Editorial policies

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The aim of Open Praxis is to provide a forum for global collaboration and discussion of issues in the practice of distance and e-learning.

Open Praxis welcomes contributions which demonstrate creative and innovative research, and which highlight challenges, lessons and achievements in the practice of distance and e-learning from all over the world.

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If our first issue in 2013 (vol. 5 issue 1) was focused on openness in higher education, again an Open Praxis issue is devoted to open education. In this occasion, the special issue is the result of an agreement between ICDE and the OpenCourseWare Consortium (OCWC) and a collaboration with Open Praxis since May 2013 to feature, in the journal, research presented at the 2014 OCWC conference, held in Ljubljana (Slovenia) in April 23–25.

The selected papers presented in this issue make visible at least two significant and complementing aspects:

• The breaking relevance of openness as a concern in education. In this sense, the recent election result deciding that the name of the OCW Consortium will change to the Open Education Consortium (http://www.ocwconsortium.org/news/2014/04/election-process-and-results/) is a meaningful shift that puts the focus in education and, specially, in the meaning of “open” in education. This emphasis in conceptualizing openness and translating it into policies and practices addresses us to both refine our epistemological position and widen our perspective when reflecting this approach in education.

• In this sense, this issue makes visible the wide range of dimensions that openness relates to; beyond OpenCourseWare and OER -traditionally- and beyond MOOCs -more recently-, openness expands its tentacles to very diverse pedagogical, technological and political issues, at the core of education: assessment, mobility, reuse, metrics, economical implications, among others. The potential that the arisen discussions and conclusions can have in education in general (and not only in open education) can be easily appreciated.

As stated in the website (http://conference.ocwconsortium.org/2014/about), the OCW Consortium global conference is the annual opportunity for researchers, practitioners, policy makers and educators to deeply explore open education and its impact on global education. Participants have the opportunity to share ideas, practices and discuss issues important to the future of education worldwide. The conference covers new developments in open education, research results, innovative technology, policy implementation, best practices and practical solutions to challenges facing education around the world. The convergence of these topics with those of interest for Open Praxis, as stated in our website (www.openpraxis.org), has facilitated the partnership for the preparation of this issue.

Papers submitted for publication in Open Praxis followed a separate review process. Submissions were first reviewed by the OCWC 2014 Programme Committee for inclusion in the conference; those accepted for presentation and best rated by the committee were then recommended to Open Praxis for peer review and possible inclusion in this issue. The papers followed the usual submission guidelines in Open Praxis; additional revisions were requested during the peer review process, and finally nine papers were accepted for publication. These papers fit the conference general strands:
• **Open Educational Policies**: policy issues and their impact on open educational practice, including licensing issues, alternative business models, cooperative efforts and governmental funding. Four papers relate to this track.

• **Pedagogical Impact**: novel uses of Open Educational Resources and their impact on education, analysis of the impact of Open Educational Resources on the learning process itself, as well as deployment of OERs in MOOCs, flipped classrooms, hybrid educational approaches and online education. Two papers deal with topics related to this theme.

• **Research and Technology**: new technologies allowing scaling and sharing of Open Educational Resources in a faster or more economical way, to index the multimodal and multilingual material, or to navigate and remix available material. Three papers fall within the spectrum of this strand.

Following the usual paper types published in *Open Praxis*, the papers have a research-oriented approach and/or an innovative practice character.

The first two papers focus on national open educational resources (OER) policies and strategies, located in a country in the first case (the Netherlands) and in a wider region in the second case (different Latin American countries).

Robert Schuwer, Karel Kreijns and Marjan Vermeulen (*Wikiwijs: An unexpected journey and the lessons learned towards OER*) analyze a five years program for the use, creation and sharing of OERs and identify seven valuable lessons learned. They do so based on three theoretical models and highlight aspects to consider in the future of this program or in similar ones, among which quality, support and clear policies are pointed out.

Amalia Toledo Hernández, Carolina Botero and Luisa Guzmán (*Public Expenditure in Education in Latin America. Recommendations to Serve the Purposes of the Paris Open Educational Resources Declaration*) also analyze some national contexts in relation to the use of educational content -mainly textbooks- and provide recommendations for developing policies supportive of the use of OERs, specially remarking economic aspects. The paper presents a summary of an extended report funded by UNESCO.

The third paper relates to strategies, benefits and policy implications of MOOCs. Andy Lane, Sally Caird and Martin Weller (*The potential social, economic and environmental benefits of MOOCs: operational and historical comparisons with a massive “closed online” course*) present a critical review of the impact of MOOCs and compare the analysis with those traditionally done with regards to open and distance education in general. The questions they formulate throughout the paper will surely promote reflection and discussion, in an effort to get further in the research and debate in the re-conceptualization of higher education.

The last paper on the open educational policies strand focuses on alternative forms of assessment and accreditation using OER. An international team composed by Rory McGreal, Dianne Conrad, Angela Murphy, Gabi Witthaus and Wayne Mackintosh (*Formalising informal learning: Assessment and accreditation challenges within disaggregated systems*) draws a new scenario, reflected in the case or the OER universitas. This partnership of 30 institutions conceives an accreditation model whose characteristics and challenges are explained in the paper.

A second set of papers is related to pedagogical impact of open education. Two papers deal with very different topics: maximizing student mobility with OER and making MOOCs truly open.

Frederik Truyen and Stephanie Verbeken (*Scenarios for the Use of OpenCourseWare in the Context of Student Mobility*), within the frame of a European project and handbook focused on student mobility, identify the roles that OpenCourseWare can play in the different phases of the mobility cycle, from helping students to choose a course to facilitating professional training. A specific section is dedicated to virtual mobility as an alternative.

*Open Praxis*, vol. 6 issue 2, April–June 2014, pp. 87–89
José Vida Fernández and Susan Webster [From OCW to MOOC: Deployment of OERs in a Massive Open Online Course. The Experience of Universidad Carlos III de Madrid (UC3M)] relate the process of converting an already tested OpenCourseWare into a MOOC. They describe in detail the undertaken steps and compare the two experiences, identifying both drivers and difficulties.

The last section comprises three papers under the research and technology strand, dealing respectively with multilingualism in OpenCourseWare, MOOCs related research and usability.

Darya Tarasowa, Sören Auer, Ali Khalili and Jörg Unbehauen [Crowd-sourcing (semantically) Structured Multilingual Educational Content (CoSMEC)] propose a concept to create multilingual content with the participation of the crowd and not only experts. Based in previous works by this group and in an implementation developed with SlideWiki, they explain the CoSMEC concept and its evaluation. The results support the viability of the concept and suggest new possibilities to continue working in the conversion of educational resources into multilingual content objects.

Nelson Piedra, Janneth Alexandra Chicaiza, Jorge López and Edmundo Tovar (An Architecture based on Linked Data technologies for the Integration and reuse of OER in MOOCs Context) explore how to reuse, integrate and interoperate isolated OER repositories using Semantic Web Technologies. They present an OER recommender model and an example of implementation, with the purpose of helping MOOC designers in the process of selecting OERs.

Finally, Jaclyn Zetta Cohen, Kathleen Ludewig Omollo and Dave Malicke (A Framework to Integrate Public, Dynamic Metrics Into an OER Platform) narrate their experience of inclusion of dynamic metrics and analytics into their OERs. They have collected feedback from different types of people involved with these OERs (faculty, librarians, etc.) and highlight the benefits of the availability of the data, thus providing useful information to other OER platforms that don't have such a project for metric-sharing.

It is our wish to contribute to the current debate about open education with the papers compiled in this issue.

We specially thank from Open Praxis to the reviewers that have participated in this issue, whose useful comments the diverse authors have reflected in the final and published versions of their papers.

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Wikiwijs: An unexpected journey and the lessons learned towards OER

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Abstract

The Dutch Ministry of Education, Culture and Science has funded a five years program to encourage the use, creation and sharing of Open Educational Resources (OER) by teachers from various types of education. This program is known as Wikiwijs. Ultimo 2013, the program has come to an end. As some of the assumptions at the start of Wikiwijs proved to work out in unexpected ways the lessons learned could fuel the next steps in developing Wikiwijs. Besides, other national initiatives on _opening up education_ may also benefit from the lessons learned reported here.

The main conclusion from five years Wikiwijs was that to accomplish mainstreaming OER, the Wikiwijs program should go along with other interventions that are more oriented toward prescriptive policies and regulations. In particular: the Dutch government should be more directive in persuading executive boards and teachers on schools to adopt OER as an important part of educational reform and the acquisition of 21st century skills.

Keywords: Wikiwijs; Open Educational Resources; OER; Open education; OER policy; repository

Introduction

The Wikiwijs program was launched early 2009 by the Dutch ministry of Education, Culture and Science to encourage respectively using Open Educational Resources (OER), creating OER, and sharing OER by teachers in every sector of education (Plasterk, 2009; Schuwer & Mulder, 2010). In other words, the Wikiwijs program should be useful for primary education as well as for higher education. In this article, the Wikiwijs program is shortly noted as Wikiwijs and the three behaviors (i.e., using, creating, and sharing) are collectively referred to as adopting OER.

The following definition of OER was used in Wikiwijs:

OER are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use or re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge (Atkins, Seely Brown & Hammond, 2007, p. 4).

The Wikiwijs program was implemented by the Open Universiteit of the Netherlands and Kennisnet, the public (semi-governmental) organization aimed to support and inspire Dutch primary and secondary education and vocational institutions in the innovative use of ICT (See [http://www.kennisnet.nl/over-ons/international-visitors](http://www.kennisnet.nl/over-ons/international-visitors)). The authors of this article were involved as project leaders or as members responsible for content related issues and research activities.
Worldwide, Wikiwijs was the first national program aiming at mainstreaming OER for all sectors and levels of education (Schuwer, 2013). Other previous approaches had limitations; the OER initiatives in Brazil, for example, focused on only the professionalization of teachers (Inamorato dos Santos, 2011) and the Open Book Project in the USA was limiting OER to only the Arab language (see: http://www.state.gov/p/nea/openbook).

Because the program was planned for the duration of five years, ultimo 2013 it has come to an end. Looking back at these five years, many challenges have crossed the path. Some of those were dealt with success, other still remain. Also, many results and lessons learned can be taken away. The most visible aspect of Wikiwijs, the portal of the Wikiwijs repository (i.e., the Wikiwijs website http://www.wikiwijsleermiddelenplein.nl) with access to over 635,000 OERs, will be continued and continuously improved by Kennisnet.

In this article we share some of our experiences on Wikiwijs and the lessons we learned. In order to explain why things went wrong or went in unexpected directions, we used the PRECEDE—PROCEED model (Green & Kreuter, 2005), the Reasoned Action Approach -RAA- (Fishbein & Ajzen, 2010), and Self Determination Theory -SDT- (Deci & Ryan, 2000). Using these models and theories we got a better insight in the problems that raised during the Wikiwijs project and a better understanding of the lessons learned. Whilst some of the problems could have been foreseen, other problems were unpredictable at the time the Wikiwijs project started.

This article starts with a description of the Wikiwijs program, its aims and strategies to encourage the adoption of OER. The article proceeds with the theoretical framework and presents the three models and theories: PRECEDE—PROCEED, RAA, and SDT. We discuss them briefly as this article is not presenting an empirical study but it is providing some insights in those factors that might have caused the problems. These problems form the next topic and the lessons learned from it. The article ends with a conclusion and discussion, and some recommendations.

The Wikiwijs Program

The Wikiwijs program has the vision of improving the quality and accessibility of education by means of OER. In that regard, the aim of Wikiwijs is to encourage the adoption (i.e., using, creating, and sharing) of OER by teachers. Activities in the program addressed both creating awareness on OER to both teachers and policy makers in educational institutions and the provision of support for using, creating and sharing OER.

To this end the Wikiwijs program has formulated a number of principles:

- The first principle was that whilst Wikiwijs has its own repository with OER it should also act as a referatory to other OER collections. This principle would make Wikiwijs a “one stop shop” for teachers searching for OER.
- The second principle entailed that all OER must be open and accessible (otherwise it wouldn’t be OER). The Creative Commons license model was chosen to regulate this openness and accessibility of OER. OER shared in the Wikiwijs repository was published with either a CC BY (reuse with the obligation to attribute the original author) or a CC BY-SA license (reuse with the obligation to attribute the author and to use the same open license when republishing); the license type was determined by the author of the OER. OER for which Wikiwijs was a referatory were outside of the influence of the Wikiwijs program. Therefore, Wikiwijs could not prescribe the license to be used for these OER.
- The third principle meant that Wikiwijs would not pay for the development of content or redeem rights for content from third parties to publish them as OER, because it would otherwise be considered as potentially disruptive for the commercial publishers.
• The fourth principle prescribed that all learning materials would be adequately described using meta-data in accordance with a standard for the Netherlands.
• The fifth and final principle was to provide sources for self-study for teachers to improve their knowledge and competences in creating and using digital learning materials.

State of Affairs after five years Wikiwijs

In 2013, 3277 remixes were made using the Wikiwijs remix tool. A remix consists of a combination of several learning materials, thus yielding a new learning material. Of these remixes, 1229 (38%) were shared with the world. The remaining remixes were shared in a closed environment (e.g., they were only shared with colleagues or trusted parties). Ultimo 2013, 9786 users of Wikiwijs had created an active profile (meaning that at least one adaptation was made to this profile by the user). In 2013, the number of downloads, uses of shared remixes within Wikiwijs and uses of references to external OER collections for which Wikiwijs was a referatory totaled to over 1M. In 2013, the site had about 200K visits. Teachers differentiated between two types of OER: OER comprising lessons or courses and OER that were half products and, thus, where some rework or remix has yet to be done (e.g., a pedagogy or an assignment has to be added). Ultimo 2013, 11,000 lessons and courses were shared using the Wikiwijs repository and over 70,000 referrals to lessons and courses. The total number of OER was over 635,000.

Theoretical framework

To understand the lessons learned, discussed in the next section, the PRECEDE—PROCEED model of Green and Kreuter (2005) is used. Whilst this model is very well known in the domain of health education and health prevention, the model is fairly unknown in the OER domain. Yet we believe that this model is quite applicable to our OER domain so to develop interventions that encourage the use of OER by teachers. The PRECEDE—PROCEED model was used in conjunction with two other theories, namely the Reasoned Action Approach of Fishbein and Ajzen (2010) and Self Determination Theory of Deci and Ryan (2000). We describe each of these models and theories shortly.

The PRECEDE—PROCEED model

The PRECEDE—PROCEED model has two components that should be considered. The first component is the “educational diagnosis” PRECEDE; the acronym stands for “Predisposing, Reinforcing, and Enabling Constructs in Educational Diagnosis and Evaluation.” The second component is the “ecological diagnosis” PROCEED; this acronym stands for “Policy, Regulatory, and Organizational Constructs in Educational and Environmental Development.” These two components represent respectively the individual, the social and environmental factors that influence teachers’ behavior to adopt OER.

In PRECEDE, the predisposing factors encompass the individual’s or population’s values and beliefs, attitudes, self-efficacy, perceived norm, descriptive norm, knowledge and skills, intention, awareness, etc. Reinforcing factors are strengthening the intention to perform certain behaviors because the behaviors are positively evaluated by others or because of the feedback given by them or the confirmation that the performed behaviors do satisfy expected behaviors. Enabling factors are those affordances of the environment that make it possible that certain behaviors can be performed. They refer to the financial, technical, and the organizational resources that can be utilized to perform the desired behaviors (i.e., using, creating, and sharing OER). A lack of these enabling factors may inhibit the performance of the desired behaviors.
In PROCEED policies, regulations and organizations should help to realize the adoption of OER by teachers. PROCEED, thus, pays attention to the implementations aspects of an intervention that should encourage the adoption of OER. This holds that care should be taken for involving all potential stakeholders, that policies are formulated by the government which, in turn, require the formulation of regulations to ensure that these policies become maintained. An organization should be setup to be responsible for the implementation of the intervention (i.e. the Wikiwijs program) and the deployment of it.

**Reasoned Action approach (RAA)**

Central in RAA (Fishbein & Ajzen, 2010) is intention. Intention is a predictor of the actual adoption of OER by teachers and is itself predicted by teachers’ attitude toward the adoption of OER, perceived norm to adopt OER, and perceived behavior control regarding the adoption of OER.

Teachers’ attitude can be defined as the overall feeling of sympathy or antipathy towards the consequences when adopting OER or when using the Wikiwijs repository or a Wikiwijs tool. Perceived norm is a form of social influence which is pressuring (Ajzen 1991; Fishbein & Ajzen 2010) and can be defined as a person’s aggregated belief that most people who are considered important (e.g., the school director, colleagues) think that he or she should adopt OER, the Wikiwijs repository or a Wikiwijs tool.

Perceived behavior control or self-efficacy refers to “people’s beliefs about their capabilities to exercise control over their own level of functioning and over events that affect their lives” (Bandura, 1991, p. 257). Self-efficacy, in other words is about the convictions a teacher has in actually adopting OER and his/her ability to overcome the impediments that hinder the adoption of OER.

**Self-Determination Theory (SDT)**

SDT (Deci & Ryan, 2000) purport that the satisfaction of three psychological needs, namely competence, relatedness and autonomy, are innate conditions for teachers’ motivation to adopt OER, the Wikiwijs repository or Wikiwijs tools. As a consequence of the striving to satisfy these needs the motivation will be controlled versus self-determined or intrinsic.

Intrinsic motivation refers to the state of fun and pleasantness one expects. Controlled motivation means that the motivation is external and in its most extreme manifestation one is forced to perform a certain behavior; the latter is referred to as extrinsic motivation. With respect to the basic needs, autonomy refers to the need of self-regulation regarding the adoption of OER. The concept is generally described by Deci and Ryan (2000) as “the organismic desire to self-organize experience and behaviour and to have activity be concordant with one’s integrated sense of self” (p. 231). It is the feeling that one is the origin of one’s action.

Competence, according to Ryan and Deci (2004) is the feeling that one is effective (in adopting OER), and that there are sufficient opportunities to demonstrate efficacy. Relatedness is the feeling that one is connected and valued by others and that one experiences a sense of belonging with respect to the adoption of OER.

RAA and SDT are models that show the theoretical relationships between all the variables, the PRECEDE—PROCEED model is more an approach for developing and planning interventions based on the insights that emerged from RAA and SDT (or from any other theory) and as such, does have phases and procedures. Also, the PRECEDE—PROCEED model helps policy makers to formulate the policies and strategies that encourage the adoption of OER and to create an organizational structure that support and evaluate teachers’ OER adoption.
Past research on the use of ICT by teachers has shown that teachers are generally reluctant to use ICT in their pedagogical practices (Becta, 2010). Indeed Ward (2005) pointed out that professional development of teachers regarding the educational use of ICT and the availability of a high tech ICT infrastructure in schools does not mean that teachers are going to use ICT. This may also be the case for OER. Or, in other words, the availability of high quality OER or the availability of sophisticated tools to create OER and to share OER does not necessarily implicate that teachers will adopt OER. Other factors may play an important role in the decision process of the teachers whether or not adopt OER.

Kreijns et al. (2013) suggested that psychological dispositions such as attitudes towards using, creating and sharing OER, and task and environmental factors such as the school and even the regulations of the Ministry may determine teachers’ intentions, and consequently teachers’ behavior. In addition, motivational factors may play a role in the teachers’ decision processes. Kreijns et al. (2014) demonstrated that self-determined motivation was affecting teachers’ attitudes and, therefore, teachers’ intentions to use OER.

Problems and Lessons Learned

Lesson One: Quality is important

It was assumed that all OER entered into the Wikiwijs repository have an acceptable degree of quality. This turned out not to be true. Teachers were complaining that some of the OER they accessed through the Wikiwijs repository were beneath standards. Teachers, therefore, tend not to visit the Wikiwijs repository anymore when they too often find OER that do not meet the quality they want. Besides, the image of Wikiwijs was becoming to be damaged.

The Reasoned Action Approach does predict that quality of OER in terms of perceived usefulness and perceived usability (i.e., ease-of-use) determine teachers’ attitudes towards OER which in turn directly influence intention to use OER. If these attitudes are very negative, then it does not matter whether or not teachers have high levels of perceived behavior control or that they perceive social pressure to use them. Many studies either using RAA (or a “stripped down” version of it known as the Technology Acceptance Model; see Davis, 1986) have shown how important quality is and how it affects attitudes and intentions (e.g., Adeyemo, Adedoja & Adelore, 2013). From these two frameworks it is “logical” that teachers won’t visit the Wikiwijs repository when the quality of OER is questionable.

It was also assumed that it was completely unnecessary to have any quality assurance system, because Wikiwijs assumed a self-regulatory system on quality having teachers as owners; a teacher would know best what quality he or she need. During the program, however, it turned out that teachers needed some yardstick on quality to use for their own OER. Wikiwijs therefore defined a minimum quality model (Schuwer, 2012). This minimum quality model addressed the types of errors that were most reported by users of Wikiwijs by defining quality criteria for each type of error. The quality criteria were categorized in two classes: must-haves and nice-to-haves. Table 1 lists the criteria encompassed by the minimum quality model.

Also, a system of quality marks was established. Each organization or group that can judge on the quality of OER is allowed to act as an issuer of quality marks. These organizations or groups actively search for OER available in the Wikiwijs repository and judge if these OER comply with their quality standards. If this is the case an icon representing the quality mark marks the material. The introduction of quality marks potentially makes quality of OER measurable and transparent.

Finally, it was taken for granted that teachers as users from OER would improve OER that do not meet the quality standards. Based upon our current experiences with Wikiwijs OER, we have no
indications that this assumption will prove to become true. To support this observation with empirical data, we currently are administering a questionnaire that addresses this issue.

Summarized: the lessons learned is that we must not underestimate the role that quality of OER have in the usage of OER and Wikiwijs. In addition, we may not assume that all Wikiwijs OER have acceptable quality thereby removing the necessity to have some form of quality assurance. These lessons learned are in accordance with the research described in (Atenas, Havemann & Priego, 2014).

**Lesson Two: Creating OER is a collective activity**

Initially, it was assumed that teachers would create OER on their own. The tools offered by Wikiwijs to create OER was, therefore, oriented towards the individual teacher. However, it slowly became

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**Table 1: Criteria encompassed by the minimum quality model**

<table>
<thead>
<tr>
<th>#</th>
<th>criterium</th>
<th>description of the criterium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Category 1: Must have</strong></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>No spelling errors</td>
<td>A maximum of three spelling errors is allowed in a sample of 100 words</td>
</tr>
<tr>
<td>1.2</td>
<td>Good contrast (in webpages)</td>
<td>It should be easy to read the text off the screen</td>
</tr>
<tr>
<td>1.3</td>
<td>Playable on a regular PC or Mac</td>
<td>No installation of extra tools is needed to be able to use OER</td>
</tr>
<tr>
<td>1.4</td>
<td>No <em>dead</em> links</td>
<td><em>dead</em> link is allowed in a sample of 10 links. If any <em>dead</em> link is discovered then this disqualifies the OER</td>
</tr>
<tr>
<td>1.5</td>
<td>Correct meta-data</td>
<td>The meta-data values should be correct for all relevant fields that describe the OER</td>
</tr>
<tr>
<td>1.6</td>
<td>Copyright cleared</td>
<td>The OER should have obtained sufficient permissions to use it</td>
</tr>
<tr>
<td>1.7</td>
<td>Not outdated</td>
<td>The OER should be up to date</td>
</tr>
<tr>
<td></td>
<td><strong>Category 2: Nice to have</strong></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Grammatically correct sentences</td>
<td>A maximum of five grammatical errors is allowed in a sample of 100 words. Note: grammatical errors do not include spellings errors</td>
</tr>
<tr>
<td>2.2</td>
<td>Correct punctuation</td>
<td>A maximum of five clear punctuation errors is allowed in a sample of 10 sentences. Examples of a clear punctuation error are a missing period at the end of a sentence or no capital letter at the beginning of a sentence.</td>
</tr>
<tr>
<td>2.3</td>
<td>Presence of a table of contents</td>
<td>A table of contents is preferable for OER that contain large pieces of text</td>
</tr>
<tr>
<td>2.4</td>
<td>Presence of learning objectives</td>
<td>The learning objectives for OER containing a lesson or series of lessons should be defined</td>
</tr>
<tr>
<td>2.5</td>
<td>Presence of required pre-knowledge</td>
<td>If OER require pre-knowledge than this pre-knowledge should be exactly described</td>
</tr>
<tr>
<td>2.6</td>
<td>Inclusion of references</td>
<td>The OER should include references when external material is used or cited</td>
</tr>
</tbody>
</table>
clear that most of the OER was created by a group of teachers within one institution or dispersed among different institutions. This observation has led to the provision of tools that permit teachers to collaborate with each other. Because these tools more matched the needs of the teachers it was observed that the number of OER contributions was increasing.

From the RAA framework this increase can be fully explained. Because first the supporting tools for creating OER were completely oriented towards the individual teacher these tools were perceived as less useful when teachers wish to create OER with other teachers. Teachers’ attitudes toward tool use were low and hindering the creation of OER. As a result, the growth of new OER in the Wikiwijs repository underperformed expectations. Adapting these tools with support for the collective creation of OER did change teachers’ attitude towards the tools and teachers felt more efficacious to create OER with these adapted tools. Besides, from SDT it can be argued that creating OER with other teachers is strengthening the interpersonal relationships between them and may possibly reinforcing feelings of competence. Also, these teachers may be completely autonomous in selecting which OER and how much is created. According to SDT feelings of relatedness, competence and autonomy contribute to feelings of intrinsic motivation to create OER.

Summarized: the lesson learned is that teachers do not create OER on their own but with other teachers. Accordingly they need tools that support this collective activity and that bring teachers together.

**Lesson Three: Creating OER is a complex task**

Creating OER is to be understand from a series of activities that possibly could be performed by teachers. Creating OER means that teachers may:

1. start from scratch and develop their own OER
2. collect existing OER and perhaps also their own OER with the purpose to remix them into new OER
3. use existing OER and perform minimum alterations so that these OER better suit the needs of teachers.

Irrespective of how OER is created or remixed, it is a complex task for teachers. To support teachers in creating/remixing OER, the Wikiwijs repository includes a remix tool supporting the situations 2 and 3. Teachers creating OER from scratch use their own tools, so there seemed no need for Wikiwijs to support this. However, there were problems with the use of the provided remix tool that ranged from missing functions to hang-ups of the tools. Not surprisingly, teachers were complaining.

To remedy this problem, Wikiwijs conducted some usability studies in labs that gave insights where precisely teachers were struggling with the remix tool. This has led to the improvement of the remix supporting functions. Besides, the usability studies also gave insights into how teachers were experiencing the navigation and the search engine of the Wikiwijs website that give access to the Wikiwijs repository. According to RAA and TAM, it could be expected that the improved Wikiwijs remix tool will lead to a positive acceptance of it and, therefore, an increase of new OER. The statistics of Wikiwijs showed indeed an increase in number of shared remixes over 2013 from 1237 to 2466.

Due to the complex nature of creation and remixing OER, teachers’ self-efficacy to create or remix OER can be low and, thus, they need the knowledge and skills of how to make OER both technically and didactically. According to the RAA framework, an increase of competence will increase their self-efficacy for creating and remixing in the future. Besides, an increase of competence will lead to a more positive attitude on using Wikiwijs. Wikiwijs responded to this with providing many
sources that teachers could use to professionalize themselves in creating and using digital learning materials. To support them in using the Wikiwijs platform, a train the trainer program was set up. At the end of 2013, about 1800 teachers had finished this program.

Summarized: the lessons learned here is that underestimating the complexity of creating and remixing OER will cause demotivation of teachers to create and remix OER. They need carefully designed easy to use remix tools. They also need a series of training sessions for acquiring the competences to create and remix OER technically and didactically. However as is warned for in the introduction, the availability of good ICT tools such as the Wikiwijs remix tool and specific professional development programs regarding creating/remixing OER does not imply that teachers will suddenly create and remix OER, though both conditions must be satisfied.

**Lesson Four: Sharing OER has to be encouraged and should be made easy**

Sharing OER means that these OER are made available for various groups of people. Data from a questionnaire administered in February-March 2013 with 1228 respondents showed that 64.5% of the respondents wished to share some of their OER with trusted colleagues within the same department/section and only 2.9% wished to share them with the broad public (i.e. the “world”) (Van Buuren et al., 2013). Consequently, sharing happened most often through the electronic learning environment of the school or via email. Teachers have several beliefs that prevent them from sharing. Most notably is the belief that when they share they will lose control over their OER and that other people can modify their OER at will, which is something that they want to avoid. It is further suggested that teachers believe that their OER is only useful for their colleagues and that they do not trust the quality of their own OER for sharing them with the broad public. These beliefs drive the forming of a low to moderate attitude towards sharing OER with the broad public and a moderate to high attitude toward sharing OER with trusted people.

An important hindrance to share OER is the condition that for sharing OER teachers have to add meta-data to their OER before they can upload them. NL-LOM, the Dutch standard derived from the standard Learning Object Metadata LOM was adopted by Wikiwijs for this purpose. The Wikiwijs upload functionality contains an NL-LOM template with fields to fill in specific keywords that specifies the NL-LOM attributes such as the title, the target school level, etc.

Filling in the meta-data, however, was felt as a heavy burden. Teachers have difficulties to understand what they were doing, how they should do it and why it is necessary to fill in all the mandatory fields. These difficulties translated into the issue that teacher were completely unacquainted with the concept of meta-data and its role when classifying OER and in finding OER via search engines such as the built-in search engine of the Wikiwijs repository.

As a result, teachers developed a negative attitude towards filling in meta-data and they feel less efficacious to fill in the meta-data template. The RAA framework predicts that for these reasons it is less likely that teachers will share their OER despite that they may have a positive attitude towards sharing their OER in general. In other words, teachers may want to share their OER but not when they have to fill in meta-data and certainly not when the meta-data template is not helping them to finish this task. The latter refers to the perceived usefulness and perceived ease to use of the meta-data template.

It is to stress here that perceived usefulness and perceived ease to use are important variables in the decision process of teachers whether to use this meta-data template or not which in turn will impact the sharing of OER. From the SDT perspective, a lack of competence to use the meta-data template will decrease self-determined motivation to use this template. To address this, Wikiwijs created an upload service to support teachers in adding meta-data to OER, thereby decreasing the
burden for teachers of sharing OER. During the program several thousands of OER were uploaded using this service.

Summarized: here the lesson learned is that we assumed that teachers are willing to fill in the meta-data, are competent to do so and know why it is important to have meta-data. It is hoped for that in the future this task will be accomplished by fully automated tools.

**Lesson Five: One interface does not fit all**

Initially, Wikiwijs had one user interface for all sectors of education. This design was selected because of the aim that teachers would be able to search for and access OER independent of the educational organization they are working from. For example, the demand for continuous learning paths crossing educational sectors would benefit by this. It appeared, however, that the demands from the educational sector for a user interface were very different. For example, teachers from primary education wanted a bright, playful user interface whereas teachers from higher education wanted a more sophisticated user interface. Furthermore, teachers from higher education expressed a hesitation to share their OER through the same interface where teachers from primary education were also sharing. The current front-end now offers for each educational sector a bespoke user interface. However, it remains unclear whether these bespoke user interfaces is causing a higher adoption rate of OER by teachers, so future research should investigate this issue.

Summarized: Assuming that one interface would serve the needs of all educational sectors turned out to be wrong. A user requirements phase should have taken place before a user interface is to be designed and implemented. Such user requirements phase would have shown that different educational sectors need different user interphases.

**Lesson Six: Existing OER communities do not join voluntary in Wikiwijs**

Wikiwijs is dependent on a vibrant community of teachers. They should create, remix, and share OER. Therewithal, it was expected that teachers would improve shared OER by writing reviews on their usefulness and by adding to the meta-data. Wikiwijs had decided not to start a new community, but to seek close cooperation with an already existing community with similar aspirations. This community had their own repository with learning materials that they shared within the community. Initially, connecting to this community with Wikiwijs was a hard case as they wanted to protect their work and autonomy. But, in the end Wikiwijs had managed that this existing community has removed their doubts and objections to cooperate with Wikiwijs.

A short overview of what has happened is listed here:

- the existing community owners and members were all teachers whereas the project members of Wikiwijs were not. Therefore, there was considerable opposition to the “outsiders” who told them that they have to participate. Adding an experienced teacher to the Wikiwijs team to act as an intermediary between the existing community and Wikiwijs caused that eventually the resistance diminished. This is in accordance with (Gollwitzer, 1999) who stated that the use of peers to communicate persuasive messages is highly recommended.
- in the existing community certain ideas existed on how to extend functionalities of their repository. Wikiwijs adopted these ideas to improve the functionality of the Wikiwijs repository thereby making the members of the community more enthusiastic about Wikiwijs and increase their willingness to cooperate with Wikiwijs.
- the existing community was funded by Kennisnet, one of the parties that implemented Wikiwijs. During the program the conditions for the budgets became stricter and target driven. Cooperation with Wikiwijs made it easier for this existing community to fulfill the targets.
Summarized: The lesson learned here is that we may not assume that existing communities would surrender without resistance to Wikiwijs just because we need them. A combination of strategies is needed. In fact, it is an intervention in its own right to help the existing community cross the line. Here the intervention was by using an experienced teacher as an intermediary, adopting the good ideas about improving a repository, and by the mild treat that otherwise cuts in budgets would be expected if they won’t cooperate.

**Lesson Seven: Governmental policies and regulations are needed**

For both school management and teachers, adopting OER is not a natural thing to do. We have the following observations. First, it is remarkable that less than 48% of the teachers did know about the existence of Wikiwijs and from these only 65% have once visited the Wikiwijs repository. Furthermore, the majority of the teachers (78%) reported to use OER that was found on the Internet using search engines (e.g. Google) and less than 18% of the teachers reported that the OER was found in the Wikiwijs repository (van Buuren et al., 2013). Third, teachers felt no social pressure at all to use OER whatsoever (Kreijns et al., 2013).

According to RAA this means that teachers’ intention to use OER in their lessons is mainly determined by their personal motives (i.e. their positive attitude, their intrinsic motivation, and their knowledge and skills to use OER). Regarding the creation and remixing of OER, far less teachers (3.1% of the teachers) were engaged in these activities. This can be partly explained by the lack of support given by the school management: 9% of the teachers reported that they were facilitated by their school (van Buuren et al., 2013).

The PRECEDE—PROCEED model points out that interventions can only be effective when the intervention includes all stakeholders that in some way can influence the adoption of OER. The government should involve parties that can exert influence on school management, headmasters, and teachers. All should participate together and this forms one of the critical factors. For the case of the Netherlands, starting only the Wikiwijs initiative was not sufficient to reach the goals which the Ministry had set in realizing mainstreaming OER. More prescriptive policies and regulations are also needed to avoid the current situation where no sense of urgency is felt by both management and teachers to adopt an OER policy.

Summarized: When interventions aims to change the behavior of individuals more is needed than just facilitating an infrastructure (i.e. the Wikiwijs repository) and professional development regarding the adoption of OER (i.e. the teacher training sessions). Again, these are necessary conditions but satisfying these conditions does not mean that teachers start adopting OER. The PRECEDE—PROCEED models clearly pointed to the gaps in the Wikiwijs program, most notably, the weak governmental policies and associated facilitations and regulations that are needed to complement the Wikiwijs program.

**Conclusion and Discussion**

The Wikiwijs Program was mainly concerned with creating an infrastructure for OER. To that end the Wikiwijs repository and portal was implemented. Professional development of teachers regarding the adoption of OER (or, broader, digital learning materials) was also part of the program.

However (and in this article it was stated more than once), we must keep in mind that the provision of a sophisticated infrastructure and professional development of teachers regarding the adoption of OER does not imply that teachers actually are going to adopt OER (Ward, 2005). More communication would have been helpful that is aimed to be persuasive in nature to convince
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various parties (school management, teachers, and so on) about the benefits and role OER can have regarding educational reform and in acquiring 21st century skills (Voogt & Pareja Roblin, 2010).

The Wikiwijs program also addressed the function that communities may have in the provision of new OER in the Wikiwijs repository. However, connecting to an existing community was difficult to achieve. By taking several strategies this was eventually successfully realized.

But the main point is that the Wikiwijs program by itself was not sufficient to realize the goals set by the government. More prescriptive policies and regulations were also needed to avoid the current state of permissiveness on adopting an OER policy by educational organizations. The PRECEDE—PROCEED model clearly showed these gaps.

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Notes

1 “Opening up Education” is an initiative of the European Commission to promote the availability of OER. See http://www.openeducationeuropa.eu/nl/initiative.

2 Information about NL-LOM can be found on https://wiki.surfnet.nl/display/nllom/Home

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Public Expenditure in Education in Latin America. Recommendations to Serve the Purposes of the Paris Open Educational Resources Declaration

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Abstract

In this paper, the authors identify and analyze public policy and the investment and expenditure that the governments of Argentina, Chile, Colombia, Paraguay and Uruguay commit to make in the development and procurement of textbooks, books and digital content for primary and secondary education (K-12). The aim is to identify and propose a roadmap for developing policies that advance the principles of the Paris Open Educational Resources Declaration. In the region, digital content coexists with and complements the traditional ones. Paper textbooks continue to have a leading role in the education systems of the region. In this context, the authors assess how the acquisition of traditional and digital materials occurs and offer some recommendations to the governments to adjust their public spending policies on educational resources development and procurement.

Keywords: Education; open educational resources; Paris Open Educational Resources Declaration; primary and secondary education; public investment/expenditure; public policy

Introduction

The rapid advancement of technologies that make it extremely easy for people to create and share materials is out of alignment with copyright law, which requires that user ask permission from rightholders to use a work. The development of open licensing and Open Educational Resources (OER) helps address this gap, by changing and questioning the current paradigm.

There are multiple definitions of this concept. The Paris Open Educational Resources Declaration born out of the United Nations Education Science and Culture Organization (UNESCO) in 2012, proposes one of the more recent definitions: “[…] open educational resources are teaching, learning or research materials that are in the public domain or released with an intellectual property license that allows for free use, adaptation, and distribution.”

Perhaps the first clear, high-impact initiative recognized as OER was that of Open Courseware at the Massachusetts Institute of Technology (MIT), described by Johnstone and Poulin in one of the first writings that address the topic explicitly (Johnstone & Poulin, 2002). MIT developed a repository of information related to its courses, which is posted on the Internet for anyone to use and reuse. The publication in 2002 of a set of open licenses created by the Creative Commons Foundation made it easier for the project, which adopted them immediately, to formalize its idea of legal reuse. Since then, a myriad of educational projects have adopted these standards.

Many arguments have been proposed in favor of these resources. It is said that OER improve access to information, increasing opportunities for learning and the application of knowledge to a broader context. They also support formal, self-guided, peer-reviewed learning. Furthermore, these resources allow feedback between agents in a broad network of users (teacher-teacher, student-teacher, etc.). They can even contribute to enhance the reputation and visibility of teachers and
educational institutions. They broaden and diversify the educational curriculum by expanding the exchange of ideas between diverse individuals and communities. Finally, OER contribute to the affordability of education by reducing the production costs of educational materials.

After a decade of existence and development of the OER concept, the Paris Declaration adopts an interesting position. It proposes that the creation of a culture of appropriation and use of these resources depends invariably on the use of incentives that stimulate the adoption of OER standards for publicly funded materials. This posture impels us to examine State public investment and expenditure in the development and procurement of educational materials. Information resulting from such analysis allows us to make recommendations to better align public expenditure with the aims of the Declaration.

This paper presents a short synthesis of a comprehensive report funded by UNESCO and carried out between April and October 2013 (Toledo et al., 2014). It identifies and analyzes investment and expenditure policies reported by governments for developing and procuring school textbooks as well as digital content for primary and secondary school (K-12). This study aims to propose a roadmap for developing policies that advance the objectives of the Paris OER Declaration.

Regarding the scope of this study, it is worth mentioning a series of choices involved in its creation that must be considered upon its review:

1. We have examined the situation of four Southern Cone countries: Argentina, Chile, Paraguay and Uruguay. We have included Colombia, as it is of particular interest for Karisma Foundation. Brazil was deliberately left out, since there is already a recent Green Paper published on this subject (Rossini, 2010).
2. Even though OER are generally associated with digital resources, there is nothing that prevents them from also including physical materials. In Latin America, the digital content coexists with and complements the traditional materials (textbooks, books, etc.). Therefore, we have looked at educational resources in print and in digital.
3. Since paper textbooks continue to play a leading role in the region’s education systems, we have evaluated the way in which their procurement takes place. This in turn allows us to draft recommendations on more efficient ways to conduct public expenditure based on the concept of OER and on the aspirations gathered in the Paris OER Declaration.
4. The data presented is either publicly available and can be accessed by concerned citizens in primary or secondary sources, or has been provided by education ministry officials from the countries studied. We expect that anyone shall have the capacity to evaluate and audit the figures noted here, but for the moment this fact shall remain as an annotation.
5. In order to limit its scope, this paper is focused on the definition adopted by the Paris Declaration. We are conscious of the importance of the various concrete elements contained in this definition (e.g. the scope of the meaning of resource, details on the technical or legal barriers to guarantee interoperability, etc.) and of the importance of establishing standards for their implementation, but the scope of this paper does not allow us to bring our analysis to this level of detail.

The methodology used for this research included a literature review, which yielded information about studies on cost, quality, analysis, etc., in education. In this sense, research reports, institutional analysis, among others, were reviewed. Once this stage was completed, it was analyzed national education systems, in particular the production and acquisition models of educational resources and programs on digital technologies in education, reviewing documentary sources –physical and virtual– from first and second hand. Interviews with the responsible national education authorities were conducted in order to fill the gaps and corroborate and clarify data. In this regard, it is worth
noting that data collection and corroboration in the distance was a limitation that we encountered when carrying out this research, in which much of the information requested is not available or compiled by public entities.

In this paper, we provide a context that seeks to locate the issue within the broad field of the right to education as a human right. We also include figures that account for the relationship between education funding and academic performance. In order to attempt to approach OER as a public policy tool, we devote a section to briefly discuss the development of this concept. It also attempts to approach OER as a public policy tool. Then, we dedicate a space to highlighting the most relevant aspects and in a comparative way offer a better understanding of the state of the art among the countries studied. Finally, we close a set of conclusions and recommendations for adjusting and channeling public policy towards the fulfillment of the principles contained in the Paris Declaration.

Background

The human right to education

Education is the pillar that underlies social and economic development for any society. International, regional and national organizations have also recognized its impact on the promotion and development of equality within and among nations. For these reasons, the right to education has been included in all the major international human rights instruments. The commitments acquired therein with regards to education have been consigned and incorporated into national constitutions and legislation. As such, there have been enshrined constitutional articles guaranteeing the right to free and mandatory education, and establishing budgetary allocations for their education systems.

In the course of this investigation it became clear that in the countries studied, governments have taken positive steps towards meeting their international obligations. Coverage of the educational system at the primary and secondary levels is practically universal in all five countries. That is, education is free and mandatory at these levels, as a result of policies that have progressively enshrined this government obligation into the law, and allocated the necessary resources to make it a reality. Nevertheless, this legal reality is not necessarily reflected in practice.

Many challenges remain. Among them, Argentina, Chile, Colombia, Paraguay and Uruguay must maximize public spending on education and guarantee the quality of the education provided by such things as improving teaching skills, effectively adopting digital technologies in teaching and learning, strengthening educational content, among other.

Regional education funding and educational performance

As the Programme for International Student Assessment (PISA) concluded, State educational investment has the potential to generate significant benefits for their social development, thanks to education’s capacity to provide similar opportunities for all. For this reason, a frequent measure used to assess the level of government commitment to education consists in comparing public spending in education with the Gross Domestic Product (GDP).

According to the Organization for Economic Cooperation and Development (OECD) survey on educational spending in the region “Fiscal policy and development in Latin America: What is the link,” published in Latin America economic outlook 2009, Latin American countries spend significant portions of their national budget on education. This expenditure experienced general constant growth between 2000 and 2008. Nonetheless, the efforts of Argentina, Colombia and Uruguay did not show weighty growth, whereas Chile and Paraguay were unable to maintain their former levels.

In the region, educational expenditure as related to GDP hovers around 4% or 5% (OECD, 2008). We therefore know that investment in education by some Latin American countries is close to the
average for OECD countries. Its ratio per capita, however, is five times higher, due to the fact that the school-age population in the region is among a quarter and a third of the total population. For OECD countries, in contrast, it was less than a fifth, according to 2006 figures—the reference figure for the 2009 report. In the Latin America economic outlook 2013 analysis, economic spending in education failed to expand, but it did in its relation to the private sector (ECLAC & OECD, 2013).

Since the year 2000, and every 3 years thereon, the OECD has conducted the international learning test PISA, whose objective is to measure competencies in reading, math and science of 15 year olds. These results are useful for measuring and comparing student performance in a diverse variety of countries. It also provides policy assessment and recommendations.

In relation to the 2006 PISA results, OECD analyst Pablo Zoido mentioned that, with similar spending as the regional average, countries such as Lithuania or Macao/China have achieved better performance for their students, who come from diverse socio-economic backgrounds (Zoido, 2008). Latin American students, on the other hand, performed three years below when compared to the OECD average. Further, their failing scores were much more drastic, given the fact that most students in the region did not achieve a basic level of reading comprehension.

By 2009, Latin American countries that participated in the test had improved their overall performance (Ganimian & Solano, 2011). However, they are still within the worst performing. In light of these results, it may be relevant to highlight the OECD’s conclusion that “the region’s true priority is that of improving the quality of spending, making it more efficient and better channeled” (OECD, 2008).

To have a positive impact on educational outcomes, economic policies must target several items simultaneously. As part of direct educational spending, one budget item is devoted to the functioning of a country’s educational system. In the countries studied, between 75% and 95% of public spending on education is devoted to the educational systems’ operation and management (Ministerio de Educación y Cultura de Uruguay, 2012; Ministerio de Educación Nacional de Colombia, n.d.; Preal & Instituto de Desarrollo, 2013). On the other hand, educational spending is also used to support educational processes, such as subsidies for textbooks’ development and procurement, and, in general, of educational resources. It is in this type of spending where we propose that efficiency could be improved.

**OER as a public policy tool for achieving states’ goals**

UNESCO first coined the term Open Educational Resources in 2002 during the Forum on the Impact of Open Courseware for Higher Education in Developing Countries. At the time, it was established that OER were understood as “[…] open provision of educational resources, enabled by information and communication technologies, for consultation, use and adaptation by a community of users for non-commercial purposes.”

In 2012, the UNESCO Paris OER Declaration was adopted at the closing of the World OER Congress organized, which gathered governments, experts, civil society, and educators to discuss and share the best current examples related to policies and initiatives in this field. As said, the Declaration’s recommendations lead the interest of this research.

Governments commonly supply the educational system with materials that are free to use. This approach limits itself to providing consumer goods to a sector whose modern pedagogical practices are conceived for re-utilization, particularly when mediated by digital technologies that facilitate collaborative production. There are many advantages in encouraging educators and students to be active participants in the creation, use, adaptation and improvement of their materials. Among them, the chance to localize them to their needs, update them and make more efficient use of public investment. These were precisely the features highlighted in 2007 in what is known as the Cape
Town Open Education Declaration: Unlocking the Promise of OER, which draws a roadmap toward openness.

In addition, the philosophy that underlies OER modifies the consumer logic of the publishing market by focusing on the efficiency of public investment and by stressing that what is funded with public resources must remain public. Thus, in the analysis undertaken by the OER expert Carolina Rossini regarding Brazil, the concept of OER “places educational materials as common and public goods from which all should benefit, [. . .] they consist in] a view that sees knowledge itself as a collective social product that naturally forms a commons that needs to be accessible to all,” and therefore, she says, “once the public has paid the resources (through taxes), how should they be managed and made available?” (Rossini, 2010, p. 5). If the answer lies in access to free materials that remain controlled by third parties that do not allow teachers and students to harness the disruptive capacities of digital technologies, we must acknowledge that we are wasting an opportunity: making the most of this public investment to develop or procure OER and, in so doing, to modify this relationship.

This decade has seen the growth of resources considered OER as well as their number of users (Carson, 2006). Worldwide, there has been an increase in State-led projects that adopt the principles and standards of OER, and some of them have documented results that demonstrate their efficiency (Creative Commons, 2013). In this last case, it is worth mentioning the Open Textbooks project in the U.S. State of Utah, which has striven to demonstrate the cost effectiveness of this approach (Utah Open Textbook Project, n.d.). It is claimed, for instance, that the State of Utah manages to produce textbooks for less than 5 dollars each (Utah Open Textbook Project, 2011). According to recent academic research, their impact is similar to that of more costly textbooks, i.e., quality is not affected (Hilton & Wiley, 2012). It is worth pointing out that it is in the English-speaking world where OER have developed most, and therefore, where the majority of data regarding these initiatives and their impact is collected (Botero & Labastida, 2008). We still have much room for improvement in other regions, as long as we learn from initiatives that have come before, and that we take seriously the Paris Declaration’s proposals.

The Paris OER Declaration proposes a commitment by governments to promote open licensing for publicly funded educational resources. Moreover, this instrument aims at discussing OER true potential for advancing the objectives of the most relevant international human rights instruments. OER represent a strategic opportunity to improve the quality and efficiency of education. OER can contribute to the compliance with international obligations and goals assigned to States, and therefore their promotion ought to be in the hands of governments themselves.

The commitment to mobilize States toward the promotion of standards for investing public resources is evidence of the alignment between the objectives of OER and the core function of any public policy.

Public investment in the production, procurement and dissemination of educational resources in the southern cone and Colombia (models)

The difficulty in finding information on public sector spending is a widespread problem, and not exclusive to the region (Batare, 2012). This situation is complicated further if we consider that spending is country-specific, given the varying structures between educational systems, its diverse funding sources, and the fact that it is subject to the way in which functions are distributed between the national and local levels, and between the public and the private sector.

Once again, we must remember that over the past few years, governments in the region have made special commitments to public education, increasing spending in relation to GDP, and enhancing the guarantees on the mandatory nature of education.
The impact of government purchases on the Latin American publishing industry is well known. Rosa Dávila, Mexican cultural researcher, asserted in 2005 that “[…] publishing development and production has been largely geared towards meeting the needs of the educational system, for which school textbooks constitute one of the highest impact sectors in local publishing and in the expansion of the book market.”

The strong dependence of the region’s textbook publishing market –closely related to public spending– appears to be corroborated by the Regional Centre for Book Development in Latin America and the Caribbean report Programs, Official Purchases and Provision of School Textbooks in Latin America (Uribe, n.d.). This dependency relationship is such that any decision adopted by governments in this regard is certain to have direct repercussions in the industry. However, the opposite is also true; precisely the same relationship has led to significant pressure to make spending for educational materials the engine of an industry, i.e., focusing on responding to the industry’s needs.

A consumption model has prevailed in the region, which obscures discussions regarding the needs of the education sector in regards to co-creation models. This becomes particularly significant in light of the capacities offered by the new technological environment. It is likely that this may help explain the absence of more aggressive initiatives in favor of adopting OER standards, since they would substantially alter the reigning model.

Key comparisons and conclusions

One could hardly conclude that government policies for the procurement of educational resources are lined up with the Paris OER Declaration’s principles. Some initiatives and programs are to some extent aligned with the OER movement, but there is still a long path ahead.

In general terms, some of the countries studied have seen some sustained –yet not exponential– growth on education investment in recent years. Chile and Paraguay are exceptions to this trend, where perhaps the effort has not been sufficient. Despite the lack of specific spending data on the provision of educational materials, it is clear that countries do purchase and offer their elementary and secondary students free educational materials, and yet have not taken steps beyond this option. For the production of these materials, each of these countries has designed mechanisms for the acquisition of textbooks and books that depend on what is available in the commercial market. Some isolated projects have proposed developing the textbooks and assuming the costs of production. However, even for these exceptions, the contracts still result in the purchase of final products that are subject to the rationale of commercial procurement.

One of the main difficulties faced in conducting this analysis was the dearth of information available from the ministries of education regarding their detailed expenditure. There was willingness by government officials to provide the necessary figures, but communication was not entirely satisfactory. This would appear to be due to the fact that the countries themselves have not systematized this information in such a way that it is easily identifiable.

Starting from the figures found, we do know that investment in education closely matches administrative and operational expenses. These expenses comprise between 75% and 95% of education budgets. Bearing in mind that the remaining percentage also includes subsidies or transfers to private entities (student households and other private institutions) as well as expenditures on educational resources, among others, it may be supposed that the proportion allocated to the procurement of school textbooks does not entail an inordinate expense.

In fact, by and large, the countries do not develop their own material. They are consumers in the publishing market. The general models for expenditure in school textbooks, with some minor
variations, correspond to the overall system of procurement of goods by public administrations: public-bidding models. Under this rationale, the State has become a passive agent of the publishing market, granting strong economic power to the school publishing industry. This situation is not intrinsically negative, but it could be better structured in order to make the most of mutually beneficial models.

Despite the marginal expense of textbook purchases by governments, we were able to establish that it constitutes a substantial percentage of the publishing market within each country. It is interesting to note that in overall terms, the participation of foreign publishers in the region is significant. One should pay special consideration to the growing presence of transnational publishers in the Argentinian market, which reaches 35%, and by Spanish publishers who encompass 25% of the market in Colombia and 47% in Chile (Ministerio de Educación de Argentina, 2013; Cámara Colombiana del Libro, 2011; Ministerio de Educación de Chile, 2009).

All five countries have commenced developing digital tools in education. It would appear that the second principle of the Paris Declaration –“Facilitate enabling environments for use of Information and Communications Technologies (ICT)”– has made greater inroads in the region. All countries have an interest in advancing and giving priority to this sector. Only Uruguay and Colombia have related this with steps towards openness. The countries analyzed have also considering the way in which such resources will circulate in the digital world. Even though each of these countries participates in initiatives such as national education portals, the preeminent concern is to endow them with resources to which the population may have free access, without deeply considering the type of licensing.

In exploring digital environments, governments begin to think beyond what is simply free. This becomes palpable in the production/acquisition projects for these materials. Uruguay, under Ceibal Plan, has been negotiating licenses to use the material for a period of two years. Colombia and Argentina are exploring public tenders for developers of digital educational resources in which they require the waiving of rights, with the understanding that funding production allows them to request control over the way in which these developments will be used in the future. Colombia has cooperation agreements for content and application developments, although the type of licensing to be applied is not known. However, none of these covers the full scope of OER.

From the data gathered, we deduce that public spending for the acquisition of educational materials is not part of any public policy. On the contrary, it falls at the mercy of succeeding administrations that promote initiatives and projects in the absence of general guidelines. In this field, the only such attempt that has made inroads has been the National Strategy for Digital Educational Resources (Ministerio de Educación Nacional de Colombia, 2012) in Colombia, where at least some thought has been given to future re-use.

Reducing the digital divide appears to be the ultimate goal of government policies on ICTs and education. The One Laptop Per Child model is well established. It is a clear policy in Uruguay, Argentina and Paraguay. Chile has opted for a variation, seeking to address learning problems and by providing one laptop per student in the classroom. In contrast, the Colombian Ministry of National Education has concluded that results in other latitudes are far from ideal, thus, has rejected the model. However, that decision is facing uncoordinated policies, in which, the Ministry of ICTs is in the midst of a national campaign to distribute tablets and computers to primary and secondary students.

On the other hand, educational systems continue to rely on the paper textbook. Several reasons come together to explain this fact. Educational institutions in the countries remain anchored in traditional teaching methods. The digital divide is also a decisive factor. Distrust of digital content and lack of skills for pedagogical uses of ICTs for teachers may be another reason. Despite the
great efforts made to introduce digital technologies into educational environments, these have not been effectively appropriated. As we saw in the case of Paraguay, it is likely that marketing by publishers has some repercussion in this area (ABC Color, 2011).

Educational portals in the countries have not replaced physical contents, nor have they transformed teaching methods. Digital contents do not appear to have the expected impact on teaching and learning. In Colombia, for instance, according to the Ministry of National Education, the hours of peak usage of the “Colombia Aprende” educational portal happen at night (Ministry of National Education official, 2013), showing that national efforts to promote the appropriation of digital technologies for education are not entirely effective.

It is also important to consider that national purchases of school textbooks play a significant role in the publishing industry. In consequence, decisions made in the future can have significant impacts on this sector. The Paris OER Declaration’s adoption will require a dialogue between governments and the publishing industry in order to transform the current relationship and to foster alternative that do not overburden the government.

In conclusion, the existing systems in the countries studies have not learned how to make the most of recent technologies, nor of the principles envisioned by the OER movement. The adoption of OER policies can harvest concrete advantages in public education: enhancing learning opportunities and greater access to knowledge; strengthening the educational communities thereby creating a more robust education system as a result; reinforcing and diversifying educational curricula; and reducing educational costs, resulting in a more accessible education. Nowadays, however, the paradigm is rooted in the production of paper textbook by an industry motivated by profit rather than by the benefit of society.

Recommendations

In order to transform the development and acquisition of educational resources in the countries studied, governments should become facilitators so educational systems become content producers. In this way, public funds could be used more efficiently for the benefit of society. The latter should be accompanied by transparency policies that account for the use of public funding and include progressive impact assessments of such uses. Moreover, the State ought to identify and foster existing communities that are proliferating thanks to technological enablers, and help them become platforms for the development and promotion of OER, i.e., collaborative knowledge producers.

These reforms can be summarized as follows:

1. A commitment to OER will require an adjustment by governments of the procurement model. The State and the publishing industry shall renegotiate their relationship. The industry could shift to providing support to improve the capacities of the educational system with the goal of sustainably developing quality educational materials. This effort begins by providing teachers with materials that they can in turn reuse and reformulate. Governments ought to consider modifying the textbook purchasing conditions, developing the idea that public sources are goods serving the educational community. The most significant change resides in the use of open licenses, facilitating materials’ search, reuse and sharing.

2. It will be important to build stronger links between programs for the educational use of ICTs and the acquisition of digital educational materials that fulfill international OER standards. Greater synergy between these government policies can address many of the current problems related to the lack of relevance, diversity and quality of educational materials.
3. This investigation revealed the need to work to counteract the general lack of indicators that would facilitate measuring the impact of OER policies, and of the use of public funds to finance their production and use. Developing these indicators would result in improved scrutiny of public investment on the educational resources production. This recommendation goes hand in hand with the need to conduct an economic analysis of current investment by these countries on the education resources acquisition, encompassing the various national and/or subnational programs responsible for developing these resources. Such analysis should also take into account the publishing market, in such a way that it can measure the real price of producing resources. A study based on clear figures should allow us to produce even stronger arguments to convince governments—and perhaps educational publishers— that taking the chance to produce OER is a strong move for education.

4. On the other hand, in response to the difficulties we encountered for finding concrete data on the educational resources acquisition, we recommend that governments produce better information, figures and indicators regarding spending in these areas. If this information were to be lifted and compiled, the State itself would be in a better position to conduct its own impact assessment for these expenditures. Any such process will require indicators designed to facilitate this analysis.

5. In direct relation to the recommendations above, we see the urgent need to inform and train the education community on the nature of OER and the advantages they may offer to the educational process. A commitment to the Paris OER Declaration demands a community that is knowledgeable on the subject and familiar with the OER ecosystem. To harness their full potential, governments ought to look into the underlying characteristics that define OER, and aim to recreate them, especially in their efforts to harness ICTs to maximize their impact.

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The potential social, economic and environmental benefits of MOOCs: operational and historical comparisons with a massive “closed online” course

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Abstract
Massive Online Open Courses (MOOCs) have recently become a much discussed development within higher education. Much of this debate focuses on the philosophical and operational similarities and differences between the types of MOOCs that have emerged to date, the learner completion rates and how they can be sustained. In contrast there has been much less discussion about how such courses do, or do not, fit in with existing higher education policy and practice in terms of the social, economic and environmental benefits. This paper begins to address this issue by comparing and contrasting current MOOCs with one large population ICT-enhanced, mostly online Open University UK course presented a decade earlier and how they have both served, or might serve, broader social, economic or environmental objectives. The paper concludes that while MOOCs are forcing a re-conceptualisation of higher education study, much can also be learned from previous and existing large population mainly online courses from open universities.

Keywords: MOOCs; online education; policy and practice; environmental impact; social impact; economic impact

Introduction
Massive Online Open Courses (MOOCs) have become a much discussed development within higher education (HE) under the aegis of open education (Daniel, 2012). Only recently have they burst upon a wider public consciousness (Universities UK, 2013) and attracted significant policy attention. In one sense MOOCs are a technology-enabled development of the slightly longer-lived open educational resources (OER) movement to support life-long learning (Lane, 2012). In another sense they represent an opening up of a burgeoning online education effort being used with traditional students within higher education institutions (HEIs) to enhance the teaching and learning experience (Johnson et al., 2012; Yuan & Powell, 2013; McAndrew & Scanlon, 2013). Many different forms and style of MOOCs have appeared which vary in how many students they attract, how open they are according to the philosophy of the Cape Town Open Education Declaration (2007), whether all activity is online and even whether it counts as a course or a connected community (Daniel, 2012; Rodriguez, 2013). Rather than follow a hard definition of what is a MOOC we examine some of this ambiguity through a comparison of some aspects of MOOCs with their nearest historical equivalents.

Various claims and counter claims about the role and significance of MOOCs for HE have been made in online media (e.g. Boxall, 2012; Craig, 2012), including their degree of openness to users and their perceived role to widen access to higher education in both developed and developing countries (Liyanagunawardena et al., 2013a; 2013b). Much of this debate focuses on the philosophical, pedagogical and operational similarities and differences between the types of MOOCs that have emerged to date (Universities UK, 2013; Rodriguez, 2013) although nearly all are free to
participants with no upfront fee, and all are open entry, in that no prior qualifications are required of the enrolees (although many do stress the expected level of prior attainment).

While there has also been much debate on whether MOOCs will disrupt HEIs, have satisfactory completion rates and build on sustainable financial models, there has been much less discussion about how such courses do, or do not, fit in with existing policy and practice of increasing participation rates in HE, of widening participation to members of society that have not traditionally participated in higher education, and of supporting completion of higher education qualifications (e.g. OECD, 2013; EU, 2012). However two recent reviews by one of us (Lane, 2013a; 2013b) examined these broader societal and governmental aims with the past experiences of achieving those aims through open and distance learning courses operated by “open” universities around the world. This paper summarises those two reviews and adds another dimension—environmental impacts. The growing drives for HE to meet environmental as well as social and economic targets (Tilbury, 2011) also make it important to consider whether MOOCs have better or worse environmental impacts than other models of delivering HE teaching and learning. Nothing as yet is being researched on the attendant environmental impacts of MOOCs, while there has been little such research into the environmental impacts of existing HE course models, with the exception of the Factor 10 and SusTEACH (http://www.open.ac.uk/blogs/susteach) projects that were conducted by Open University of the United Kingdom (OUUK) research teams in the past 10 years (Caird et al., 2013).

This paucity of research data will no doubt change but in their absence it can help to direct data collection and research on “non-formal”, fully online MOOCs through a considered comparison of these new forms of online courses with the research data available from their nearest equivalents—“formal”, mainly online courses run by “open” universities—and in particular The OUUK (McAndrew & Scanlon, 2013). The aim of this paper is therefore to review what is currently seen as the widening access and environmental policy objectives for HE, and to compare and contrast the ways in which MOOCs and their open university counterpart courses with large student populations serve or might serve those policy objectives. It does so by building upon the social, economic and environmental data that have previously been applied to mainly online courses and OERs from The OUUK, in particular a pioneering open entry, fee paying Information and Communication Technologies (ICT)-enhanced course entitled T171 You, Your Computer and the Net that regularly had thousands of students for each presentation from 2000–2005 (Mason & Weller, 2000; Weller, 2000; Weller & Robinson, 2002). It both compares and attempts to extrapolate these now historical data to recently published data on MOOCs to identify similarities and differences. We look firstly at the issues around widening participation, followed by those around environmental impacts, and finishes by drawing out some conclusions on future research directions.

Social and economic objectives: widening participation in higher education

As described in more detail by Lane (2012, 2013a) widening participation in HE has different dimensions. OECD regularly publish data on the proportion and type of people completing specified levels of education although without information on the numbers that participate for some period but do not “complete” a particular level (e.g. OECD, 2013). The report is clear about the benefits of educational attainment:

Higher levels of educational attainment are strongly associated with higher employment rates and are perceived as a gateway to better labour opportunities and earnings premiums. Individuals have strong incentives to pursue more education, and governments have incentives to build on the skills of the population through education, particularly as national economies continue to shift from mass production to knowledge economies. (OECD, 2013, p. 28)
While it follows that widening access to, and attainment in, higher education has both a social and an economic dimension, as noted in this quote, the levels of educational attainment in a particular population may hide great inequalities in the opportunities to do so throughout all sectors in society.

Inevitably, as outlined by Lane (2012), the chance to participate is constrained firstly by the absolute availability of places for study within a country (e.g. the number of higher educational institutions and the capacity of those institutions to teach students). It is constrained secondly by the affordability of opportunities (for instance study may involve great costs) and thirdly by its accessibility (such as being taught in a second or third language for the student or involving significant travel or assuming advanced student knowledge at the course beginning. Fourthly there is a question of acceptability of the opportunities on offer (for example the provision may be of poor quality, have an implied bias in the intellectual position taken by the teachers or it may be in subjects that prospective students do not want to study). Nevertheless, even where provision is available, affordable, accessible and acceptable, it may not be taken up by some less privileged groups in society for other wider, physical, social, psychological and cultural reasons.

The newness of MOOCs, coupled with logistical difficulties in getting either pre-enrolment or exit data on the participants, means that it is difficult to compare MOOCs from different providers, let alone make comparisons with fee-based large online courses. However two sources give some early indications of who is attracted to these MOOCs and how do those “students” perform.

The first source of data on MOOCs and their student characteristics comes from a researcher, Katy Jordan (2013) who has been working to aggregate any published information on MOOCs, and in particular, the stated completion rates where there are different assessment modes and where the course length varies (see also Jordan, 2014). The second source is a report from the University of Edinburgh (Edinburgh @ MOOCs Group, 2013) who have run six MOOCs through Coursera (https://www.coursera.org) and surveyed “students” on entry and, where possible, on exit from those courses (a more recent University of London Report, 2013, confirms the main trends noted here).

It is tricky to draw very firm parallels between current day MOOCs and their fore-runner massive ICT-enhanced, mainly online courses within open universities. Nevertheless, there are a number of similarities and differences which it is worth commenting on, particularly in relation to access and achievement in higher education study.

First, the student demographics show that the age profiles were similar. Interestingly 75% of MOOC participants were doing their first MOOC while about 70% of T171 students were new to the OUUK and thus online and distance learning. Geographical dispersion differed, as the MOOCs attract more people from different countries than was the case with T171 who were mostly UK based.

Second, while both are open entry, the fee for a credit bearing course tied to teaching grant support from an HE funding council, plus the nature of tuition and support from regional centres, means the OUUK course was much more geographically-focussed (most students were from the UK). Whilst some MOOCs charge fees for credits none offer the place-based network of tutorial support, and instead provide all tutorial support online.

Third, most T171 students were signing up for a long duration course lasting 32 weeks (in contrast most MOOCs last ten weeks or less).

Fourth, for T171, like many early MOOCs, the medium was the message. The extensive interest by large numbers of people that surprised the early course providers in both cases was in learning about subjects that related very much to computers and communications technologies. In both cases too, online courses have quickly moved into many other disciplines.

Fifth, interest in the topic seemed to be a prime motivating factor rather than any vocational or job-related factors. However, whereas that interest in MOOCs has been mostly with the already
well-educated, the interest in the OUUK course was from as diverse educational backgrounds as most other OUUK courses, with up to 40% having low previous educational qualifications. The fact that this course was clearly part of the existing credit-bearing provision aimed at opening up opportunities to attain qualifications rather than a separate adjunct to it, might account for some of this difference in educational backgrounds.

Sixth, completion rates (35–50%) were much higher for the OUUK course than nearly all MOOCs to date (5–20%). Again, the fact that T171 was part of existing credit-bearing provision would account for this as well as the higher levels of direct tutorial support provided by Associate Lecturers compared to the much lower levels of personal support given in MOOCs, mainly provided through peer interaction. In fact there are many different logistical challenges associated with the T171 provision for large numbers of students as noted by Weller and Robinson (2001) and Mason and Weller (2000).

Accepting the limitation of comparing data from different sources, at different times, using different categorisations, it is fair to conclude that MOOCs do not appear to help meet the main social and economic objectives set out for HE as they support the already-privileged over the less-privileged in contrast to the T171 OUUK example. However, MOOCs are not products of national and international policy and so cannot be expected to be designed to meet that need without further research and thought given to the roles they might play. Nevertheless, if they were to be assimilated into such policy frameworks then much more attention would need to be given to how MOOCs fit into educational systems in general and the open education movement in particular.

As noted by Lane (2013b) open education is driven by a fundamental reciprocal desire to share knowledge and ideas at various scales amongst individuals, organisations and nations alike. Aided by digital technologies, the extent of open education represents a balance between the need to provide education as an organised and regulated business (the economic aspects), and education as a public good (the social aspects). In essence open educational systems offer the potential to break the iron triangle of access, cost and quality that apply to education and create more flexible forms of provision alongside the existing more traditional but rigid forms (Daniel & Uvalic-Trumbic, 2011).

The advantages of open education are particularly apparent when consideration is given to the relatively fixed costs of the physical infrastructure of schools, colleges and universities and the number of teachers they employ due to the relatively small cohorts that each teacher can manage to teach successfully (there are many debates worldwide about optimum class sizes and effects on pedagogic quality [e.g. see Kokkenenberg et al., 2005] but the physical limitations of most existing classroom sizes in expensive buildings and their occupancy rates are universal). This physical infrastructure is equally a major factor in determining environmental impacts.

Environmental objectives: lowering carbon impacts

As noted earlier, all HEIs are expected to contribute to sustainable development and reducing their environmental impacts (Tilbury, 2011). Nevertheless very little attention has been paid to the direct (and indirect) impacts of HE teaching models except by the OUUK.

If we examine the results of a carbon-based environmental assessment of a large population course such as T171, we can compare the impacts of the ICT-enhanced distance teaching model used to teach this course with the impacts associated with using other teaching models. From this we can extrapolate to consider the likely environmental impacts of fully online MOOCs.

The environmental impacts of T171 were first examined within the Factor 10 Visions study (Roy et al., 2008), and then subsequently reanalysed as part of the SusTEACH project using the latest
measures of energy consumption and carbon conversion factors (Caird et al., 2013). This involved an assessment of the main sources of HE course-related energy consumption and carbon emissions, including travel, the purchase and use of ICTs, the consumption of paper and printed materials, residential energy and campus site operations. A large sample of 846 students responded to surveys about their course-related activities on T171 and 55 staff provided information on the course production and initial presentation. Data analysis was supported by energy databases and energy assessment software, and the development of a classification of teaching models using a range of teaching methods including ICTs, face-to-face teaching and classic distance teaching methods. The results for each area of environmental impact were converted to measure the average energy consumption and CO$_2$ emissions of a course per student/per 10 CATS credits (i.e. equivalent to 100 hours of study) (The Open University, 2014).

As nothing has been researched so far on the attendant environmental impacts of MOOCs, the detailed analysis of the large population mainly online course T171, and findings of the SusTEACH project have implications for considering the likely environmental impacts of MOOCs. T171 can be described as having a blended ICT-enhanced distance teaching model rather than being primarily delivered online. Teaching materials were accessible via a dedicated course website that partially replaced the course books, audio-visual materials and assignments that had previously needed to be printed and distributed, although students continued to receive two printed set books by post. Whilst an ICT-enhanced tuition and assessment system replaced the need for travel to examination centres and to attend face-to-face tutorials, students continued to attend at least one face-to-face tutorial. T171 is therefore a blended course using a mix of online, classic distance and face-to-face teaching methods.

The SusTEACH project compared four ICT-enhanced courses with four online courses and fourteen mainly face-to-face taught courses. The online courses had an almost fully online teaching, learning and assessment provision together with some minimal face-to-face day school provision. The findings showed that HE online and blended ICT-enhanced distance teaching models had significantly lower impacts than face-to-face teaching models (Caird et al., 2013). It is evident from Table 1 that the main sources of carbon emissions were associated with travel, residential energy and campus site operations. The use of online and ICT-enhanced distance teaching models reduced carbon emissions by reducing the requirements for students to travel to classrooms; establish additional residential accommodation away from their main home; and use campus facilities.

Table 1 compares the carbon impacts associated with T171 as an example of an ICT-enhanced distance-taught course, with courses taught using traditional face-to-face teaching and online teaching models. The analysis showed that T171 achieved strikingly lower overall carbon impacts that were 81% lower than those associated with a face-to-face teaching model. More significantly

<table>
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<th>Average CO$_2$ emissions (kg)</th>
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<th>Campus site operations</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Travel</td>
<td>ICTs</td>
<td>Paper, print, and other materials</td>
<td>Residential energy</td>
<td>Campus site operations</td>
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<tr>
<td>Face-to-face</td>
<td>129</td>
<td>4</td>
<td>11</td>
<td>57</td>
<td>77</td>
<td>278</td>
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<tr>
<td>T171</td>
<td>8</td>
<td>14</td>
<td>9</td>
<td>6</td>
<td>16</td>
<td>52</td>
</tr>
<tr>
<td>Online</td>
<td>2</td>
<td>13</td>
<td>4</td>
<td>1</td>
<td>16</td>
<td>36</td>
</tr>
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in terms of implications for MOOCs, carbon reductions of 87% could be achieved by replacing face-to-face teaching with a primarily online teaching model.

Further insights into considering the likely carbon-based environmental impacts of MOOCs may be gained by comparing the emissions associated with the T171 course with courses primarily produced and delivered online. The data in Table 1 shows that online models can achieve reductions in carbon emissions of 31% compared with T171, mainly as a result of reducing student travel and the consumption of paper and printed materials. The reduction or elimination of face-to-face tutorials explained why students taught mainly online travelled on average only 8 miles per 10 CATS credits compared with the 33 miles travelled by T171 students per 10 CATS credits. Furthermore, reduction both in the production and transportation of delivered course materials, and printed books purchases explained why students taught mainly online had lower paper and printed materials consumption per 10 CATS credits than T171 students. An unexpected finding was that students taught mainly online consumed on average more paper (195 sheets) per 10 CATS credits than T171 students (169 sheets). This may be explained by a preference of many students to print online materials rather than read on-screen. As the consumption of paper and printed materials for other purposes was low by students taught online, this supports the contention that online delivery of course materials may increase printing, despite lower overall average CO$_2$ emissions.

These findings inspire confidence that the online delivery of MOOCs should achieve lower carbon emissions in comparison with other models of delivering HE teaching, as MOOCs can eliminate the need for student travel and residential accommodation, and reduce the use of campus accommodation and facilities. We would therefore expect that the carbon emissions associated with MOOCs to be lower than the online teaching model’s average carbon emissions of 36kg per student per 10 CAT credits as this includes some day school travel impacts, albeit allowing for possible rebound effects that might manifest. Furthermore, the energy consumption and carbon emissions associated with the production and delivery of MOOCs are expected to be extremely low compared with other teaching models when calculated per student, as by definition MOOCs offer education on a large scale to massive student populations and therefore can achieve scale efficiencies. However these calculations may be confounded by the lower levels of participation and completion in MOOCs.

Conclusions

This paper has raised as many questions as answers around some of the social, economic and environmental benefits of MOOCs.

If MOOCs attract and suit a well-educated audience, should they be used simply for lifelong learning or as a prelude to postgraduate studies? How can MOOCs be designed to develop their potential to widen participation beyond existing well-educated students? Should they aim to be more vocational and serve a continuing professional development agenda? If so, then developing mechanisms for accreditation and qualification award as well as pedagogical quality standards becomes the priority. In addition, will MOOCs be mainly a test-bed for pedagogical developments using online technologies? If nothing else these questions need to be framed within the growing policy focus on open education in general and policy-focussed reports (e.g. Falconer et al., 2013).

On an economic front, does it matter if completion rates are low when the provision is free? Arguably it does, as it weakens the impact of MOOCs which powers the case for policy support at institutional, national and international levels. Whether MOOCs are free at the point of delivery they nonetheless have a production cost. Completion rates may be inversely related to zero-cost courses as people may have difficulty valuing what they get free. Would more people complete if they paid a small fee and is a different business model needed?
For learners, education can provide both economic and social returns on the investment of time and money that they make. To justify the increases in tuition fees many governments and other agencies highlight the personal economic returns on education and particularly higher education (see, for example, OECD, 2012). This usually relates to improved career prospects and higher lifetime earnings. However, researchers are now trying to widen the debate on returns on investment by trying to estimate the social returns on investment (SROI) for adult education in the UK (Fujiwara, 2012). The key findings of this study are: “Participating in adult learning is found to have significant positive effects on individual health, employability, social relationships, and the likelihood of participating in voluntary work. In turn these domains have positive impacts on individual well being” (p. 2).

Such modelling is new and subject to much debate but it would be valuable to apply SROI to MOOCs.

Lastly, whilst MOOCs are likely to have low environmental impact there is a need for research to assess the additional or reduced impacts of campus site operations involved with external-facing MOOC provision, as well as other impacts of MOOC based course activities that offer supplements or replacements to face-to-face based activities for formally registered students. There is also a greater need to account for the environmental impacts of teaching within the sustainability reporting of HEIs.

This paper concludes that MOOCs are forcing a re-conceptualisation of higher education through the use of online study amongst all universities that was previously mainly found in “open” universities. While the scope of that re-conceptualisation in the literature has been focussed on business and pedagogical models within HEIs, we argue that more focus is needed on the wider social, economic and environmental impacts for regions and nations. We also conclude that “non-formal” massive online courses need to be more closely examined for how they might better serve national and international policy through making comparisons with their “formal” counterparts within open universities, and that research effort needs to be directed at this issue.

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Note

1 Such as that at http://openeducationeuropa.eu/

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Formalising informal learning: Assessment and accreditation challenges within disaggregated systems

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Abstract

This report shares the findings and lessons learned from an investigation into the economics of disaggregated models for assessing and accrediting informal learners undertaking post secondary education. It presents some key economic and governance challenges for universities to consider in implementing OER assessment and accreditation policies. It also includes discussion of findings from a small-scale survey conducted by two of the authors on perceptions, practices and policies relating to openness in assessment and accreditation in post secondary institutions, with a particular focus on the OER universitas (OERu) concept.

Keywords: accreditation; assessment; disaggregation; Open Educational Resource (OER); open learning; recognition of prior learning

Introduction

The concept of “openness” is arguably the most persistent and controversial educational innovation of recent years, provoking the potential for important change in post secondary education, worldwide. The two key concepts contained within the movement are Massive Open Online Courses (MOOCs) and Open Educational Resources (OER). Following an explanation of these important phenomena, this paper explores the key issues of assessment and accreditation that are raised by the notion of openness in learning. It is based on a report that examines potential models to address the learner assessment, certification and accreditation issues for learners participating in MOOCs as well as in other formal and informal learning contexts using OER at the higher education level (Conrad, Mackintosh, McGreal, Murphy & Witthaus, 2013). We focus here on the organisation and mandate of the Open Education Resource universitas (OERu), a global consortium of post secondary institutions whose collaboration around the assessment and accreditation of learners studying online and using open educational resources (OER) facilitates greater access and flexible learning paths for learners.

MOOCs have experienced a rapid growth in interest, often negative, since their inception in 2008. While permitting access to the same course for large numbers of learners in many countries, the
introduction of MOOCs has given rise to the need to address issues of learner assessment and accreditation. Learners who access digital learning content via the Internet and acquire knowledge and skills either formally or informally, alone or in groups, cannot readily have their learning assessed, and are consequently unable to receive appropriate academic recognition for their efforts (Taylor, 2011; Mackintosh, McGreal & Taylor, 2011). This critical issue is the sticking point for many educators and as such has attracted attention both from institutions leading the OER movement and from its critics (Phelan, 2012; Yuan, MacNeill & Kraan, 2008; Olcott, 2012).

OER have provoked similar controversy, and institutional participation in the development and use of OER has been patchy across the globe. In many parts of the world, few institutions indicate that they either produce or use OER, and in the regions where production and usage of OER are higher, there is little coordination between institutions and generally not much governmental support to sustain OER activities. (See, for example, the early findings from the POERUP project, Bacsich et al., 2013.) Even fewer institutions have implemented open courses for assessment and accreditation (Conrad et al., 2013). In spite of resistance, the open movement continues to expand as evidenced by the growth of online OER repositories and the ongoing swirl of attention to MOOCs as well as the establishment of collaborative initiatives based on the use and reuse of OER.

The Study

In 2012, two of the authors of this paper developed a quantitative research survey to investigate the perceptions, practices and policies of post secondary institutions worldwide, toward openness in assessment and accreditation. A sample of 110 individuals representing 83 education institutions was obtained over a three-month period from June to August 2012. The survey was programmed and hosted online, with invitations to participate disseminated through social media channels and discussion forums aimed at educators interested in Open Educational Resources (OER). Invitations were also emailed to individual representatives of higher education organisations that were known to be engaged with OER assessment and accreditation initiatives such as the OER universitas initiative (previously known as the OER university).

Responses originated from 29 countries including the regions of Western Europe (United Kingdom and Ireland) (40%, n=44), North America (17%, n=19) and Asia (14%, n=15) followed by Australia or New Zealand (9%, n=10), Africa (9%, n=9), South America (7%, n=6), and other parts of Europe (6%, n=7). A range of education institutions was represented, with universities forming the largest cohort (64%, n=68), followed by public organisations, not for profits or other non-teaching organisations (27%, n=29), polytechnic universities or institutes of technology (including TAFE) (9%, n=10), secondary institutions (8%, n=9), vocational training providers (6%, n=6) and 3 year community colleges (2%, n=2). Representation from a range of levels within organisations was obtained, including practitioners (48%, n=53) including lecturers, teachers, trainers, educational designers, and project workers to researchers (25%, n=14), managers (8%, n=9), senior managers (14%, n=15) and executive management (11%, n=12).

The Open Education Resource universitas (OERu)

The OERu is a collaborative partnership currently comprising 30 partner institutions. The network includes both nationally accredited universities, colleges and polytechnics and publicly-funded organisations (Mackintosh, Taylor & McGreal, 2011). OERu’s current geographic spread of institutions includes Australia, New Zealand, Canada, the USA, England, Ireland, Spain, South Africa, India and the South Pacific. The initiative is coordinated by the OER Foundation, which is an independent, not-for-profit organisation that works internationally to support the mainstream adoption of OER into the formal education sector (Mackintosh, 2012).
Mackintosh, Taylor and McGreal (2011) described the aim of the OERu as providing free education to learners worldwide using OER as learning materials, thus providing pathways to enable learners to gain credible qualifications from government-recognised or accredited educational institutions. The OERu concept is rooted in the notion of community service and outreach, and institutions that are members of the OERu network have committed to developing a “parallel learning universe” that will augment and add value to traditional delivery systems in post-secondary education. The ultimate vision of the OERu is to provide free learning opportunities on a massive scale for learners who lack the financial means to access traditional higher education (Conrad et al., 2013).

One of the cornerstones of the OERu philosophy is that the components of higher education that are traditionally packaged together in a single institution can be disaggregated and provided by different institutions. Anderson and McGreal (2012) suggest that discount service models may become attractive, suggesting that the Open Educational Resources universitas initiative could support disaggregation as a disruptive model. Murray and Friesen (2011) explain that in traditional education models, learners enrol with a single institution and expect that institution to provide the teaching, the content, the assessment and the eventual accreditation. In the OERu’s disaggregated model, “the basic elements of education, traditionally conceived, are redefined as placeholders and are opened up to substitution and disaggregation. Any student can study any content, supported in any number of instructional arrangements” (Murray & Friesen, 2011, p. 4). This “disaggregation” distinguishes the OERu model from other open learning models such as MOOCs and gives rise to the discussion of assessment and accreditation potential that follows.

Accreditation and assessment in post secondary education: Issues and approaches

The assessment of learning and its resultant accreditation toward a credential presents a major hurdle to the integration of open learning with formal learning (Conrad, 2013; Friesen & Wihak, 2013) and provided the raison d’être to the study that backgrounds this paper.

Academic assessment remains, universally, the privilege and purview of individual post-secondary systems. While several jurisdictions have developed and implemented national accreditation frameworks, notably the UK and Australia, international accreditation and assessment services are not currently available. It is the premise of this paper that developing a robust system that can service thousands or even hundreds of thousands of learners internationally would change the dynamic of access to post-secondary education for learners. The necessary systems technology is already available within post-secondary institutions and would remain within their control: payment systems, content management systems, automated examination applications, and online invigilation.

There are two main types of assessment or accreditation relatively common at the post-secondary level of education outside of traditional classroom-based assessment: the Recognition of Prior Learning (RPL) and post secondary credit transfer, where formal credentials obtained at another institution are transferred into learners’ programs at their current or home institution. RPL is often referred to as Accreditation of Prior and Experiential Learning (APEL), Prior Learning Assessment (PLA, primarily in the USA), and Prior Learning Assessment and Recognition (PLAR, primarily in Canada) as well as several other terms.

RPL processes exist at post-secondary institutions in many countries. Research shows that the use of learning portfolios in RPL is very popular, followed by examinations that allow learners to challenge-for-credit through assignments, examinations, interviews, courses, tutorials, demonstrations, self-assessment, external evaluations, essays, face-to-face or online workshops, and a variety of other instruments (Conrad & McGreal, 2012). Proficiency and knowledge acquisition can be demonstrated through the use of a single assessment methodology or a combination of the
above. The least frequently used and available (though it could possibly be the most effective from the perspective of learners) is the option to write a challenge examination or engage in some other form of challenge-for-credit. Other methods of RPL are much more resource intensive, requiring staff dedicated to spending significant time with prospective students. RPL-supportive institutions have developed resources and structures that cover most aspects of accreditation and assessment, including policy, research, repositories and experience with licensing.

Credit transfer refers to the willingness of institutions to grant credit to students who have taken courses at other institutions. While easier and less labour-intensive than RPL, credit transfer— in those institutions that permit it— is sometimes problematic for students. In North America, with its standard three credits for a one-semester course, credit transfer is easier to implement and therefore reasonably common, especially in the first two years of post secondary education. However, this is not the case in jurisdictions outside of the USA and Canada, where many institutions are reluctant to accept transfer credits and the majority of students are restricted to taking all of their courses at one institution.

The MOOC phenomenon has opened up interest in the possibility of alternative assessment and although many institutions around the world are considering these alternatives, breaking down institutional silos continues to present a major hurdle in the “cottage industry” of post secondary education, a hurdle that must be cleared before large-scale OER-based courses can be put in place. Using RPL for assessment could possibly offer a solution (Camilleri & Tannhäuser, 2012; Conrad, 2013).

In a scalable, open environment, the necessary unbundling of services to separate assessment and accreditation from teaching and institutional support can be much easier using OER-based courses rather than commercial content. Scalability is problematic for initiatives that rely on commercial content that is restricted by technological protection measures and restrictive licensing. Because of the ease of copying, adapting and otherwise reusing OER, OER-based initiatives can be scaled up and made freely available in different jurisdictions and institutions.

Learning the hard lessons: Issues around and barriers to implementing OER

Murphy and Witthaus’ (2012) findings uncovered issues and barriers to the implementation of OER in post secondary institutions. The study also suggested that the notion of disaggregating traditional university services, while providing a useful conceptual framework for considering assessment and credentialing alternatives in open learning environments, has yet to be fully understood by the wider higher education community and has yet to be operationalised in practice at anything approaching a meaningful scale.

Study findings suggest that there is sufficient evidence to justify the unbundling of traditional services in order to provide more affordable access to post secondary education and formal academic credit. A small number of institutions are already utilising these opportunities as part of their existing delivery models. For example, the University of South Wales is already implementing RPL on a larger scale than most UK universities and is planning to expand the scope of its accreditation activities in partnership with other institutions in the OERu (Witthaus, 2013). Even if we consider the commitment of only the 30 OERu member institutions to establishing a “world OER credit bank” and “specifying what credit they are willing to accord those who successfully complete the learning outcomes associated with [the OER]” (OERu, 2011, p. 20) it is reasonable to assume that the inventory of full programmes of study that will be available under an assessment-only model will grow in the coming years. For example, in 2012, Otago Polytechnic announced that the new Graduate Diploma in Tertiary Education approved by the New Zealand Qualifications Authority will be based entirely on OER and will also cater to assessment-only options for prospective learners (Otago
Polytechnic, 2012). Also in 2012, the South African Ministry of Higher Education and Training stated that “collaborative development of high quality learning resources made available as Open Educational Resources (OER) provides the possibility both for increased access and quality and lower unit costs due to reduced duplication and greater usage.” (DHET, 2012). Additionally, the DHET (Department of Higher Education and Training) has more recently declared its intention to work “toward creating a post-school distance education landscape based on open learning principles” (DHET, 2013).

Mainstream assessment approaches that are used for summative assessment and credentialing in traditional models, such as examinations, tests, and, increasingly, portfolios, can be reused effectively within a disaggregated system. Challenge-for-credit examinations present an alternative within disaggregated systems that enable learners to prove mastery of a set of learning outcomes by sitting a challenge exam at a reduced fee compared to the full-tuition price of a course (Conrad et al., 2013). And while portfolio assessment processes can accredit knowledge gained from prior experience toward learners’ credentials, the labour intensive nature of this process may be less suitable for reuse within disaggregated systems. The study did not identify any material policy barriers for assessment and credentialing that would curtail the implementation of a disaggregated model, although in the UK there is a perception that the Quality Assurance Agency’s (QAA) strict rules for “collaborative provision” could make it difficult for UK institutions to operate in this way (Bird & Witthaus, 2012, p. 3). Elsewhere in the world, it appears that the majority of post secondary institutions would be able to implement assessment-only models within existing policy frameworks. However, minor adaptations and refinements to operational management and processes may be required. For example, student administration and processing of payments within a disaggregated model would require the accommodation of individual payment-per-assignment submitted for assessment. Such a system would also create a labour-intensive process that may be problematic within traditional models that require payment by learners prior to the recording of credit on university transcripts.

The practice of providing free online learning opportunities and corresponding solutions for assessment, certification and credentialing services will continue to evolve. Consider, for example, that the American Council of Education (ACE) has begun a project to explore whether credit recommendations from the Council can provide a viable pathway for accreditation of MOOC learning (Fain, 2012). This forms part of a $3 million investment by the Bill and Melinda Gates Foundation in several MOOC-related investigations including the Association of Public and Land Grant Universities (APLU) that are designed to create an interactive learning consortium to study the potential of MOOCs for public community colleges and universities and the Ithaka Strategic Consulting and Research group that will work with the University System of Maryland to test and study the use of MOOCs across their system (Fain, 2012).

Moreover, following the adoption of the 2012 Paris OER Declaration at the UNESCO OER World Congress, governments of member states of the United Nations will be encouraged to adopt policies that require teaching and learning materials produced from public funding to be released under open content licenses (UNESCO, 2012). This action may foster new policy imperatives for publicly funded universities and colleges to encourage them to diversify formal assessment and credentialing protocols for their citizens using OER courses as they can provide cost-effective pathways for widening access to post secondary education.

Although research on OER initiatives is contributing new knowledge for both researchers and practitioners, barriers to forward-movement in “openness” were also identified in the Murphy and Witthaus study (2012). The following section discusses barriers encountered and lessons learned to date.
Current institutional processes for international credit transfer and course articulation are idiosyncratic, usually dependent on institutional policy, with a lack of standardisation when working across regional and national borders (Conrad & McGreal, 2012). As such, current course articulation processes are not well suited to the recognition and credentialing of OER learning. This is potentially the most significant policy barrier for scalable implementations of assessment and accreditation for official recognition of learning on a large and global scale. Current institutional processes often result in unnecessary duplication and inefficiencies that hinder the cost-effective implementation of assessment and credentialing, which could be avoided through carefully structured collaboration around OER (see, for example, the case studies described by Lane, 2012).

Other significant barriers to OER identified by faculty and administration include fear of change, confusion over copyright issues and the use and reuse of OER, concerns regarding the effort required for implementation of OER initiatives, and the possibility of conflict with commercial publishers and other special interest groups (Murphy & Witthaus, 2012). Perceived barriers to the kind of collaboration proposed by the OERu are also numerous, and include concerns about the role of national quality assurance bodies, a belief that students might not get sufficient support, concerns about the “true” cost of collaboration around OER (in financial terms), and some scepticism around the philanthropic motives of the OERu (Bird & Witthaus, 2012, p. 14). However, the greatest barriers to participation in open assessment and accreditation practices are the lack of availability of committed staff members to support such activities and the potential costs of redeveloping courses as OER (Murphy & Witthaus, 2012). Lack of support for OER-based courses from senior management is also a substantial concern.

These “barriers” can be countered by incentives such as the low cost of entry and use of OER; minimal or non-existent licensing requirements; the ability to localise and update the content and make other changes without restriction; greater acceptance by students; organisational leadership by educators; and the potential to increase the institution’s ability to serve a greater number of international students and raise the profile of the institution in the global higher education community.

Within institutions, key factors for the success of open assessment and accreditation implementation appear to be a reliance on a strong base of support within the institution—both in terms of leadership and resources—and an existing culture of openness that includes policies and practices around the creation and use of OER (Murphy & Witthaus, 2012). Policies that enable either open access or recognition of prior learning via credit transfer or RPL are also important. Institutions that already have these features in place are likely to be in the best position to implement assessment and accreditation of OER-based learning services, and, as such, could provide models for other organisations that would like to participate in collaborative open education, assessment and credentialisation initiatives in the future.

Considerations for future research

Several areas for future research become obvious when the barriers and hurdles facing further implementation of OER are considered:

Establishing cross-border systems of articulation and transfer. As outlined above, the current state of idiosyncratic course articulation processes does not foster credentialing processes within disaggregated systems for OER learning. Further research is required to explore alternatives for cross-border credit transfer and course articulation in an open and disaggregated manner. As institutional accreditation is closely associated with quality assurance mechanisms, this research will need to consider corresponding implications for quality assurance processes in a disaggregated system.
Applying RPL processes to a disaggregated model of learning. The majority of OERu institutions and practitioners consider RPL methods and approaches to be the main vehicle for the assessment and credentialing OER learning in a disaggregated model (Murphy & Witthaus, 2012). Although a preliminary analysis of the costs to students for RPL are expensive when compared to other credentialing alternatives, for example, automated assessment and course assessment packages, these alternative methods should not be considered as substitutes for RPL because portfolio assessment offers meaningful opportunities for the assessment and accreditation of learning acquired outside of conventional course delivery (Camilleri & Tannhäuser, 2012; Conrad, 2013; Friesen & Wihak, 2013). While for many learners, RPL is the only option available to gain formal recognition of their learning, there may be specific RPL processes which could be reused, repurposed and repackaged to augment and support assessment and credentialing processes for OER learning in a disaggregated system. To investigate these possibilities, further research focusing on the following areas of RPL is recommended:

- Activity-based costing analysis of RPL processes to identify cost-behaviours of appropriate RPL activities;
- Investigation of possible solutions for cost-effective and scalable RPL processes when working with large numbers of learners; and
- Analysis of alternatives for packaging RPL assessment and credentialing processes and corresponding pricing for sustainable operations in a disaggregated system.

Conclusion

Academic boards and senates at many universities are reluctant to reuse open-licensed courses and their corresponding assessments, even though those materials have been formally approved by another accredited university and even though these open courses can be adapted locally at no cost and offered in parallel with existing courses in order to diversify curriculum at the home institution. This reticence may prove to be short-sighted and poor business strategy. As they so often do—think Coursera—the commercial sector will be quick to appreciate the business value of building assessment and credentialing strategies from assets which do not require any upfront investment. And governments hard-pressed to reduce fiscal deficits may consider alternatives for a more cost-effective post secondary sector that recognises the benefits of favouring the disaggregation of traditional university services.

The formal post secondary sector has a unique opportunity to take a leadership role in determining its own futures because the token esteem of a university credential continues to be highly valued by both society and economy, as Brown and Duguid (1996) outlined:

in our highly commodified society it is naïve to believe that access on its own is enough. Those who have the label but not the experience present one problem. But those who might have the experience but not the label face another. Experience without a formal representation has very limited exchange value—as those whose only degree is from the university of life well know. (p. 10)

Universities, as institutions, are understood to have the requisite knowledge and experience and have long enjoyed the trust of society in the process of accrediting the formal learning of those seeking formal academic credentials. The disaggregation of assessment and credentialing services for OER learning can provide a viable pathway for more affordable access to post secondary education and formal academic recognition while simultaneously continuing to serve universities’ core academic missions of disseminating knowledge and engaging in community service.
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Scenarios for the Use of OpenCourseWare in the Context of Student Mobility

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Abstract
In the context of a European OpenCourseWare project, funded by the EU Lifelong Learning Program, a handbook has been created with the purpose of showing how students and universities throughout Europe can get the most out of OpenCourseWare in order to become part of new learning communities and facilitate virtual exchange across borders. The main part of the handbook is the presentation of the Student Mobility Cycle that has been developed within the project and that defines five phases in the process of a student participating in Student Mobility. This article describes the five phases, each consisting of one or more scenarios that show the added value of OpenCourseWare in that particular phase.

Keywords: Learning Communities; Lifelong Learning; OpenCourseWare; Open Education; Student Mobility; Virtual Student Mobility

Introduction: the Context of the Student Mobility Handbook
In 2012 five European universities and three third party organizations started a European Lifelong Learning Program project1 with the main goals to (1) create the preconditions for a strong European OpenCourseWare (OCW) framework and (2) to create guidelines and informative handbooks to support other universities who want to use OpenCourseWare.2 The particular context of this project is clear in its full title: “OpenCourseWare in the European Higher Education Context: how to make use of its full potential for virtual mobility.” The deliverables of the project thus seek to enhance quality and increase the usage of online courses and therefore facilitate virtual mobility.

One of the deliverables is a Student Mobility Handbook. Under the notion “Student Mobility,” we understand students in higher education moving to another institution inside or outside their own country to study for a limited time.3 This is clearly exemplified in the EC Erasmus Programme.4 We speak about Virtual Student Mobility when a similar experience is achieved without the student physically moving to another place5 (De Gruyter et al., 2011; Van Petegem, 2011). With the handbook, our aim is to show how students and universities throughout Europe can get the most out of OpenCourseWare to become part of new learning communities and facilitate virtual exchange across borders. The main part of the handbook is the presentation of the Student Mobility Cycle that has been developed within the project and that defines five phases in the process of a student participating in Student Mobility.

Methodology
The scenarios were obtained through several workshops, where we collected input from participants coming from the Higher Education (HE) world6 (Tovar, 2012). They were subsequently validated.
at international offices from participating universities. A survey was held amongst students about OpenCourseWare and Virtual Mobility, where these scenario’s were presented (OCW Consortium Europe, 2013). This more specific survey adds to the research already done on OCW user feedback (OCW Consortium, 2012).

The Student Mobility Cycle

We opted to describe the possible scenarios of using OCW –so, open courses offered for free by HE institutions- in the context of Student Mobility as a cyclical process which can be divided into five different phases, as depicted in figure 1, above.7

When discussing these scenario’s, we are not hinting at the use of actual, existing OCW sites –such as MIT (http://ocw.mit.edu), Irvine (http://ocw.uci.edu), TU Delft (http://ocw.tudelft.nl) or KU Leuven OpenCourseWare (http://ocw.kuleuven.be)- as many of them will currently not offer adapted content for the scenario’s described here. We just list possible courses that can meet such a scenario.

The first phase involves study selection. In this phase, candidate students are gathering information about their potential future studies in order to choose a study. Taking an Open Course from different universities as teaser courses, can be invaluable to get a better perspective/understanding on what particular institutions offer. Once a student has chosen the study he/she wants to

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1 Open Praxis, vol. 6 issue 2, April–June 2014, pp. 135–144
commence, he/she can start preparing himself for this course, e.g. by taking Open Courses to learn a foreign language, to gain insights in the learning culture of the institution (certain habits peculiar to the institution), or he/she can use an Open Course to fill what we call his “knowledge gap.” A lack of knowledge in specific areas can be bridged through Open Courses. In the next phase, the phase of the actual study, OpenCourseWare can be used as an extra learning resource: learning materials provided by the teachers of the courses one takes can be complemented by Open Educational Resources and OpenCourseWare from other Higher Education institutions. This helps the student in adapting to the context he/she finds him/herself in.

The fourth phase is the phase where a student wants his learning efforts to be validated, e.g. in the form of credits and where a student wants to keep updating the acquired knowledge and/or skills from that particular study, using OpenCourseWare, whether that comes from a university where he/she took a course or not. We call this fourth phase the sustaining phase. This scenario of Lifelong Learning, in our opinion, is to be distinguished from the professional trainings in the capitalizing phase. Lifelong Learning happens when one perceives a learning need and is based on intrinsic motivation. Professional training however is mostly requested by the company one is working at. A separate phase, which is not to be put chronologically after the five previously described phases, is a possible alternative for students who, for several reasons, cannot travel abroad. Virtual student mobility is a well-known alternative for actual student mobility, meaning that students can take (open) online courses as part of their curriculum, but without travelling physically to another institution. It goes without saying that in this case too, OpenCourseWare can be a valuable alternative.

Every phase consists of several scenarios. The orange blocks next to the text contain the names of each of the scenarios in order to provide a visual link to the cycle above (figures 2 to 7).

Phase 1: Choose

Before going to university one needs to make decisions as to the appropriate course of study. In this selection process several questions might arise such as “what is it like to take classes at a university?”, “what is it like to follow a class with 300 other students instead of 20?”, “what do scientific articles and readings look like, and will I be able to understand them?”, etc. . . Using OCW and its educational materials could be useful to provide prospective students with information about the new study they might be uncertain about (figure 2). Such materials can help to understand the real difficulty of the content or the organization of the course structure before the student officially enrolls.

Deciding on the appropriate course of study as well as choosing an appropriate institution normally involves comparing several higher education institutions. When those institutions offer OCW, a student can assess the type of materials offered and thereby increase his confidence as to pursue his studies outside his usual environment.

Phase 2: Prepare

Once a student has chosen the university he/she wants to attend and the study he/she wants to commence, he/she has to start preparing for that particular study. Several problems might indeed arise, such as the need for learning the language of the destination or encountering a knowledge gap. Both scenarios are described below.

Using OCW can fill a “knowledge gap” (figure 3). There might be a difference between the curriculum in the university of origin and the university of destination. When a student couldn’t take a certain course in his curriculum that he/she should have had to be able to take a course of a
higher level at the university abroad, he/she can autonomously take the open course in order to fill the knowledge gap. This is particularly of interest when the study abroad concerns a doctoral study, e.g. when someone wants to update or broaden his knowledge of statistics in order to conduct his/her PhD research. In addition to filling the knowledge gap, OCW can also be a solution when a doctoral researcher doesn’t manage to attend certain classes because of the combination of several tasks -often PhD students work as an assistant for professors at university, or they combine a job with a doctoral study.

An Open Course of the university of destination can be used to assess Language requirements for studying at a particular institution. Using the openly available resources might provide answers to questions such as: “will my language mastery be sufficient to understand the lecturers?”, “will I be able to study a scientific text in a foreign language?”, etc . . . If it appears that the language skills of the student are indeed insufficient, he/she could take an open language course in order to improve his competence. When a student prepares to study abroad, he/she could therefore use OCW to acquire communication skills in the required language and to fulfill the conditions of admissions in the university of destination.

An open language course can also facilitate the integration into the academic and cultural world of destination. After all, language courses often contain a lot of cultural background about the countries where that language is spoken.

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In short, OCW can encourage students to perform (virtual) mobility periods outside of their country of origin, because it introduces them to the new institution and it can negotiate the emotional barriers that are created when planning a move to a place with another culture and possibly a different language.

**Phase 3: Adapt**

When a student is following courses at university of destination he/she will often stumble upon references to other local courses that local students might have taken but that are not directly accessible to him. These are contextual elements that are important for a correct understanding of the course content and that need to be clarified. Good OCW is so designed that it makes explicit dependencies of the open course to other materials and ideally refers to other open content to resolve these pointers. More broadly, courses are always also embedded in cultural practices and unspoken local conventions which are part of the local learning community. A university might consider courses specifically designed to explain and make explicit these kinds of cultural assumptions that prove to be a frequent hurdle for foreign students. An open course “introduction to our campus life” makes as much sense as a course on local educational terminology (figure 4).

By joining open online learning communities the student can organise contacts with local students in direct relation to the course content, e.g. by getting information from local senior students, which
partly compensates for the disadvantage of having a real social network in place from the start. But, conversely, the student can remain active in the social network of his home base by taking part in open online communities of the online education of his home university. In general a real open course should also be a course where students have the possibility to add content to the course and share it with each other. The main message is that the study of an open course comes to its full potential when the student actually becomes part of a social learning network or open study community related to that course. Such a learning community can go beyond students and teachers to also include external stakeholders that might have a relation with the field of study. An example can be found in a master of Computer Sciences where students assess certain software and have to blog about it. Interestingly, due to the fact that this blogging happens openly, the developers of the software are able to react to the students’ assessments. This open and authentic learning situation is a win-win-situation for students, teachers and stakeholders in the domain of computer sciences.

The added value of an Open Community over membership driven communities of practice is that the student typically has not yet any formal responsibilities towards the field of study and should be able to roam free through this knowledge space without having to take up responsibilities and commitments that he/she is not prepared to tackle. The experimental status of the learning experience is pedagogically fundamental.

Figure 4: Student Mobility Cycle. Phase 3: Adapt
Phase 4: Sustain

Open educational resources, open courses and open information about course metadata can help facilitate course certification for the student, in the form of certificates of accomplishment, badges, credits or credit transfer (figure 5). Exemption for Accredited Prior Learning (APL) can be attributed more easily when study materials and student activities are publicly available as OERs online.

When a student graduates and becomes active on the labor market, his knowledge will need to stay up-to-date. When the course(s) he/she took are Openly available, there is the opportunity to have access to the renewed and relevant content in the courses and to read and learn about state of the art research results concerning their field.

Moreover he/she can in return complement the course with practical knowledge and insights he/she gained from working in the field of the Open Course. A real Open Community can be constructed.

Phase 5: Capitalize

Professional trainings are in a certain way a form of Lifelong Learning. We opted to distinguish both in that sense that Lifelong Learning is motivated from within a person. One keeps learning because he/she wants to, because he/she feels a certain learning need, and because he/she truly wants to.
achieve certain knowledge or skills. Professional trainings on the other hand, are often required by but also provided by the company someone is working for. Companies often organize internal trainings to certain groups of employees to teach them new skills or to update them about the procedures that are common in the organization. Usually these professional trainings are closed for anyone outside the organization. Moreover, often they are not accessible for employees of that particular company not belonging to the specific target group the training is developed for. We believe that when these trainings are made accessible for all the employees within a company, and even for anyone also outside the company, that an extra target group might be served, namely the unemployed who can use the content of these trainings to increase their job opportunities on the labour market (figure 6).

A second issue in this regard is the fact that there is a discrepancy between the kind of skills that companies need from employees and what they actually get when people start working for them. If companies open up their training materials they showcase their needs and requirements prominently. This can be easily linked to the teaser courses as described in Phase 1 of this Student Mobility Cycle. Having access to training materials beforehand can help graduates to (1) get a perspective on what the employer wants, (2) needs better prepare for their prospective roles and (3) possibly be even more successful during the job application process.
Virtual Mobility as an alternative for physical Student Mobility

Since not everyone has the possibility or the wish to travel abroad, students can opt to be virtually mobile (figure 7). Virtual Mobility is defined by the European Commission (2007) as a complement or as a substitute to physical mobility (Erasmus or similar) in addition to a type of independent mobility which builds on the specific potentials of on-line learning and network communication. It may prepare and extend physical mobility, and/or offer new opportunities for students/academic staff who are unwilling or unable to take advantage of physical mobility. (…) Full academic recognition is given to the students for studies and courses based on agreements for the evaluation, validation and recognition of acquired competences via Virtual Mobility. In this context, cooperation agreements are key to ensuring sustainable mobility schemes. (p. 12)

Given this definition it might become clear that for several of the above-described scenarios a virtual equivalent exists. It all boils down for students to take (open and online) courses from universities other than their own institutions, with the goal to experience an international study and to include that course in their study programme at the home university.

Conclusion

In this paper several scenarios are offered on how to use OpenCourseWare courses in the context of Student Mobility, whether that is virtual or not. These scenarios are defined as a cyclical process...
involving five distinct phases: *choose, prepare, adapt, sustain, capitalize*. The alternative scenario of Virtual Student Mobility is presented as well. In all these cases, we argue that OCW courses provided by host institutions offer a distinct advantage to students. We also indicate which kind of support those courses can offer in each student phase. Higher Education Institutions are encouraged to consider offering these kind of OCW courses to the benefit of their Student Mobility policies.

**Acknowledgment**

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**Notes**

1. EC funded Life Long Learning project “OpenCourseWare (OCW) and its potential for virtual mobility and Life Long Learning in the European Context—518373-LLP-1-2011-1-NL-ERASMUS-ESMO, see Retrieved from [http://www.opencourseware.eu](http://www.opencourseware.eu)
2. OpenCourseWare are course lessons created at universities and published gratis via the Internet, see Retrieved from [http://en.wikipedia.org/wiki/OpenCourseWare](http://en.wikipedia.org/wiki/OpenCourseWare); originally offered by MIT: Retrieved from [http://ocw.mit.edu/](http://ocw.mit.edu/)
7. Scenario infographics: Sophie Touzé.

**References**


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From OCW to MOOC: Deployment of OERs in a Massive Open Online Course. The Experience of Universidad Carlos III de Madrid (UC3M)

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Abstract

The emergence of Massive Open Online Courses (MOOCs) is focusing all its attention on open education. There is growing interest in creating MOOCs, which can be done by transferring OCW courses to MOOC format. However, a series of doubts arise regarding the pros and cons implied in this transformation. In this paper we discuss the conclusions derived from our experience at Universidad Carlos III de Madrid with a widely disseminated OCW course that was satisfactorily converted into a MOOC. This experience has allowed us to compare two different models of open education initially based on the same content. We also analyze the difficulties incurred in the transformation process and present strategies to successfully carry out this change.

Keywords: Massive Open Online Courses (MOOC); MOOC Design; OpenCourseWare (OCW); Open Education; Open Educational Resources (OERs)

Introduction

Higher education is being transformed all around the world due to open online access (Cooperman, 2014). However, this change process is not uniform, rather it depends on the context in which it takes place.

In the case of Europe the advent of open educational resources is determined by two factors. First, the application of information technologies to educational processes stands out among the various forces driving this trend. Second, the change in the teaching and learning methodology in the development of the European Higher Education Area (the so called Bologna Process) that implies a more practical approach to education (Adelman, 2009). The combination of these two factors has given rise to a proliferation of digital teaching materials (texts, cases, slides, videos, podcasts and so on) created by the teachers themselves for their own pupils who traditionally only had access to on-campus classes and references to textbooks in paper format as study elements.

This multiplication of teaching materials in digital format has coincided with the emergence of open education, and has thus encouraged a large number of teachers to disseminate their work that was originally intended to be used by their pupils in a closed environment. These teaching materials can be disseminated by simply publishing the documents in digital format (open archive), or organizing them in course format to foster self learning (OpenCourseWare). These prior experiences have lead to the creation of specific courses to be developed online with audiovisual and interactive elements that guide the students in the learning process (MOOC).

The various modalities described above correspond to a certain extent with the different stages in the evolution of open education initiatives (Falconer et al., 2013). They all stem from university courses but at the same time they differ, to a slighter or larger degree, depending on how they adapt to the real format of a university course and the implications implied therein for the teacher.
and the educational institution. On the one hand, from the social aspect this is a way of allowing access to a university education for those who cannot afford it (Marshall, 2013) and, at the same time, gives both the institution and the quality of the teacher’s work greater visibility (Matkin, 2013). On the other hand, this implies an additional workload for the teacher and the institution, which may not always have a positive impact on the learning process for both current and potential future students (Mackness; Mak & Williams, 2010).

Thus, the choice of teaching mode and the specific platform for developing open education activities is extremely important for both the teacher participating in such activities and the institution that sponsors them. In this sense, it is paramount to be aware of the real implications of each mode of open education and consider possible strategies that can be developed when joining an Open Access movement that is unstoppable in the higher education sector.

The aim of this work it to offer professors and university institutions information and reflections derived from the experience obtained by a group of professors at Universidad Carlos III de Madrid (UC3M) in using different modes of open education. This experience is particularly interesting since it addresses one of the first courses in Spain adapted to the Bologna Process offered on the OCW site (http://ocw.uc3m.es) that was later converted into one of the first Spanish MOOCs. It provides a comparative analysis of the two main forms of open education and likewise studies the transformation process showing the difficulties incurred in the development process and the benefits derived from this change. The results of this experience can help other teachers and institutions when deciding on which open education model to develop and also help those responsible for designing open access policies and platforms to improve their own projects.

The content of this article covers, first of all, the context in which the experience was developed, analyzed from the standpoint of open educational policies and resources at UC3M. It then refers to the initial situation, i.e. the courses developed in the framework of the OCW Project at UC3M, and then goes on to analyze the transformation from OCW to MOOC, and finally analyzes the results of the UC3M MOOC.

**The Context: Open Educational Resources and Policies at the Institution (UC3M’s OER policy)**

When considering any serious analysis of open education it is important to take into account the context in which it takes place. Creating OERs is not an isolated action undertaken by a professor rather it stems from the strategy of the academic institution that is going to define its characteristics and scope (Kennedy et al., 2009).

For this reason it is important to consider the open education policies and resources available at the institution that is contemplating this open education initiative. As regards open education policies, they determine that professors can project their teaching activities in an open and online format, whether they are on-campus courses or new courses designed specifically for that purpose. A suitable political strategy that encourages open education initiatives (by reducing teaching hours, recognizing merits, etc.) will foster the advent of a greater variety of courses and of better quality. Regarding the human and material resources that are available at the institution to support faculty, they will define the format of the courses, as well as the variety, sophistication and quality of the educational resources they incorporate.

In the case of UC3M the fundamental guidelines of open education are part of its philosophy: sharing, reducing barriers and increasing access to education. The development of open education activities at UC3M has been determined by two circumstances that have fostered the creation of open courses. Firstly, the broad experience of its teachers for more than a decade in the use of...
information technologies thanks to the university’s Virtual Learning Environment (Aula Global) that has encouraged faculty to digitize their teaching materials and put them online for their students. Secondly, the change in the teaching and learning methodology brought about by the new programs designed according to the criteria of the Bologna Process to adapt them to the European Higher Education Area. UC3M was one of the first universities to adhere to the Bologna Process, so since 2008 a more practical approach to teaching based on continuous formative assessment has become widespread, which has lead teachers to create their own teaching materials.

This favorable context has allowed UC3M to successfully develop its open education policies. OpenCourseWare was the first open educational resources initiative to be set up at the University. The University joined the OCW movement in 2006, when it reached Spain under the auspices of Universia. This project has helped to foster open publishing culture among professors and has been a catalyst for other OER initiatives. UC3M currently offers 209 courses in the fields of Engineering, Humanities and Law and Social Sciences and has won several awards of excellence, for the quality of its OCW courses, from Universia and the OpenCourseWare Consortium.

In 2007 UC3M launched another initiative that indirectly favors open education, that is E-Archivo (http://e-archivo.uc3m.es/), the university’s Open Archive. Its aims are to collect, store and preserve the intellectual production resulting from the academic and research activities of the university community, in digital format, and offer open access to these works. The collection includes doctoral theses, periodicals edited by UC3M, working papers, preprints, articles, conference proceedings, reports, etc.

In 2012 UC3M set up two important working groups to establish a stable and coordinated basis for furthering the creation, use, dissemination and preservation of OERs and supporting instructors in the process (Malo de Molina, 2013).

- **MaREA.** This is a multidisciplinary working group composed of professors who are specialists in Intellectual Property Rights, Open Access and OERs and interactive technologies; as well as members of the Library and Communications and Computing Services. Its aim is to define policies and strategies for creating, managing and disseminating quality educational resources.

- **UTEID (Unit for Educational Technology and Innovative Teaching).** This is a unit that is integrated in the Library Service with support from the Communications and Computing Service and the Undergraduate Management and Academic Support Service, to a) support faculty in creating educational resources, using new educational technology, and protecting, preserving and disseminating these resources; b) evaluate platforms and tools for course design, content creation and student evaluation. It supports teachers participating in projects such as Khan Academy Zero Courses, MOOC-UC3M and MOOC-Universia. The UTEID website can be found at: http://portal.uc3m.es/portal/page/portal/biblioteca/UTEID

In 2013 the first UC3M MOOCs were launched on the MiriadaX platform (https://www.miriadax.net) promoted by Telefónica Learning Services and the Universia Foundation, that encompasses the majority of Spanish and Latin American universities. Finally, in 2014 UC3M joined the MIT-Harvard’s edX platform and plans to initially launch four MOOCs. Currently, all the university’s open education initiatives (OpenCourseWare, MiriadaX, Khan Academy Zero Courses, YouTube Edu, iTunes U) are gathered on the “UC3M Digital” web site (digital.uc3m.es).

As can be seen, UC3M is really committed with open education which it fosters by way of specific measures that encourage professors to offer their courses in an open format. Faculty participation in these kinds of initiatives is recognized as teaching merit that has academic and economic repercussions. Also the teachers have the support of the UTEID to advise them regarding the course design and delivery with the latest generation audiovisual and computer technologies.
This context explains why UC3M has been a pioneer in the development of OERs in Spain and is a conditioning factor for the evolution to new formats of open education, encouraging the transformation of OCW courses to MOOCs.

The Starting Point: Launching OpenCourseWare (UC3M-OCW Project)

The traditional starting point in open education so far has been OpenCourseWare. OCW courses have the advantage of allowing teachers to develop open educational experiences without too much effort as long as they have a course for which they have developed their own teaching materials.

OCW courses are in effect repositories of teaching materials that teachers use in their on-campus courses and have undergone certain adaptations. This means that the teaching and learning is based on the student’s self learning process. The student has all the instructions and teaching materials at his/her disposal to follow the course, but s/he has to do so by him/herself since no guided learning is entailed. Furthermore, in OCW courses students have no contact with the teacher which means that they have to access knowledge on their own without being able to ask questions or request further explanations. Although the courses have practice materials and other learning activities they are not interactive so it is the responsibility of the student to do them properly. Overall, the students undergo a self assessment process that provides no means of recognition or accreditation of the knowledge they have acquired.

These characteristics explain why OCW courses have a limited teaching capacity and, in general, have been used as complementary tools in open education. From our experience we have found that students do not tend to follow a full OCW course on their own but rather use the materials as if they were textbooks to broaden and deepen their knowledge of certain aspects, either because they are enrolled on a similar course or because they are interested in the topic.

Regarding the course design and preparation, the majority of OCW courses are not prepared from scratch for that purpose, instead they are a digital version of an on-campus course that has been slightly adapted. This has the advantage of offering access, although partially, by way of these materials to the real and unadulterated teaching that is carried out at the most prestigious universities in the world.

OCW content is in fact very diverse and can be classified in study materials (texts and audio-visuals), practice materials and assessments. Most OCW courses include limited text materials that in general cannot be accessed directly, instead they offer limited readings or bibliographical references that the students have to acquire of their own accord. Sometimes they include articles and other documents as elements for analysis, but the textbook in digital format on which the classes are based is not normally included. As for audiovisual materials, these are usually slides that constitute the basis of the study texts.

With regard to the practice materials these tend to be more abundant and include approaches to problems and case studies (with or without solutions), as well as guides for developing laboratory tests and exercises. The assessment materials tend to be more limited as they usually include previous years’ final exam questions and, on occasions, tests and partial exams prepared for each lesson. Finally, there is no monitoring or follow-up of OCW courses on behalf of the professor who limits him/herself to publishing and providing open access to his/her materials online.

Regarding the UC3M experience, in 2007 a group of professors of the Public Law Department initiated a series of OCW courses with very specific characteristics, due to their orientation, design and subject area (Administrative Law), which should be taken into account during the analysis stage. These are four courses on Administrative Law that are reviewed and updated on a yearly basis and new content is added.

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Firstly, since these courses focus on a subject that applies to a local domain, as is the case of Administrative Law, their international scope is limited. Furthermore, it is a subject based on specific language, which makes it difficult to translate into other languages. Thus, the potential students for these courses are Spaniards or Latin Americans from countries that share the same legal tradition as well as the language.

Secondly, due to the nature of a subject such as Law, which is a conceptual-intellectual creation, it is taught by studying and reflecting on texts (regulations, decisions and doctrine). This limits the teaching resources that can be used as in the case of visual presentations or videos that do not consist in a presentation by the teacher, and it is not possible to teach through laboratory experiments.

In spite of these difficulties, four courses that correspond to the core subjects of the Bachelor’s Degree in Law were developed and are currently available at http://ocw.uc3m.es/derecho-administrativo:

a) Basics of Administrative Law  
b) Administrative Organization and Process  
c) Public Procurement, Public Personnel Administration and Public Property Law  
d) Administrative Action on Main Economic Areas.

The materials of these courses are composed of readings (20–40 pages), case problems, multiple-choice tests for each lesson (there are 45 lessons in total), as well as overall evaluation activities (final exams). The result of the teachers’ work is an astonishing amount of materials: about 1,500 pages of original text, which equate to four open online textbooks (one for each course). In fact publishers have approached the teachers, but they have preferred to stay in the OCW movement keeping their content open and free for all.

The courses receive an average of 2,000 visits each per month, of which 90% are from Spain and the rest from Latin American countries (Argentina, Chile, Peru and Colombia). Although it is difficult to know the profile of these visitors and how they use the course materials, we can reach some conclusions from the pattern of the visits and the keywords they use to find the courses. The materials are mostly used by UC3M students as a textbook for the corresponding on-campus subject, although they may be taught by different teachers. It is possible that they are also used as supplementary materials by students from other universities. Other frequent users are people preparing for competitive exams to join the Civil Service, who mostly use the tests and practical case studies. Regards the rest, the text readings are usually used for consultation purposes by other professors and lawyers in general, as they tend to appear among the top results of search engines when doing a technical search in legal matters.

These UC3M-OCW courses make a difference with regard to the rest of OCW courses, mostly for their extensive online content. To a certain extent, in their approach and design they have tried to overcome the limitations of the majority of OCW courses. On the one hand, they are “fully open” compared to the rest that only provide supplementary teaching materials (slides, assignments, exams) and refer the user to bibliography that does not have open access. These courses, on the contrary, offer online and open access to all the teaching materials necessary to study the subject, which is the only way for open education to be effective.

On the other hand, these courses offer a “real and up-to-date education” since the volume of content of the original text, that contains in-depth and updated analysis of legal affairs allows student to receive a complete legal education, and converts them into reference works not only for students but also for law practitioners. In fact, the courses go beyond education into research and it is possible to find references to these materials in hard-copy published textbooks and also reports and studies of various kinds.
The Transit: From OCW to MOOC

Both OCW courses and MOOCs have common elements which we can consider in order to set up a comparison, as can be seen in Table 1: OCW-MOOC Comparison.

Converting an OCW course into a MOOC constitutes a natural evolution in open education. The design, planning and delivery of a MOOC in undoubtedly easier when it is based on an OCW course, not only for the experience acquired but also, above all, for the materials that have been developed.

However, the transition is not simple and before tackling it certain factors concerning the significance and the relationship of OCW courses and MOOCs in open education have to be taken into account.

Firstly, MOOCs are not improved versions of OCW courses that have come to take their place. They both constitute different tools that have their own advantages and limitations. In general they can coexist and be offered simultaneously as their target audiences are seeking a different kind of education in both cases.

Secondly, MOOCs can benefit from all the teaching materials prepared for OCW courses, but these are not enough. In particular the transit to a MOOC demands preparation of additional audio-visual materials (video lectures) as well as interactive components (online tests, practice materials for peer review).

Thirdly, MOOCs are dynamic since they are delivered in a specific time period and are interactive to the extent that they require a certain degree of intervention on behalf of the teacher. This is the element that really distinguishes them from other open education models, among others (North, Richardson & North, 2014, p. 70). This requires designing a program and a schedule for the course delivery that has to be adhered to as well as encouraging student participation in the forum and blogs.

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Table 1: OCW—MOOC Comparison

<table>
<thead>
<tr>
<th>Characteristics and Content</th>
<th>OCWs</th>
<th>xMOOCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differentiating elements</td>
<td>Self discipline: Self guided learning, no contact with teacher, no interaction, no assessment nor certification.</td>
<td>Hetero-discipline: Guided learning, contact with teacher, interaction, assessment and certification.</td>
</tr>
<tr>
<td>Preparation and design</td>
<td>Minimal. Adaptation of class teaching materials.</td>
<td>Demanding. Specific course design is required.</td>
</tr>
<tr>
<td>Text materials</td>
<td>Necessary. Bibliographical references at least.</td>
<td>Necessary. Although audiovisual materials acquire greater importance.</td>
</tr>
<tr>
<td>Audiovisual materials</td>
<td>Recommendable. Usually in the form of slides.</td>
<td>Necessary. Video lectures, as well as slides.</td>
</tr>
<tr>
<td>Activities</td>
<td>Necessary. Although no correction system is required.</td>
<td>Necessary. They should be programmed and allow for feedback.</td>
</tr>
<tr>
<td>Assessment</td>
<td>Necessary. Although no correction system is required.</td>
<td>Necessary. On concluding the course and should guarantee quality and originality control.</td>
</tr>
<tr>
<td>Student monitoring</td>
<td>Inexistent</td>
<td>Necessary. Supervision of each stage to allow for adjustments.</td>
</tr>
<tr>
<td>Interaction</td>
<td>Inexistent</td>
<td>Necessary. Assessments (test, peer review) as well as tutoring by way of forum and blogs.</td>
</tr>
</tbody>
</table>

All these factors should be carefully considered by the professor since the transit from an OCW course to a MOOC can affect his/her academic work considerably. In particular s/he should take into account the time available for preparing and developing the MOOC, the impact it will have on his/her OCW course and, above all, on his/her on-campus courses, since the students may have less incentives for attending classes.

As far as the UC3M experience is concerned, it should be remembered that, according to the European MOOC Scoreboard (http://openeducationeuropa.eu/en/european_scoreboard_moocs), Spain is the country with the most Massive Open Online Courses (MOOCs) largely due to the MiriadaX initiative launched towards the end of 2012 by Universia and Telefónica Learning Services. 2012 was indeed the “Year of the MOOC,” as coined by the New York Times (Pappano, 2012).

During the 2012–13 academic year the group of professors mentioned earlier decided to take their work a step further converting one of their OCW courses to MOOC format. The course ran on the MiriadaX Platform (Figure 2) supported by Telefónica Learning Services and Universia. As in most cases, when a specific platform is used the course materials and interactions were centralized there following the xMOOC model (Daniel, 2013). It was therefore important in the MOOC design stage to take into account the affordances provided by the platform as these determine the format of the learning contents and the types of assessment that can be supported.

The course was comprised of 9 modules, one per week, plus a brief introductory module in week one. The total estimated study time amounted to 27 hours. Each module contained 4 videos of 15 minutes each one, plus reading texts and Prezi presentations. The forum, Q&A, and blog provided...
by the platform were used for communication with the students, and assessments were carried out using the interactive test and peer review of the case problems.

The fact that most of the materials (digital textbooks, tests, case problems, and final exams), originally prepared in the form of OERs for the OCW course, already existed was a considerable advantage. These materials can be transferred to the MOOCs with a few adaptations (just adjust them to the new platform format).

The additional materials prepared specifically for the MOOC were, first of all, the Prezi presentations in two versions, a short one to be projected during the videos and a longer version to be downloaded and used as a study plan; and secondly, the audiovisual materials, 36 videos with a total duration of 540 minutes.

It was also necessary to prepare links to topics of current interest for the blog and answer students’ comments, reply to questions from the Q&A and take part in the conversations in the forum.

The two features that characterize a MOOC, the audiovisual materials and course interaction, are precisely the ones that present greater complexity and a larger workload for the professors.

Regarding the audiovisual materials it is not just a question of recording the sessions but also doing intense preparation in advance. So that the videos will be effective a script has to be written and the materials that are going to be projected have to be adapted to the length of the video, at the same time making sure they cover all the necessary content. This time limit and the lack of contact with the students require the teachers to adopt a more direct and concise approach than in normal classroom teaching.

As for the dynamic feature of MOOCs, this requires the teachers to maintain a different attitude than with OCW courses, as it is necessary to monitor the course schedule closely making sure that the materials are published in the right sequence. The teachers also have to take part in the Q&A, blog, forum, and wikis, which multiplies the workload, since this requires feeding all these resources
with content as well as answering students’ questions, comments and remarks since lack of feedback creates negative reactions that quickly spread and affect the course development.

In summary, based on our experience we can say that to successfully convert an OCW course to a MOOC a professor has to fulfill the following requirements:

a) To prepare the course in a specific format. A MOOC project cannot be approached in the same way and with the same content as an on-campus course. The amount of time students have available and their working pace is different and so MOOCs require specific design and planning.

b) To be able to count on a documentary and audiovisual support team. The professor should be able to rely on at least a technician to help him with editing the text materials. Likewise another technician (or a team in this case) in charge of recording and editing the videos.

c) To prepare the videos in advance. It is not enough just to record a normal class, instead it is convenient to plan the content of each video, prepare a script and rehearse it.

d) To monitor the course through all its stages. Even though the professor does not intervene directly s/he should supervise each stage in order to identify the students’ reactions and, if necessary, carry out the necessary adaptations or corrections.

e) To intervene in the course. The students need to know that there is a teacher behind the course, so it is important to interact as far as possible leaving some messages in the forum, on the blogs or any other social media.

In short, a MOOC implies greater effort on behalf of the professor and the institution that is difficult to quantify. In any case, we can state that a well designed and delivered MOOC is the equivalent in working hours to a teacher preparing a new subject from scratch. In the case of having already prepared an OCW course with course materials that are ready to be published then we can say that the workload is reduced by half.

The Result: The Massive Open Online Course (UC3M-MiriadaX MOOC)

With regard to open education experiences MOOCs are currently attracting all the attention and are creating great expectations that have derived in a “global virtual university” (Marshall, 2013).

The reasons for this phenomenon are the unique characteristics of MOOCs that bring them closer to an on-campus education experience (see Table 1: OCW-MOOC Comparison). In particular MOOCs focus on the knowledge to be learned or xMOOCs (Haggard, 2013) that are courses entailing guided learning in a previously established time period that has to be adhered to by the students. In MOOCs students have contact with the teacher who provides them with access to knowledge by way of videos and with whom they can interact in the forum, blogs, wikis, etc. Likewise the students learn by interacting with the various activities (online tests, peer reviews, etc.). Furthermore, they have to take the final assessment to verify the degree of knowledge acquired that will allow them some form of accreditation.

In this way the students are subject to a hetero-discipline that is more in align with on-campus courses and will also allow them some form of certification. These are powerful incentives for students to finish their learning process with greater success.

As far as preparation and design are concerned, MOOCs require a specific effort since it is not enough to adapt on-campus class materials. MOOCs require course planning depending on their format and creating specific materials as well as adapting those that already exist.

MOOCs tend to focus on audiovisual materials since they are distinguished by containing a series of videos in which the teacher explains the course content. This does not mean that text materials

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are not necessary, quite the contrary and in the case of MOOCs that have been transformed from an OCW course these materials already exist.

The practice materials in a MOOC take on new significance thanks to the feedback mechanisms since, in general, the tests, practice cases etc., can be submitted and corrected either automatically (tests) or by peer review. This means that the practice materials have to be adapted to the course format and to the MOOC platform in question.

Assessment is another distinctive feature of MOOCs which means that a final assignment has to be prepared in order to grade the degree of learning obtained that will give the student the corresponding accreditation or certificate.

Finally, MOOCs require monitoring in real-time which means that the teachers have to supervise each stage of the course carrying out the necessary adjustments. They also usually interact with the students in different ways, in the forum, chats, blogs, wikis, etc.

Going back to the UC3M experience, the OCW course on “Public Procurement, Public Personnel Administration and Public Property Law” turned into a MOOC, ran on the MiriadaX Platform from January 31 to April 15, 2013 (Figure 3).

The students had a program of 9 weeks of work according to the following plan: watching the videos (4 videos of 15 minutes in length), studying the reading text with the help of the Prezi presentation plan, answer a 10 question test, with 4 options per answer, and submit a practical assignment for peer evaluation. Each assignment had to be completed in order to be able to go on to the next one.

As for communication tools (among the students, with the professors and with the platform administrators) the students had a Q&A, a blog, a forum and a wiki. Some of these tools were redundant and the students only used the forum and the blog. In the forum they asked questions concerning
the content and the development of the course to which the professors had to respond. The blog was also used for drawing the students’ attention to further sources of information such as institutional web pages, press news or TV programs (Figure 4).

More than 2,000 students enrolled on the course, the majority from Spain and Latin American countries. The latter was rather surprising since, as noted before, Law Studies tend to have a local focus depending on each country. Most of the students were not taking degrees in Law at the time but were graduates that were hoping to refresh or increase their degree of knowledge on the subject, many of them being civil servants or preparing for competitive exams to join the Civil Service. About 200 students successfully completed the MOOC, and those that did so felt it had been hard work but a very rewarding experience.

Just like the OCW course, which is the origin of this MOOC, this course has certain very specific features. First, beyond the audiovisual materials, it relied on an important amount of reading texts, originally from the OCW course, which contributed a more in-depth and solid approach to the subject matter. In this respect we should consider whether videos and activities are enough to teach higher education content (Young, 2013); without doubt audiovisual material is a good supplement but we should not try to replace traditional study materials if we are going to seriously engage in open education.

Furthermore, this MOOC contained an important workload for the student following an intense program with complex assignments and evaluation tasks. As a result, a large number of students dropped out during the first week, but those who continued and reached the end of the course obtained a solid education similar to students enrolled in a Bachelor’s Law degree. At this point we
should reflect on whether MOOCs are merely showcases for teachers and universities (Haggard, 2013) trying to overcome the crisis in higher education (Vardi, 2012; Watters, 2013) or whether we really want to offer an open education on the same level as on-campus education for which students pay tuition fees.

**Conclusions**

The transformation of OCW into MOOCs is a step forward in open education, which is worthwhile not only for teachers but also for educational institutions (Delgado Domínguez, 2014).

The work contained in an OCW course constitutes a solid base from which to create a MOOC. The fact that one has already developed an OCW course is always a conditioning factor, which distinguishes the MOOCs with an OCW origin from others, due to the additional materials available for the students to help them further their understanding of the concepts presented in the videos.

However, the work and experience accumulated in OCW are not enough. Before starting a MOOC one has to consider the important workload involved in preparing adequate audiovisual material that goes beyond recording the sessions. Likewise, one should take into account the fact that a MOOC implies greater involvement on behalf of the teachers that cannot neglect the course and have to attend to its development and contribute with a certain degree of interaction.

In fact, when both instructors and support staff face designing and preparing a MOOC for the first time, we tend to underestimate the workload as well as the pedagogical, logistical, technological and financial issues involved. We think that a tool, such as MOOC Canvas (http://mooccanvas.com), that offers a conceptual framework for the description and design of MOOCs could be extremely useful for future courses.

For this reason a high level of support is required for recording, editing and subtitling all the audiovisual material and easing the workload entailed in preparing and running a MOOC. It is also necessary to support the course when it is online as often incidences occur that have to be solved by technical staff.

The move to MOOCs means an important step forward in open education that should be seen as a supplementary model to OCW and not a substitute (Peter & Farrell, 2013). OCW courses and MOOCs are intended for different target audiences that are looking for different learning dynamics (Zhenhong, Wen & Zhi, 2013). In the case of OCW the content is usually used as reference material on a one-off basis for consultation or similar purposes. Whereas, in the case of MOOCs a more guided learning process is preferred that culminates in some form of certification.

The transformation of OCW into MOOCs provides the opportunity to develop a more serious, committed and rigorous model of open education. Having already published a series of teaching materials as OCW will guarantee that the MOOC will not only be a collection of videos and exercises but instead will contain a solid teaching project.

MOOCs can be the best showcase of the universities and offer an insight into the quality of on-campus courses, which could attract future students; but, at the same time, they should provide a solid and useful learning experience for those who cannot afford it.

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Note

1 The effort made by this group of professors has been recognized by the OpenCourseWare Consortium. In 2011 the course “Instituciones Básicas del Derecho Administrativo” (Basics of Administrative Law) won the Award for OpenCourseWare Excellence (ACE) in the text and illustration courseware category (see Figure 1) (Source: OpenCourseWare Consortium Awards for Excellence, retrieved February 2014 from http://www.ocwconsortium.org/projects/awards-for-ocw-excellence/2011-winners-of-ace-awards/2011-winners-courseware-categories). In 2012 professor José Vida Fernández on behalf of the rest of the group won the Educators Award for his work in support of the OCW movement (Source: OpenCourseWare Consortium Awards for Excellence, retrieved February 2014 from http://www.ocwconsortium.org/projects/awards-for-ocw-excellence/2012-winners-of-ace-awards/2012-ace-winners-individual-categories).

References


Crowd-sourcing (semantically) Structured Multilingual Educational Content (CoSMEC)

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Abstract
The support of multilingual content becomes crucial for educational platforms due to the benefits it offers. In this paper we propose a concept that allows content authors to use the power of the crowd to create (semantically) structured multilingual educational content out of their material. To enable the collaboration of the crowd, we expand our previously developed CrowdLearn concept and WikiApp data model to support multilingual educational content. The expanded concept, CoSMEC, was evaluated with an example implementation within the web-based educational platform SlideWiki. Based on this experience, we provide solutions for the most complicated technical issues we faced during the implementation. This paper also discusses statistics which show the flow of multilingual content usage.

Keywords: OER; multilinguality; collaborative authoring

Introduction
Nowadays, the support of multilingual content becomes crucial for educational platforms because of the benefits it offers. One of the most important benefits of multilingual content supplying is an opportunity to educate without language barriers. This causes the number of learners to increase according to the number of languages content is available in. The learning quality for previously presented users increases as well, due to the possibility of studying in their mother language. Another benefit of the multilinguality is the ability to share and exchange knowledge within a multicultural environment. This opportunity is crucial for fostering the increase of education quality, especially in developing countries. Institutes and universities in these areas often base courses on outdated information, concepts and theories. Access to the international scientific knowledge through content synchronization would help experts and educational institutes to be aware of the state-of-art in their field.

The creation of high-quality educational content is a time and resource consuming task. The task requires even more resources if there is a need to offer the content in different languages. A winning strategy in this case is to produce the content collaboratively. The collaboration can be established within a limited group of experts (1) or involve the power of a crowd (2). The first approach has a number of issues:

- it requires a lot of preparation, as the domain experts with the knowledge of certain languages have to be found first;
- each expert has her own background and point of view on the topic, thus, the negotiations can have a negative effect on the time costs;
• it results in production of content available in only a limited number of predefined languages;
• the content easily becomes outdated, as a limited number of experts being spread internationally might not be aware of all new findings in the domain;
• the content refinement is time-consuming and can cause de-synchronization of the content.

To overcome these issues, we propose to use the power of a crowd to author the content available in a number of different languages. In this case the list of available languages is not fixed and the number of languages depends on the community size, diversity and activity. An example of the successful application of crowd-sourcing techniques to multilingual content authoring is Wikipedia (http://wikipedia.org). However, the Wikipedia concept does not suppose an (semi-)automatic synchronization of the content presented in different languages. Although synchronization is sometimes being done manually by contributors, the versions in different languages often stay contradictory to each other.

In order to facilitate content synchronization, we propose the content to be semantically structured. By semantic structuring we mean the splitting of the content into elements in such a way, that each of them fully covers an individual piece of knowledge. To organize the content in this way we propose to use our previously developed CrowdLearn concept (Tarasowa et al., 2013). CrowdLearn enables collaborative authoring of semantically structured educational content. The concept is an application of crowd-sourcing techniques to e-learning content creation, re-purpose and reuse. It includes the WikiApp data model to support the versioning of structured content objects. Furthermore, CrowdLearn supports social networking activities and enables users to proactively interact with each other to acquire knowledge.

In the current paper we expand the CrowdLearn concept to support multilingual educational content. The expansion requires the defining of additional concepts and relations for the WikiApp data model. We named the expanded version of the CrowdLearn concept 'CoSMEC—Crowd-sourcing (semantically) Structured Multilingual Educational Content' to reflect the support of multilinguality. The paper is structured as follows: we first describe our CoSMEC concept. Then, we present an example implementation of the concept and describe our solutions for the most complicated implementation issues. We evaluate the concept and discuss the results in “Evaluation” section. After that we show the connections with the current research in the field. In the end, we summarize and conclude our work.

Concept

The proposed CoSMEC concept combines and expands several existing paradigms. The paradigm of Open Educational Resources supposes the creation and sharing of reusable, re-purposable learning objects, annotated by standardized metadata. The wiki paradigm allows every user to refine the published content by creating a new version after every edit. The crowd-sourcing technique supposes version control of the content and allows branching and merging of the revisions. In order to efficiently apply the paradigms above, the concept requires the content to be highly-structured. CoSMEC enables the support of multilingual content for this complex data model. The overview of the concept is presented in Figure 1.

Collaborative authoring of structured educational content

To enable collaborative authoring of semantically structured educational content, we use our CrowdLearn concept, as described in detail in Tarasowa et al. (2013). The CrowdLearn concept is an application of crowd-sourcing techniques to e-learning content creation, re-purpose and reuse. In this paragraph we give a short overview of the concept.
As its main innovation, CrowdLearn combines crowd-sourcing techniques with the creation of highly-structured e-learning content. E-learning material, when combined with crowd-sourcing and collaborative social approaches, can help to cultivate innovation by collecting and expressing individual's (contradictory) ideas. In accordance with the CrowdLearn concept, instead of dealing with large learning objects (often whole presentations or tests), we decompose them into fine-grained learning artifacts. Thus, rather than a large presentation, users will be able to edit, discuss and reuse individual slides; instead of a whole text she/he will be able to work on the level of individual questions. This structure efficiently facilitates the reuse and re-purpose of the learning objects.

The concept of decomposition meets the requirements of modern e-learning content standards. This allows the CrowdLearn concept to produce standard adhering content. In particular, the concept adopts the SCORM standard (ADL, 2011a) and practical recommendations (ADL, 2011b) and expands the standard for the collaborative model.

To enable versioning of the content, the CrowdLearn concept proposes the WikiApp data model. The WikiApp is a refinement of the traditional entity-relationship data model. It adds some additional formalisms in order to make users as well as ownership, part-of and based-on relationships first-class citizens of the data model. A set of content objects connected by part-of relations can be arranged and manipulated in exactly the same manner as an individual non-structured object. The model natively supports versioning and structuring of the content objects.

Supporting social networking activities in CrowdLearn enables students to proactively interact with each other to acquire knowledge. Besides increasing the learning process quality, social activities improve the quality of the created learning material. Even when answering a quiz, users can contribute by analyzing the quality of the questions and making suggestions of how to improve them. Thus, knowledge is being created not only explicitly by contributors, but also implicitly through discussions and answering the questions of assessment tests; in other words through native learning activities. Furthermore, social activities enable social network analysis of users (both teachers and learners) and learning objects (Linta et al., 2011). We illustrate the WikiApp data model in Figure 2.
Managing multilingual educational content

In order to enable the support of multilingual content, CoSMEC allows the content versions to be presented in different languages by adding the `translatedInto` and its inverse `translatedFrom` relations to the WikiApp data model. CoSMEC does not deal with the objects being originally created in different languages. Instead, our concept requires the presence of the source content object, as well as its translations. Enforcing this requirement allows us to:

- distinguish between users’ authoring and translating contributions to the content,
- present the list of original content authors in all translations,
- propagate changes in order to synchronize the content of translations with the source.

The CoSMEC concept introduces the paradigm of co-evolution of multilingual content, that means the ability to update a translation to the current state of the source object and vice versa. However, the requirement above only allows users to update the content of a translation according to an original version, but not contrariwise. To overcome this limitation, we enable the translation of an object back to the original language, thus creating a revision of the source object. This back-translation requires a mechanism of merging the revisions, as we do not want to overwrite the original content with a repeatedly-translated one. Thus, in order to function efficiently, the mechanism of co-evolution requires three operations to be defined:

1. initial translation (see Figure 3, box 1);
2. synchronization of the translation with the source (see Figure 3, box 2);
3. merging the revisions (see Figure 3, box 3)

Details of the mechanism implementation are presented in the next section.

Implementation

We implement and evaluate the CoSMEC concept with SlideWiki (http://slidewiki.org)—a web-based crowd-learning platform.

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SlideWiki deals with two types of (semi-)structured learning objects: slide presentations and assessment tests. The content is organized according to the CrowdLearn concept. Thus, SlideWiki uses two implementations of the WikiApp data model. The first implementation is used for managing slides and presentations. It includes individual slides (consisting mainly of HTML snippets, SVG images and meta-data), decks (being ordered sequences of slides and sub-decks), themes (which are associated as default styles with decks and users) and media assets (which are used within slides). The second implementation was developed for managing questions and assessment tests. It includes questions for the slide material (the question is assigned to all slide revisions), tests (which could be organized manually by user or created automatically in accordance with the deck content), and answers (which are part of the questions).

We implicitly connected these two WikiApp instances by adding two relations. Firstly, we assigned questions to slides. Thus, during the learning process users are able to answer the tests and have a look at the assigned slide if necessary. The important issue here is that we assign a question not to an individual slide revision, but to the slide itself. This decision gives an opportunity to create a new slide revision, that already has a list of questions, collected from other revisions. Secondly, we assigned assessment tests to concrete deck revisions. Thus the automatically created test saves the structure of the corresponding deck revision. This allows us to use module-based assessment to score the test results.
The basic functionality of SlideWiki is described in details in Tarasowa et al. (2013). In the current paper we focus on recently implemented support of multilinguality.

Co-evolution of the SlideWiki content

As was already discussed, the implementation of co-evolution of source object content and its translations supposes the implementation of three operations: initial translation, synchronization and merging of the revisions. In this subsection we describe an example implementation of these operations in SlideWiki.

Translation. Our architecture allowed us to implement a translation operation backed by the Google Translate service (http://translate.google.com). After translation into one of 71 currently supported languages, the presentation can be edited, re-structured and reused independently from its source. The implemented interface of the translation management is presented in Figure 4.

Synchronization. To enable synchronization of original and translated versions, every further revision of translated objects inherits the link to the source revision (see v2.1, Figure 5). The changes in the original version of the object cause the creation of new revision v1.1. Additionally, users are notified of translations that have become out of sync with the source (exclamation marks in v2.0 and v2.1, Figure 5).

In SlideWiki implementation of the synchronization is slightly different for slides and decks. We decided not to implement manual synchronization of decks, as we considered the process to be too complicated for users. Users can only trigger an automatic synchronization. However, our data model allows us to get all existing translations for all existing slide revisions. Then, during an automatic deck synchronization we do not repeatedly translate the slides which have already been.

Figure 4: Interface of translations management: 1- language of selected object; 2- a drop-down list with links to languages available for the selected object; 3- button for translation; 4- dynamically updated list of the languages supported by Google Translate service

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translated to the target language before. Instead, we include in the translation the latest revision of the slide in the target language. Thus, the synchronization of decks only adds the slides and subdecks that were not included in the source deck at the moment of previous translation.

For the slides both automatic and manual synchronization are enabled. The users are able to compare v1.0 and v1.1 and decide, either they want to redo the translation (scenario 1 at Figure 5) or they want to update the content manually (scenario 2).

*Merging the revisions.* SlideWiki implements the revision control in accordance with the WikiApp data model. However, we defined rules and restrictions to increase the performance. We wanted to avoid an uncontrolled proliferation of deck revisions. However, this would happen due to the fact that every change in a slide would also trigger the creation of a new deck revision for all the decks that slide is a part of. In addition, when creating a new deck revision, we always need to recursively spread the change into the parent decks and create new revisions for them if necessary. To deal with this issue, we introduced the content owner and member of editor group roles. If the changes are made by a user belonging to one of these two roles, the creation of a new deck revision is not triggered (the new slide revision however is created).

As we allow the owner of a deck revision to change it without the creation of a new revision, it was an important issue whether we should allow the multiple translation of the same revision into the same language or not. We decided to allow it, however, this led to the situation that we would get several identical presentations with content of bad quality, since it was translated automatically and not edited manually. However, we could not disable the multiple translations, because in that case it would be impossible for example to get translations of new slides if they were added by the owner. Thus, merging the revisions became the crucial operation, not only for merging back-translation with the source, but also for merging multiple translations in the same language. Figure 6 illustrates the interface for comparing and merging deck revisions.

Figure 5: Two scenarios of content synchronization between translation and source: 1- automatic; 2- manual synchronization

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Evaluation

To evaluate our work, we collected statistics on the usage of the translation tool as well as statistics on the multilingual content it produced.

Figure 7 presents the distribution between original and translated versions in relation to the total number of content objects. As the WikiApp data model does not enable deletion or update of the content, the graphs can be viewed as time trends. The blue line shows an example moment in time, when the SlideWiki database consisted of 16321 slides overall. The graphic shows that 78% of the slides at the moment were in their original language, 22% were translations and 5% of the total number of slides were revised after translation. At the same moment, about 35% of the decks were translations. Thus, the percentage of translated decks increases faster than that of translated slides. This means that the presentations consisting of less than average number of slides are being translated more often. This can be due to the fact that users want to try the feature before using it on large decks. However, the assumption needs further investigation.

According to the statistics, the percentage of content created by translation has a strongly increasing trend. We predict that percentage of translations will soon prevail over the percentage of source objects. From one perspective, the prevalence means decreasing the production costs and a large diversity of languages available. However, from another perspective, it causes the reduction of
average content quality, as refining the translation needs time and human resources. This is illustrated by the decreasing percentage of revised slides in comparison with translated ones. The solution is in additional user motivation to put effort in refining the concrete translations according to their knowledge in both domain and languages.

The diagrams on Figure 8 show the language distributions for decks, slides and visitors (according to Google analytics). Only unique visitors are counted. Due to its large percentage, we excluded English language from the resulting diagrams to increase readability. The statistics show the visible correlation between number of content objects available in a concrete language and number of visitors speaking the language (for the most of languages). The results look promising, as they prove the involvement of non-English-speakers into the global e-learning community activity. Especially promising is the fact that more than 13% of overall visitors belong to developing countries and regions (mostly Eastern Europe and Russia, Turkey, Arabic-speaking countries, Thailand). We believe that this percentage will increase with increasing popularity of the source.

Related work

Multilingual content management

Our work is based on previously done experiments and investigations. The most significant of these are summarized in O’Leary (2008). In particular, we based our work on the results of the experiment described in Nomura et al. (2003). This was one of the first studies on multilingual collaboration. The experiment was organized within a multilingual bulletin board system. It was found that machine translations were problematic, impairing communication. As a result, the authors propose to allow multilingual users to modify translated sentences to improve the overall level of the translation.

Modern research on multilingual content managing is mostly aimed to synchronize existing texts using NLP methods. For example, Monz et al. (2011) introduce a framework for content synchronization of wikis. However, all automated approaches of content synchronization face an important issue, namely, their application, especially in wikis, results in propagating incorrect statements from one language to all others. We consider this issue to be crucial in the educational domain, as it complicates the removal of outdated concepts from the content. In our semi-automatic approach of slide content synchronization, the incorrect sentences are not propagated between versions, because synchronization for each language has to be triggered and controlled manually. Therefore, outdated
concepts in one of the languages will not be accepted by the more advanced in the domain community members from another region.

Another approach, proposed in Negri et al. (2011), applies crowd-sourcing techniques to the creation of cross-lingual text entailment corpora. The paper is mainly aimed on improving the quality of translation and does not discuss the challenges of collaborative content authoring. However, we consider the study for future work, as we plan to increase the quality of translation, made by Google Translate Service.

**Collaborative creation of e-learning content**

The importance of creating reusable and re-purposable e-learning objects is widely accepted by the e-learning community (Devedzic, 2006). However, most of the works address the learning object reuse problem by means of semantic meta-data annotations, content tagging and packaging instead of by creating richly structured, reusable learning objects from the ground. The importance of creating learning objects with reuse already in mind was, for example, stated by Pedreira, Méndez and Martínez (2009, p. 532): "Content (...) should be represented not as an object of study but rather as necessary elements towards a series of objectives that will be discovered in the course of various tests." There are only a few approaches to the direct authoring of reusable content, such as, for example, learning examples creation (Kuo et al., 2008) or semantic structuring and annotation of video fragments (Barriocanal et al., 2011).

We should also mention two Learning Objects Repositories (LORs), that allow to produce structured reusable content. The first of them, Connexions (http://cnx.org/), presents the learning material as a combination of paragraphs, of which each could be easily edited or deleted. However, this structuring is done more for comfortable editing and does not have any functional benefits; the paragraphs cannot be reused or annotated independently. Thus, Connexions presents only an improved user interface for wiki-based systems. The second example of structuring, which is closer to our idea, is LeMill (http://lemill.net/). LeMill provides a way of collaborative editing of presentations by implementing presentations as a group of images which can be edited collaboratively. However, to edit a slide, a user has to replace it with another one. Also, it is impossible to have several subgroups of slides within a presentation. Searching through the slides (not presentations) is also not implemented. This means that slides can not be manipulated as independent learning objects.

The CrowdLearn concept differs from the existing approaches for managing e-learning content. It enables the construction of semantically structured learning objects from existing sources by combining, reordering and simple editing.

**Wiki-based collaborative knowledge engineering**

The importance of wikis for collaborative knowledge engineering is widely acknowledged. In (Richards, 2009), for example, a knowledge engineering approach which offers wiki-style collaboration is introduced, aiming to facilitate the capture of knowledge-in-action which spans both explicit and implicit knowledge types. The approach extends a combined rule and case-based knowledge acquisition technique, known as Multiple Classification Ripple Down Rules, to allow multiple users to collaboratively view, define and refine a knowledge base over time and space. In a more applied context, Haake, Lukosch and Schümmer (2005) introduce the concept of wiki templates that allow end-users to define the structure and appearance of a wiki page in order to facilitate the authoring of structured wiki pages. Similarly the hybrid wiki approach (Matthes, Neubert & Steinhoff, 2011) aims to solve the problem of using (semi-)structured data in wikis by means of page attributes. In our approach we apply the wiki paradigm to the creation and collaboration around (semi-)structured learning objects.
Conclusions

In this paper we presented CoSMEC, a concept for organizing collaborative authoring of multilingual educational resources. CoSMEC leverages the conversion of educational resources into multilingual content objects. Versions in different languages are inter-connected and can be semi-automatically synchronized. Our implementation proves the viability of the concept and shows possible directions for further work. For example, the Google Translate API does not allow users to create domain vocabularies or choose the best term like the Google Translate online service. This decreases the quality of the initial translation and can sometimes result in not-understandable content. Another field for future work is matching users with content they might help to translate. Such matching should take into account not only language knowledge, but domain experience and interests of the users as well. This can then motivate users to a higher degree to revise translations and improve the quality of the learning content.

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An Architecture based on Linked Data technologies for the Integration and reuse of OER in MOOCs Context

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**Abstract**

The Linked Data initiative is considered as one of the most effective alternatives for creating global shared information spaces, it has become an interesting approach for discovering and enriching open educational resources data, as well as achieving semantic interoperability and re-use between multiple OER repositories. The notion of Linked Data refers to a set of best practices for publishing, sharing and interconnecting data in RDF format. Educational repositories managers are, in fact, realizing the potential of using Linked Data for describing, discovering, linking and publishing educational data on the Web. This work shows a data architecture based on semantic web technologies that support the inclusion of open educational materials in massive online courses. The authors focus on a type of openness: open of contents as regards alteration i.e. freedom to reuse the material, to combine it with other materials, to adapt, and to share it further under an open license.

**Keywords:** OER; OCW; MOOC; Linked Data; Integration; Reuse; Open

**Introduction**

The amount of open educational resources available nowadays is permanently growing, making difficult their use, re-use, organization and their efficient access. There is a current global movement towards open digital reusable educational materials. Open Educational Resources (OER) are currently seen as a practical way for realizing education for all. In particular, developing countries can benefit through OER from developed regions. The term OER is used to mean a small self-contained unit of self-assessable teaching with a measurable learning objective, often in digital format and free to use. To attach an open license to OER is an efficient way to avoid reuse problems.

The arrival of Massive Open Online Courses (MOOCs) and the growth of open and online education -OER, Open Course Ware (OCW)- is increasingly focus on self-learners as the primary target group. The OER movement has tended to define “openness” in terms of access to use and reuse educational materials, and to address the geographical and financial barriers, among students, teachers and self-learners with distinguished educational institutions (Petrides, Nguyen, Jimes & Karaglani, 2008).

The emergent MOOCs (Piedra, Tovar, Dimovska & Chicaiza, 2013) advance is a similar proposes on the idea of “open,” frequently promoting unprecedented massive access to the world-class education that has so far been available only for a select group of few students. MOOC initiatives emphasize free access and interactive features rather than static content, the dominant message is of the quantity of access rather than the openness of educational resources for use, re-use, adaptation or repurpose.
In the last years, the amount of Open Educational Resources (OER) on the Web has increased dramatically, especially thanks to initiatives like OpenCourseWare (OCW) and other OER movements. The potential of this vast amount of resources is enormous but in most cases it is very difficult and cumbersome for users (teachers, students and self-learners) to visualize, explore and use these resources, especially for lay-users without experience with search technologies.

The Semantic Web is a collaborative movement led by the World Wide Web Consortium (W3C). Tim Berners Lee, the creator of the Web, coined the term (Berners-Lee, Hendler & Lassila, 2001). The Semantic Web promotes common data formats for publishing content on the World Wide Web, by encouraging the inclusion of semantic content in Web pages. The objective is to convert the current Web, dominated by unstructured and semi-structured documents, into a “Web of Linked Data.”

The purpose of this paper is present a framework based on Semantic Web technologies (Bizer, Cyganiak & Heath, 2007) to support the inclusion of open materials in massive online courses. The authors focus on a type of openness: opening of contents as regards alteration i.e. freedom to reuse the material, to combine it with other materials, to adapt it, and to share it further under an open license (Hilton, Wiley, Stein & Johnson, 2010; Hodgkinson-Williams & Gray, 2009). The framework provides a service that allows people to discover and access open educational resources that are extracted from open repositories distributed. Our principal OER providers are OCW institutions. In this context, we opted to apply the principles of Linked Data (Heath & Bizer, 2011; Berners-Lee et al., 2001) to integrate, interoperate and mash up data from distributed and heterogeneous repositories of open educational materials. The purpose is to significantly improve discovery, accessibility, visibility, and promote reuse of open educational content in massive courses (Piedra, Tovar, Colomo-Palacios, López & Chicaiza, 2014).

Open Educational Resources Movement

Main Purpose: ensuring wide access to quality higher education

The main purpose of Open Educational Resources (OER) movement is to provide open and free access to high quality digital learning materials. There is wide participation by universities, global and national organizations, and volunteers (Piedra et al., 2013). The movement has gained an important and widely applicable effects or implications on higher education. In this work, the goal is to seek and combine OERs into a great variety of learning programs custom-made for each user of our architecture.

OERs are defined as teaching, learning and research materials in any medium, digital or otherwise, that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions. Open licensing is built within the existing framework of intellectual property rights as defined by relevant international conventions and respects the authorship of the work (UNESCO, 2012).

The term was coined by UNESCO (2002) at its 2002 Forum on Open Courseware for Higher Education in Developing Countries, and emphasized at their published Paris OER Declaration (UNESCO, 2012).

They are typically made freely available over the Web. Their principal use is by teachers, students and self-learners. OERs include a wide range of learning objects and free applications, from whole course, open access journals, to lecture material, references and readings, simulations, experiments and demonstrations, as well as syllabi, curricula and teachers’ guides. OERs are critically important
for guaranteeing wide access to quality higher education and full participation in the rapidly evolving world higher education system.

**Enhance the reusability of OER**

The openness of a content can be measured in terms of the rights a user of the content is granted. One of the primary benefits of an OER is that it can be discovered and adapted to the needs of specific situations. The OER should be designed to be easily adaptable for other users. It should have metadata sufficient for discoverability. OER reusability means that the content is relevant to the specific needs of a user, which is technologically accessible and that it is sufficiently open for use, re-use, re-mix, adapt and re-distribute.

**OERs discoverability:** Different studies have highlighted the difficulty, finding OERs and how this affects their use. In (White & Manton, 2011) some of the causes that affect the location of OERs are identified: technical issues around search engines and repositories, practical searching skills and the volume of available resources in different subject areas. While discoverability is probably the major barrier to reuse, tutors are still expecting to find useful materials online and are prepared to spend time searching for them (White & Manton, 2011).

**Open Licensing:** Most of OER repositories are licensed under Creative Commons Licenses. The use of open licenses can help users to discover materials that they know can use, reuse, adapt and redistribute. Reuse is to use a resource for using as another resource, usually for a purpose unintended by the original creator. Thus creators of OER should consider the degree to which they want their OER to be open, and license the resource accordingly. In addition for licensing there are technical aspects that make OER suitable for a new use or purpose, easier to discover, adapt and remix, and consequently affect the level of openness of an OER. This implies the right to adapt, adjusts, modify, or alter the content itself.

**OERs Reuse:** One of the two fundamental concepts related to OER is “the ability to freely adapt and re-use existing pieces of knowledge” (Abeywardena, 2012, p. 3). (White & Manton, 2011) identified 3 factors that influence the decision to reuse of digital material: improve quality, meet a teaching need and peer suggestion.

**Related Works**

The need to reduce the workload for educators during the creation of learning material and the need to provide personalized learning paths according to styles and preferences of learners have been addressed in some works.

The Wiley’s concept of learning object, presented in (Koper, 2003), highlights three characteristics related to its reusability: online availability, reproducibility and addressability. In this sense, the OERs extracted from OCWs meet these features and can be reused in different contexts. Koper (2003) explores some underlying issues in the reuse of learning resources and presents these within the context of a teacher and an instructional designer who wish to reuse resources within their own practice. Moreover, Kellar, Stern, Watters and Shepherd (2004) highlight the importance of that a reuse environment includes a component that models the user’s profile and thus it supports the dynamic composition of objects into personalized content.

From the technological point of view, the system based on Adaptative Hypermedia (AH) and the intelligent tutoring systems (ITS) have been used to create courses based on existing educational material. However, as noted in (Brusilovsky & Nijhavan, 2002) the approaches based on these
technologies “are building around a close corpus material. Collecting and preparing this material to use in adaptive systems is an expensive process. Thus these systems can’t directly benefit from existing repositories of learning material.

One of the reuse environments of educational material is provided by the ARIADNE Foundation (Klerkx, Vandeputte, Parra, Santos, Van Assche & Duval, 2010). The courseware re-use framework of ARIADNE allows a course author to search for the learning objects in repositories of educational material and include them in their courses (Brusilovsky & Nijhavan, 2002). Despite the large amount of resources indexed by ARIADNE, updated content could not be found and services of recommendation based on particular needs have not been located.

Brusilovsky & Nijhavan (2002) suggest a courseware-reuse approach named KnowledgeTree. It is a framework for adaptive e-learning based on distributed re-usable learning activities, the most recent version that has already been used in several courses at the University of Pittsburgh. The framework allows the presence of multiple portals, activity servers, and user-modeling servers. However, the service of resource discovery has not been addressed in the current version of KnowledgeTree, it that is one of the core components of our proposal.

Kellar et al. (2004) describe an architecture that supports the dynamic composition of Web based lessons based on a database of learning objects tagged according to the IMS Metadata. A prototype has been developed specifically for an e-learning environment (users of health informatics learning modules). The scalability of this proposal can be discussed.

Other proposals found in the reuse of educational material have been defined for closed corpus, i.e. repositories of learning objects previously that have been described and classified by metadata schemas as LOM or IMS.

Instead, the OERs are published on the Web an open and extensible repository where each person can share resources; therefore, an open architecture that captures new resources and classify them according to different criteria is required to provide more relevant resources when developing MOOCs.

Regarding the web technologies and linked data there is an increasing use for topic classification and annotation of digital resources. The Semantic Web approach is about adding formal structures and semantics (metadata and knowledge) to Web content for easy access, management, discovery and integration, to make the resources machine-understandable. Some proposals, as Cano, Varga, Rowe, He and Ciravegna (2013) or Husby and Barbosa (2012) are based on the use of repositories of linked open data to determine the topics that describe social content as micropost or blogs. These and other studies have found similar findings, “DBpedia resources are a good starting point to define keyword meanings due to the fact that a huge part of the knowledge base is related to classes in the DBpedia Ontology” (Cano et al., 2013).

MOOCs and Open Education

The recent emergence of MOOCs has introduced another version of potentially disruptive and likely to threaten existing practices in higher education, connected with the academic open content movement. A massive open online course (MOOC) is a model for delivering learning content online to any person who wants to take a course, with no limit on attendance. New start-up companies such as Coursera and Udacity, and the non-profit edX, have begun to provide free online access to mass-produced courses taught by leading faculty members at the world’s most prestigious and prominent universities.

MOOCs represent the next stage in the evolution of open educational resources. First was open access to course content, and then access to free online courses. Accredited institutions are now accepting MOOCs as well as free courses and experiential learning as partial credit toward a degree.
Students do not pay fees to the content provider for basic enrolment in the course, nor do they receive credit from the content-providing institution. Social networking, interactive services, and automated grading or peer assessment are provided by the platform provider, as is a nominal certificate for the completion of assignments.

Although MOOCs may be considered open in the sense of “free to try,” they are not offered under an open license. Any use of the content or services for academic credit-bearing purpose is restricted and requires payment to the MOOC provider. MOOCs have become attractive because their technology brings modularity to several components of higher education content such as lectures and recordable demonstrations to reach mass audiences in a flexible and accessible on-demand format.

Unlike the OCW and OER model, MOOCs promote training scenarios at large-scale of participation and open access via the web. MOOCs are a progression of the kind of open education ideals suggested by open educational resources. Though the design of and participation in a MOOC may be similar to college or university courses, MOOCs typically do not offer credits awarded to paying students at schools. However, assessment of learning may be done for certification.

Linked Data Vision

To date, most OER data are collected in heterogeneous and distributed repositories, such as OER Commons, (http://www.oercommons.org) OCW initiatives (http://www.ocwconsortium.org and http://ocw.universia.org), Merlot (http://www.merlot.org/merlot/index) and other OER repositories, where data are annotated using different metadata mechanisms [e.g. IEEE LOM (http://ltsc.ieee.org/wg12/), ADL SCORM (Advanced Distributed Learning (ADL) Sharable Content Object Reference Model (SCORM) http://www.adlnet.gov/capabilities/scorm), custom metadata schemas], and retrieved by ad-hoc mechanisms, individual Web APIs/Services or other mechanisms (e.g. OAI-PMH, Open Archives Initiative—Protocol for Metadata Harvesting http://www.openarchives.org/pmh/); however, these technologies are limited because the data cannot be de-referenced.

This work explores on how reuse, integrate and interoperate isolated OER repositories using Semantic Web Technologies. Semantic Web technologies and, more precisely, Linked Data are changing the way information is stored, published and exploited. The term “Linked Data” refers to a set of best practices for publishing and connecting structured data on the Web (Heath & Bizer, 2011; Berners-Lee et al., 2001). Linked data is mainly about publishing structured data in RDF using URIs rather than focusing on the ontological level or inference. OER provided with Linked Data (Linked Open Educational Resources Data) supports the process of discovery, reuse, integration and interoperability of open educational materials.

The W3C’s Semantic Web provides a common framework namely Resource Description Framework (RDF) for describing resources on the Web. With RDF, automated software can store, exchange, and use machine-readable information distributed throughout the Web, in turn enabling users to deal with the information with greater efficiency and certainty; also, RDF data can be shared and reused through application, enterprise, and community boundaries.

RDF is based upon the idea of making statements about resources (in particular web resources) in the form of subject-predicate-object expressions. These expressions are known as triples in RDF terminology. The subject denotes the resource, and the predicate denotes features or aspects of the resource and expresses a relationship between the subject and the object. Uniform Resource Identifiers (URIs) are used to identify these resources. RDF Schema (RDFS) is to represent the web resource and SPARQL (Standard Protocol for RDF Query language) is to extract information from RDF graphs for machine understandable representation.
The Linked Data Design Issues, outlined by Tim Berners-Lee back in (Berners-Lee, 2006), provide guidelines on how to use standardized Web technologies to set data-level links between data from different sources (Heath & Bizer, 2011). Linked data is an opportunity to mitigate complexity in OER reuse. These Linked Data Design Issues, in OER context, are:

1. Use URIs as names for things, which can be unambiguously identified (e.g. OERs, courses, MOOCs, OER creators, OCW providers, knowledge areas,)
2. Use HTTP URIs so that people can look up those names. With the aid of URIs, the corresponding OER data and relevant interlinked data can be dereferenced.
3. When someone looks up a URI, provide useful information, using the standards (RDF, SPARQL) to describe linked OER data, which are machine-readable and repurposed to serve the proposed architecture to enhance integration with reused and interoperated OER data.
4. Include links to other URIs, so that they can discover more entities. Linked Data—particularly data available using open licenses—has an important role to play on information systems and could be a key feature for Open Education based on OER data on the Web of Data.

In Piedra et al. (2014), authors apply the Linked Data Design Issues to explore, visualize and use information that is semantically related to open educational resources that are accessible via the OCW Consortium. Linked data have the potential of create bridges between OCW data silos. The authors demonstrate that OCW resource metadata can be enriched using datasets hosted by the Linked Open Data cloud. Additionally, the Linked OER and OCW Data environment enabled us to discovery and reuse open educational materials.

**Architecture of OER-reuse**

The vision of Semantic Web is the idea of having data on the Web described and linked in a way that it can be used by machines not just for display purposes, but for automation, interoperability, integration and reuse of data through various applications and contexts. It provides a promising platform for Open Educational Initiatives. In this section, we describe our proposal for the integration and reuse of OER: an architecture based on Linked Data technologies.

The main objective of this work is to propose a linked OER data architecture (Figure 1), able to adapt, reuse and re-mix OERs in the MOOC context. The architecture is composed by five services which have been designed to carry out this task in a collaboratively way. This linked data architecture enabling us to ask questions and solve open educational problems across a heterogeneous and distributed information landscape extending beyond the traditional boundaries of each OER contributor.

Our approach is based on identifying distinctive features with the help of MOOC preferences and resources needs data. As with all recommender systems, the main goal is to help users to find information or resources and match information that is important about needs with information that is important about resources. Figure 1 summarizes the architecture in a general model of OER recommendation for MOOC Designers. Accordingly, the process can be broken down to the following steps:

1. OER collecting.
2. OER Data Publication and Semantic Annotation of OER.
3. MOOC profiles provider.
4. Seeker of resources.
5. OER recommender.
Component 1, OER collecting

Goal: Identify and select OER repositories, then extract metadata and educational resources with Open Licenses

Description: The initial step is to identify and select the OER repositories that are available in the Web. There is a large amount of unstructured data of an OCW resource available on the Web, but only in a human-readable representation, HTML.

Most OCW web sites do not have APIs for data consumption. So, the only other alternative for automatically reconstitute the underlying data from an OCW web site is to use web-scraping techniques (Piedra et al., 2014).

Examples of extracted OER properties include the name of the resource, its creation date, abstract, keywords, information about creator, language, open license information, format, MIME type, expected study duration, expected level of difficulty, and so on. On the other hand, content metadata correspond to the properties of the knowledge and skills designed, such as learning objectives, learning pathways, and examinations.

Component 2, OER—Data Publication and Semantic Annotation of OER

Goal: Development and delivery of open educational resources data as Linked Data.

Description: Linked Data design principles are increasingly employed to publish and consume heterogeneous datasets in a distributed way. Data is still locked up in applications. The technical problem with today’s most common information architecture is that content, metadata and schema information are not separated well from application logics and presentation layer. Data cannot be re-used as easily as it should be.
Publication of OER data:

Using Linked Data design issues, developers can query Linked Data from multiple sources at once and merge it without the need for a single common schema that all data shares. Linked data technologies can also help to integrate the work of disperse institutions producing diverse linked data.

The following is an outline for producing Linked Data in OER context:

1. Identify and select heterogeneous repositories.
2. Model vocabularies for OER domain.
3. Data extraction from OER repositories.
4. Generate OER data as Linked Data.
5. Publish linked data.
6. Consume and display linked data.

Vocabularies and ontologies provide the mechanism to organize the Web information in structured way. The web contents can be understood by the computer as well as by human beings. Piedra et al. (2014) described LOCWD RDFS vocabulary using W3C’s RDF technology, for open educational resources with the aim to describe the specific types and classes of resources in OCW domain. This vocabulary was called Linked OpenCourseWare Data (LOCWD). A machine-friendly version is also available in http://purl.org/locwd/schema on RDF/XML format. LOCWD reuses a set of RDF(S) vocabularies. Each vocabulary includes a set of terms and classes that are common to a particular knowledge domain. The aim of these vocabularies is to connect the described OCW domain with Datasets in the LOD cloud.

LOCWD is a RDF(S) vocabulary devoted to linking OERs, open licenses, OCW repositories, and other academic information using the Web. Different kinds of applications can use or ignore different parts of LOCWD. With LOCWD, the OER/OCW initiatives can retain some control over their information of materials and courses in a non-proprietary format.

Semantic annotation:

In this section we also focus on semantic or conceptual annotation of OERs, which consists in attaching “semantic labels” to a resource or parts of a course using semantic features provided by a formal knowledge organization called ontology or semantic vocabulary. The use of ontologies in the annotation process of OERs has a particular benefit: the queries for information retrieval and annotated resources share the same vocabulary.

We present an approach to semi-automatic semantic or conceptual annotation of OER that aims at bridging the gap between the ontology formal language and user’s natural language terms or keywords. The approach provides candidate concepts for a user’s term.

The primary external source of semantic annotation of OER is DBpedia, the most important part of the Linked Open Data. The Linking Open Data cloud currently provides access to hundreds of datasets in various areas such as Media, Geography, Publications, Government, and Life Sciences. As a consequence of Linking Open Data community project, datasets in a wide range of domains are now semantically described and connected to each other.

Some of the key resources for OER annotation in DBpedia include “dbpedia:Category” and the SKOS semantic relations between SKOS concepts that is inherent in the meaning of the linked concepts that provide information about concepts (see Figure 2). In this work, SKOS properties (W3C, 2009) are used to infer hierarchical links, which can then be used to annotate resources and access direct or indirect hierarchical links between OER and concepts.
Several relations link resources to their concepts, such as “owl:sameAs,” “skos:broader” (a hierarchical link between two concepts what indicates that one is in some way more general -broader-than the other -narrower-), “skos:narrower,” “skos:related” (an associative link between two concepts indicates that the two are inherently “related,” but that one is not in any way more general than the other) is used to assert an associative link between two SKOS concepts., and “dcterms:subject” to describe the topic of the resource (typically, the subject will be represented using keywords, key phrases, or classification codes. In DBpedia is used as a controlled vocabulary). The properties skos:broader and skos:narrower are used to assert a direct hierarchical link between two resources using SKOS concepts.

In the architecture proposed, it is necessary to make use of both direct and indirect hierarchical links between concepts, to improve search recall through query expansion. For this purpose, the properties skos:broaderTransitive and skos:narrowerTransitive are provided (W3C, 2009).

**Component 3, MOOC profiles provider**

Goal: Extract Data from a course profile that serves as a view of filter onto the whole universe.

Description: The idea is evolving into a more interoperable and integrated system to share, connecting and discovering data and metadata of MOOC profiles. Users don’t know precisely what they can find on OER site, or what to search for. Self-learners are trying to discover relationships or trends between MOOC profile and OER data.

**Component 4, Seeker of resources**

Goal: Merge the functionalities of recommendation seeker and Course Profile.

Description: The architecture uses seekers based on SPARQL to express preferences and resources needs by rating OERs. The system focuses on SPARQL query-based algorithms for matching OER based on MOOC preferences and weighting the interest of MOOC designer with similar taste to produce a recommendation for the resources seeker. Table 3 shows the properties of a topic for a Java Course.

This module is designed to access two data sources: The first one reline on LOCWD data, which provides RDF data extracted from OCW and OER websites. The second one use the LOD Project, particularly from DBPEDIA, which provides RDF data extracted from the info-boxes of Wikipedia pages in a structured way.
Component 5, OER Recommender

Goal: For our purpose, a preference is an individual mental state concerning a subset of items from the universe of alternatives. Users can use the architecture because a single taxonomic order or a single folksonomy is not suitable or sufficient for explorer OER resources.

Description: The architecture proposed attempt to recommend OERs that are similar to educational resources planned by the MOOC designer and others records of social activity, such as OCW Syllabus and system usage history.

Performance Evaluation

Experimental Context: Selection and Collection of OER repositories

Scope: 15 associate consortia, as well as 212 higher education institutions and 57 organizational members compose OCWC; all courses are available for adoption and adaptation by faculty and students around the world.

When publishing an OER Repository, the providers are sharing digital educational resources with an attached open license that allowing others to reuse, adapt and share their work. Ideally, this resource when combined with others OERs provides great value.

On this paper, we focus on finding OER published by open licenses and useful to MOOC or Open Course Ware production. Authors selected and extracted information from 80 heterogeneous OCW repositories from OCWC and OCW-Universia members (Piedra et al., 2014), sifting through a total of 7,239 OCW courses and 90,000 OERs approx. Data scraping was used to extract data from OCW platforms that was later structured and stored in a database. Scraping eliminated the need for having to do the retrieval manually.

In this context, authors opted to apply the principles of Linked Data to integrate, interoperate and mash up data from distributed and heterogeneous repositories of open educational materials. The purpose is to significantly improve discovery, accessibility, visibility, and to promote reuse of open educational content in massive course.

Integration and reuse of OER in MOOCs Context

In the context of this paper, authors opted to apply the design issues of Linked Data to integrate, interoperate and mash up OER data from MOOC Designer requirements. See table 1 by examples of MOOC profile properties.

SPARQL queries are used to semantically annotate OER materials. SPARQL is a query language designed to gather data from multiple sources for anything that asks a question. The next code shows the SPARQL Query that permits annotating the resource Java Programing, an entity of type Concept (see table 2).

SPARQL Query:

```
  <http://dbpedia.org/resource/Category:Java_programming_language> <http://www.w3.org/2004/02/skos/core#broader> ?area .
  FILTER( lang(?labelarea) = "en" )
  FILTER( lang(?labelrelatedTopic) = "en" )
}
```

Table 1: Some properties for describe a MOOC profile for Java Course in tripletes

<table>
<thead>
<tr>
<th>Course as RDF resource</th>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>:JavaCourse</td>
<td>rdf:type</td>
<td>:MOOCProfile</td>
</tr>
<tr>
<td>:JavaCourse</td>
<td>:title</td>
<td>Java Fundamentals</td>
</tr>
<tr>
<td>:JavaCourse</td>
<td>:description</td>
<td>This course will cover the main concepts about Java. Students will learn the fundamentals of Java. The focus is on developing high quality, working software that solves real problems.</td>
</tr>
<tr>
<td>:JavaCourse</td>
<td>:language</td>
<td>English</td>
</tr>
<tr>
<td>:JavaCourse</td>
<td>:alternative_language</td>
<td>Spanish</td>
</tr>
<tr>
<td>:JavaCourse</td>
<td>:level</td>
<td>Basic</td>
</tr>
<tr>
<td>:JavaCourse</td>
<td>:requirements</td>
<td>The course is designed for students with some programming experience</td>
</tr>
<tr>
<td>:JavaCourse</td>
<td>:learningOutcome</td>
<td>Learners will be guided through the fundamentals of object-oriented programming on the Java platform.</td>
</tr>
<tr>
<td>:JavaCourse</td>
<td>:relatedConcept</td>
<td>“Java”</td>
</tr>
<tr>
<td>:JavaCourse</td>
<td>:relatedConcept</td>
<td>“Programming”</td>
</tr>
</tbody>
</table>

Table 2: Some properties and values about the entity Java Programing

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>owl:sameAs</td>
<td><a href="http://dbpedia.org/resource/Category:Java_programming_language">http://dbpedia.org/resource/Category:Java_programming_language</a></td>
</tr>
<tr>
<td>rdf:type</td>
<td>skos:Concept</td>
</tr>
<tr>
<td>rdfs:label</td>
<td>Java programming language</td>
</tr>
</tbody>
</table>
| is skos:broader of        | category:Java_APIs  
category:Java_specification_requests  
category:Eclipse_(software)  
category:Software_programmed_in_Java  
category:Articles_with_example_Java_code  
category:Java_libraries  
category:Java_programmers |

UNION {
  ?area <http://www.w3.org/2004/02/skos/core#broader> <http://dbpedia.org/resource/Category:Java_programming_language>  .
  FILTER( lang(?labelarea) = "en" )
  FILTER( lang(?labelrelatedTopic) = "en" )
}

Table 3: A specific topic for Java Course: Introduction to Java programming

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>:topic</td>
<td>Introduction to Java programming</td>
</tr>
<tr>
<td>:description</td>
<td>Studying the necessary elements that allow you to build simple Java programs</td>
</tr>
<tr>
<td>:time</td>
<td>One week</td>
</tr>
<tr>
<td>:subTopic</td>
<td>Programming Introduction</td>
</tr>
<tr>
<td></td>
<td>Java program structure</td>
</tr>
<tr>
<td></td>
<td>Program flow</td>
</tr>
<tr>
<td></td>
<td>Arithmetic Operators</td>
</tr>
<tr>
<td></td>
<td>Primitive data types</td>
</tr>
</tbody>
</table>

Figure 3: An example of annotation of OER from DBPedia. The annotation process not only provides access to a large amount of structured data sources but also enables machines and software agents to automatically analyze this semantic knowledge.

An example of annotation of OERs can be seen in Figure 3. This graph structure of Linked Data consists of resources described and connected with other concepts through semantic relations.

Table 4 shows the resources retrieved from DBPedia related to “programming and Java.” The query returned 899 related subjects.

Table 5 shows some of the resources returned. The major complexity with the existing query is the lack of information on the particular domain, how to locate the accurate data in repository.

Linked Data technologies can also help to integrate the work of disperse institutions producing diverse linked data. Linked Open Data (LOD) is well known for providing an extensive amount of detailed and structured information (see LOD Cloud maintained by Cyganiak & Jentzsch, 2011).

As we discussed, the architecture not only uses LOCWD dataset, but also uses information from Linked Open Data project. This allows exploiting the LOD community benefits. Table 6, summarizes OER found in LOCWD data source.
The framework provides transparent access to RDF data sources for OER stored in OCW repositories. In the architecture, the recommendation seeker is based on SPARQL. With Sparql it is possible to filter OER using multiple category or taxonomy terms at the same time, and combine text searches, category term filtering, and other search criteria (table 7). Then, it may ask for an OER recommendation based on MOOC data profile (Module 3).

**Conclusions**

The use of linked data approach on OCW repositories provides the framework for their evolution into a more interoperable and integrated system for sharing, connecting and discovering data and metadata of OER and OCW initiatives. The framework provides an approach that allows to MOOC designers to discover and access open educational resources that are extracted from open repositories distributed; our principal OER providers are OCW institutions.

This study advocates the use of Linked Data technologies as an enabler for the development of the next generation of Open Educational Resources, allowing the separation of semantics from syntax, the improvement of discoverability and access, and the use of common vocabularies. In addition, the proposed architecture provides to data consumers an opportunity to merge data distributed across different libraries.

**Acknowledgment**

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---

<table>
<thead>
<tr>
<th>URI of Category</th>
<th>Related subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://dbpedia.org/resource/Category:Java_platform">http://dbpedia.org/resource/Category:Java_platform</a></td>
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</tr>
<tr>
<td><a href="http://dbpedia.org/resource/Category:Object-oriented_programming_languages">http://dbpedia.org/resource/Category:Object-oriented_programming_languages</a></td>
<td>162</td>
</tr>
<tr>
<td><a href="http://dbpedia.org/resource/Category:Java_libraries">http://dbpedia.org/resource/Category:Java_libraries</a></td>
<td>86</td>
</tr>
<tr>
<td><a href="http://dbpedia.org/resource/Category:Concurrent_programming_languages">http://dbpedia.org/resource/Category:Concurrent_programming_languages</a></td>
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<td><a href="http://dbpedia.org/resource/Category:Articles_with_example_Java_code">http://dbpedia.org/resource/Category:Articles_with_example_Java_code</a></td>
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</tr>
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<td><a href="http://dbpedia.org/resource/Category:Class-based_programming_languages">http://dbpedia.org/resource/Category:Class-based_programming_languages</a></td>
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<td>37</td>
</tr>
<tr>
<td><a href="http://dbpedia.org/resource/Category:Eclipse_(software)">http://dbpedia.org/resource/Category:Eclipse_(software)</a></td>
<td>36</td>
</tr>
<tr>
<td><a href="http://dbpedia.org/resource/Category:Sun_Microsystems">http://dbpedia.org/resource/Category:Sun_Microsystems</a></td>
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</tr>
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<td><a href="http://dbpedia.org/resource/Category:Java_programming_language_family">http://dbpedia.org/resource/Category:Java_programming_language_family</a></td>
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<tr>
<td><a href="http://dbpedia.org/resource/Category:Software_programmed_in_Java">http://dbpedia.org/resource/Category:Software_programmed_in_Java</a></td>
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</tr>
<tr>
<td><a href="http://dbpedia.org/resource/Category:Java_programmers">http://dbpedia.org/resource/Category:Java_programmers</a></td>
<td>2</td>
</tr>
</tbody>
</table>
Table 5: Some of the resources returned

<table>
<thead>
<tr>
<th>Concept URI</th>
<th>Concept label</th>
<th>Related Topic URI</th>
<th>Related Topic URI</th>
</tr>
</thead>
<tbody>
<tr>
<td>dbpedia:Category:Java_platform</td>
<td>Java platform</td>
<td>dbpedia:Classpath_(Java)</td>
<td>Classpath (Java)</td>
</tr>
<tr>
<td>dbpedia:Category:Java_platform</td>
<td>Java platform</td>
<td>dbpedia:Jreality</td>
<td>Jreality</td>
</tr>
<tr>
<td>dbpedia:Category:Java_platform</td>
<td>Java platform</td>
<td>dbpedia:Virtual_Database_Manager</td>
<td>Virtual Database Manager</td>
</tr>
<tr>
<td>dbpedia:Category:Java_platform</td>
<td>Java platform</td>
<td>dbpedia:JavE</td>
<td>JavE</td>
</tr>
<tr>
<td>dbpedia:Category:Java_platform</td>
<td>Java platform</td>
<td>dbpedia:Java_security</td>
<td>Java security</td>
</tr>
<tr>
<td>dbpedia:Category:Java_programmers</td>
<td>Java programmers</td>
<td>dbpedia:Markus_Persson</td>
<td>Markus Persson</td>
</tr>
<tr>
<td>dbpedia:Category:Java_programming_language_family</td>
<td>Java programming language family</td>
<td>dbpedia:BeanShell</td>
<td>BeanShell</td>
</tr>
<tr>
<td>dbpedia:Category:Java_programming_language_family</td>
<td>Java programming language family</td>
<td>dbpedia:Scala_(programming_language)</td>
<td>Scala (programming language)</td>
</tr>
<tr>
<td>dbpedia:Category:Java_programming_language_family</td>
<td>Java programming language family</td>
<td>dbpedia:Processing_(programming_language)</td>
<td>Processing (programming language)</td>
</tr>
<tr>
<td>dbpedia:Category:Java_specification_requests</td>
<td>Java specification requests</td>
<td>dbpedia:Java_Persistence_API</td>
<td>Java Persistence API</td>
</tr>
<tr>
<td>dbpedia:Category:Java_specification_requests</td>
<td>Java specification requests</td>
<td>dbpedia:Java_virtual_machine</td>
<td>Java virtual machine</td>
</tr>
<tr>
<td>dbpedia:Category:Java_specification_requests</td>
<td>Java specification requests</td>
<td>dbpedia:Java_3D</td>
<td>Java 3D</td>
</tr>
<tr>
<td>dbpedia:Category:Java_specification_requests</td>
<td>Java specification requests</td>
<td>dbpedia:Java_Database_Connectivity</td>
<td>Java Database Connectivity</td>
</tr>
<tr>
<td>dbpedia:Category:Java_specification_requests</td>
<td>Java specification requests</td>
<td>dbpedia:Java_Servlet</td>
<td>Java Servlet</td>
</tr>
</tbody>
</table>
### Table 6: Summary of Resources found in LOCWD data source for Topic “Introduction to Java programming”

<table>
<thead>
<tr>
<th>Number of recommended resources</th>
<th>SubTopic</th>
<th>Kind of resources recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Arithmetic Operators</td>
<td>Learning guides, Lecture, Exercises, Tutorial</td>
</tr>
<tr>
<td>7</td>
<td>Java program structure</td>
<td>Learning guides, Lecture, Exercises, Labs</td>
</tr>
<tr>
<td>3</td>
<td>Program flow</td>
<td>Lecture, Exercises, Tutorial</td>
</tr>
<tr>
<td>7</td>
<td>Programming introduction</td>
<td>Lectures, Learning resource, Tutorial, Labs</td>
</tr>
<tr>
<td>7</td>
<td>Primitive data types</td>
<td>Learning guides, Exercises, Tutorial, Labs</td>
</tr>
</tbody>
</table>

### Table 7: OER recommended for subtopic: Programming introduction

<table>
<thead>
<tr>
<th>OER Title</th>
<th>Kind of resource</th>
<th>URL of OER recommended</th>
<th>Some metadata</th>
</tr>
</thead>
</table>
References


OCW_forum_report_final_draft.doc/OCW_forum_report_final_draft.doc


A Framework to Integrate Public, Dynamic Metrics Into an OER Platform

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Abstract
The usage metrics for open educational resources (OER) are often either hidden behind an authentication system or shared intermittently in static, aggregated format at the repository level. This paper discusses the first year of University of Michigan’s project to share its OER usage data dynamically, publicly, to synthesize it across different levels within the repository hierarchies, and to aggregate in a method inclusive of content hosted on third-party platforms. The authors analyze their user research with a target audience of faculty authors, multimedia specialists, librarians, and communications specialists. Next, they explore a stratified technical design that allows the dynamic sharing of metrics down to the level of individual resources. The authors conclude that this framework enables sustainable feedback to OER creators, helps to build positive relationships with creators of OER, and allows the institution to move toward sharing OER on a larger scale.

Keywords: analytics; APIs; CMS; data; metric; OER; user-research

Introduction
Open.Michigan was launched in April 2008 as an umbrella open education initiative at the University of Michigan (U-M). Open.Michigan has two primary goals: to sustain a thriving culture of sharing knowledge at U-M, and to provide comprehensive public access to all of U-M’s scholarly output. The Open.Michigan website (http://open.umich.edu/) serves as the primary portal to Open Educational Resources (OER) produced by U-M. It acts as both a repository and a referratory, with some content hosted within the system and some links to content hosted on third-party platforms (e.g. YouTube, Slideshare, Internet Archive). The Open.Michigan website contains OER and learning experiences from eighteen U-M schools and colleges, as well as materials from several partner institutions. The collection includes thousands of learning materials, including over 100 courses, dozens of learning modules, over 30 books, over 1500 videos, and over 150 translated caption tracks for videos. The most comprehensive departmental collections are the Medical School, the School of Information, the School of Dentistry, and the Library.

As an initiative that promotes a culture of sharing knowledge, we believe in following fully open practices for our operations. This includes incorporating principles of public access and open licenses into our learning materials (http://open.umich.edu/education), software (https://github.com/openmichigan/), scholarly publications (http://open.umich.edu/about/infokit/), and process documentation (http://open.umich.edu/share/).

Over the past several years, we have seen an increase in the number of requests from authors and departmental administrators for customized usage reports for their learning materials in the Open.Michigan collection. Since 2008, Google Analytics has been the primary method that we use to monitor the Open.Michigan website traffic. This means that there is extensive historical usage data for Open.Michigan resources, but that data has been traditionally restricted to those with access to our Google Analytics account (Rodgers, 2011). When usage details were requested, a member...
of our staff usually collected it through the Google Analytics web interface. This approach was not scalable due to the level of individual effort required for each request.

We needed a way to more systematically communicate the usage of our OER. In 2011, we created a dashboard using Geckoboard (http://www.geckoboard.com/), primarily for internal use, which provided a single-screen view of aggregate usage data. In early 2012, we wrote python scripts to collect usage data for a subset of our resources using the APIs for Google Analytics and YouTube to prepare spreadsheets to be analyzed by volunteers during a weekend-long data analysis event (http://open.umich.edu/education/si/resources/datadive/winter2012).

In 2013, we launched a project to extend those principles to increase access to the usage data for our collections (http://openmi.ch/dyn-metrics). Making our usage data publicly available would provide authors, departmental administrators, and the general public with access to that information for use as they deemed fit. The goal of our “Dynamic Metrics and Analytics Project” is to build a framework for sharing usage data in more useful, accessible, and timely ways for our audience. In early 2013, we released a button on the right margin of all course and resource pages. When the button is clicked, it reveals aggregate, lifetime metrics (updated daily) for that course or resource. We proceeded with user interviews to prioritize subsequent features and designed the scaffolding to integrate new functionality into the framework.

In this paper we discuss the past year of this project, including our user research and technical design. We explore our ability to share dynamic metrics down to the level of individual courses and resources. We conclude that this stratified framework helps us to deliver sustainable feedback to OER creators on their efforts toward openly sharing materials, helps us to build positive relationships with creators of OER, and allows us to move toward sharing OER on a larger scale.

User Research

We conducted semi-structured interviews in order to identify what metrics and indicators were of particular interest to our audience and why. Twenty interviewees were selected from a pool of faculty, students, and staff who had recently worked with Open.Michigan to create, support, or promote OER in some way. Of the people contacted, nine individuals responded to our requests for interviews: two librarians, two faculty members, three multimedia specialists, and two communication specialists. Eight of those people were from the University of Michigan, and one was from an Open.Michigan partner organization for the African Health OER Network (http://oerafrica.org/healthoer/). The semi-structured interviews focused on usage data and the production of OER. All the interviews aimed to identify what, if any, metrics were of particular interest to our audience, and why.

Each interview was 30–60 minutes. We used a loosely structured interview protocol to guide the direction of these interviews, and allowed discussions to evolve, if relevant, within the interview time. Most were conducted at the Open.Michigan office, two were conducted in the respective faculty or staff member’s office elsewhere on the University of Michigan campus, and one with a colleague outside the university was conducted as an audio conference via Skype.

Depending on interview length, some interviews included a card-sorting exercise with 15 cards (http://openmi.ch/dyn-metrics-cards) that represented potential features for a metrics display tool. Each interviewee was asked to rank the potential feature cards in their personal order of importance. Some of the features discussed included: “a time series chart of course page views over the past thirty days,” “a comparison of metrics over the past month and the past year,” “total aggregate numbers of views and downloads,” and “a summary in PDF format regularly emailed to me.

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The card-sorting exercise allowed us to examine users’ priorities in more detail (Holtzblatt & Beyer, 2013). While in a more free-form user interview, an interviewee might express an interest in information communication via any medium, or across many different timelines (30 days, 1 year, full history), the requirement of prioritizing these features in the card-sorting exercise was helpful to give context to the interview data. For instance, a PDF presentation of metrics was repeatedly brought up in comparison to the Google Analytics PDFs that one support staff member regularly sent to her department. Through the card-sorting exercise we surmised that an online view of charts and aggregate numbers would be a better fit for her use cases overall.

The user interviews and card sorting exercises determined our priorities for subsequent metrics features. For instance, access to metrics on more third-party platforms such as Slideshare and the ability to look at different time ranges on time-series charts are both features approaching release at the time of this writing. Additionally, the user interviews and the card sorting exercises surfaced two primary motivations for public, dynamic OER usage metrics, which are explored in the next section.

**Analysis of User Interviews**

An analysis of the user interview notes revealed two primary motivations for sharing and accessing dynamic usage metrics for OER: to strengthen relationships with authors and to justify the effort and expense of OER practices.

**Readily Available Metrics Strengthen Relationships with OER Authors**

The librarians, multimedia specialists, and communication specialists with whom we spoke suggested that publicly displayed metrics could be used to initiate conversations with authors. A conversation with supporting metrics can demonstrate the tangible impact of published OER, thereby creating “less disconnect from [the] content” and its author(s). One interviewee added, “having numbers available in passing such as on the landing page is good way to demonstrate that their OER has value.” One interviewee noted that the metrics data and other small gestures such as highlighting learning materials as featured resources are “bits of ‘yay’ and kudos for creators, it gives people that encouragement.” A communications specialist who regularly prepares handouts about OER to share at campus events for prospective and current faculty, researchers, and students added, “[It] can’t hurt every now and then to say what’s super popular.”

The online audience for the material may not be visible to the author once an OER is published. This is especially true for OER that are published on platforms that are primarily for use by individual self-paced learners. Publicly displaying metrics for published OER in a centralized location, such as the Open.Michigan website, provides a space for the authors to view the frequency with which the public accessed and downloaded their materials. One librarian interviewed commented that revealing these stats demonstrates that even content that was shared several years ago may still be actively used. One multimedia specialist noted that publicly displaying metrics “provides a structure where people can interact with it in more ways.”

These interviewees suggested that strengthening the relationship between the authors and their OER may also strengthen the authors’ relationship with the campus OER community and the Open.Michigan staff in particular. Furthermore, the interviewees believe that strengthening relationships between the authors, their published OER, and Open.Michigan may someday encourage future authorship of OER. One interviewee noted that such sharing of metrics could “document impact and may persuade people to join the open content party.”
Readily Available Metrics Are Evidence to Support Effort and Expense for OER

Developing learning materials involves time and money. Interviewees reported that metrics can be important evidence to justify the effort and expense for those activities—both on a personal level for the authors and on an organizational level for allocating resources.

Faculty we interviewed stated that it was satisfying to know if their OER are being used and were particularly interested in the geographic makeup of their audience. One faculty member printed and posted a world map of views in various countries for one of his open courses, which he has kept on his office door for over a year.

Both faculty members also expressed the importance of granularity of metrics—at the level of a whole course and at the level of individual files. Having that granularity was “personally satisfying” and “very important”; stratified level detail can indicate the level of audience engagement. For example, one author wanted to know if there were particular materials within a course that were especially popular and whether the audience was accessing materials beyond a cursory view of the syllabus. One of the librarians echoed that sentiment, and added that having that level of granularity lends itself well to benchmarking against peers: “it would be great to be able to say it was a bestseller” for a particular topic. One librarian echoed that simply “satisfying curiosity is good.”

Interviewees who worked in communications or multimedia support expressed the importance of having readily accessible metrics to report value back to the organization for its OER collections. One librarian added, “how can this data be used to make decisions about how we invest in things?” One multimedia specialist expressed he has to “be ready to make our case with numbers” when explaining the motivations and results of open licenses. Another added, “as soon as you add a number, people see it as more tangible.”

Being able to collect and stratify metrics from OER hosted across multiple hosting platforms can also be used to inform decisions about which platforms to prioritize for distribution: “We use the stats to communicate to management where to spend money on this stuff. Maybe a course is more popular on iTunes U than YouTube. That helps us decide where to put the subsequent course. Is it worth the staff time to put in both places?”

Technical Design

The technical architecture used by an organization to host and reference OER is tied closely to the organization’s ability to share detailed usage data for its OER. The Open.Michigan website was built using a customized distribution of the open source content management system (CMS) Drupal (http://www.drupal.org/). Drupal’s hierarchical structures allow us to provide metrics at varying levels of that hierarchy. Drupal relies upon a relational database (MySQL, in our case). In our Drupal customization, called OERbit (http://open.umich.edu/oerbit), the database uses a tree-node structure. This structure allows us to identify metrics for individual courses and resources and for aggregating usage data on content associated specifically with that course or resource or that unit.

Each node excepting the single site root has a parent node, most nodes have peer nodes, and individual materials act as leaf nodes. For example, the course M2 Cardio (http://open.umich.edu/education/med/m2/cardio) is a child of the second-year medical school curriculum and a grandchild of the Medical School Unit. The M2 cardio course contains several dozen materials, such as a syllabus, a schedule, lecture slides, lecture videos, and lecture notes. It also has peer courses in the M2 curriculum. This structure is shown in Figure 1.
Courses and resources on the Open.Michigan website may also include links to OER hosted on a number of external websites (e.g. YouTube, SlideShare). The tree-node structure is also useful for collecting metrics from these third-party platforms. Third-party content is included as materials with links to external websites. By parsing the hyperlink, we can determine both the service and the ID for a particular resource. For example, the M2 Cardio course includes a material that is a lecture video for The Normal Electrocardiogram. The hyperlink is http://www.youtube.com/watch?v=BuH_5Wvc8k. The service is YouTube and the video ID is BuH_5Wvc8k. Through YouTube’s Application Programmable Interfaces (API), we use the video ID to collect usage details for that particular video. Those details are aggregated with the other YouTube videos for the course.

By leveraging REST APIs, we can collect these metrics from third-party services and use Drupal modules to drive cron jobs that update metrics information daily. This process is run most efficiently during a time when the website receives the least amount of traffic.

By integrating the metrics from these third-party platforms, Open.Michigan is able to provide a more comprehensive snapshot of the metrics for the OER associated with a particular course or resource. This structure provides course or resource level metrics for individual content creators.
and staff, who generally create one or a few particular courses or resources and are curious about those in particular rather than the entire collection or the unit to which those courses or resources belong.

Many OER providers share site-wide aggregate usage data summarized by month or by year, but usually this information is shared in a static .PDF format (OpenCourseWare Consortium 2014; MIT OpenCourseWare 2013). Our metrics framework allows Open.Michigan to share metrics in a more detailed manner, as discussed, and much more dynamically.

Based on the user interviews, we are currently integrating the metrics APIs from SlideShare and Amara into the dashboards. In addition, we are developing export and API functionality as additional methods to share the aggregated usage metrics for courses and for academic units.

**Metrics Enable Detection of Patterns and Deeper Analysis of Use**

Our user interviews point us toward more specific future directions for our projects, both conceptually and technologically.

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Metrics can inform quantitative investigation, but they do not answer “why” questions (e.g. “why does this course have so many downloads compared to this other?”) Analytics, which we define as meaningful patterns derived from metrics, are the answers to the whys. Metrics are part of the pathway to analytics and understanding audience use and engagement (Muramatsu & Caswell 2010; Alevizou 2012). Synthesis and analysis of social context is necessary to progress from metrics to analytics in order to determine answers to “why” and “who” questions, about which many of our interviewees were curious.

People wanted to know the whys and the hows, while metrics can tell only the counts and the whats. We know that efficient gathering of numbers, and time-stamped data, is the first step toward diving deeper into whys and hows of OER use. Are these OER helping people? A faculty member noted that if people were using things he created, it would be “good to know where, it would be good to know why.”

One faculty member noted that usage data is particularly interesting “not as a cumulative [measure], but as a pattern over time.” Looking at when school terms begin and end (both locally

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**Figure 3: Dynamic Metrics Dashboard In Development for Course Landing for M2 Cardio.**

Note: From Google Analytics, the dashboard shows views and zip downloads over the past 30 days, total lifetime views, total number of nations, and the names of the top 10 nations. From YouTube, the dashboard shows total views and number of comments.
and in other countries with frequent access) and measuring rises or dips in access of certain materials coinciding with those times. Faculty and librarians both expressed interest in comparing similar courses and resources and discovering which courses and resources were seem to have similar frequencies of use.

Many interviewees noted future possibilities given an available supply of usage metrics, which allowed us to do something. Many of these future possibilities hinged on extracting interesting patterns from data over time. A multimedia specialist noted that it would be nice to be able to give anyone who wanted them the tools for a spontaneous data analysis event like the one previously mentioned in 2012. Like the interviewee comments referred to earlier about how this data can be used to make decisions about how we invest in things, questions about the raw metrics we are gathering can lead us toward making decisions about what to build next such that it will provide value to those in our community.

**Conclusion**

Metric-sharing is currency in relationships between OER-publishing-platforms and the faculty, staff, and students of universities and businesses who create OER. This is not the only benefit, but it has been a clear one for us: we are giving a population we have identified as a primary audience something they want. Our experience and user research confirm this.

The technical architecture an organization uses to host and reference OER is tied closely to the organization’s ability to share detailed usage data for its OER. Our use of the hierarchical structure of a Drupal-based platform allows us to easily provide metrics for individual courses or resources. Metrics on a small scale are interesting, especially to their creators. Metrics can inform quantitative investigation, but they do not answer "why" questions (e.g. “why does this course have so many downloads compared to this other?”). To find analytics, metrics are necessary, but not sufficient. Due to the structure by which OERbit platform stores metadata, Open.Michigan can group OER and its associated metrics in various ways. This positions Open.Michigan to progress from dynamic metrics to dynamic analytics in the future.

Much like seeing nodding and note-taking when you speak in front of an auditorium, seeing evidence of views, downloads, or comments where your OER are published is validation, evidence that there is some likelihood your effort provides real value to others. Having that evidence allows many to justify the additional effort it may take to openly license educational materials to supervisors and administrators. Open.Michigan’s sharing of individual OER metrics sustains development of open resources and allows an open education initiative, such as ours, to build strong relationships with its surrounding community and thus support the development and sharing of OER on a larger scale.

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