Abstract

In this article we consider the situation of OER in virtual environments taking into account accessibility aspects. We propose the utilization of accessibility metadata through a process in which students and teachers participate adapting OER in terms of accessibility. This accessibility 2.0 process is a collaborative one that adds metadata to OER in order to make the journey to and from repositories an iterative process of adaptation and improvement.

Open educational resources (OER) constitute from an economic point of view, savings in investment in educational materials, but its main importance lies on the possibility of adapting them to each educational situation. In each case, we can generate adaptations that use a language according to the aim of the community and examples that motivate and provoke engagement. OER aid teachers when preparing and planning the materials for their courses, adapting quality resources to context and specific needs.

Accessible open educational resources (AOER) constitute OER adaptations as it has been indicated by IMS Global Learning Consortium in the specification IMS access for all. AOER are fundamental in order to achieve an inclusive education that encompasses not only physical disabilities but also socio-economic marginalization. Adaptation to preferences of all kinds are the reflection of the uniqueness of students.

The AOER do not operate in isolation, but participate in educational processes within institutions that have their educational policies within the framework of the countries policies. Open educational resources, open educational practices, inclusive education and educational quality are elements that are intertwined in a more comprehensive scenario.
Within this panorama, librarians are an angular element of these processes. Traditional tasks of description and availability of resources, support to users in their informational needs, also operate in virtual learning environments and in repositories or digital libraries of OER. In addition there are new duties such as planning of support services for both students and teachers using and producing OER. Review, reuse, adaptation and remixing of OER are key processes for open education and require professional involvement to achieve these objectives.

Within virtual environment and its surroundings there are several elements acting as an ecosystem: metadata of OER, conceptual models of accessibility, Learning Management Systems and OER repositories. These elements interact through processes in which students, teachers and tutors participate. Processes are analyzed from perspective of social accessibility model. Aim is the participation of all actors involved. These processes are not confined to courses and virtual environment but extend to internal or external repositories and participation of librarians.

Strategy to achieve better access is to provide enriched information collected from participation of different actors in the contribution of metadata and qualification of needs to adapt or improve resources. This process of improvement and constant adaptation seeks to facilitate natural flows in teaching-learning process and is called “accessibility 2.0”.

Proposal is prototyped for accessibility but it is a general framework for description, use, reuse and improvement of any aspect of OER.

**Keywords:** OER, accessibility, inclusive education, inclusive librarian

**Introduction**

Open educational resources (OER) are learning resources that are published under an open intellectual license that allows free use with different purposes. They can be redesigned to adapt to different needs; they can be improved according to specific teacher needs, and they can also be remixed with other resources and distributed and shared with others.

Education and high education in particular involve using virtual environments as a framework used standalone or in a blended manner. These OER, which are displayed on these environments, become a practical tool that helps a growing number of students to accomplish educational activities.

OER are also an opportunity to bring down costs on the creation of educational resources but one of the most relevant aspects is that they can adapt to each educational situation and be reused as personalized educational quality content.

All students are different; they come from different socioeconomic situations; they have difficulties in certain areas of knowledge, have different learning styles, have different expectations or motivations and have disabilities that prevent their access to learning content. In brief, they are completely different but equal in their right to access education. Education is a human right and is a social, economic and political integrator. Teachers have an ethical commitment to articulate this right. The message of UNESCO (UNESCO, 2017) is:

> …every learner matters and matters equally. The complexity arises, however, when we try to put this message into practice. Implementing this message is likely to require changes in thinking and practices at every level of an education system, from classroom teachers and others who provide educational experiences directly, to those responsible for national policy.

Technological advances in the Information and knowledge society have triggered deep changes in all subjects and these are still being processed. In this scenario, Manuel Castells has stated the need for changes in traditional education practices from information transmission to innovation, experimentation and promotion of autonomy. He also pointed out the need for a new teacher role. (Castells, 2000).
The teacher’s role is changing, mainly in higher education institutions. Teachers have become tutors, guides, motivators. A teacher is somebody who sets challenges, who focuses on innovative pedagogies, who promotes participation and collaboration, and their hierarchical role comes from a process in education community rather than from the Educational Institution. This new role may be accomplished in a virtual environment or a hybrid one. This new teacher’s role sets new challenges where OER become an opportunity, a support artifact and a starting point to build personalizations that match each situation.

OER can help improve educational quality as they are involved in iterative processes of reuse, revision and adaptation. In this paper we focus on getting accessible OER and the role that librarians may have in supporting inclusive education. Accessibility (AENOR, 2012) refers to the condition that environments, products and services must accomplish to be understandable, usable and practicable by all people. This definition is not focused on a medical problem or a concrete disability that can be treated in isolation but it places emphasis on the diversity of people and situations related to access and on the fact that this access must be granted in a general form.

**Conceptual framework**

We will analyze some aspects that are brought together in the topic:

**Social model of disability**

In each historical stage, society beliefs and customs build the notion of disability. The medical model of disability begins after world wars and emphasizes impairment in medical terms. This model promotes that persons with disabilities receive special education separated from the rest of the students. (UN, 2006) recognizes that disability is an evolving concept and that disability results from the interaction between persons with impairments and attitudinal and environmental barriers that hinder their full and effective participation in society on an equal basis with others. The notion of disability, beyond functional diversity, lies on the limitations that the society imposes. Social model conception of disability breaks down with the standardized model that presents an equal solution to all and does not cater for individual needs. On the one hand, there exist limitations, and on the other hand attitudinal barriers or environmental barriers imposed by limitations. The model advocates acceptance of human diversity and focuses on how to proceed in terms of educational inclusion. (Palacios, Agustina, 2008) expressed that:

“...deficiency – or functional diversity -would be that characteristic of a person that consists of an organ, a function or a mechanism from the body or the mind that does not function or that does not function in the same way in most people. On the contrary, disability is composed by social factors that restrict, limit or prevent persons with functional disability from living in society. This distinction allowed for the construction of a model that is known as “social” or as “social barriers” of disability. In this way, if in the rehabilitation model the disability is derived from an individual pathology, in the social model it is seen as a result of social barriers and power relationships, rather than an inevitable biological destiny”

**Accessible OER**

An accessible OER is one that is created taking into account recommendations for accessibility like WCAG and will include accommodations for different physical disabilities, learning disabilities and cognitive limitations. “Nucleo REAA” (Accessible OER group) is an interdisciplinary research group in the University of the Republic in Uruguay that integrates fields like Education, System Engineering, Librarianship, Sociology, Social Labor, Communication and Law. “Núcleo REAA” considers that OER accessibility refers not only to having access to the content of resources using sensorial capacities, but it also considers access to resource conceptual content including pedagogical and cognitive aspects. Accessible OER are seen as part of a wide ecosystem of subjects that covers inclusive education, accessibility on Learning Management Systems, OER repositories, creation, usage and reuse of OER, OER metadata, OER quality, data analytics, OER semantic recommendation and legal framework. In this paper accessible OER are considered with relations to OER metadata, Learning Management Systems and OER repositories.
OER metadata helps us to retrieve an adequate OER for our needs in a repository. OER metadata will inform us if there are different adaptations of the OER in it, if there exists a translation to another language, a version that is adequate for low vision or another one with captions for hearing impairment. OER metadata can even inform us about OER quality or usage, or what comments a teacher who used it has made, and so on.

The accessible OER group (Núcleo REAA) is an interdisciplinary research group which belongs to the University of the Republic in Uruguay that integrates fields such as Education, System Engineering, Librarianship, Sociology, Social Labor, Communication and Law. “Núcleo REAA” considers that OER accessibility refers not only to access to the content of resources using sensorial capacities, but it also considers access to resource conceptual content including pedagogical and cognitive aspects.

Usage of metadata to evaluate OER is mentioned in the ESVIAL project (Proyecto ESVIAL) and this evaluation was carried out by all the end users, experts and community actors involved. This evaluation also took into account content comprehension from different needs profiles and pedagogical objectives of the educational resource. (Moreira, 2013)

Librarians are community actors that can describe OER in repositories and LMS. Librarians manage metadata standards, manage specifically accessibility metadata that can lead to different adaptations. Librarians are also involved in teaching about generating digital accessible content. Librarians are involved in creating accessible digital content.

In this line we can also mention librarians fostering easy reading adaptation of content (DISCAPNET), that consists of an adaptation to make content clearer and easier to understand to users with intellectual disabilities.

**Concept Model “IMS”**

Underlying the idea of OER metadata there is a more comprehensive conceptualization that takes into account two entities: OER and students and how they interact. This conceptualization is developed by The IMS Global Learning Consortium (IMS).

IMS is an organization that strives to enable the adoption and impact of innovative learning technology. It is formed by educational institutions, suppliers, and government organizations that develop open interoperability standards. IMS raises a double perspective, the one of the user and the one of the educational resource. What is desirable is that a matching is done between user needs and OER characteristics. If there is no coincidence, then an OER adaptation is needed. There is a user specification -Personal Needs Preferences (IMS PNP, 2012) - that establishes the user needs and preferences profile.

In this profile there is an attribute called “Access mode” that can be defined as a sensorial or cognitive way in which a person can process or perceive information. Access mode domain can be: textual, visual, auditory or tactile. Textual means that a text format can be read by a screen reader.

The resource also has a specification (IMS DRD, 2012) that establishes the resource access mode.

IMS establishes a conceptual model, an abstract way of thinking about the situation as it is shown in illustration 1. OER metadata schemas implement this conceptual model and express it its own way.

Illustration 1. IMS concepts

DRD and PNP specifications work together to provide students with those resources that match their needs and preferences.

The original resource has an access mode and can have many OER with different adaptations that constitute different versions (subtitle, short text, long text) with adapted access mode.

The concepts models that underlie the specification are independent from a representation or technological deployment in particular.

The model foresees extensions from a common core that can be extended for specific situations. The common core interoperability is accomplished and the extensions permit flexible personalization to adapt to students’ specific needs.

**Learning Management Systems (LMS) and repositories**

1 http://www.bibliotecaaccesible.ei.udelar.edu.uy/
OER repository is something similar to a digital library or a digital collection but repository items are more heterogeneous than in a library. Taking a look at Merlot repository for instance (http://info.merlot.org/merlothelp/topic.htm#t=MERLOT_Collection.htm) we can observe that items are in different formats, cover different topics, are different in their pedagogical format, and as a result, the strategy to locate an OER is essential and also the metadata that describe OER as the other face of the same situation. LMS are the places where teachers produce or present OER in their courses. These OER can be stored in institutional repositories or can be kept in the LMS inside the course. Metadata of OER in LMS is generally functional to the service that the LMS offers and are of a general descriptive type.

If OER are stored in an institutional repository, then they can be shared with other repositories or federation of repositories. From these repositories OER can go to other courses of other teachers in other institutions that will reuse them just the way they are or create new versions or versions adapted to accessibility requirements. The European project eu4all yet in 2010 posed that inside virtual environments, the librarian had a role adding and adjusting OER metadata and particularly providing accessibility metadata as it is shown in Illustration 2. Grupo de Investigación AdeNu (2015) from UNED in EU4forall project explained that in OER metadata repository (MR) - which is a repository of accessibility characteristics of OER and other activities – there are two roles connected with performing improvements in accessibility: transformation technicians and librarians. Both roles involve making OER accessibility adaptations and setting accessibility metadata.

Mortera Gutiérrez (2009) states that librarians contribute not only to setting OER metadata but also to evaluating metadata to ensure OER quality.

Illustration 2.Actors in LMS schema (retrieved from EU4all presentations)

OER Metadata

OER are mainly located in LMS or OER repositories that constitute something similar to virtual libraries. OER must be catalogued and indexed to encourage discovery and reuse. Cataloguing OER means adding metadata that describe OER characteristics with an appropriate schema that permits information retrieval. Indexing OER is the addition of a subject access point that behaves in the same way as any other type of resource. Discovery and reuse operations are joined. First of all, we have to locate the OER that suits our needs and then we can reuse it without changes or we can adapt it to our specific situation creating in this way a new version that is linked to the original but constitutes a variation. OER reuse allows for increased quality and gets more productivity in LMS (Sans Rodríguez, 2008).

Wiley [11] considers that metadata are formed by a set of information to describe a resource using a standardized structure, making the retrieval and access to OER possible. Metadata have great importance in this process of openness, use and reuse, because metadata improve OER location. If the metadata schema considers accessibility, it permits specific retrieval according to the accessibility needs of the user. OERs have general metadata as any other resource but it also has specific characteristics inherent to the field of education. General metadata can be described using for instance Dublin Core schema 4 but this type of general schemas do not cover specific or relevant aspects of OER. To catalogue these aspects, an appropriate metadata schema must be used. That is the case of LOM (Learning Object Metadata) that consider relevant learning attributes from resources.

LOM and its profiles have entries to describe accessibility in accordance with IMS and so does Agent-Based Learning Objects Metadata Standard - OBAA - a schema that was born as a variation of LOM.

2 https://www.tecnologiasaccesibles.com/es/proyectos/eu4all
3 https://www.uned.es/universidad/inicio.html
4 https://www.dublincore.org/
Metadata are also important to interoperate between different repositories, or federation of repositories and virtual environments.

Librarians must play an active role describing and indexing OER and also assessing teachers or designers on OER.

Proposal

From analyzing OER metadata and specifically accessibility aspects we propose a minimal accessibility metadata set, taking into account the IMS model (Temesio, 2017)

Taking LOM as a basis, slight changes are proposed such as the ones displayed in illustration 3:

- Creation of an accessibility category with one metadata, access mode.
- In the LOM category, “relations”, the relation “is equivalent (accessibility)” and its inverse “has equivalent (accessibility)” are included as can be seen in the illustration. This added element allows a given OER to find its adaptations or in some cases an adaptation finds the original OER.
- In the category “Annotations”, where comments regarding accessibility are included, the metadata access mode is introduced, when it is added as a comment proposed by another actor different from the author and the role of the person who makes the comment (student, professor, librarian, etc.). These comments are a way of participating and collaborating to improve the accessibility process, as an “accessibility 2.0”.

Illustration 3. Lom changes proposed

This metadata and the IMS model are included in the LMS and a prototype to Moodle is downloadable at:

- https://sourceforge.net/projects/accinform/
- https://sourceforge.net/projects/accinformacionrecursos/

The prototype implements the situation when a student within a course in LMS finds a resource and he/she cannot access it and then:

- he/she can find if the resource has adaptations that match their needs and preference profile and ask to be included in the course.
- if the resource does not have an appropriate adaptation then the student can make comments about the situation in order to initiate a process in which a teacher can make the necessary adaptations.
- if the resource has incorrect metadata and it is not completely appropriate, the student can give adequate metadata and can explain the problem by writing a comment. That could be the case when a student has accessed mode text and the resource has images without an alternative text that cannot be read by a screen reader. In this case, the OER is tagged incorrectly as text because there are images that are not described. In this case the student explains the issue and the resource is tagged as visual access mode too, indicating that visual parts are not being described. Later, this OER can be adapted to the required comment, and the tutor inputs the images descriptions.
- Another case could be when a tutor or a teacher finds that the alternative text in images is confusing so he/she comments on the need to provide a long description adaptation to images. These comments facilitate the adjustment of OER accessibility.

The Prototype also implements some duties at teacher level:

- Permits the tagging of OER access mode, which means that teacher can input the corresponding value to metadata access mode (text, visual or auditive) when the OER is uploaded.
- Permits the declaration of OER adaptations and the relationship with the original OER so students can find the required resources.
- Permits the export of resources with all this rich metadata. The metadata of an OER is accompanied by its access mode, equivalent resources that have different adaptations tagged with their access mode, and all the comments, with correction to tagging and source (student, teacher, librarian, other). The tagging source might be different according to the stage the course is in: student or tutor during performance, teacher or
librarian during course evaluation or implementation. Librarians can be part of a team in the process of improving accessibility and quality at the level of a course or a program with several courses. The next video shows how the plugin acts according to the prototype described above.

https://youtu.be/9T3S7zmwa6o

When the OER goes from LMS to an institutional repository to be shared, all this metadata is exported, too. For instance, OER1 is exported and the metadata gives information of access mode of OER1 and if there are adaptations (i.e. OER2) this is stated and also the access mode of adaptations and all the comments about OER1, OER2 and all the adaptations mentioned and the source of these comments. The information is standardized and can be exported and imported between different frameworks in an interoperable way.

Accessibility is not seen as a static phase, but as a dynamic process in which the student, the teacher, the tutor, the librarian and everyone in general who is involved can participate and collaborate to accomplish improved resources and variations that lead to accessible and quality content. Accessibility is the process in which several actors participate: some asking for accessible resources, some correcting qualification of accessibility, some generating adaptations, some reusing other adaptations and improving them, some giving access to resources and adaptations with their metadata, some generating metadata, and so on. These processes occur at different stages and in different frameworks, and the path changes. Nevertheless, we don’t know what paths we can add or how we can get rich information on the resources at each moment. (Temesio, 2016).

This proposal is prototyped for accessibility but it is a general framework for description, use, reuse and improvement of any aspect of OER. The proposal is to improve any aspect of OER in a collaborative way.

Conclusions

We have briefly described an ecosystem where OERs participate as well as accessibility aspects in order to outline the complexity in which diverse actors and elements participate.

In this outline some considerations need to be made:

- Metadata usage and the adherence to standards are important. By doing so OER can be described and its accessibility aspects as well.

- OER must be analyzed and evaluated in a learning-teaching context, in the course where OERs are used and where students’ needs and preferences have an important role. OER users are the most significant element to evaluate OER accessibility because they can say if an OER is appropriate for their needs and preferences and can suggest how it could be improved.

- Librarians can contribute with adequate metadata and by doing so they help manage OER collections and “Accessibility 2.0”. Librarians manage OER metadata schemas, so they can input metadata, can help by explaining how to input metadata to producers, teachers or students and can add accessibility metadata when testing OER.

- Librarians can participate in adaptation processes and particularly in terms of accessibility and also collaborate in teachers’ training to produce accessible OER. Participation of librarians in multidisciplinary groups and technical offices that adapt and adequate OER to the culture and context in which those OERs will be used is of great importance.

- Librarians have a reference expertise and in this case applied to LMS and OER repositories are fundamental to support proper characterization that facilitates reuse.

These are some activities that information professionals can develop. There are certainly others which have not been mentioned. To accomplish these activities, there is need to train on this expertise area and spread this knowledge participating in inclusive education processes. We can call this librarian an inclusive librarian. A librarian that has knowledge about creating accessible content, that has knowledge about accessible OER metadata, that has
knowledge about exploring repositories to get adequate OER and its adaptations, and in general has the training to support teachers and students on aspects related to accessibility.

Education Institutes are changing and libraries inside them too. Libraries have new goals, new users, new ways of finding and producing information, new ways of practicing reference.

Nevertheless, librarians will always have a role to support education, to support inclusive education, to move to new scenarios, to participate in the processes to support all students, as diverse and unique as they are.

References


WCAG. Web Content Accessibility Guidelines. Retrieved from https://www.w3.org/WAI/standards-guidelines/wcag/