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Green Education Using Open Educational Resources (OER): Setting up a Green OER Repository

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Abstract

A wealth of open educational resources (OER) focused on green topics is currently available through a variety of sources, including learning portals, digital repositories and web sites. However, in most cases these resources are not easily accessible and retrievable, while additional issues further complicate this issue. This paper presents an overview of a number of portals hosting OER, as well as a number of “green” thematic portals that provide access to green OER. It also discusses the case of a new collection that aims to support and populate existing green collections and learning portals respectively, providing information on aspects such as quality assurance/collection and curation policies, workflow and tools for both the content and metadata records that apply to the collection. Two case studies of the integration of this new collection to existing learning portals are also presented.

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Keywords: Green-OER; open educational resources; green learning; digital resources; digital collections; learning portals

1. Introduction

Despite the wealth of available digital educational resources that cover a variety of green topics, like environment, sustainability, agriculture, ecology, biodiversity etc., it seems that these resources are published in a sparse and un-organized manner, as in many cases they are not organized in repositories nor indexed/classified for the facilitation of their retrieval as in the case of other content (Littlejohn, 2003). For example, a number of these resources are hosted in local databases of various institutions and are accessible only by the students of the specific institutions, while an additional number are hosted in

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digital repositories which are not interconnected by any means with other related repositories, leading to limited accessibility of these resources (McNaught 2007). On top of that, even in the case that the resources are publicly available and described with metadata, there is the possibility that this metadata are not based on any established metadata standard used for describing educational/learning resources (e.g. IEEE LOM or Dublin Core) (Ternier et al., 2008), so these metadata records cannot be aggregated by an OAI-PMH harvester and made available through a learning portal or the results will be really poor (Hatala et al., 2004).

The first step towards the creation of a collection which includes green resources is the selection of the appropriate digital repository system that will allow the storage, organization, creation of metadata descriptions for the resources and the retrieval of the resources. According to the Directory of Open Access Repositories (OpenDOAR) data (OpenDOAR 2012) and the Repository 66 map (<http://maps.repository66.org>) on February 22nd, 2012, the majority of available institutional repositories in general (not limited to the Green ones) are built using Open Source software including EPrints (www.eprints.org), DSpace (www.dspace.org), Digital Commons (<http://digitalcommons.bepress.com>) and Fedora Commons (<http://fedora-commons.org>) (see Fig. 1). This software not only supports the local hosting of the metadata records for these resources, but also supports their harvesting by external systems/databases using the OAI-PMH protocol (Open Archives Initiative Protocol for Metadata Harvesting), leading to their interconnection with other repositories and the publication of their content through related learning portals.

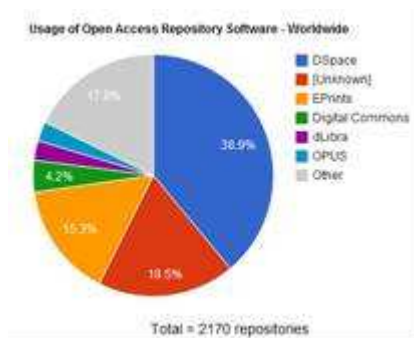


Fig. 1. Distribution of Open Access repository software on 22/2/2012 (source: OpenDOAR, 2012)

The selection of an appropriate metadata application profile (AP) for educational purposes is also an important factor for the interoperability and compatibility with other systems/collections. Despite the high number of available APs for the description of digital educational resources, the IEEE LOM (IEEE, 2002) is the most appropriate for this purpose since it was designed specifically for the description of educational resources. In addition, one of LOM's greatest advantages is that it is simple to use and in addition it features an inherent extension capability, which allows for the easy incorporation of new elements and enables LOM to meet the specific needs of applications (Koutsomitropoulos et al., 2010). The selection of a commonly used AP will ensure the interoperability of the content with other related repositories and portals, minimizing the effort for manual transformation of metadata or for working on the mappings necessary in order to align different metadata APs.

Last, the comprehensive definition of a policy for the collection and curation of the educational resources, as well as quality assurance criteria are crucial factors for the creation of a digital collection of educational resources. This will ensure that not only the content selected for the collection is actually

related to the scope of the collection and is of high quality but also that the metadata records also meet predefined criteria, providing complete and accurate description of the corresponding resources.

This paper presents the case of the Green-OER collection, an ever growing collection of quality open educational resources that are carefully selected from various online sources. This collection was set up with the collaboration between Agro-Know Technologies (www.agroknow.gr) and MetaSolutions (www.metasolutions.se) using an alternative repository system, Confolio (www.confolio.org), in order to support existing collections in related activities/projects like Green OER Commons (www.oercommons.org/green) and Organic.Edunet (www.organic-edunet.eu). The collection consists of metadata records based on an adapted version of IEEE LOM and created following specific rules to ensure the high quality of the metadata records, while the content is also selected using a predefined set of quality criteria.

2. OER and learning repositories providing access to OER content

2.1. About OER

Open Educational Resources (OER) are “digital materials that can be re-used for teaching, learning, research and more, made available free through open licenses, which allow uses of the materials that would not be easily permitted under copyright alone” (Hylén 2007). This term was initially used in 2002 during UNESCO’s 1st Global OER Forum (Paris, July 1st-3rd), adopted and referred to providing free access to educational resources on a global scale (UNESCO 2002). Another definition of OER is “digitized materials offered freely and openly for educators, students and self-learners to use and reuse for teaching, learning and research” (Hylén 2007). These resources are of various types (e.g. lesson plans, lessons, reports, multimedia files) and formats (e.g. documents in .doc format or .pdf files, mpg/avi videos etc.) and in most of the cases they are covered by Creative Commons licenses (<http://creativecommons.org>) which clearly define the conditions for using, reusing and mixing this material.

OER are freely available and licensed in a way that gives users the legal permission to

- reuse – use the work “as-is” without having to ask permission
- revise - alter or transform the work to meet the user’s needs
- remix – combine the work with other works for an enhanced effect
- redistribute – share the work or derivative work with others,

always depending on the license which describes the conditions of use for each resource.

2.2. Learning Portals and OER

A number of repositories hosting OER resources are available, such as OER Commons, MERLOT, NSDL, while some others have ceased their operation throughout the years (for example CAREO - <http://careo.ucalgary.ca> and EDNA - www.edna.edu.au). Some of the most commonly used digital repositories or learning portals providing access to OER are mentioned in the following paragraphs.

A nice example of an OER learning portal is OER Commons (www.oercommons.org). OER Commons is a huge database providing access to a wealth of learning resources for school and university level. It was developed by the Institute for the Study of Knowledge Management in Education (ISKME – www.iskme.org) in February 2007, in order to “provide support for and build a knowledge base around

the use and reuse of open educational resources (OER)”. OER Commons acts as an aggregator, providing a single point of access to more than 30,000 OER coming from over 120 content providers. The resources are classified and can be retrieved using a number of filters, such as subject area, grade level, material type and content provider, among others (Fig. 2). The main target groups of OER Commons are both educators and learners of various educational levels, from pre-school to university level. All of these resources are publicly available for all to use and most of them are licensed using a Creative Commons license, therefore they are legally available for using, reusing and modifying.

| Subject Areas | | Grade Levels | |
|---------------------------------|-------|---------------------------------|--------|
| Art | (102) | Primary | (1788) |
| Business | (843) | Secondary | (1467) |
| Healthcare | (287) | Post secondary | (1117) |
| Mathematics & Statistics | (123) | | |
| Science & Technology | (173) | | |
| Social Sciences | (118) | | |
| Materials Types | | | |
| Activities & Labs | (140) | Lesson Plans | (1819) |
| Assessments | (172) | Readings | (1549) |
| Audio Lectures | (73) | Simulations | (178) |
| Cartoonish Illustrations | (102) | Hybrid | (104) |
| Classroom Lessons | (98) | Teaching & Learning Strategies | (217) |
| Full Courses | (183) | Textbooks | (17) |
| Games | (29) | Training Materials | (86) |
| Homework & Assignments | (128) | Video Lectures | (186) |
| Lecture Notes | (107) | Other | (183) |
| Course Related Materials (1922) | | Libraries and Collections (552) | |
| Full Courses | (8) | Primary Science | (178) |
| Learning Modules | (187) | Teaching & Learning Strategies | (171) |
| | | Other | (103) |

Fig. 2. Classification of resources available through OER Commons

Another widely used learning portal offering access to OER is MERLOT (www.merlot.org). MERLOT (Multimedia Educational Resource for Learning & Online Teaching) is a free and open online community of resources designed primarily for faculty, staff and students of higher education from around the world to share their learning materials and pedagogy. MERLOT is a user-centered collection of peer reviewed higher education online learning materials catalogued by registered members and a set of faculty development support services. MERLOT covers a wide variety of thematic areas which are clearly classified according to their content and the underlying resources can be retrieved using an advanced search function based on criteria such as keywords, title, language of the resource, material type, technical format and educational level. Apart from free resources, MERLOT features a number of communities dedicated to each one of the thematic areas available through the portal, as well as the option for the user to enter his personal information and create a personalized profile.

Edutopia (www.edutopia.org) is a learning portal which provides a wide variety of open educational resources and related content. It is mostly focused on K-12 level and provides a classification of resources according to the grade level. Apart from the educational resources, it provides tools for supporting the teachers in their teaching context, such as strategies for improvement of teaching, videos, guides, blogs and communities that encourage the active participation of the teachers. In some cases, a free registration to the portal is required before anyone is allowed to download a resource.

Finally, NSDL (<http://nsdl.org>), The National Science Digital Library, is the National Science Foundation's online library of resources and collections for science, technology, engineering, and mathematics education and research. It currently provides access to more than 120 collections and 140,000 educational resources, including images, video, audio, animations, software, datasets and text documents such as lesson plans and journal articles. It is one of the few repositories that support a form of quality reviews for the content offered. More specifically, “reviews for quality and appropriateness are made by specialist(s) in appropriate fields of science, education, and educational research. The

qualifications of specialists and their selection processes are documented by individual resource providers. Common mechanisms for selection include peer review boards, content creation committees, and user recommendations.” In addition, it features a handbook with detailed information about the quality criteria covering, among others, the selection of the content published through the NSDL and the criteria used. The resources are mostly available for schools and higher education institutes, aiming at both tutors and learners.

2.3. Green OER portals/repositories

Apart from these portals which provide access to OER covering a wide range of topics, there are also portals which narrow their topic availability to green topics, as mentioned earlier. Among these specialized portals, some of the most commonly used ones are described in the following paragraphs.

One of the most interesting green learning portal is the Go Green Database (www.edutopia.org/go-green). It is an initiative launched by George Lucas Educational Foundation, as a part of Edutopia, which provides teachers with a wealth of high-quality educational resources. The Go Green Database provides access to a variety of open educational resources in the form of lesson plans, websites, green projects and other forms of resources, both free and paid. These resources can be retrieved using a search option using filters for topic, type of resource, location, grade level, cost and duration (see Fig. 3). The database also features a number of social navigation options which allow users to add, rate and comment on existing resources or even upload their own resources in the database.

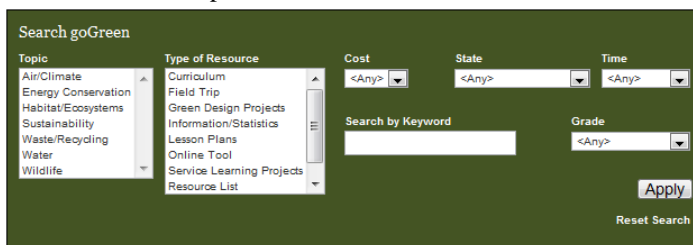


Fig. 3: Search filters found in the Go Green Database

The target group of this database is diverse and includes students, teachers, educational administrators as well as various stakeholders involved in environmental education.

Another interesting source of OER focused on green topics is EnviroLink (www.envirolink.org). The EnviroLink Network is a non-profit organization providing since 1991 access to thousands of free online environmental resources, including articles, publications, events and information about related initiatives. The available resources are classified according to their thematic area (topic) or category, while a more detailed classification can be found within each topic.

EELinked Networks (<http://eelinked.naaee.net>) is a service of the North American Association for Environmental Education (NAAEE - www.naaee.net). It is a global community of environmental educators that not only provides access to downloadable educational materials, but also engages the users in discussions, encourages users to upload their own resources (e.g. lesson plans) and also provides an opportunity for collaboration with Environmental Education (EE) partners. EELinked comprises of many different networks, each with a specific focus. The user is allowed to search, browse and download materials from any number of networks in EELinked without having to log in or register. However, a free registration provides the user with additional features such as posting announcements, communicating with colleagues, sharing materials, offering recommendations and making inquiries. Classification of resources is based on thematic areas, tags and date of publication.

Finally, a learning portal with a different orientation, as it aims mostly at the vocational training section comes from FAO (Food & Agriculture Organization of the United Nations) and it is titled Capacity Development Portal (www.fao.org/capacitydevelopment/capacity-development-home/en). This portal provides access to learning resources and learning services, such as knowledge, information, tools, good practices, and services related to Capacity Development. The target groups of the FAO portal include FAO staff, collaborators, partners, Member Countries and other international, national and local development actors. The Portal provides links to FAO's thematic areas that feature Capacity Development as critical for the success of their programmes, as well as links to related external resources from within the United Nations and the broader international development community. The resources available through this portal are mostly focused in food security, agricultural development and sustainability.

Table 1 below includes information about the use of metadata, collection/curation policy and any visible quality criteria that may apply to the aforementioned collections. The results presented in the table above raise the need for a new collection, which will use educational metadata for the description of resources, will be ruled by a clearly defined collection/curation policy and will meet specific quality criteria which will ensure that the quality of the resources provided is not only high but constant and homogeneous.

Table 1: Information about the Green Learning Portals

| Collection name | Use of metadata | Visibility of collection/curation policy | Visible quality criteria |
|---------------------------------|-------------------------------|---|---------------------------------|
| Go Green Database | Yes - Basic | No | No |
| Envirolink | Yes – Basic | Yes: http://www.envirolink.org/suggest.html | No |
| EElinked Networks | No | No | No |
| FAO Capacity Development Portal | Yes – Not in all cases | No | No |

3. The Green-OER collection

3.1 About the collection

Green-OER is a collection of OER focusing on green topics, created by Agro-Know in order to serve and support a variety of collections. It is essentially a collection of metadata records which describe quality educational material on green topics which are carefully selected by the Agro-Know team. The resources of the Green-OER collection focus on green topics, such as sustainability, agriculture, environment, ecology, energy, biodiversity and related topics. They mostly aim at both tutors and learners at school and university level, while there are also resources interesting for different audiences, including vocational education and training stakeholders, researchers and general audience. The resources provide educational information and can be complete lessons or lesson plans, guides and handbooks, journal articles and information sheets, among others. Most of these resources are available as online resources (mostly web pages), with additional types such as documents in the form of Microsoft Word or PDF files, presentations and videos, as well as in the form of images, audio files or other types.

3.2 Content population workflow

In order for the collection to be populated, a number of content experts are browsing through the web, mostly in related learning portals, digital repositories or even web sites hosting quality OER on green topics in order to find the most appropriate resources for the Green-OER collection. Additional content may be suggested by other domain experts, not directly involved in the development and population of the collection. As soon as a suitable resource is identified, the content expert creates the corresponding metadata record using an online tool (Confolio, described in the following paragraph) providing basic information such as title, summary, author/publisher, keywords, educational level and copyright information. An additional field available in Confolio allows the creation of relationships between concepts based on a domain-specific ontology developed by the Organic.Edunet project (Sanchez-Alonso et al., 2008), which facilitates the retrieval of the resource through the Organic.Edunet Web portal. After the metadata record has been created, an experienced user on both the domain and the corresponding educational metadata (validator) checks the relevance of the resource against the scope of the Green-OER collection as well as the information that exists in the metadata record. In case no issues are identified, the validator validates the metadata record, which is then ready to be published in external sources (e.g. learning portals) through automated harvesting using a dedicated OAI-PMH target.

3.3 Quality Assurance Process

Any resource that is going to be integrated in the Green-OER collection is initially checked against its relation to the scope of the collection, an action performed by the content expert. The subject of the resource has to be related to any green topic covered by the collection. In addition, and before the metadata record is created, the resource has to be pre-checked against the following four core criteria, initially set by Organic.Edunet and adapted in order to meet the needs of the Green-OER collection:

1. Accessibility: The resource can be opened using the provided URL
2. Appropriateness against violence, pornography, racism etc.
3. Relation of metadata and content to green topics
4. The Intellectual Property Rights (IPR) of the resource do not prohibit the resource from being promoted through other learning portals (such as the Organic.Edunet Web portal). Since the resources

discussed are open access, all resources can meet this criterion, unless otherwise stated in the source of the resource.

If the resource meets these four criteria, then a metadata record can be created for its description and this description can be subsequently published to other learning portals.

Additional steps ensure the quality of the resources available in the Green OER collection. For example, domain experts periodically check a sample of the available resources and may suggest the revision of domain-specific metadata while metadata experts will perform the same task ensuring that the metadata entries are filled with correct information. In addition, in the case of the Organic.Edunet Web portal, registered users are motivated to contribute to the quality assurance process through the availability of a number of tools, including the rating, reviewing and tagging of the resources, while a reporting mechanism ensures that inappropriate content will be re-evaluated and may be revised or rejected by the experts. In the case of the Green OER-C portal (through which the collection will also be available), there are several user-regulated mechanisms that contribute to ensuring that the resources are of high quality: users can evaluate (see for example <http://www.oercommons.org/courses/1900-air-pollution/view#evaluate>) the resource by rating and reviewing, adding comments, tagging it, sharing it using various services.

3.4 Repository system

The repository system that is used for the Green OER collection, Confolio (also known as EntryScape - <http://code.google.com/p/entrystore>), is a platform for information management that has been under development at several Swedish universities since 2007. The gist of Confolio's backend, EntryStore, is the flexible model for working with entries, which is resources and descriptive information about these resources. The resources can be located anywhere and be disparate things like your own uploaded documents, YouTube movies, calendar events, people, concepts, products etc. Entries can be private or be shared with others. An important principle is that entries can be connected with other entries in various ways, i.e. using predicates. The tool set allows content providers to connect their repository in a federation, as it is the case with e.g. the Organic.Edunet federation (www.organic-edunet.eu). For this to work it is necessary to employ open standards and protocols for search queries and metadata harvesting, such as the Open Access Initiative Protocol for Metadata Harvesting (OAI-PMH) and the Simple Query Interface (SQI). The repository backend is resource-oriented and stores metadata according to a Resource Description Framework (RDF) representation of a LOM AP. An API which exposes the repository's content closest to the internal representation is based on a resource-based software architecture built entirely on top of well established standards such as HTTP.

The metadata are presented using the JavaScript library RForms (<http://code.google.com/p/rforms>), which is tightly integrated with Confolio. The user interface of Confolio can be run as a stand-alone application or sub-elements can be embedded into other web applications (Fig. 4).

Fig. 4. Metadata records of the Green-OER collection

Due to the Semantic Web-based approach of EntryStore it is possible to collaborate loosely (Ebner et al., 2007) around metadata. A powerful outcome of this is that a resource can be annotated by multiple users without interfering with each other. In this case, the original metadata is not edited directly; instead it is enhanced by an external annotation. Confolio is currently used in several EC-funded projects for managing educational resources (Ebner et al., 2009). Both EntryStore and Confolio are available under Open Source licenses.

In the case of the Green OER collection, a new portfolio has been created in the Organic.Edunet Confolio installation and is manually populated with the metadata records of the resources that consist of the Green OER collection. These records are created using the integrated in Confolio Organic.Edunet LOM metadata application profile, which is a version of the IEEE LOM AP, properly adapted in order to meet the specificities of the Organic.Edunet collections (Palavitsinis et al., 2010). Finally, an OAI-PMH target has been created for the automatic harvesting of these metadata records by various harvesters, including the Organic.Edunet one. This methodology was based on the corresponding one that was developed during the Organic.Edunet project (Manouselis et al., 2009)

3.5 Use cases

As a first step, the Green-OER collection will be published through two learning portals; the EU-based Organic.Edunet Web portal and the US-based Green OER Commons portal.

The Organic.Edunet Web portal (www.organic-edunet.eu) is a multilingual (its user interface has been translated in eighteen languages so far) learning portal that was developed during the Organic.Edunet EU eContentPlus project (<http://project.organic-edunet.eu>). The portal provides a single point of access to almost 11,000 digital resources related to green topics, mostly organic agriculture and agroecology, but also environment, biodiversity, energy, sustainability and related topics. The initial content providers of Organic.Edunet were consortium members of the Organic.Edunet project, including a number of digital collections from European Universities along with established organizations such as FAO (www.fao.org), Organic Eprints (www.orgprints.org), Soil Association (www.soilassociation.org), Organic Agriculture Information Access (<http://quod.lib.umich.edu/n/nal>) and others. Nowadays, this number of content providers is constantly increasing and now initiatives such as Digital Green (<http://digitalgreen.org>) and Green OER-C (www.oercommons.org/green), which are closely related to the scope of the portal, are in the process of making their content available through the Organic.Edunet Web portal (Fig. 5).



Fig. 5. The Organic.Edunet Web portal

The dynamic of the Organic.Edunet web portal can be proven by the fact that during almost the first two years of its operation (January 2010 – February 2012), the portal has received more than 96,000 visits and 331,000 page views from 77,000 unique visitors coming from 186 countries all over the world. In addition, even though the visitors of the portal have full access to the content provided through the portal and the various functions offered, more than 4.300 users have registered in order to have access to a number of social navigation features, such as tagging, rating and reviewing the resources.

The Green OER collection has been created using the Confolio tool, as mentioned earlier, and features a unique OAI-PMH target. A number of metadata records describing quality open education resources are manually created on a periodic basis in Confolio by experienced staff and the records are carefully checked both in terms of content and in terms of metadata quality before they are validated by a qualified person. The validated records are then harvested by the Organic.Edunet harvester on a periodic basis and are made available through the Organic.Edunet Web portal. Both the full metadata record and the link pointing to the actual resource will be available through the portal in this step. Since the Confolio tool was developed during the Organic.Edunet project, the metadata AP integrated in the tool is totally compatible with the back-end of the Organic.Edunet Web portal, therefore no further work (e.g. mapping or adaptation) is required in order for the metadata records to be displayed correctly through the portal.

The Green OER-C portal (www.oercommons.org/green) is a learning thematic portal, dedicated to OER that deals with green topics (Fig. 6). It is a project in OER Commons developed by ISKME in partnership with Agro-Know Technologies. This portal aims to provide access to quality, green OER coming from various sources. For example, a number of the resources available through the portal are already available through the generic OER Commons portal (www.oercommons.org), so they were selected and “channeled” to the Green OER-C portal by applying the appropriate filters. Another source of OER for this portal is the contribution of resources by individuals, who are willing to register and follow the simple process of providing the required metadata description for the corresponding resources. These resources undergo a quality assurance process, during which the validity of the metadata, their relevance to the scope of the portal as well as the relation of the resource itself to green topics covered by the portal are evaluated before they are approved.



Fig. 6. Home page of the Green OER Commons learning portal

The Green OER-C portal currently provides access to almost 2,000 educational resources and the number is constantly growing. These resources are classified according to “Green Subtopics”, each one of which includes a number of thematic areas, according to the educational level/context and material type. In addition, resources can be retrieved by clicking on keywords found in a keyword cloud, which are used to label the resources. Apart from that, there is a traditional simple search and advanced search option for

retrieving resources based on text and other filters. The user community is encouraged to contribute to the portal through a variety of means; sharing new interesting and relevant resources and their quick annotation is facilitated by a bookmarking button that is available for the majority of web browsers while the tagging, rating, reviewing, sharing through Web 2.0 tools and commenting on these resources is performed through a user-friendly interface. This feedback from the user community ensures the sustainability of the portal and at the same time it provides additional value to the content available through the portal.

In order to make the Confolio-hosted Green-OER collection available through the Green OER-C portal, the metadata AP used in the collection and by the portal have to be mapped, in order to come up with a compatibility schema. This process requires manual intervention, during which the metadata elements of the AP used by the collection have to be matched to the corresponding ones of the AP used by the portal. After the mapping process is complete, the resources will be automatically harvested using the OAI-PMH target provided by the collection and the resources of the Green-OER collection will be published and available through the Green OER-C portal. As this collaboration is still in its early stages, the whole process is described in a working document, which also includes quality criteria for the content that is populating the portal.

4. Conclusions

The short overview of the corresponding available green learning portals performed by the authors of this paper revealed some of the weaknesses that are present in the context of green learning repositories and related content. Not only the resources are not always available through an organized repository or learning portal, rendering them hard to access by the average user, but in addition the majority of the portal does not have any quality criteria and collection policies available to the users, therefore one cannot be sure about the quality of the resources that he uses. In this paper we presented the case of a new digital collection with OER covering green topics, which attempts to meet the challenges raised by the aforementioned issues, as it is based on clear quality criteria and the collection/curation process of the content is clearly defined and followed by the content/metadata experts working on this collection. The application of the integration of the collection was also presented using two ongoing case studies, which present various differences.

Since the development of the Green-OER collection is still in progress various issues are expected to rise in various steps of the procedure, mostly related to the publication of the collection in various related learning portals. Most of them are expected to occur during the harvesting process, and additional effort is expected to be required towards the mapping of the metadata schema used by the collection as not all learning portals use the IEEE LOM AP. During the next months, an effort will be made towards the finalization of the quality criteria set and the development of the necessary handbook for each case, describing all the procedures and steps in details, thus minimizing the possibility of errors and questions raised regarding the process.

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