question was theorized: "How are the Portuguese institutional repositories, for primary and secondary education levels, positioned in what concerns international quality criteria?" Our methodology design is a qualitative one and of type i) descriptive, as it is intended to characterize the main Portuguese institutional DER repositories for primary and secondary school education, aiming to assess the key dimensions that affect their quality and ii) comparative since it has in view comparing those repositories with reference European ones. In this sense, *Lektion* in Sweden and *Scoilnet, Portal for Irish Education* in Ireland are considered. The study was undertaken from the view of the DER producers and users. As a tool for data collection it was used a framework of analysis built on the *Guía para la Evaluación de Repositorios Institucionales e Investigación* (GERII), a joint publication of the Spanish Ministry of Science and Innovation and other organizations in the fields of Education, Science and Technology (Villar et al, 2010). The GERII guide includes a set of guidelines for the creation and evaluation of a repository, bringing together a battery of 31 evaluation criteria, distributed over seven dimensions that any repository must accomplish to meet quality and therefore was considered an excellent basis for our analysis. Comparing the three Portuguese repositories, target of this study, with two reference European repositories in order to contextualize the national reality in the international arena will stand for the Portuguese institutions that hold the repositories as an opportunity for improvement. Thus, Portuguese teachers will have an increased chance to access an eclectic collection of quality resources, in order to diversify their teaching strategies.

Keywords: comparative study; digital educational resources; evaluation; quality; repositories

1. Introduction

The 2010 edition of the Horizon Report (Johnson et al., 2010) refers to the *Open Content* as an emerging trend. In fact, we are witnessing a growing volume of digital content from different sources (OECD, 2007) in the education field. It is shared in the cloud DER which: i) contain inherently educational purposes; ii) are framed on the needs of education systems, iii) have identity and autonomy in relation to other objects and iv) meet the defined quality standards (Ramos et al., 2010).

This environment of sharing and reuse makes the access, by teachers, to a wide range of resources easier, increasing the exploitation of more diversified contents (OECD, 2007), which is considered as an important condition for the improvement of quality in education.

In this study we aimed to develop a descriptive and comparative study in order to characterize the reality of three Portuguese repositories and compare it with European examples of good practices in order to evaluate how Portuguese institutional repositories stand in the international arena. To achieve that we established the following research question: "How are the Portuguese institutional repositories, for primary and secondary education levels, positioned in what concerns international quality criteria?"

After examining the state of the art of educational repositories in Europe (EdReNe 2009, Poulsen, 2008; Dumitru et al, 2009), we verified that the variety in DER repositories in Europe is huge and the approaches taken by the various countries (22, altogether) differ. However, all countries and developers share the objective of making resources available and visible to the users and face the same challenges of reaching many users, managing rights and adapting standards (EdReNe, 2009: 4). The same state of the art showed us that three major Portuguese repositories: *Portal das Escolas* (Schools Portal – ME), *Casa das Ciências* (House of Sciences – FCG) and *BOA* (Learning Objects Exchange – INESC-ID), were not mentioned in recent European reports although the 2nd Strategic Seminar of EdReNe took place in Lisbon on June 9th – 11th, 2008 [exception for *Portal das Escolas* once, under the Portuguese Technological Plan for Education (PTE) and its three axes, “(...) the content area will be supported by a Schools Portal to be used by teachers and students in schools all over the country (...)” (EdReNe 2009: 68)]. We considered these to be the main Portuguese repositories for the following reasons: 1st – a varied typology of resources; 2nd - curriculum areas covered; 3rd - number of publications; 4th - number of downloads made; 5th - number of visits.

Lektion, a web community for teachers, created in 2002, was chosen because it is Sweden’s largest teachers’ site, a so called “(...) *meeting place for teachers and all who work in Swedish schools* (...)” (Lektion.se, 2011). *Scoilnet* is the department of Education and Skills official portal for Irish education (Scoilnet.ie, 2011) and was selected because it is an institutional repository whose resources are constantly being reviewed by a team of over 30 curriculum experts. Besides, it allows the users to meet the repository at their local school web portal. Both *Lektion* and *Scoilnet* were still selected because i) their *url* was available; ii) their diversity of resources and iii) they were launched well before the Portuguese ones.

The relevance of this study is also justified by the fact that the results could prove to be inputs to the three institutions holding the Portuguese repositories analyzed, with the goal to continue acting towards the improvement of their quality.

2. Repositories drivers and barriers

The repositories are online systems intended to archive, preserve, make available and disseminate the intellectual output of a community, available in a digital space where data and information are stored and updated (Ramos, 2010; Poulsen et al., 2008) or "digital store boxes that host collections of digital resources in a learning object format: i. e. resources that are designed to be integrated, aggregated and sequential in an efficient way to produce “units of learning” that are meaningful to learners” (Margaryan, 2007: 3).

2.1 Drivers

As there are several potentialities in a repository, we have decided to stress some of those established by the Organization for Economic Co-Operation and Development (OECD, 2007):

- To facilitate the change of teaching practices;
- To stimulate more interactive and constructivist teaching practices;
- To promote the use of DER as a complement or substitute of teaching in the classroom;
- To make collaborative approaches in teaching easier and faster (OECD, 2007; GEPE, 2009);
- To induce and streamline the production and usage of tools, content, resources and information on digital support;
- To minimize the digital divide, allowing remote access at low cost to content, modules and courses;
- To enhance the inclusion in teaching and learning of people with special needs;
- To develop and strengthen a culture of lifelong learning

2.2 Barriers

Studies identify several barriers that limit the access and use of repositories (Collis, 1995; Davis et al., 2010; OECD, 2007, Pawlowski and Zimmermann, 2007), such as:

- Technical: lack of broadband availability;

- Economic: lack of resources to invest in hardware and software required to develop and share DER;
- Social: lack of skills to use technical inventions; communication style;
- Cultural: resistance to share or use the resources produced by other teachers or other institutions, cultural perceptions of the teacher and student's roles;
- Political;
- Legal: intellectual property and copyrights.

3. Digital Educational Resources repositories

The objects of this study are the three most visible institutional repositories of DER in Portugal, in primary and secondary education: *Portal das Escolas*, *Casa das Ciências* and *BOA*, which are compared with the Swedish *Lektion* and the Irish *Scoilnet*. The three countries – Ireland, Portugal and Sweden – are members of EdReNe thematic network (edrene.org, 2011) which was established in 2007 with support from the European Union's eContemplus programme (ec.europa.eu, 2011). The overall goal of EdReNe "is to improve the provision of and access to learning resources" (Poulsen and Lund, 2009: 86).

3.1 Portugal

3.1.1 Portal das Escolas

The *Portal das Escolas*, launched on the 22nd June 2009 and addressed to the educational community (teachers, students, parents and non-teaching), intends to establish itself as the institutional platform *par excellence* in the educational community, through which the Portuguese teachers can produce and access, anytime and anywhere, a wide range of online services that add value to the teaching and learning process. This repository provides "material and reliable information", adopting the ME mechanisms for validation of educational resources (ME, 2010).

3.1.2 Casa das Ciências

The *Casa das Ciências* project was created by the Fundação Calouste Gulbenkian (FCG), a Portuguese private institution of public utility whose statutory aims are Art, Charity, Science and Education.

It stands as "an integrator and amplifier vehicle of current efforts in using Information Technology in teaching and learning, made by many different agents and whose results are scattered" (FCG, 2010), establishing itself as a subject repository. This repository "aims to give visibility and usefulness to the efforts of many teachers, recognizing the merit they actually have and becoming a website of reference for all Portuguese Science teachers" (FCG, 2010). All the materials submitted are assessed by referees from a scientific and educational point of view, in an approach to peer-review. This quality control of the submitted materials complies with a set of rules stated in a regulation, which considers the awarding of prizes to the DER considered of higher quality, as a way to encourage the submission.

3.1.3 BOA

The *BOA/VemAprender* (INESC-ID, 2010) project is a research initiative sponsored by the Information Systems Group of INESC-ID at Lisbon with the aim of designing, developing and evaluating the implementation of collaborative platforms within teaching and learning contexts. Its main purpose is the creation of a web platform to which the educational community of various levels of education can access. This way it aims to enable everybody to participate collaboratively in building a repository of learning objects, with a significant set of associated information. This initiative intends to foster the creation of a community of practice that is a facilitator and an enhancer of quality in the teaching profession. In this repository, when submitting a DER, the author gives a certain value – credits – to its object. The value initially given is regularly updated according to the number of downloads made, this being the mechanism that allows the evaluation of the object submitted.

3.2 Sweden

3.2.1 Lektion

Lektion, the largest Swedish teacher site, created in 2002, is a repository owned and developed by a web company named *Lektion Sweden AB*. This company, located at Helsingborg, took the initiative of starting the *Lektion.se* site to connect Swedish teachers in an internet community. *Lektion.se* is an idea with suggestions for lessons by teachers, for teachers and the lesson database is referred to be gigantic, containing thousands of tips and ideas for teaching. This concept of community is favoured by the fact that the teachers can share ideas about the DER through a forum. There is a *Vendor Archive* where teachers can find everything to do relating school and even find a job in the *Jobs Archive*.

3.3 Ireland

3.3.1 Scoilnet

Scoilnet is the official education portal of the department of Institutional Education and Science in Ireland. This repository is responsible for the promotion and use of the internet in education under the Government Information and Communication Technologies in Schools Programme. Launched in 1998, the website is managed by the National Centre for Technology in Education (NCTE, located at Dublin City University). Its current interface was launched in 2003 with design tweaks in September 2009 (*scoilnet.ie*). *Scoilnet* contains a database of over 11 800 digital resources (theme pages, reviewed websites, quizzes, lesson plans, crosswords and other multimedia). The content of the *Encyclopaedia Britannica Online* and of *Word Book Online* was specifically authorized for educational use within the site *Scoilnet*. Curriculum focused, it acts as a support to teachers, students and parents. *Scoilnet* promotes actively the integration of Information and Communication Technologies (ICT) in teaching and learning.

4. Methodology

The type of study followed in this research fits the descriptive and comparative ones. The main institutional repositories of DER for primary and secondary levels of education in Portugal are characterized, the key dimensions that affect the quality are assessed and they are compared with other European repositories. To do this study it was required to previously identify the dimensions to be evaluated (Vilelas, 2009).

With that purpose, the *Guia para la Evaluación de Repositorios Institucionales de Investigación* (GERII), published jointly by the Ministry of Science and Innovation of Spain and other organizations in the field of Education, Science and Technology, was adapted (Villar et al., 2010). The GERII includes a series of guidelines for the creation and evaluation of a repository. For that function it gathers together a set of 31 evaluation criteria, distributed over seven dimensions that any quality repository must meet and therefore it was considered an excellent base for our analysis.

In the present study, we chose to make some adjustments to the evaluation model followed in GERII. Thus, we considered five of its seven dimensions and it was decided not to include the dimensions: *Interoperability and Security, Authenticity and Integrity of Data* because: i) since they are essentially technical dimensions, they do not fit in the methodology of data collection defined and ii) it is intended to perform an evaluation of the repositories only in the perspective of producer and user.

In table 1, and according to the guide GERII, we present the criteria to be considered in any evaluation of the five dimensions considered in this study:

Table 1: Dimensions to be evaluated

Dimension	Evaluation Criteria
Visibility	Visibility in the major search engines; existence of a standard name and a proper <i>url</i> ; presence of incentives for participation and information on the mode of submission.

Dimension	Evaluation Criteria
Policies	Disclosure of the mission, goals and function; information on who can submit, what can be submitted and in what formats; information on documents archive policies and preservation of content; forms of contact and support.
Legal aspects	Information on the intellectual property of DER present in the repository.
Metadata	Information on formats used; use of classifiers or definition of a policy of indexing content.
Statistics	Mechanisms to record access logs to the server and access, use and download of DER.

The methodology of data collection was based on the analysis of the repositories websites. Thus, each repository was classified for each criterion of the five dimensions and the evaluation was made from the point of view of the producer and user of DER.

5. Results

The study results allowed a global assessment of the quality of the five repositories of DER for primary and secondary levels of education, from the perspective of the author and the user of DER and are presented in a comparative summary for each of the dimensions assessed.

The following table 2 summarizes the *Visibility* dimension results.

Table 2: Dimension: *Visibility*

Advantages	Limitations
Excelent visibility in the search engines.	The website homepage of the Portuguese institutions makes no reference to the repository.
Standardized name of repositories (except <i>BOA</i> , facilitating its identification).	
Apropriated <i>url</i> .	Lack of public disclosure in the case of <i>BOA</i> (limitations not applicable to <i>Lektion</i>).
Incentives for participation in the repository.	
Clear information on how to submit RED.	
In this dimension, there aren't significant differences between the Portuguese repositories and the foreign ones.	

In a search for repositories, by "denomination", in the three most used search engines (*Google*, *Bing*, *Yahoo*) (SEO, 2011), they all appear as the first result. The exception is *Lektion* that in *Yahoo* appeared in third place.

The fact that the ME, FCG and INESC-ID homepages do not make reference, in their internal search engines, to their repositories, may lead the target audience to consider the repositories as not worthy. This may be evidence that the repositories are not central in the policies of the institutions that hold them.

In all the analyzed repositories, information on how to submit resources is published and messages encouraging the participation and collaboration in them are promoted. It is noteworthy the dynamics of the repositories *Lektion* and *Scoilnet* which present a video explaining how to find a resource and/or how to make a submission. The *Scoilnet* repository also presents additional information on *10 ways to use Scoilnet*.

The main results of the dimension *Policies* are summarized in Table 3.

Table 3: Dimension: *Policies*

Advantages	Limitations
The mission, goals and functions of the repository are present.	There isn't established a policy of preserving content.
It is established how users can <i>upload</i> the content, what kind of content is accepted and in what formats.	
There is a requirement to register in order to download a resource (<i>Portal das Escolas</i> and <i>Scoilnet</i> are exceptions ¹).	
Several ways of contact and support are available.	
Unlike the Portuguese, the Swedish and Irish repositories have a video demo of their features.	
¹ Navigation is not subject to registration but some features are only accessible to teachers who are registered users.	

It appears that institutions do not declare their commitment to make content available on an ongoing basis and to take measures for their preservation (as in the case of migration, for example) to ensure access to them and create and maintain file formats. This condition can contribute to the reduction in the confidence of authors, inhibiting their collaboration. This less favorable aspect occurred in the Portuguese repositories as well as in *Lektion* and *Scoilnet*.

The *Legal Aspects* were compared and with regard to compliance with the fundamental requirements of authors' rights guarantee, we present a summary in table 4.

Table 4: Dimension: *Legal Aspects*

Advantages	Limitations
Confirmation by the author during submission, that the material does not violate any intellectual property right (<i>BOA</i> is an exception and it was not possible to confirm in <i>Scoilnet</i>).	Not identified.
Request for an authorization from the author that allows the distribution of content (not possible to confirm in <i>Scoilnet</i>).	
Existence of information on copyright like <i>Creative Commons</i> or any other.	
Like <i>Lektion</i> , the Portuguese repositories adopt the <i>Creative Commons</i> philosophy in response to the protection of copyright. <i>Scoilnet</i> refers to Irish and European legislation, not materializing the type of license.	

The safeguard policy of intellectual property and copyright encourages the dissemination of ethically correct behaviour in the production and use of DER.

The enormous amount of DER available in the repositories makes it important that they are described by metadata (table 5). These allow the recognition of the repositories both by humans and computers, so that they can be located by using different criteria. This is a capital issue since the resources will be of little use if they cannot be easily found.

Table 5: Dimension: *Metadata*

Advantages	Limitations
There are standard procedures for indexing DER (indication of the author, description, topic, subject, school grade, keywords, target audience, resource type or time).	Not identified.
The metadata allow search by standard criteria.	
Metadata facilitate research of DER into the archives of the repository.	
In this dimension, there were no significant differences between the Swedish and Portuguese repositories (couldn't be confirmed in <i>Scoilnet</i>).	

Upon uploading the authors are asked to categorize the resources through a series of standard criteria such as author, description, topic, subject, school grade, keyword or time, for example. Similarly, the repositories enable a search of DER by the same criteria.

Finally, the dimension *Statistics* (table 6) is also important, both from the perspective of the user or from the author.

When you use a repository, the statistics for a given DER, allow you to realize, for example, which resources were the most voted, information that can help you on the decision to download a particular resource, helping to give it visibility. From the author's point of view, this knowledge will give him

feedback on the interest that his own DER created in the community of peers and will encourage him to produce and share more resources. Knowing the number of visitors to a repository helps the teacher/user to understand its importance and so he starts seeing it as a tool that he might consider using to facilitate his work and diversify his practices. The existence of various statistics relating to the access to the repository is also valuable to the institution that holds the repository, as it provides information on the dynamics of the repository which is very important to its management.

Table 6: Dimension: *Statistics*

Advantages	Limitations
They report on the number of available and/or published objects.	Not identified.
They refer to the number of downloads and/or visits made.	
They indicate the number of visitors (<i>Casa das Ciências</i> and <i>Portal das Escolas</i> have several historical data).	
They present the latest, top rated, most popular and/or most visited DER.	
The authors that share more learning objects are highlighted (<i>BOA</i>).	
In this dimension, there were no significant differences between repositories, although it was noted that <i>Scoilnet</i> does not indicate some of the items evaluated in this dimension; in addition, by not admitting the login, it did not allow the identification of possible limitations.	

6. Conclusions

Repositories contribute to the opening of the classroom to the world. The DER online availability allows them to be accessed from anywhere, anytime and by anyone who has appropriate training and an Internet connection.

The data presented in table 7, concerning the implementation of each one of the repositories evaluated in this study, as well as the discussion of the results, allowed us to answer to our initial research question: “*How are the Portuguese institutional repositories, for primary and secondary education levels, positioned in what concerns international quality criteria?*”.

Table 7: Data on the implementation of the evaluated repositories

	PORTUGAL			SWEDEN	IRELAND
	<i>Portal das Escolas</i>	<i>Casa das Ciências</i>	<i>BOA</i>	<i>Lektion</i>	<i>Scoilnet</i>
Inhabitants	10 647 763 ¹			9 354 462 ²	4 470 700 ³
Teachers	115 680 ⁴			78 400 ⁵	55 052 ⁶
Registered Users	83 000 ⁷	8 226 ⁷	326 ⁷	229 123 ⁷	4 000 ⁷
Published DER	2 620 ⁷	1 407 ⁷	168 ⁷	Not available	11 800 ⁷
Teachers/registered teachers	1,4:1	Not applicable for being a subject repository	355:1	No possible evaluation	14:1
Registered teachers/published DER	32:1	6:1	2:1	No answer from request to <i>Lektion</i>	1:3
¹ Estimate, National Statistical Institute, February, 2011; ² 2009, most recent census; ³ estimate 2010, CSO; ⁴ GEPE, ME, 2009; ⁵ 2003; ⁶ 2007; ⁷ Data repositories, May, 2011.					

The data shows that Portugal is, as far as population size and number of teachers is concerned, closer to Sweden than to Ireland. Although Ireland is the smallest country in terms of population and number of teachers, it has the highest number of published DER. The reasons for that might be: i) the fact that the repository is quite user-friendly, allowing the teacher to file his preferences in the tab *My stuff*, ii) it is possible to submit any resource without peer-review (the teacher is the sole responsible for the material he submits and he can leave it in the repository for as long as he wants or take it off when he wants) and iii) the age of the repository.

The number of registered users in the Portuguese repositories is substantially smaller than in the two foreigner ones. This probably happens because of the youth of our repositories. However it is

noticeable that there has been an effort to keep increasing levels of quality since their creation. The ME *Portal das Escolas* requires the registration of teachers so that they can be certified in terms of ICT skills, which possibly explains the ratio 1,4:1.

Taking into consideration the few limitations detected for the Portuguese repositories in the dimensions evaluated on the basis of GERII, it appears that the solution of some of them (unavailability of broadband and the lack of resources to invest in hardware and software, for example) does not depend directly from the institutions that control them and others (the institutions homepages that make no reference to their repositories or the lack of definition of a public policy of preserving data) can be easily minimized.

The *Portal das Escolas* has recently launched (March 10th, 2011) an area of educational blogs and on May 30th, 2011 the *Casa das Ciências* launched a bank of images and the first scientific encyclopedia written in Portuguese: the *WikiCiências* with a collaborative basis and constantly quotable on the Internet. We should highlight the uniqueness of this repository which, being related to a subject, is totally different from any of the two European repositories analyzed. For the sustainability of DER repositories in Portugal it will be important to foster communities of practice of which the *Casa das Ciências* seems to be the most paradigmatic one.

As a result of this comparative study, it was found that the foreign repositories meet certain requirements not found in the Portuguese ones. Thus, we present the following proposals for inclusion in the Portuguese repositories:

- Video demonstration on the process of submitting a resource and/or all the repository functions;
- Different tabs with information for parents and students;
- Forum for sharing ideas among users;
- Diversify the user generated content like blogs, wikis, twitter and podcasts in a logic of Web 2.0 technology;
- Engage in the provision of a web hosting service to all schools (in *Portal das Escolas*). This would enable schools to easily develop and host their website on a school's broad band network and to assume as a repository that actively promotes the integration of ICT in teaching and learning, under the Portuguese PTE.

Navigation in the five analyzed repositories could only be made in the language of the country of origin. It would be important to consider the development of interfaces, at least bilingual, in the language of the country of origin and in English. The same applies to metadata. We consider this to be a relevant step since in the European Union there are several projects of mobility of both teachers and students and exchange programmes between schools. This would also enable all teachers to access and adapt DER from other countries other than their own, thus creating a European network of repositories.

The comparative study held, whose goal was to verify how the Portuguese institutional repositories, in lower and middle education, are positioned in what concerns international quality criteria, allowed us to conclude that the Portuguese repositories are facilitators of authors collaboration and general users' access. They also contribute to promoting the pursuit of new practices in the classroom by teachers in primary and secondary schools in Portugal, as they make accessible DER with scientific and teaching quality.

In short, it seems that the Portuguese experience, in spite of being a recent one, when compared with other European experiences, is on the right track to achieve educational innovation. Repositories focused on people, on the community of education stakeholders and on teaching practices will help to overcome individual and organizational inertia and other barriers, towards the success among its users.

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