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Special Issue – Open Educational Resources: Opening Access to Knowledge

Editorial – Volume 14, Issue Number 2

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This issue is made up of contributions to the OER Knowledge Cloud by authors working in three of the world's leading open universities, namely the OU UK, Athabasca University, and the Dutch Open University, as well as other researchers working in the OER field. The articles begin with a case study of an OER implementation followed by a rationale for using OER on mobile learning and a description of developing content for use on mobile devices. Other articles explore the longterm sustainability of OER and their disruptive influence on traditional institutions, as well as the need for national policies and their use in other languages. In the final article, the author looks at visualisation and mapping of OER and their use.

Supporting the widespread availability of OER is a goal that Athabasca University (AU) has embraced through association with the Commonwealth of Learning and by becoming a charter member of the OER University. The article by Ives and Pringle, "Moving to Open Educational Resources at Athabasca University : A Case Study," reviews what OER are, who creates them, how they are paid for, how they are distributed, and how staff and faculty members at AU work with them. This article also describes the context within which AU provides teaching and learning services, including the challenges and opportunities that have led it to consider moving to OER. It outlines the design theory and instructional principles underpinning completed OER projects, with a brief illustration using two examples. The article concludes with a description of the current plan and expected next steps towards including OER in large numbers of AU online courses.

In the following article, Mohamed Ally and Mohammed Samaka focus on the link between OER and mobile learning. They recognize that these new devices and increased access to quality content will cause significant shifts in the way education is designed, delivered, assessed, and accredited, even suggesting that future learners may bypass formal education providers. They are proponents of student created content as open access. They note that quality must be assessed not only in terms of the content and the pedagogy, but also in terms of the appropriateness for diffusion on mobile devices accessible to learners over the Internet.

Content development tools can improve the adoption of OER for content creation and subsequent reuse. Kinshuk and Ryan's article "Mobile Authoring of Open Educational Resources as Reusable Learning Objects" introduces an authoring tool for creating learning objects and activities in mobile contexts. This implementation demonstrates in-situ capturing of location-aware multimedia examples representing authentic learning situations. The platform enables learners and instructional designers to capture authentic, real-life learning scenarios using integrated mobile device sensors, whenever and wherever they occur. Captured authentic learning examples can be utilized within learning activities, and the learning activities are encapsulated within a learning design. To enable content reuse in other contexts, metadata are collected, and IMS open content standards are used for exporting it. The content is automatically and freely published in a repository and reused in various learning management systems, learning design players, as well as other standardized OER editing and authoring tools.

Developing and sharing OER have great potential to enable people in developed and developing economies to transform their talents into professional competences. Yet, due to the economic crisis and changes in governments, funds for the development of OER are scarce, making it important to think about the sustainability of OER in terms of financial sustainability. This does not necessarily mean that an OER-organization has to generate a competitive return on investment in financial terms for the providers, but an OER business model can help to maximize the supply and maintenance of OER, and to ensure sustainability. In his article "Strategies for Sustainable Business Models for Open Educational Resources" DeLangen provides an overview of possible business models in terms of a Business Canvas. Then, moving on towards more complex *value networks*, DeLangen proposes that an OER-business model should involve both a network approach and a reversal of the concepts of the consumer and the stakeholder as used in regular business analysis.

The article "Government Support for Open Educational Resources : Policy, Funding, and Strategies" by Stacey argues that whilst grants from foundations (such as Hewlett, Mellon, and Gates) played a critical early role in establishing the field of OER, these solutions are not long-term and cannot be relied on for sustaining ongoing operations or generating widespread adoption. In order to sustain ongoing operations and development, government support and funding is required. This article examines the role government policy and public funding is playing in the OER field and the strategies

and practices public funders are using, including taking over from the early stage funding that foundations provided.

The evolution from paper to online production and consumption of instructional materials is a disruptive technology in which much lower cost and increased accessibility of online work opens the product to a completely new group of potential users. The scholarly and professional discourse related to OER has largely focused on open learning objects, courseware, and textbooks. However, especially in graduate education, articles published in scholarly journals are often a major component of the course content in formal education. Further, open access journal articles are critical to expanding access to knowledge by scholars in the developing world and to fostering citizen science, by which everyone has access to the most current academic information and research results. In the article "Open Access Scholarly Publications as OER" Anderson presents the rationale, common practices, challenges, and personal anecdotes from a journal editor on the production, use, and reuse of peer-reviewed scholarly articles as OER. Anderson also highlights some of the challenges, economic models, and evidence for quality of open access journal content and looks at new affordances provided by the Net for enhanced functionality, access, and distribution.

It can be argued that making OER sustainable cannot be left to the educational institutions, but should be facilitated in a national setting, by means of a national OER policy or strategy. Many countries (for example, Brazil, China, India, Indonesia, Japan, Korea, Poland, South Africa, The Netherlands, Turkey, UK, Vietnam) have introduced specific measures and subsidies in order to stimulate the production and use of OER. Some of these countries are considering a national OER approach. In such circumstances, a significant intervention with OER in the educational system will need to facilitate improvement in accessibility, quality, and efficiency at no extra cost. In the article "The LOGIC of National Policies and Strategies for Open Educational Resources" Mulder pays special attention to the Dutch Wikiwijs Program as an example of an intervention with a far-reaching scope.

OER in other languages besides English are growing in popularity. In his paper, Cobo analyses several other languages and focuses on "the language gap". He examines large databases and discusses the increasing relevance of technology in opening access and reports on some of the challenges for OER production and dissemination in other languages. These include not only the linguistic but also the cultural barriers that exist when OER are implemented.

The affordances of hypertext mark-up languages and the Internet coupled with the range of potential OER assets available means that visualization mapping approaches are useful and often necessary in both the design and development of OER. They are particularly helpful in understanding how to navigate and use OER once they are published. In "Visualization Mapping Approaches for Developing and Understanding OER" Connolly examines how a variety of visualization mapping methods have been

used: at a strategic macro level in terms of OER institutional planning, at the meso level concentrating on the design and production of OER materials, and at the micro level as a navigating interface to OER assets. In addition, they enable learners and researchers to make sense of published OER materials. Most examples in this article are drawn from the OpenLearn OER project with some other illustrations, for context, from other OER projects.

We'll end this editorial with a sincere thanks to all those who make IRRODL possible: first to our sponsors Athabasca University and the Social Sciences and Humanities Research Council of Canada (SSHRC) then to our authors, reviewers, subscribers, and readers.

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Moving to Open Educational Resources at Athabasca University : A Case Study


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Abstract

Since the birth of the World Wide Web, educators have been exchanging ideas and sharing resources online. They are all aware of the turmoil in higher education created by freely available content, including some hopeful developments charted in this issue. Interest has grown steadily over the past decade in making a university-level education openly available to students around the globe who would otherwise be overlooked, and recommendations for how to do this are well documented (e.g., UNESCO, 2002; OECD, 2007). Initiatives in the United States (Thille, 2012), Canada (Stacey, 2011b), Africa (OER Africa, n.d.), and the United Kingdom (JISC, 2012) are easily accessed and case studies abound (e.g., Barrett, Grover, Janowski, van Lavieren, Ojo, & Schmidt, 2009). Supporting the widespread availability of OER is a goal that Athabasca University (AU) has embraced through association with the Commonwealth of Learning and by becoming a charter member of the OER University (OERu, 2011). The use of OER in AU programs has strategic local implications that go beyond the five reasons for institutions to engage in OER projects described by Hylén (2006). Recently at AU explorations have begun into the potential of using OER in course design and production.

Keywords : Open education resources; course design; course production

Introduction

As leading open education advocate Stephen Downes (2007) notes, understanding the sustainability of OER includes knowing "what they are, who creates them, how we pay for this, how we distribute them, and how we work with them" (p. 29). This article reviews briefly what they are and looks at the other questions with respect to the AU case. It describes the context within which AU provides teaching and learning services, including the challenges and opportunities that have led it to consider moving to OER. It outlines the design theory and instructional principles underpinning completed OER projects, with a brief illustration using two examples. The article concludes with a description of the current plan and expected next steps towards including OER in large numbers of AU online courses.

The AU Context

As is the case for all Canadian universities, Athabasca University is provincially accredited. It is a comprehensive research university with distance education as its mandate. AU is also an open university. When it was founded in 1972, "open" meant primarily that the university was committed to removing barriers that restricted learner access. But the notion of openness as a philosophical stance has continued to influence policy on diverse matters. For some time, in addition to open admission, the university has had a philosophical and practical commitment to using open source software; it also supports open-access scholarship and research publishing.

Reflecting its mission to serve non-traditional students in Alberta and beyond, AU is one of the small number of universities that have no entrance requirements for undergraduate programs. The university does provide screening self-tests to help students decide which level they are prepared for in subjects such as math and English, and individual courses do have prerequisites. The year-round registration policy enables learners to begin courses on the first day of any month, completing them at their own pace. This open, continuous admissions policy is the first degree of openness at AU, "which admits students without regard to their previous educational background or achievements. To enter Athabasca University as an undergraduate student, you must be 16 or older. No other conditions apply" (Athabasca University, 2009).

The second area of AU's commitment to openness is the use of open source software. As an institution for which technology is the infrastructure for teaching and learning—AU classrooms are virtual—open software, such as Moodle, Alfresco, Mahara, and Elgg, allows systems to be customized to meet backend integration needs that are fundamentally different from those of most universities. Athabasca University is active in the international Moodle community; for example, AU's adaptations of the base code have been added to the Moodle resource pool, and AU has hosted three Moodle Moot conferences since 2007.

A third category of openness at Athabasca University is open access to scholarship. In 2006 an open access research policy was established that encourages faculty and staff to deposit their publications in a digital repository conforming to international open access standards. Currently AUSpace, an institutional configuration of DSpace, is used for this purpose. Athabasca University Press — "the first scholarly press to be established by a Canadian university in the twenty-first century" — is an open access scholarly press "dedicated to the dissemination of knowledge and research through open access digital journals and monographs, as well as through new electronic media" (Athabasca University, 2008). In further support of the AU mission of overcoming barriers, AU Press also encourages emerging writers and researchers by publishing their scholarship.

AU researchers collaborate with academic colleagues across the world in projects that share data and results. Under the auspices of the Technology Enhanced Knowledge Research Institute (TEKRI), research resources are being dedicated to open education as well as support for the massive open online courses (MOOCs) that George Siemens and his colleagues have pioneered (McAuley et al., 2010).

Initiatives in course development using OER commenced with an external grant (2009–2011) that funded the development of 25 digital enhancements for 17 high-enrolment courses. Many of these enhancements are licensed through Creative Commons and available in learning object repositories for others to use or adapt. The award in 2011 of the UNESCO/Commonwealth of Learning Chair in Open Educational Resources (Athabasca University, 2011) to Athabasca University has been a further catalyst, inspiring recent development and implementation activities related to OER. Responsible for capacity building on institutional, national, and international levels, the Chair collaborates with partners and networks to support awareness, training, and research activities as well as the use of OER.

Challenges and Opportunities

Athabasca University is facing a number of challenges related to its transformation from a twentieth-century distance education university delivering mainly print-based course materials with tutor support to an innovative online university that engages students in dynamic and interactive learning environments. Digital learners in the twenty-first century have high expectations for anywhere, anytime service (Gabriel et al., 2012; Oblinger & Oblinger, 2005). Academic and administrative systems at AU need to be completely re-conceptualized to support online learning. Some faculty and staff are reluctant to embrace the changes needed to move teaching and learning into a digital environment. Others lack the skills needed to adopt new practices. Opportunities to address these challenges are being sought while courses are being redesigned for the online world.

The cost of course materials, particularly textbooks and online learning resources, is rising faster than enrolment revenue and is contributing to already tight budget pressures of declining provincial funding, inadequate ICT infrastructure, and rising

employment services costs. Another challenge to course development is the recent threat from the Canadian copyright collective, ACCESS Copyright. Its new fee structure is proposed to increase the licensing cost to include third-party materials in online courses from $3.38 to $45.00 per full-time-equivalent student. AU is unwilling to pass the increased costs on to students and unable to incorporate the new tariff into existing practices, especially as ACCESS proposes to include charges for internet resources and links to Web sites that are already openly available. While educational publishers now offer digital learning resources through companion Web sites and learning support systems, the terms of access frequently cannot accommodate AU's continuous enrolment practices. Access agreements tend to be based on the semester or academic year typical of traditional universities. And the cost of these resources is often prohibitive for courses with lower enrolments.

Regarding intellectual property, AU owns all aspects of all its courses; copyright concerns are limited to the use of third-party materials embedded in courses (any source can be linked to without obtaining copyright clearance). In response to uncertainty in the permissions arena, AU is moving away from third-party resources that cannot be directly accessed in digital form—this is a long-term strategy which is quite different from historical practice. Advocates of OER within the university have proposed including priority for OER in the course development policy currently under review to bring it up to date with online teaching and learning. They believe it will speed up production and reduce costs significantly. The possibilities are just beginning to be tested.

Thus OER have become an attractive option. For a university in transition from print-based to digital course development, the prospect of having conversations in the academic community about digital resources is a real advantage. OER offer us a chance to collaboratively explore new ideas and to test new course development and production approaches that better support an online teaching and learning environment. These discussions are helping course developers at AU consider alternative sources for content and activities in support of learning outcomes. Improved quality in our courses is already evident. For example, faculty members are adding RSS feeds of free online information that provide updates on rapidly changing topics; students are motivated by the invitation to contribute resources they have found to the course content; rich image and video illustrations help to create an appealing, supportive learning environment. And members of course development teams are now working collaboratively on the development of engaging learning objects to make these environments more interactive with the idea that these may be shared as OER.

Designing Open Educational Resources

AU course designers and developers are influenced by a number of learning and instructional theories, and have established design principles aligned to these models. While much of the potential value of OER is expressed as easier, less costly access to content (Caswell et al., 2008; D'Antoni, 2009) AU learning designers also focus on the

potential of OER as resources for learning *activities*. One reason for this strategy is the desire to address a traditional weakness of distance education – low learner persistence. It is well established that interactive learning can enhance student motivation in an online world (Keller & Suzuki, 2004; Hamada, 2008; Clark & Mayer, 2011). Another reason emerges from a conception, supported by various learning theories, of learners as active co-constructors of their own knowledge rather than as passive recipients of the knowledge of others (Jonassen & Land, 2000).

AU learning designers do not emphasize the structuring and presentation of content; rather, the course design process begins with an exploration of the most difficult concepts and content in the course to be revised or created. Attention and resources are focused where they will support students' learning outcomes most effectively as well as address overarching needs for various literacy and lifelong learning skills. Since online courses are easily updated, formative evaluation is incorporated in an iterative design process (Scriven, 1996) for ongoing improvement.

The learning design approach at AU consciously attempts to apply design principles that can be inferred from recent research in learning sciences. To structure interaction, the guidelines for increasing motivation advanced by Keller's ARCS framework are followed: attention, relevance, confidence, and success (Keller & Suzuki, 2004). Since attention is often captured through images, multimedia, and other visual features including page layout, Mayer's (2005) principles of multimedia learning are considered good practice for online design. Application of the learning design approach to educational resource development is influenced by the work of Graínne Conole and her colleagues in the UK and Australia (Conole, 2010).

Suggesting that learning is enhanced for students when interaction is present, Anderson (2003) proposes a three-part model. Learning requires student interaction with instructors, classmates, and/or content. Tutors are encouraged to demonstrate teaching presence (Anderson, Rourke, Garrison, & Archer, 2001), but the current AU tutor model limits student–instructor interaction. Interaction with classmates has been difficult to facilitate in AU's self-paced courses. New students can enter the course every month, so there is no stable cohort. Therefore in the past, course design resources were focused primarily on interaction with content. However the development of the Landing, Athabasca University's Elgg-based social learning environment, has provided a way for course professors to add a significant social learning dimension to AU courses. Students can interact with one another and with instructors to share ideas and resources in a dynamic virtual meeting place. Inviting students to informally contribute course content via the Landing seems to be both motivating and engaging. It is anticipated that interactive content that can both be used by AU and shared as OER will increasingly be complemented by social learning activities on the Landing.

Storytelling and linking to resources that connect content with real-life experiences are encouraged. Quizzes and self-tests that allow students to assess their new knowledge are produced in collaboration with subject matter experts. Through opportunities to

practice with automatic feedback (Kluger & DeNisi, 1998), learners are gradually led to a sense of accomplishment that will stick through their assignments and examinations. While students' learning needs are supported as much as possible, mental effort is necessary, and students need to commit to working on their learning. The motivation that comes from engagement (Clark, 1999) will help support students' success. The research results on self-regulation in education (Weinstein, Husman, & Dierking, 2000; Winne, 1995; Zimmerman, 2008) have inspired AU learning designers to explore opportunities to embed learning strategies that support this in self-paced courses. Other design principles underpinning course development work include attention to inclusive design (Treviranus & Coombs, 2000) through simple navigation, captioning of audiovisual material, and other techniques that allow students with disabilities to successfully learn from AU courses.

With respect to OER specifically and other generally innovative approaches to course development, design-based research methods (Sandoval & Bell, 2004) are used to guide pilot projects. Design-based research provides several methodological advantages for the design and assessment of innovations in education. It is systematic and iterative, in line with emerging understanding of how people learn; it is based in real-life educational situations and is therefore relevant to teaching and design practitioners; and it encourages researchers and practitioners to work collaboratively to create and assess the impact of solutions to learning problems. This approach provides opportunities to monitor the progress of organizational change against goals for enhancing learning success.

Examples

As a first step towards using OER consistently in course development across the disciplines and to learn more about the potential of OER, AU piloted their creation and use in three projects. In 2007–2009 a set of five just-in-time learning activities for calculus students having difficulty with basic algebra concepts was produced, licensed with Creative Commons, and shared in learning object repositories. With funding from the Inukshuk Foundation, Carnegie Mellon University's open source Cognitive Tutor Authoring Tool (part of the Open Learning Initiative [Carnegie Mellon University, 2011], funded by the Hewlett Foundation) was adapted as the Athabasca University Tutor Authoring Tool (AUTAT). This tool allows instructors to insert their own variables, creating an infinite pool of practice questions. The algebra activities were contributed to the Merlot, Currriki, and WikiEducator OER repositories, as was the code for the AUTAT tool itself. In 2009, a physics course on waves was created using MIT open courseware adapted to the needs of AU students. And finally, in 2010, a group of researchers from TEKRI collaborated with colleagues at the University of the West Indies to find and aggregate open materials for adaptation and inclusion in a graduate program in instructional design (Richards, Marshall, Elias, Quirk, Ives, & Siemens, 2010).

The success of these initial experiments led to a much larger scale project in 2010–2011. Funded by the Community Adjustment Fund through the government of Canada's Western Economic Diversification program that supported the digitization of course materials, 25 online enhancements for 17 of AU's highest-enrolment undergraduate courses were designed and developed. The subject areas included management, accounting, finance, calculus, biology, music, communications, psychology, nursing, and languages. Teams of learning designers, subject matter experts, visual designers, and programmers collaborated on digital learning enhancements following the design guidelines described above. The enhancements included podcasts, interactive tutorials, crosswords, videos, visualization exercises, and multimedia learning objects of various types. While not all of the learning objects qualify as OER due to the nature of their content or format, several of them have already been repurposed for use in other courses. Most of them have been licensed with CC-BY licenses and, in line with UNESCO (2002) recommendations, are available to anyone on AU's open courseware site at http://ocw.athabascau.ca. Eventually they will also be contributed to the same learning object repositories as the algebra modules.

Expert reviews of most of the OER produced have been completed, and authoring interfaces for many of the resources are currently being developed. Later, with the results from formal formative evaluations with students, they will be improved using these authoring interfaces. These interfaces, or "editors," will be released as well, since they are being designed to support future development and improvement by non-programmers.

Two examples will illustrate the value of attention to the authoring interfaces and openness to the process of ongoing improvement. First, the functionality of the AUTAT and usability of the open source MathML editor used to generate Flash tutorials were increased, and an AU XML editor was created. This editor simplifies the process of adapting the tool to alternate topics or disciplines. This new tool was demonstrated at the Open Education Conference in Utah in October 2011 (Ives, Graham, & Manuel, 2011), and several potential beta testers were identified. The source code and documentation will be provided to them so they can explore the possibilities of repurposing the learning activities and authoring interfaces in their own context. It is anticipated that suggestions for improvement will emerge from these tests.

The second example is a decision tree initially created for a psychology course in counseling. While the application turned out to be too complex for learners in this course to use, it was adapted as a different kind of learning tree for a biology course. It now lives as a bacteria classification tool, complemented by case studies that lead students through the interactive identification exercises. Since the project ended, the object has been further developed as an iPad app in an exploration of AU's capacity for developing mobile learning applications. Further development is planned for Android devices. It is hoped that testing with students and tutors will help confirm the observation that the tactile element of this learning resource engages students and helps them learn. The authoring interface for this tool will also be made available soon.

The investment in institutional and individual learning about OER to date has been substantial, but further commitments of time and training are necessary to approach sustainable practice (Wiley, 2007). In time AU will be in a position to determine how fully the promise of OER is likely to be realized in this context.

Next Steps

In response to the challenges facing AU as it transforms the university and to the opportunities offered by open educational resources, an OER plan that captures AU's strategic and operational approach over the next couple of years has been prepared. The plan includes a series of workshops and community conversations designed for internal learning and capacity building across the university. AU has already hosted visiting OER advocates, including Rory McGreal and Wayne Mackintosh, and sponsored group participation of AU faculty and staff in the Educause Learning Initiative fall 2011 virtual seminar "Open Educational Content: Addressing Challenges and Seizing Opportunities". In future sessions, learning designers and academics will be exploring the potential of OER in their disciplines. They need to learn how to effectively search for, identify, evaluate, and determine whether to use or repurpose open resources as content and activities for online courses. They may need to acquire technical skills to accomplish the re-use of what they find.

The plan also includes a series of showcases and demonstrations of OER already developed and integrated into courses, with results from student and tutor feedback. These presentations will share experience gained to date and stimulate ideas about how using OER in course design may improve productivity (Thillle, 2012) by reducing costs, speeding up development, and offering students opportunities for engagement with learning resources in ways that should keep them interested in their studies and focused on their learning.

Newly created web resources to be linked from a variety of AU Web sites, including the Centre for Learning Design and Development (CLDD), the Research Centre, TEKRI, and the Library, will support the virtual and in-person showcases and workshops. An inventory of existing OER is being developed for general access through an open repository. Other visiting experts and OER champions will present lectures and seminars. Open Access Week 2011 and 2012 activities showcased the current state of affairs in all things open at AU. Staff members with expertise in open access are encouraged to participate in conferences and other opportunities for professional development in this area and to share their new learning with colleagues across the university. Design-based research projects are under way, and a survey of the perspectives of university faculty and staff on OER was delivered in the fall of 2012. The results not only provide a benchmark against which we are able to measure awareness and adoption, but also serve as an OER readiness tool.

Conclusion

As an open university, AU observes openness through commitment to open administration (which includes open admission and continuous enrolment). Other practices include the use of open source software, the provision of open access to scholarship, the prioritization of open educational resources, the practice of open research, and the exploration of open pedagogies (including hosting of massive open online courses). This characterization, inspired by the key components of Stacey's "University of Open" (Stacey, 2011a), adapts his ideas to the AU context and extends the definition of what it means to be an open university.

To date most of the activity at AU in OER has been uncoordinated and unreported. This article aimed to gather information on advancements together in one place to provide a benchmark against which to measure future progress. The AU experience so far has shown that the shift from static proprietary content to dynamic learning environments populated by openly available learning resources needs to be approached as a systemic change with complex and often unanticipated ramifications. Like a brain developing new neural connections, the institution has to open new channels of communication amongst faculty, course designers, course developers, and copyright officers. For example, it is now more acceptable to link directly to an online video or open tutorial whereas in the recent past, all required course content had to be housed on University servers. The focus has shifted to evaluating the reliability of free resources and accepting a certain level of risk with respect to permanence. For externally produced OER such as Carnegie Mellon's Cognitive Tutor Authoring Tool that can be appropriated and repurposed, the necessary staff technical expertise needs to be fostered. In addition to basic quality of OER, features such as availability of base code, ease of repurposing, and appropriate Creative Commons licensing all must be considered.

Building on the research and practice of online educators and proponents of open educational resources around the world, Athabasca University is positioning itself for greater involvement in the development, adoption, and inclusion of OER into its courses. Wiley (2007) points out that "open educational resource projects must be explicit in stating their goals and tenacious in focusing on them." AU's recent pilot projects are consistent with its mission to remove barriers that restrict access and limit success in university-level study. Through a commitment to both increased equality and quality of educational opportunity for adult learners worldwide, AU is opening up many aspects of university practice, including course development. Issues such as sustainability (Wiley, 2007) and productivity (Thille, 2012) will guide the strategy for future OER practices at AU.

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IRRODL
THE INTERNATIONAL REVIEW OF RESEARCH IN OPEN AND DISTANCE LEARNING

Open Education Resources and Mobile Technology to Narrow the Learning Divide[1]


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Abstract

As the world becomes more digitized, there will be an increasing need to make available learning resources in electronic format for access by information and communication technologies. The question education will face is whether these learning resources will be available for learners to access at no cost or affordable cost so that there will be equity in access by anyone regardless of location, status, or background. With initiatives such as the Millennium Development Goals and Education For All by the United Nations (United Nations, 2011) learning materials must be available as open education resources to achieve the goals. Currently, most learning materials are available at a cost for people to purchase to learn, or they have to travel to a specific location (school or library) to access learning materials. In some parts of the world, especially in developing countries, these costs are prohibitive, preventing learners from achieving a basic level of education so that they can be productive in society and improve their quality of life (Bhavnani et al., 2008). Some would say that people in remote locations and developing countries do not have computers to access learning materials. It is true that many do not have desktop or laptop computers to access learning materials, but they have mobile devices and are now obtaining tablets with wireless capability to allow them to access learning materials from anywhere and at any time. These countries are bypassing the wired desktop stage and moving directly to wireless mobile technology (Bhavnani et al., 2008). Storing open education resources (OER) in electronic repositories will allow learners to access the resources using mobile technology. With mobile technologies, learners can complete coursework and assessments from anywhere and send their work to their tutors electronically and receive feedback (GSMA, 2011).

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Keywords : Open education resources; mobile technology; reusable learning objects

Introduction

With an estimated 5.3 billion mobile cellular subscriptions worldwide (ITU, 2010), we are starting to see the disappearance of the digital hardware divide; however, we now have the learning divide where the gap is between learners who have access to learning materials and learners who do not have access to learning materials because they cannot afford to travel to other locations or pay for the high cost of textbooks and other learning materials. Educators need to narrow the learning divide gap by making learning materials available as OER which will bring down the cost of learning materials. The combination of mobile technology and OER will enable institutions, organizations, and companies to narrow the learning divide so that there can be Education For All. Everyone has a right to obtain at least a basic education level so that they can contribute to society and improve their quality of life; however, education is more than providing access to content. It should facilitate the formation of learning communities for learners to interact (Cleveland-Innes et al., 2012; Cross, 2008; Havelock, 2004; Jeng et al. (2010), share experience, and learn from each other. Use of mobile technology allows learners to access OER and at the same time participate in learning communities. The OER initiatives and Web 2.0, which supports high levels of social interaction, are moving education into the Learning 2.0 era where content and social interaction will go together to provide global education (Brown & Adler, 2008).

A major issue in education around the world today is the shortage of teachers and physical schools for students to go to learn. The United Nations estimates that 8 million teachers will be required by 2015 (The Guardian, 2011; West, 2012). It is impossible to train 8 million teachers by 2015. Rather than training more teachers there should be a transformation of education where fewer teachers are required and learning materials are delivered to learners in their communities rather than taking the learners to the physical schools. Governments cannot continue to fund the current education system, which was designed many years ago. The current system is geared to those learners who have the resources to go to a physical school to learn. The education system must be changed so that it is flexible to meet the needs of all students regardless of location, economic status, social status, or gender. Learning materials should be delivered to students using mobile technology rather than denying students an education because of any shortage of teachers and physical classrooms. The country of India alone reported a shortage of 460,000 physical classrooms to educate students (The Economic Times, 2011). Resources are required to build the classrooms and more resources are required to maintain the classrooms. In addition, the students have to obtain the financial resources to travel to the physical classrooms to get an education. Many students in developing countries and in remote locations cannot afford to travel long distances to learn and governments cannot afford to build and maintain physical schools. The use of

mobile technology to deliver OER will provide equal opportunity for everyone to learn by allowing access from anywhere and at any time.

Making the Transition for Education For All with OER and Mobile Learning

Citizens in developing countries do not have desktop computers to access information and learning materials; however, they have mobile devices. Mobile phone subscription is rapidly increasing in developing countries (The World Bank, 2012). While the mobile devices are becoming affordable, the cost of connecting to the Internet is still very high in some countries. This is a major barrier to education. Some countries (e.g., Finland) are realizing that giving citizens affordable or free access is a competitive advantage since citizens can access up to date information and connect to the world to become global citizens. Also, easy-to-mirror repositories, which make it possible to access resources with mobile devices without broadband connections, will facilitate the delivery of OER in remote areas with limited connectivity (OECD, 2007). With the rapid development of cloud computing, there will be learning in the cloud where OER and access to learner support will exist everywhere and anytime where cloud applications will facilitate sharing, networking, communication, and the production and publishing of OER (Kop & Carroll, 2011; Wheeler & Waggener, 2009) .

There are initiatives around the world to develop affordable mobile technology so that every citizen can own or have access to a computing device. Placing a mobile device in learners' hands will allow them to access learning materials and empower them to learn. For example, South Korea announced an initiative to digitize the K-12 curriculum by 2015 for access on tablet computers (Mims, 2011). This will allow learners of any age to use a tablet to access learning materials to continue their education as they need the knowledge and skills. Countries such as Thailand are planning to give one computing device to each child (Bangkok Post, 2011).

It is a simple task giving mobile technology to learners compared to the task of designing and delivering affordable learning materials for access with mobile technology. Based on personal experience, many innovative education initiatives that implement technology-based learning fail not because of the technology, but because of a shortage of quality learning materials and buy-in from teachers. For some developing countries in some regions that acquired computing technology for learners, the technology is not being used or utilized to the maximum because of the lack of affordable learning materials, the lack of motivation of teachers, or the lack of information and communication technology skills of teachers using the devices (Corbeil & Valdés-Corbeil, 2007).

Another issue that educators have to deal with is that many mobile applications are developed for business and entertainment rather than education. Hence, educators have

to adapt the education system to fit the technology. For example, mobile technologies developed for business use are more textbased since they are developed for email, texting, and accessing information. Quality learning that caters for different learning preferences and the upcoming generations of students requires mobile technologies with multimedia capabilities and the ability to deliver content to meet individual learner's needs and for learning to be interactive. Educators need to provide input to both hardware and software companies to develop appropriate mobile technologies that are multi-purpose to meet the needs of education and the other sectors of society. There should be multi-purpose mobile technology for education, business, entertainment, and information access.

There are many benefits of accessing OER using mobile technology. Learners are given the flexibility of accessing the OER from anywhere and at any time and learners can learn in their own context (Ally, 2009). In traditional face-to-face instruction, learners have to go to a specific location at a specified time to learn. This can be inconvenient, especially for those who live in remote locations. With mobile learning the learning can be more learner-centered since students are the ones who have control of their learning. Also, with the communication capabilities of mobile technology, students can interact with each other anytime and they can access the tutor from anywhere.

A major challenge for delivery of OER on mobile technology globally is that most currently available OER are in English, and learners in many countries do not read or speak English. However, some countries see students completing courses in English as an opportunity for them to learn or improve their English language skills. Yilmaz (2011), in a study of international students' use of OER, reported that 88% of the 27 students preferred to read or use OER in English even though only one respondent's mother tongue was English. The study reported that since OER are generally in English, students are obliged to choose English as a language of preference for learning from the OER.

The Future of Education with OER and Mobile Technology

As education moves further in the 21st century and to meet the needs of the new generations of learners, educators need to re-think the way they design open education learning materials (Evans & Forbes, 2012; Olcott, 2012). In a world where there is an information explosion and constant changes in content, having students completing long courses and programs may not be appropriate anymore. The learner should be the focus of the OER not the developer of the OER or the system. Educators should not develop and deliver OER to fit the current education system. If learners cannot access and benefit from the OER then it is a waste of resources developing OER (McAndrew, 2011). The current course and program structure and length of courses were developed for classroom face-to-face instruction where the information resided in the teacher's mind. The information is now recorded in electronic format and learners want access

anytime and from anywhere rather than waiting for when a teacher is available to disseminate the information. For delivery of mobile technology, the structure and length of courses must be re-examined. Courses should be shorter and be designed in the form of modules and learning objects. Developers of open education courses must keep this in mind rather than using the same structure and length that were used for classroom face-to-face instruction.

The new generations of learners do not want to spend many months completing a course or many years completing a program as in the current education system. Hence, education programs should be developed in the form of modules, which are about four to eight hours long. Each module should consist of five to eight learning objects that are independent but are linked together. After students complete the learning objects in a module, and have their learning properly assessed, they will have successfully completed it and should be given credit for that module.

Problem-based learning can be used to promote deep learning. In problem-based learning, learners are given problems and they have to locate the information and apply that information as they solve the problem. Problem-based learning also allows learners to collaborate with each other and be active in the learning process (Hmelo-Silver et al., 2007; Rhem, 1998). If learners need help while solving a problem, they can access a coach or a tutor. The use of mobile technology for problem-based learning makes learning flexible where learners can access information from anywhere and anytime and they can communicate with experts in the field and with their tutors and peers. With mobile learning, learners can also learn in their own environment and in an environment where they can apply what they learn. They can solve problems in their own contexts rather than in contexts they are not familiar with.

Classroom face-to-face courses should not be copied and placed on the Internet as OER. Online OER courses must be designed properly to facilitate flexible delivery. It is important to train educators on how to design OER so that they are of high quality, resulting in high level learning as well as meeting the needs of learners globally. The OER should take into consideration cultural differences, different values, and different contexts of the learner. Educators need to internationalize the OER to maximize access. In a recent UNESCO report (OPAL, 2011), some barriers for implementing OER that were identified include lack of skills to create global OER and lack of OER that are culturally relevant.

It is important for learners and teachers to locate OER easily to meet their needs. Chen (2011) conducted a study on teachers' use of OER and found that two major obstacles for teachers in the use of OER are locating the OER and finding the most appropriate OER. The resources should be tagged properly so that anyone from anywhere can locate them. The interface the learner is using should have built-in intelligence to monitor learner progress and needs and to find the appropriate OER. The selection of OER for specific learners could be based on the learner's preference and context, the learner's

level of expertise, and the language of the learner. The system should select and assemble the OER for learners.

Teachers should be trained on how to integrate OER into their existing courses and courses they are developing for mobile learning. Students are using mobile technology and social media to communicate with each other and to share information. Teachers need to be trained on how to effectively use social media in the teaching process since this is how students interact with each other and form virtual communities (Yardi, 2008). Teachers should allow students to use mobile technology to interact with each other, to access information, and to interact with experts in the field.

There are many open source learning management systems available to help teachers deliver courses over the Internet (van Rooij, 2009). For example, MIT announced an open source learning platform called MITx that will allow teachers to organize and present course material to enable students to learn at their own pace, build interactivity, complete online laboratories, participate in student-to-student communication, conduct individual assessment of any student's work, and allow students who demonstrate their mastery of subjects to earn a certificate of completion (MIT, 2011). Mobile technology with open source learning platforms and OER will provide flexible and affordable learning for all. An example of an open source learning management system for mobile learning is Mobile Moodle which allows educators to deliver and manage courses on mobile devices.

The proliferation of the Internet and social media is allowing learners to learn from each other and to access information when needed for just-in-time application. If learners have a question about a course they usually ask their peers first before they contact the teacher or tutor, especially if they need the information during non-working hours when the teacher or tutor is not available. In a study on how students access information, Saw and Todd (2007) reported that when they asked students where they begin their search for information on a topic, 84% said they use a search engine, 6% said they email someone, while only 1% connect to the library Web site to access information. This result is not surprising since students usually search for information on the Internet when they need the information. They are the "now" generation and they want the information right away.

The information on the Internet and social media is being generated by students, researchers, and educators. The challenge for learners is to make sure they access accurate information when they use other learners' generated content. Pérez-Mateo et al. (2011) proposed quality criteria for evaluating user-generated content under the categories content, format, and process. As learners are trained and become experienced using the criteria to develop learning objects, they can develop quality OER (Moisey et al., 2006). As more and more users of the Internet generate information and learning materials, learners must check with experts in the field to make sure the learning materials are valid. One way to do this is for learners to access learning materials from accredited educational institutions, credible organizations, and experts

in the field. The challenge for OER providers and researchers is how to make sure the open education resources are accurate for learners to obtain a valid education. Some studies on the use of OER reported that educators are concerned about the quality of OER (Badarch & Knyazeva, 2011; Chen, 2011; Yilmaz, 2011). A major challenge for educators is the development of quality OER. But the question is how to define quality for global use and to meet global needs. This requires setting global standards for the development of OER so that the OER meet the needs of users around the world.

Keegan and Bell (2011) conducted a study where they asked students to generate videos as OER. They reported many benefits of having students generate their own content. Benefits included the following: Students became creative in the process of generating the video, they learned the content as they produced the videos, and they were able to share the videos with their colleagues. The videos were posted on YouTube with many peers and users providing excellent comments on the video. Having students generate OER has many advantages for them and their peers. As novices in the field they will use simple language, step-by-step procedures, and examples their peers will understand. At the same time, students will process the content at a high level as they generate the OER (Craik & Lockhart, 1972; Schwier & Misanchuk, 1993; Sternberg, 1998; Stoyanova & Kommers, 2002).

To achieve Education For All (UNESCO, 2000) with mobile learning, there must be significant shifts in the way education is designed and delivered and in how learning outcomes are evaluated for certification. Learning materials must be designed and be accessible for everyone to access. For example, a lesson on mathematics can be developed and validated by experts at one educational organization and placed on the Internet for everyone to access rather than having millions of teachers around the world developing the same lesson. Having many teachers developing the same lesson topic is a misuse of human resources and a waste of teachers' time. Teachers should spend time tutoring students rather than duplicating the development of learning materials.

One example of an initiative that is helping to achieve the Education For All goal is the Khan Academy. As of the end of 2011, over 92 million lessons were accessed around the world (Khan Academy, 2011). If learning materials are available as OER, learners and teachers will use the learning resources as illustrated by the Khan Academy initiative. Some publishers are publishing their books as open access so that anyone can use the book for educational purposes. For example, Athabasca University Press is publishing books as open access, which is contributing to bridging the learning divide and making education available for all. Other initiatives include The Open Content Alliance (2012), which is building a permanent archive of multilingual digitized text and multimedia material that will cater for different cultures and learning styles. The University of the People (2012) is the first tuition-free online academic institution dedicated to providing global access to higher education. It is taking advantage of the Internet to reach people around the world so that they can have access to education. Courses that can be delivered on mobile devices will allow learners with mobile devices and connectivity to access the learning materials from anywhere and at any time. Also, the World Digital

Library (2012) is a global initiative that will allow free access to information and learning materials. Libraries will be networked together to maximize the amount of information learners can access. Bonk (2010) listed a number of Web sites that provide free learning materials for students to access anywhere and anytime.

A recent initiative that will reduce the cost of obtaining a formal education is the Open Education Resources University (OERu), which is a consortium of accredited universities around the world that is planning to offer formal courses at a significantly reduced cost, making education affordable to millions of students (Attwood, 2011). The OERu system will check students' prior knowledge and skills to see if they already have the expertise in the course they are interested in completing. If students pass the prior learning assessment, they will not have to complete the course and they can move on to the next course. The use of prior learning assessment benefits students and the education system. If students already have the knowledge and skills that will be presented in the course, why should they waste their time taking the course? The education system and students will benefit since some students will not have to take courses they already know. The OERu will play an important role in lifelong learning around the world since learners of any age can complete courses at an affordable cost. The OERu will have a major global impact if the courses are delivered on mobile devices since many citizens in developing countries do not have desktop computers but they have mobile phones and tablets. For citizens in developing countries, low-cost education and low-cost computing devices are important for them to access education.

A recent report from the Commonwealth of Learning provided suggestions for academic staff to successfully implement OER (COL, 2011). These include the following: develop skills to evaluate OER; consider publishing them; assemble, adapt, and contextualize existing OER; leverage networks and communities of practice; encourage student participation; promote OER use through publishing about OER; provide feedback about, and data on the use of, existing OER; and update knowledge of intellectual property rights, copyright, and privacy policies. Guidelines such as these are important for the successful implementation of OER; however, there should be training programs for teachers on how to develop and implement them and how to provide support to students who are completing OER courses. Educators should be made aware that OER exist and be educated on how to access them and the benefits of using them (Nikoia & Armellinib, 2012). If educators do not see the benefits of using OER, they will not use or promote their use of OER. In a discussion forum involving 500 individuals from around the world, participants identified awareness, training, and promotion as major issues for the successful implementation of OER in education (Antoni, 2008).

Conclusion

There have been many conversations on what an OER is and how OER will benefit the world but not enough dialogue on how to implement OER to have a global impact so

that we have Education For All. There has to be a sense of urgency to prove to decision makers that OER will have a significant impact on education through social inclusion and justice so that everyone can achieve a basic level of education. In addition, research is needed on developing OER for lifelong learning, setting standards for developing and delivering quality OER, developing intelligent OER, and designing optimal assessment and certification of learners after they complete OER. Also, as libraries become mobile friendly and librarians continue to develop their technological skills, they will have a major role to play in the organization and delivery of OER (Krist, 2011; Singh, 2008). More work is needed to determine the changing role of librarians and how they can contribute to the successful implementation of OER.

All too many OER are being developed using the face-to-face classroom paradigm of education. If OER are to have a significant impact on education so that Education For All is possible, and the need for millions of teachers and physical classroom space is reduced, there must be a significant shift in the way education is delivered. Many learners around the world cannot afford to go to a physical location to learn because of a lack of financial resources and transportation infrastructure. Citizens of all countries must be empowered to learn by giving them the technology to access learning materials from their local communities. Educators must design OER for access at no cost or low cost so that learners can readily access the OER. Future learning will be ubiquitous where learners will be mobile and will learn anywhere and anytime (McGreal, 2010). Mobile learning with open educational resources is the future of education (Young, 2009). As we move into the OER era we need to transform education with the goal of Education For All. If educators do not take the opportunity to implement OER, future learners may bypass the education system and access OER without registering at an educational institution. The learners can then demonstrate to potential employers that they have the expertise for employment and the potential employers will certify and hire the learners. This could be one potential model of education in the future that will change the way education is delivered. For many people around the world the cost of education is too high, the education system is too rigid and inflexible, and the system is resistant to change. There has to be a transformation of education before there is an educational revolution by the current and upcoming generations of learners. This is the time to transform education because learners have the technology in their pockets and are able to access OER anywhere and anytime.

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Mobile Authoring of Open Educational Resources as Reusable Learning Objects


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Abstract

E-learning technologies have allowed authoring and playback of standardized reusable learning objects (RLO) for several years. Effective mobile learning requires similar functionality at both design time and runtime. Mobile devices can play RLO using applications like SMILE, mobile access to a learning management system (LMS), or other systems which deploy content to mobile learners (Castillo & Ayala, 2008; Chu, Hwang, & Tseng, 2010; Hsu & Chen, 2010; Nakabayashi, 2009; Zualkernan, Nikkhah, & Al-Sabah, 2009). However, implementations which author content in a mobile context do not typically permit reuse across multiple contexts due to a lack of standardization. Standards based (IMS and SCORM) authoring implementations exist for non-mobile platforms (Gonzalez-Barbone & Anido-Rifon, 2008; Griffiths, Beauvoir, Liber, & Barrett-Baxendale, 2009; Téllez, 2010; Yang, Chiu, Tsai, & Wu, 2004). However, this paradigm precludes capturing learning where and when it occurs. Consequently, RLO authored for e-learning lack learner generated content, especially with timely, relevant, and location aware examples.

Keywords : Open education resources; reusable learning objects; mobile technology

Introduction

The tool presented in this article fits within the definition of open educational resource initiatives which includes open content, open software tools (e.g., learning management systems or authoring tools), and repositories of learning objects (Downes, 2007). Moreover, experts have suggested "that adopting a learning design methodology may provide a vehicle for enabling better design and reuse of Open Educational Resources (OER)" (Conole & Weller, 2008, p. 1); thus provisioning of tools to author learning designs, like the one presented in this article, can improve adoption of OER for content creation and subsequent reuse. The learning objects created within the subject tool can be considered an open, technology and format specific subset of an OER (Friesen, 2009).

At the macro level, this system allows learners to create OER to be shared under social constructivism. At the meso level, this article presents a framework for the development of an implementation for assembly and creation of OER. At the micro level, the system can author learning design which can be used for instructional design within an OER. Additionally, new information technology developments enable the creation of OER on a mobile device. Each aspect of this project is discussed next.

Learning Objects

Functionally, as Wiley (2000) states, learning objects serve as an instructional design component in e-learning for the development and delivery of educational content. RLO are small digital entities containing instructional media for electronic delivery. Electronic courseware developed for a learning management system, such as Moodle, contain standardized learning objects which may contain digital text, video, audio, and assessment tasks (McGreal, 2004). Furthermore, McGreal (2004) submits that learning objects serve an educational purpose or learning outcome by being components "in a lesson or assemblage of lessons grouped in units, modules, courses, and even programs" (p. 11). This assertion is supported by Downes (2004) who stipulates that learning objects must be modular and able to be combined and packaged into larger units. For the aggregation of learning objects into larger units to be possible, the property of granularity must be maintained in a learning object (Koper, 2003).

Downes (2004) asserts that learning object repositories (LOR) are what enable discoverability of learning objects. Repositories are collections of learning object metadata in which learning objects can be stored, indexed, and retrieved for reuse.

Standards based LOR are aimed at increasing the effectiveness of both online and blended learning by increasing the sharing, which, in turn, decreases LO development costs (McGreal, 2008). The interoperability of learning objects stored in various repositories has not been fully achieved due to non-standard independent development (McGreal, 2007; 2008), a need addressed by the implementation outlined in this article which demonstrates a repository for standardized learning objects and OER.

Mobile Device Sensors

The inclusion of integrated hardware sensors in mobile devices provides the possibility of augmenting learning activities with sensor data. Technology enhanced learning activities, such as those created with the mobile authoring tool in this project, capture spatially distributed physical sensory data, such as video, photos, audio recordings, and GPS locations. Vogel, Spikol, Kurti, and Milrad (2010) state that there are ongoing research challenges related to integrating this collected sensor data to support learning but conclude that "mobile learning can best provide support for learning in context" (p. 65). Thus, the proposed tool must promote capturing contextual experiences via multimedia examples of the environment and their locations. Context is defined as any information illustrating the situation of a learner such as location, time, activities, and surrounding environmental characteristics (Vogel, Spikol, Kurti, & Milrad, 2010). As a result, the proposed tool will capture a representation of these contextual attributes.

Kuo, Huang, Liu, and Chang (2008) present an implementation of a system using mobile devices for creation of authentic examples. However, their described system does not implement standardization or a method for exporting content beyond the system in which it was created. Herein lies the traditional boundary to reuse. Standardization of content will explore reuse in a multitude of other tools implementing the same standards. Related mobile capture systems do "not provide for learning objects interoperability and reuse with other systems" (Svensson & Pettersson, 2008, p. 610). While the above described systems do create authentic learning and demonstrate mobile learning via sensor data, reuse in multiple contexts is limited. Typically, the contextual and authentic learning examples created within these projects appear to be shared only within the system they were authored for.

IMS Global Learning Consortium Metadata, Content Packaging, and Learning Design specifications were selected as they are well defined and context agnostic. IMS standards are widely implemented within e-learning but are less well developed in mobile learning. Together, these standards permit the creation of metadata, reusable learning objects, and learning activities within a single, portable package.

Metadata

McGreal (2006) adds that learning objects are educational resources with metadata descriptors for use in technology supported learning. Metadata, or data about data, is essential for addressing implementations of a learning object. Moisey et al. (2006) assert that more comprehensive metadata "enhances the usability of a learning object—the more complete the metadata, the greater the likelihood that the learning object will be found and reused" (p. 145). Furthermore, Moisey et al. (2006) assert that IEEE LOM is the only standard which has officially been approved for learning object metadata, and Svensson and Pettersson (2008) state that the IEEE LOM is "the most renowned and widely accepted standard to date" (p. 607).

Specht and Kravcik (2006) present the RAFT project for capturing images and audio in a mobile environment and tagging with metadata. However, content reuse within a learning design or standardized content is not explored. Other implementations that allow for mobile capture and publishing of learning content do not typically reuse the content beyond the system in which it was authored, nor is the capture process integrated (Comas-Quinn, Mardomingo, & Valentine, 2009; Kiili, Multisilta, Suominen, & Ketamo, 2010; Volgin, Hung, Vakili, Flinn, & Shin, 2005).

Several projects implement various types of metadata. Some projects implement an authoring system for metadata such as Learning Resources Metadata Authoring & Management subsystem of the ASK LDT Project (Sampson, 2005), MEAT: An Authoring Tool for Generating Adaptable Learning Resources (Kuo & Huang, 2009), Automatically Producing IMS AccessForAll Metadata (Boni, Cenni, Mirri, Muratori, & Salomoni, 2006), HyCo LOM Editor (Berlanga & García, 2005), and Reload (Beauvoir, 2011). However, these are not within a mobile context.

While mobile metadata tagging projects have been documented, such as ZoneTag (Ahern et al., 2006), CARDS (Verdejo et al., 2006), GeM Project (Svensson et al., 2010), Mobile Media Metadata (Sarvas, Herrarte, Wilhelm, & Davis, 2004), Context-Aware Metadata Creation in a Heterogeneous Mobile Environment (Volgin et al., 2005), and Mobile Collector (Kravcik, Kaibel, Specht, & Terrenghi, 2004), they do not typically implement a widely adopted standardization. Volgin et al. (2005) further support this claim by stating that “contextual metadata gathered in the presented initiatives ends up in a variety of structures, which has an impact on interoperability” (p. 16).

Content Packaging

The most cited de-facto format of a reusable learning object is that of an IMS Content Package: “IMS Content Packaging is the most widely used learning technology standard in the world” (IMS GLC, 2011b). This standardized format of an RLO enables packaging of instructional content, such as authentic learning objects, to provide aggregation, distribution, and deployment (IMS GLC, 2007). The format permits authors to build learning content that can be easily managed and deployed by learning administrators, interacted with by learners in the runtime environment (IMS GLC, 2007), and provides the format for exchange of learning objects between systems (IMS GLC, 2011b). The IMS Content Packaging specifications aim to “enable the encapsulation in a concise and easily browsed manner, of all the required content resources, supporting information, and structure required to promote interoperable, online learning experiences” (IMS GLC, 2001, p. 1.1).

Learning Design

IMS Learning Design (LD) specification supports distributed learning environments (Berlanga & García, 2005). This specification seeks to meet the following goals, which closely support the aims of OER (Berlanga & García, 2005).

- Reproducibility: The playback, runtime, or execution of IMS Learning Design is possible in different settings or contexts, or by different users.
- Interoperability: IMS LD enables exchange and reuse of learning designs across different platforms and courses.
- Compatibility: IMS LD is compatible with other specifications, particularly those published by IMS GLC.
- Reusability: IMS LD provides an identity for each element of learning, decontextualizes it, and exchanges learning elements to permit their reuse in other contexts.

A concept central to IMS LD is that of units of learning (UOL). A UOL is a self contained entity which holds the learning objects and services required in the learning process (Koper & Olivier, 2004). UOL granularity can vary depending on the objective and may represent a whole course, or a single concept, but contains both the learning resources and learning activities (Stauffer, Lin, & Koole, 2008) and can be authored completely within the tool described. In this application, a unit of learning can be considered to be an IMS Content Package with the addition of IMS Learning Design which defines activities and related elements.

Koper and Olivier (2004) stipulate that one task leading to adoption of the IMS LD standard is creating authoring tools for different pedagogical and learning development methods. The proposed authoring tool is an implementation, which seeks to satisfy this recommendation. Authoring and editing tools, such as Reload, ASK-LDT (Sampson, 2005), and eXe (eXe, 2011) require non-mobile platforms; thus this represents a limitation for authoring IMS LD in a mobile context. Tools discussed in the next section on authentic learning are designed for capturing authentic learning examples in a mobile context, but do not implement standardization to encourage reuse. Other authoring tools, such as LAMS (Michailidis & Demetriadis, 2009) and the web-based authoring system by Stauffer et al. (2008), are not fully standards compliant, an impediment for reuse beyond the context the learning design was authored in. Thus, the tool presented authors activities which reference and reuse captured learning objects in a standardized format to enable interoperability.

Authentic Learning

Authentic learning is an instructional theory focused on learning in context, or real life application of knowledge (Rule, 2006). Rule states that authentic tasks are used to integrate knowledge and skills into life or work settings, via complex activities. Instructional approaches that utilize authentic learning tasks include problem based learning, situated learning, constructive learning environments, and collaborative learning environments (Rule, 2006). This paper presents a tool to capture and create learning activities within these approaches. Mobile device sensor data collection for

authoring of learning objects created in an authentic context, or authentic learning examples, will be demonstrated in the Methodology section. This content will then be encapsulated in the authentic learning task, described by IMS Learning Design. While the task is authored in a mobile context, the playing or executing of the authentic learning activities can take place in a variety of contexts such as web-based learning or mobile learning. In the past, learning by doing may have been difficult to implement; but technological tools like observation using remote instruments and field work with mobile devices as data collection platforms enables authentic learning experiences (Lombardi, 2007).

An authentic learning example is a subset of reusable learning objects, as previously defined; however, the content contained within an authentic learning example is necessarily captured in an authentic environment. Within the scope of this project, an authentic learning example can be defined as an RLO created in a mobile context in a real life situation, for example, a digital photograph taken with a smart phone of a procedure in a biology laboratory. In addition to the metadata describing a reusable learning object, authentic learning example metadata may be supplemented with location-aware metadata such as a GPS location. Within the proposed implementation, data collected with a mobile device by the authentic learning example authoring tool will be utilized in the activities by the learners without the requirement of being in the authentic location.

Kuo et al. (2008a) present an implementation of a system using mobile devices for creation of authentic examples. This system aims to fulfill the gap in e-learning materials created by a lack of timely, accessible, and well organized examples by providing students a means to create their own examples. Capturing real-world examples using mobile device sensors, appending metadata, and uploading to an e-learning platform, allows authentic examples to be created and shared amongst co-learners. This platform creates authentic learning objects, however, they are not standardized; the sharing and reuse of the authentic learning examples would be limited to students with access to the same learning platform. This content could not be imported into an LMS or submitted to a standards based repository. Thus, in this context, the previous assertion of an authentic learning example as a subset of reusable learning objects is not well founded. In order for this claim to be supportable, the lack of authentic learning example standardization will be addressed in this project with the use of IMS Content Packaging.

Social Constructionism

There is a growing influence of constructionism as an approach to learning. However, moving towards a more “authentic” learning environment produced by social constructionism coupled with technology has several challenges. These challenges must be overcome before a paradigm shift resulting from the deconstruction of institutionalism and reconstruction of a social constructionism model can occur. Social constructionism is, in this instance, seen as an extension of authentic learning.

Authentic learning examples can be captured where and when they occur, and shared under a social constructionism pedagogy in a LMS.

Communications in social constructionism learning are no longer one directional as in traditional instructionalism. Instead, members of the learning community contribute their authentic learning examples to the larger learning enterprise. Computer applications can be used by constructionism theory to create "a computer-based interactive learning environment where the prerequisites are built into the system and where learners can become the active, constructing architects of their own learning" (Sawyer, 2006, p. 40). This project extends this concept beyond computer based learning environments into the mobile learning sphere.

One such technical challenge, and, indeed, an opportunity for innovation, is the ability for a learner to contribute meaningful examples of his or her own learning in a constructionism model. Castillo and Ayala (2008) provide justification for this approach in a mobile context: "The conversational nature of mobile devices and their capabilities to capture and transmit multimedia data (photos, video, audio and texts) make them suitable to collaborative development of learning objects" (p. 55).

In social constructionism, members of the learning group are responsible for introducing new learning objects and activities while the coordinators and mentors act in a support role (Sawyer, 2006). This is precisely the focus of the reusable learning objects, which the tool seeks to create and share. The learning design authored with this tool will support both the learner role and the tutor role and assign learning activities and support activities, respectively.

Providing the proper inclusive medium for this communication to take place is critical to lesson design (Jones, 2006). The focus of bringing cases and real life experiences into content prevents strictly textbook learning, and creates links to experiences the group has undergone. Allowing each learner to exemplify their own experiences creates a wider communal knowledge base which can be shared amongst the group, falling squarely within social constructionism.

Castillo and Ayala (2008) proposed that

> when the learner collaborates in the social development of mobile learning objects, he can play two different roles: recorder (record text, voice, audio, still images or video from physical learning environments using mobile devices) or editor (edit these records in such a way that they can be used in learning activities and they can be shared, manipulated, and refined by others). (p. 57)

The recorder role is experienced while capturing authentic learning examples. The editor role is conducted should the author opt to utilize the authentic learning examples

in a learning design's activities. Using standardized output, both the recorder role and the editor role will provide content that can be "shared, manipulated, and refined by others" (Castillo & Ayala, 2008, p. 57).

Mobile sensors enable capturing of learning objects in an authentic learning situation. "Mobile devices can be used to collaboratively create, edit and share" learning experiences which specify tasks and roles "based on capture, editing and sharing of audio, photos and texts using a mobile phone" (Castillo & Ayala, 2008, p. 54). Authoring tools for content capture are identified as a principal component in a mobile learning paradigm (McLean, 2003). Any movement towards social constructionism demonstrates the need for tools in which learners can capture and share learning resources in support of authentic learning. Cleveland-Innes et al. (2005, p. 380) maintain that "learning object creation, tagging, storing and retrieving must be learner centered."

Thus, the research goals are as follows:

1. to demonstrate mobile device sensor data used to author authentic learning examples for use in reusable learning objects/open educational resources;

2. to utilize learning objects created in a mobile context to author learning designs conforming to IMS standards;

3. to permit sharing of authentically authored learning content and learning designs across contextual boundaries.

These research questions are reflected in the conceptual design (Figure 1) of the tool. Learners could use the tool to capture learning examples from their daily life and share with co-learners in a learning management system or runtime environment. Instructional designers could create authentic learning examples as the basis for authoring learning activities.

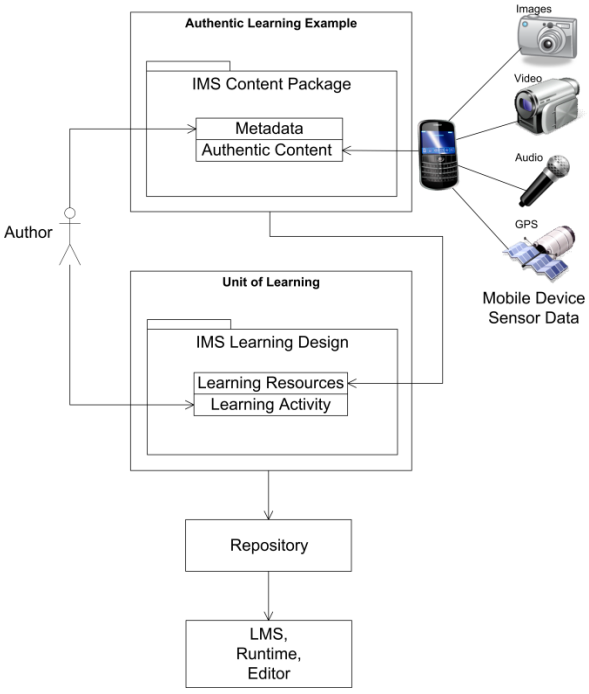


Figure 1. Conceptual design of the mobile authentic authoring tool.

System Architecture

In order to achieve the task of creating IMS standard learning objects in a mobile context, the implementation solution is a two-tier application consisting of a mobile client and a server component. This architecture compiles the content on the server, which automatically shares content in the repository, and avoids the situation where the content would only exist on the mobile device. A mobile application without a server component would require explicit and manual effort to upload the learning content to a repository for sharing with others.

Mobile component.

The resulting solution is a mobile application, entitled "MAAIMS", which is an acronym for Mobile Authentic Authoring in IMS. The MAAIMS client runs on a smart phone, with current implementation focused on Research in Motion devices with Blackberry OS 5, 6, or 7 installed.

The component in the mobile device runs on top of the operating system. The mobile platform allows multitasking so the MAAIMS application can be always-on, running in the background, until the user comes across an authentic learning situation he/she wishes to capture.

This component presents the user interface and interacts with the hardware mobile device sensors and IO channels, such as the touch screen, keyboard, the global

positioning sensor, the embedded camera, and the microphone. Functionality like authentic learning example capture necessitates this subset of sensors to be present on the mobile hardware.

The mobile client connects to a server for uploading metadata and authentic learning content, and subsequently for downloading the resulting content package to local storage on the mobile device. By default, this ensures that learning content is stored on the server, which acts as a repository. However, it necessitates that the mobile device is connected to the Internet for the duration of the application execution. Given the rapid proliferation of 3G and 4G mobile data networks, along with Wi-Fi coverage increasing all the time, the connectivity requirement of this application was deemed an acceptable requirement.

GPS coordinates are used to individually tag authentic learning examples with their capture location. MAAIMS is designed to capture real-life learning examples, such as fieldwork demonstrations. Thus, outdoor examples which are location dependent can be geo-tagged. Learners could thereby visit a location of a learning example, or location data could enable adaptive learning at runtime wherein content is conditionally presented depending on learner location.

Server component.

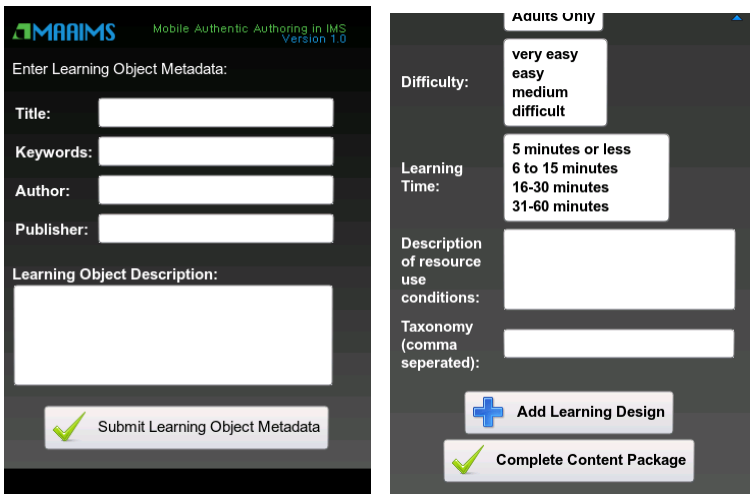
The server interfaces with the mobile client over standard HTTP and TCP/IP protocol. The server component accepts the metadata and multimedia uploaded by the client, stores it in a database, and then dynamically generates HTML (environments, activities, objective, prerequisite, and resources) and XML (imsmanifest.xml) according to the IMS standards, and bundles generated content and multimedia into a package interchange file.

The package interchange file is a uniquely named .zip file that contains all of the learning resource HTML files, the imsmanifest.xml, and the captured multimedia files representing authentic learning objects. The zip file is stored on the server for the mobile client to download to local storage and a copy is retained on the server in the web-based repository for reuse.

Methodology

This methodology subscribes to the design for Learning Design authoring tools developed by Boticario and Santos (2007). Course materials should be developed as a set of learning objects as the first step in an IMS LD authoring tool. Secondly, metadata should be added to those learning objects. Finally, the published methodology states that instructional design should be added next.

Collect Learning Object Metadata



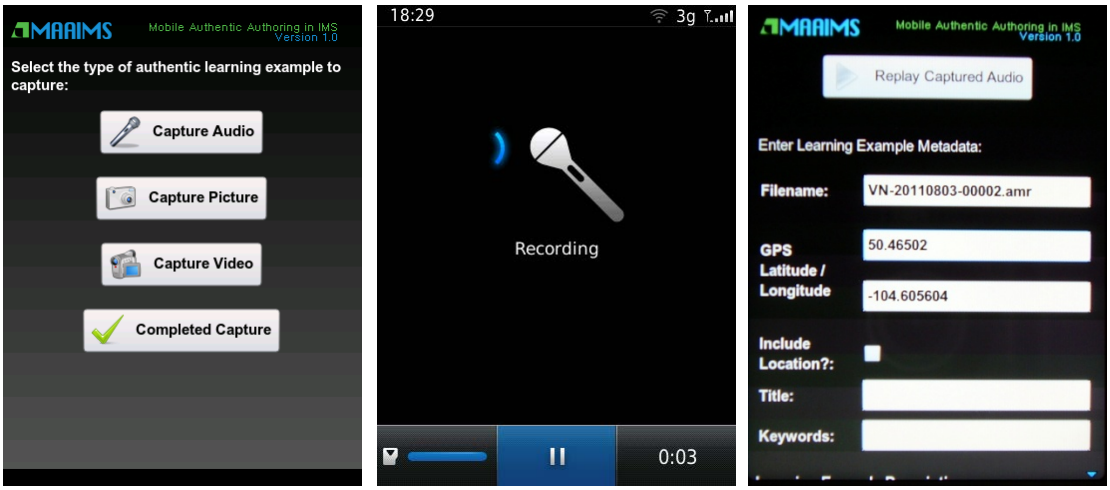
(a) (b)

Figure 2. RLO metadata collection in MAAIMS: (a) represents general metadata and (b) collects educational metadata.

The metadata fields collected follow the IMS Metadata specifications based on the IEEE/LOM Metadata. Figure 2(a) shows the initial screenshot of the mobile component where IMS Metadata is collected which represents the general and lifecycle elements. This metadata "groups information describing learning object as a whole" (IMS GLC, 2001b).

The technical section describes the technical contents of the resources in the content package. This includes requirements to view the content at runtime, file types included in the package, and the location at which the content package is available. Wherever possible, metadata is application generated to minimize user input. Furthermore, other metadata elements fields can be assumed to be constants, such as the rights section which specifies the conditions of use of content package (IMS GLC, 2001b). By default, all content produced with MAAIMS is free of cost and copyright; thus these XML element values are set by the application to maximize content reuse. MAAIMS metadata could also include a Creative Commons license which would limit content reuse to individuals and educational institutions or organizations not seeking to commercialize the content, all while retaining attribution rights.

In Figure 2(b), the educational metadata is presented after the collection of authentic learning examples because the responses to fields such as typical learning time will depend on the content, number, and type of the learning examples collected. This metadata represents the "educational or pedagogic features of the learning object" (IMS GLC, 2001b).



(a) (b) (c)

Figure 3. The authentic learning example capture process: (a) shows the selection of media type, (b) displays the capture, and (c) shows the captured filename, location, and example description.

Collect Authentic Learning Examples

Key to this project is the use of mobile sensors to capture authentic learning examples. The MAAIMS application achieves this task by integrating with the native applications of the mobile device for three mediums of media capture. GPS location and learning example description are also independently obtained for each example.

Figure 3(a) is presented after the initial learning object metadata has been submitted. It presents options for each type of authentic learning example. If the user selects “Capture Audio,” the application will launch the audio recording application, as shown in Figure 3(b). Similarly, the camera application will launch if the “Capture Picture” option is selected and the video camera application will launch if “Capture Video” is selected. The user can then capture the authentic learning example by recording an authentic learning scenario. The GPS coordinates are queried simultaneously as each authentic learning example is captured.

Figure 3(c) displays the description collection for each authentic learning example. The filename field and latitude/longitude fields are auto-filled by the application, and cannot be overwritten by the user. The location fields are only available if the mobile device was able to receive GPS coordinates.

Once a suitable capture has been completed and the required metadata has been entered, the user can press submit the metadata and multimedia. This uploads the media to

binary file storage on the web server, and the corresponding example metadata to the database.

Complete Content Package without Learning Design

Once the completed capture option has been selected, the application collects educational metadata as previously discussed. Prior to submitting the educational metadata, the user is presented with two options, as seen in Figure 2(b). “Add Learning Design” will create learning activity within the content package, and “Complete Content Package” will complete the content package without embedded learning design. If the user opts to complete the content package, the server generates the physical files (actual media representing authentic learning objects) and the manifest (containing the metadata, resources, and organizations sections), which are created and compiled into a standalone package, and then shared to the repository.

Add Optional Learning Design

This step displays how to create a content package including IMS Learning Design Level A. Figure 2(b) shows the educational metadata collection screen's options. Pressing the “Add Learning Design” button will direct the program flow as this step details.

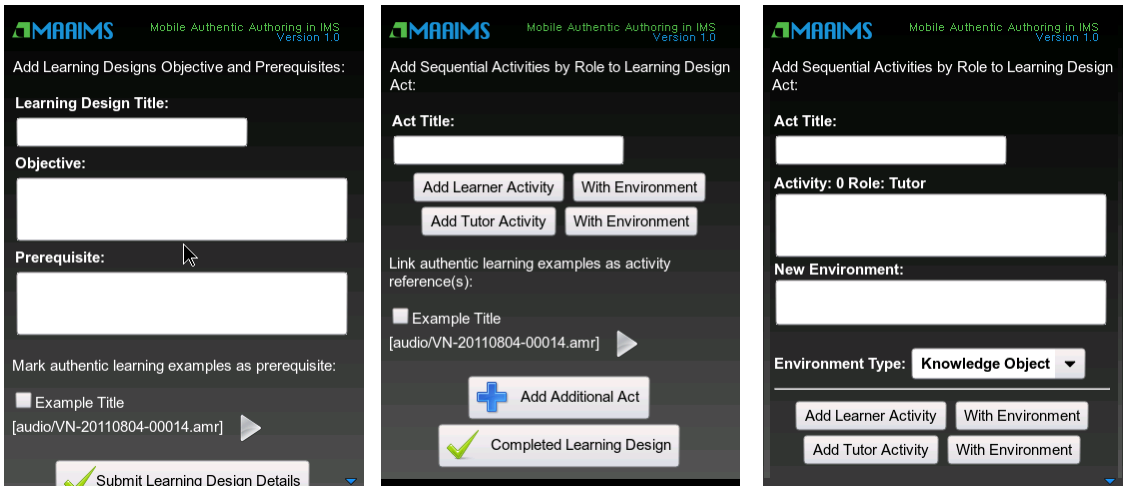
The IMS Learning Design information model specifies title, learning-objectives, and prerequisites as learning design elements, which are collected, as shown in Figure 4(a).

The learning objective field represents the overall goals to be met by learners who complete the activities in the learning design and the authentic learning examples contained in the content package. MAAIMS defines the learning objective at the global level and not on each activity.

Next, Figure 4(a) requests the user input prerequisites. Previously captured authentic learning objects can also be tagged as a prerequisite to the unit of learning. The check box representing each of the previously captured learning examples can be selected if the example specifies one of the entry requirements for interacting with the learning design.

Activities can be added to an act as shown in Figure 4(b). Pressing the “Add Learner Activity” button will create a new activity, assigned to the learner role, in the current act.

The “Add Tutor Activity” button will perform the same function, but the tutor role will be assigned, as shown in Figure 4(c). Activities can also be created with an environment, which creates a relationship between the activity and an environment within which the activity is executed. An environment is a learning object, service, or tool which is available to the learner at runtime, and the type is set by the author as seen in the drop down selection of Figure 4(c).



(a) (b) (c)

Figure 4. Learning Design objectives and prerequisites are created in (a), (b) shows new activities created within acts, and authentic learning examples tagged as references, and (c) displays activities created with an environment.

Previously created authentic learning examples can be referenced within an act in a similar manner to how they are referenced as a prerequisite. If an authentic learning example is referenced within an act, it would be considered a relevant learning object to the activities contained within the act. It would be treated as reference material for completing the activities defined.

After all activities have been entered into the current act, two options are given to the user, as shown in Figure 4(b): “Add Additional Act” and “Completed Learning Design.” The add additional act option will insert another act into the learning design, and will repeat the process of adding activities, environments, and referencing authentic learning examples. As many acts can be added as the author deems necessary to meet the defined learning objective.

Once the learning design has been completed, the package interchange file, including learning design, is generated by the server which can be accessed from the mobile client or the repository.

This methodology demonstrates that mobile device sensor data can be utilized to author authentic learning examples. These authentic learning examples are, in turn, utilized within IMS Content Packages and IMS Learning Designs. The MAAIMS implementation indicates that a mobile application can complete these tasks in a mobile context. A video demonstration of an authoring scenario can be viewed at http://goo.gl/eaVqd.

Results

The remaining research goal is to share the created content packages in other contexts beyond the mobile platform in which they were authored. This goal seeks to demonstrate the reusability and applications of MAAIMS output since OER are required to be able to be repurposed by others.

Repository

Repositories are collections of learning object metadata in which learning objects can be stored, indexed, and retrieved for reuse; thus a repository is required to address the sharing and reuse research goal.

Figure 5 displays the MAAIMS repository, containing each package interchange file created by MAAIMS.

Validation

To confirm that the learning design produced by MAAIMS is compliant to the standards, CopperCore Version 3.3 is used to validate the package interchange file. A .zip file, from the MAAIMS repository or stored locally on the mobile device, can be input into CopperCore for validation. The validation engine checks the XML compliance against the schema, meaning that the imsmanifest.xml file is both valid and well-formed, ensures that the content is properly referenced, and the learning design is semantically correct. A successful validation of the learning design supports the assertion that MAAIMS can produce valid IMS Learning Designs in a mobile context.

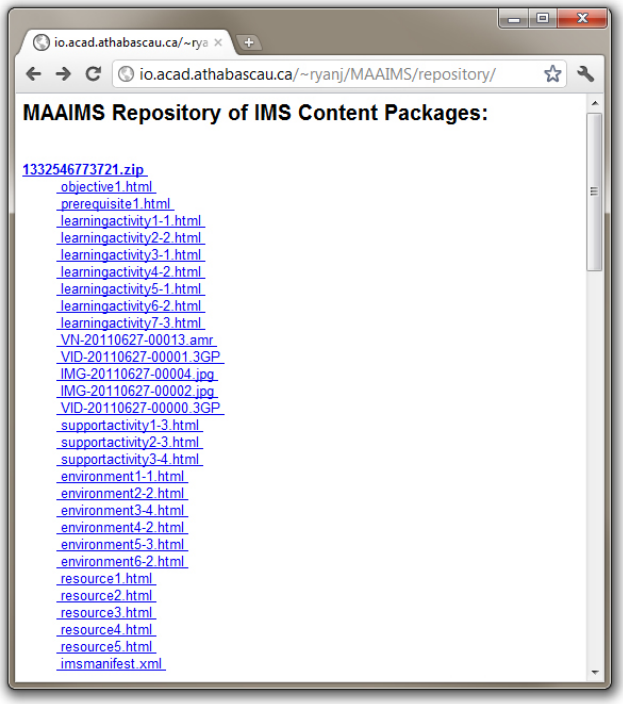


Figure 5. A MAAIMS repository entry of a content package containing a learning design. The uppermost .zip file is the content package which contains the learning contents and learning design. This represents a single unit of learning which could be imported into other systems, such as an editor or LMS.

Learning Management Systems (LMS)

Key to the reuse of MAAIMS created content is importing into an LMS which can deliver web-based learning for distance education, continuing education, or blended classrooms. Many LMSs implement compatibility with SCORM or IMS standards. Using various LMSs, it is demonstrated that MAAIMS produces content compatible for use outside of the MAAIMS authoring environment. Thus, authentic learning examples will be able to be shared with learners using an LMS.

It remains important to import IMS Learning Design in an LMS to demonstrate MAAIMS content in an e-learning context. For this demonstration, an LMS called dotLRN is used. “Regarding its functionality, it is strongly compliant with educational standards for courses delivery (IMS-LD, IMS-CP, IMS-MD) (Munoz, 2007, p. 240)”, which align with the standards MAAIMS utilizes for authoring.

The package interchange file can be imported from the repository and LMS users can be assigned to the roles in the LD. A new instance of the learning design runtime can then be created and executed.

All MAAIMS created IMS Learning Design elements, such as activities, roles, environments, authentic learning examples as resources, prerequisites, and objectives are successfully processed at runtime in the dotLRN LMS. This demonstrates MAAIMS authentic learning examples and learning design reuse in an LMS.

Findings

"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 et al., 2007, p. 4). Since OER can include full courses or modules, MAAIMS authored modules, or units of learning, could be aggregated into a full course to satisfy this most comprehensive definition. Learner-generated course materials could be developed with this tool, which could include video or other multimedia samples. Learning design can be employed within the tool to create activities which could form the basis of evaluation. In fact, the MAAIMS tool, or the software itself, fits within the scope of this OER definition, rather than just the resulting RLO output.

The tools used to test MAAIMS produced content were limited to a subset which met selected criteria. To be considered for testing, functionality must be available to import IMS Content Packages or IMS Learning Design and the tool must be publicly available.

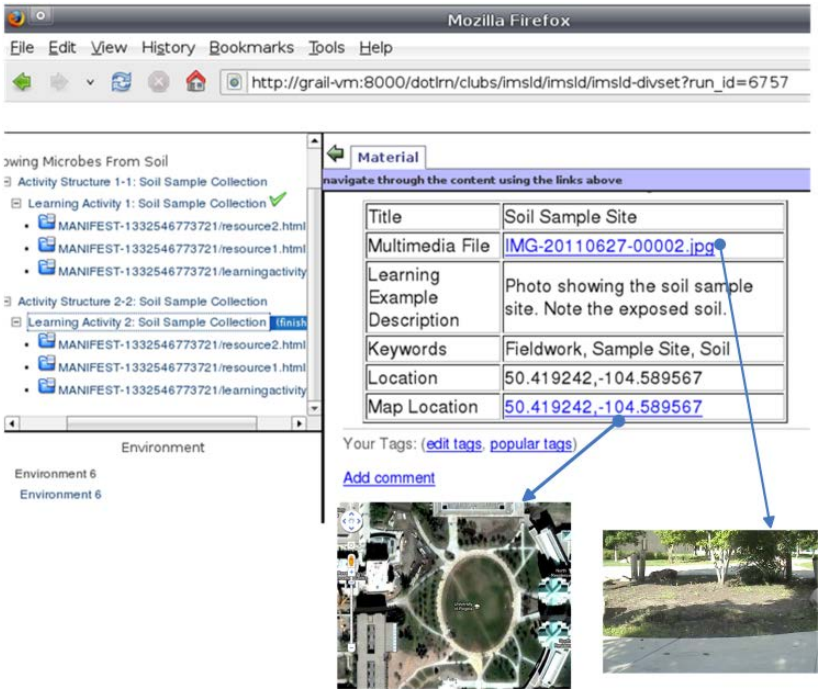


Figure 6. A MAAIMS authored learning design in an LMS. An authentic learning example and the location it was captured are accessible via hyperlink.

Moodle's prevalence in the education sector positions this LMS as the target test platform for MAAIMS units of learning. However, this was not possible as the community has not developed an integrated import implementation for IMS LD, despite prior plans indicating the contrary. However, players such as SLeD, CopperCore Player, and Reload Learning Design Player can effectively be linked as an external resource to Moodle. The URL of the player is added as an external resource, and the unit of learning can be played within the learner's browser. Berggren et al. (2005) have proven this to be a practical solution to the lack of embedded Moodle LD runtime. Typically, there is additional overhead with this configuration; for example, an additional web server and database are required. Moreover, the results of the learning design, such as a particular learner completing the unit of learning, are not integrated into the LMS. Role management is also handled separately; users must be assigned roles within the LD player, instead of selecting users already present in the LMS.

There is a parallel between the concepts contained within MAAIMS and other mobile applications, such as using smart phones as sensors. For example, capturing photos of friends and uploading to Facebook using a mobile application is similar to capturing a photo with MAAIMS and uploading to a repository. The concept of metadata is similar to tagging a friend in a photo on Facebook – simply augmenting captured multimedia with further descriptive information. Mobile applications can capture video and upload to YouTube, a process similar to capturing authentic learning example videos and sharing as learning content. Moreover, mobile applications like Foursquare's functionality of geolocation and location based services are similar to those in MAAIMS. Experience with these similar mobile application functionalities should help users understand the concepts when applied to learning content.

Testing with various platforms revealed that editing and runtime environments typically do not have native players installed that are required to view all types of authentic learning content.

As a result, future exploration into integrating authentic learning example multimedia from MAAIMS into a streaming service such as YouTube may be warranted. This would allow content packages to refer to the authentic learning examples as external resources and reduce package interchange file sizes, which were a problem for some LMS systems.

Initial testing was completed with Moodle, in a mobile context, using MAAIMS content packages containing authentic learning examples. This allows learning content authoring to be completed in a mobile context and learning content sharing *and* playback to be completed in a mobile context. This conceptually demonstrates a set of fully mobile learning tools which complete the mobile learning cycle wherein learning content authoring (design time) and playback (runtime) occur in a mobile context. Further testing is required with SMILE PDA Learning Design Player as a mobile runtime environment using MAAIMS content.

Conclusion

This article presented MAAIMS, a mobile authoring tool for standardized learning content. MAAIMS' novelty stems from the smooth transition and integration between metadata collection, authentic learning example collection, and learning design authoring. The tool demonstrated authoring of authentic learning examples with mobile sensors and location-awareness in a mobile context, and utilization of the authentic learning examples in IMS Metadata, IMS Content Package, and IMS Learning Design. The standardized output permits the content to be reused in other platforms and contexts as a reusable type of OER, a reusable learning object. Content is shareable via the repository, is validated against the standards, and is reusable in multiple contexts, editing tools, runtime environments, and learning management systems. The adoption of OER necessitates authoring tools to create digital assets like learning objects. MAAIMS provides a method for open education resource creation in a mobile context, and sharing in a social constructivism pedagogy.

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Strategies for Sustainable Business Models for Open Educational Resources

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Abstract

For several years, the importance of continuous education has been stressed by several governmental and non-governmental institutions (Janssen & Schuwer, 2012; Marshall & Casserly, 2006). Education is seen as important both for personal growth and empowerment for one's personal wellbeing and for developing the professional capabilities needed in today's society. In his 2011 State of the Union address President Obama put emphasis on the government's ambitions to "out-innovate and out-educate" the rest of the world. Almost at the same time, at the Davos World Economic Forum (2011), the urgency of appropriate education was stressed, observing that the current lack of adequately educated people hinders prosperity and economic growth in the near future. The OECD is preparing a proposal to translate these intentions into a concrete policy.

Keywords : Open education resources; business model

Introduction

Kumar (2009) stated that the present organization of education will not be able to meet the increasing demand for education, especially in newly developing countries such as India and China. He saw the answer to this in the increasing possibilities of the Internet in combination with open educational resources, which create an opportunity to broaden the access of education towards different sectors and communities beyond existing possibilities.

Open educational resources are one of the instruments which can contribute to this development. Recently, ideas emerged on how open access and the use of educational resources would serve education around the world. This vision of developing and sharing OER, open educational resources, has great potential to substantially help solve some existing problems by enabling people across continents and organizations to transform their talents into professional competences and growth (see for example, Kumar, 2009; ETA, 2011; Stacey, 2012).

Yet, due to the credit- and euro-crisis, but also as result of a change in (political) orientation, we see a withdrawal of funds away from OER, towards other goals. For example, the House Appropriations Committee adjusted the TAACCCT grant program (Watters, 2011):

> None of the funds made available by this Act for the Department of Labor may be used to develop new courses, modules, learning materials, or projects in carrying out education or career job training grant programs unless the Secretary of Labor certifies, after a comprehensive market-based analysis, that such courses, modules, learning materials, or projects are not otherwise available for purchase or licensing in the marketplace or under development for students who require them to participate in such education or career job training grant programs.

Similar statements have been made in the Netherlands (verbal communication; also see the blog of Wiley, 2012). It is therefore important to think about the financial sustainability of open educational resources. This does not mean necessarily that an OER-organization has to generate a competitive return on investment in financial terms for the providers, but it helps to maximize the effect of the supply of OER within the financial boundaries or to expand these boundaries and expand possibilities. Efforts to supply, to exploit, and to maintain OER can be financed through voluntary activities, but will also require financial support of some kind (see the discussion in Stacey, 2012).

In this article, we will discuss briefly what a business model is, after which the motives of participants of the OER-system will be given. Based on work in de Langen (2011) we

can give an overview of possible business models in terms of the Business Canvas of Osterwalder and Pigneur (2009).

Moving on from the simple Osterwalder Business Canvas towards more complex *value networks*, we will argue that an OER-business model should involve a network approach, but also a reversal of the concepts of the consumer and the stakeholder as used in regular business analysis.

Open Business Models for OER

The fact that educational materials should be given away for free inspired many authors to try to develop revenue models to analyze the different sources of possible funding for OER (Downes, 2006; Dholakia et al., 2006; Koohang et al., 2007; OECD, 2007; Guthrie et al., 2008; Lane, 2008; de Langen, 2008; Stacey, 2012). By focusing on revenue models (Afuah, 2004), these contributions ignore the complexity of the business model, which provides an integrated framework from inputs to the customer (Osterwalder, 2004; Chesbrough, 2006, Osterwalder & Pigneur, 2009, see Figure 1).

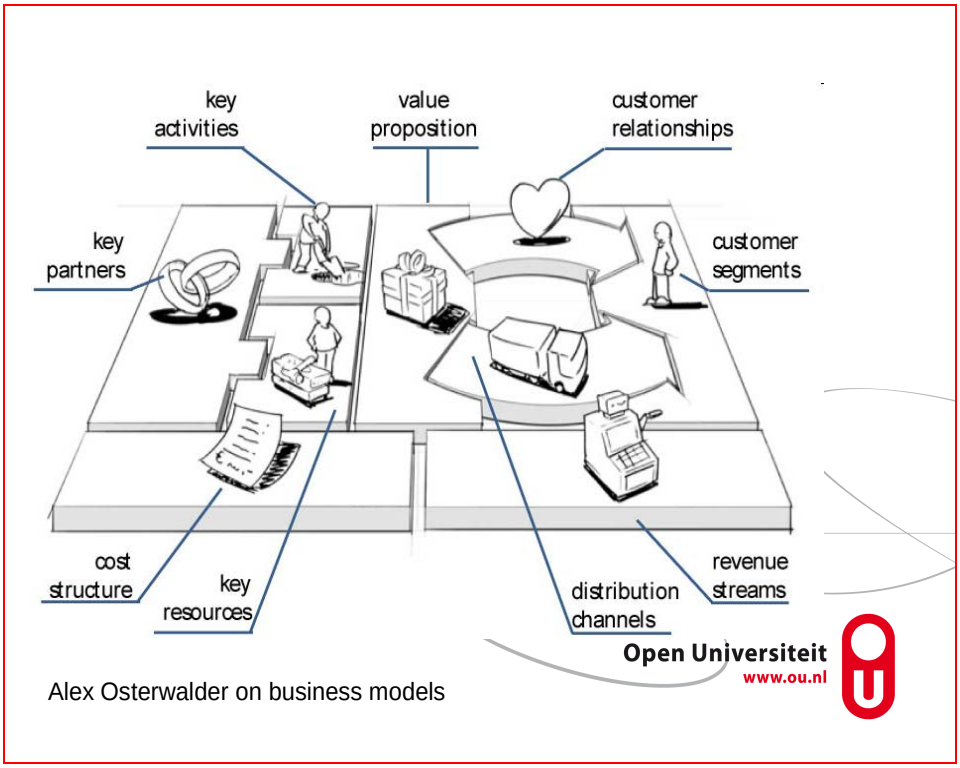

Figure 1. Alex Osterwalder's Business Canvas.

There is a shift in attention in these new (open) business models. Traditionally business models are used to describe the relationship between resources, activities, and the product offering (Porter, 1985; De Wit & Meyer, 2005), viewed from the organization.

In modern open business models (especially Osterwalder & Pigneur, 2009, see for example Business Model Generation, 2011), the preferences of the consumer are central. This is combined with the importance of alliances and cooperation on the side of the suppliers. Those two trends are apparent in the work of Prahalad and Krishan (2008), for whom each consumer is unique ($n = 1$), and co-creatorship between the supplier and the consumer exists. This uniqueness requires multiple partnerships to fulfill all the preferences of this unique consumer ($r = g$ in the philosophy of Prahalad and Krishan, 2008). The business model is opened up in two ways, the influence of the customer and the necessity of partnerships, shifting the view from the internal organization towards the environment.

Central to this open approach is the question of why customers and partners are interested in the offerings of the organization. In de Langen (2011) and Bitter and de Langen (2012) the methodology of these business models is linked to the philosophy of open educational resources. The question then becomes why people, institutions, and organizations participate in OER.

To answer this, Hylén's (2009) listing of motives was used to analyze the motives of participants in OER (government, organizations, individuals). Table 1 gives an overview of the arguments used (see de Langen, 2011 for a more extensive treatment).

Table 1

Motives of Participants in OER

Governments	**Users**
a. Sectoral arguments b. National arguments	a. Institutionalised user, educators/institutions, using the open educational resources in their own teachings b. Students and self-learners, who want to further their knowledge
Organizations	**Individuals**
a. The public good motive b. The efficiency motive c. The marketing motive	a. Altruistic reasons b. Non-monetary gain c. Commercial reasons d. Arguments of usefulness or costs

If the different motives of participants or stakeholders in OER confronted each other, it would be possible to distinguish fields of tension where the motives of one stakeholder disagree with those of other stakeholders, for example when individuals supply OER from an altruistic motive, but their materials are used for marketing purposes by the organization offering the materials to potential students. It is also possible that the motives enforce each other. Based on overlapping motives, several different business models can be distinguished.

1. *Freemium*: Giving away OER to get paying students, for example the MIT-experience. This is the marketing motive. Also the split-component model of Mulder (2011) can be seen as a variant of the freemium model.

2. *Efficiency*: Exchanging OER to become more efficient and effective, for example Wikiwijs (http://www.wikiwijs.nl/sector/) or several government-financed knowledge bases. Governments and educational organizations are prepared to contribute to the development and exploitation of these kinds of educational instruments because they expect the cost of education to decline and/or the efficiency to rise.

3. *Subsidizing*: Because of the perceived importance of education for economic development and social cohesion, different (international) institutions and national governments will subsidize the development and exploitation of OER. The involved organizations have to show that their OER does have a positive effect on education locally or abroad. Several initiatives were financed by private institutions (such as the William and Flora Hewlett Foundation), public institutions (such as the different European governments under the Lisbon agenda), and international public institutions (such as the European Union and UNESCO).

4. *Platforming*: Once an organization has a respected supply of OER, other producers of educational resources could choose to link their resources to the portal of this organization, or even host their materials there. The hosting organization can ask for a contribution to the costs, supplying the OER for free. For example, The ARIADNE infrastructure provides access to some hundreds of thousands of learning resources from repositories and collections around the world. This infrastructure is serving a dual purpose: First, it hosts repositories for collaborating institutions that use the ARIADNE tools in order to set up and populate their repositories using the ARIADNE infrastructure; second, it harvests and stores locally metadata records from federated repositories that are hosted elsewhere and operated by institutions cooperating with ARIADNE. The list is non-exhaustive as the ARIADNE network is continuously growing (ARIADNE Foundation, n.d.).

Of course, combinations of the models above are possible. Writers like Osterwalder and Pigneur (2009) and Teece (2010) point to the importance of an explicit analysis of the combination of models, in relation to the internal and external possibilities, to avoid conflicts in the use of resources or market approaches.

However, if open is defined in a strict sense, meaning that no kind of payment takes place between the users and the suppliers of OER, the only sustainable business model is the one based on grants and subsidies; whereas, the marketing motive can be a reason for an organization to compensate for the costs of the OER-supply. This means that any organization offering OER should organize testimonials and other proof that the goals of the financers are met.

New Business Model of OER: A Community-Based Model

Just as is the case with different kinds of patents and copyrights (Chesbrough, 2006), there is no open market in which supply and demand for OER-products is coordinated. The role of an OER-organization within the OER-system could be to organize the marketplace. Instead of three interactions between the end-user, with the institutions and individual suppliers (for materials), and with the government to testify to the importance of OER for its learning process, the end-user has only one relation, with the OER organization which coordinates the incoming streams of money, materials, and testimonials and the outgoing streams, distributing the comments with respect to the supplied materials, the testimonials, and the publicity.

Traditional educational institutions "earn" their income by both educational subsidies and student fees. In contrast, the OER organization "earns" its income through

- hosting activities,
- quality controls,
- distributional activities.

An OER organization in the sense above could be a real organization, such as MIT or the Open University, or a web-based platform, such as Ariadne or Opener.

The overview above indicated that sustainability of OER would depend on the construction of a non-monetary exchange system: depending on non-monetary exchange rather than monetary trade. By combining the targets of the different stakeholders, organizing an exchange of products, the independent OER-organization could create a sustainable system. As stated by Truyen et al. (2011, p. 7), "(..) it becomes clear that OER can only function as part of a well thought-through network that embeds the course in the knowledge and human activity domain it pertains to". Truyen et al. (2011, Figure 1) does situate OER in the middle between several stakeholders (also see the slides from the presentation by Truyen, 2011 at the OER-HE stakeholder workshop at Leuven, 2011).

Here, we see the organization supplying OER (called OER-organization) as the center of a network, consisting of different stakeholders. This network will be called the OER-system for short, and we assume that it consists of individuals and other organizations using and providing OER, as other institutions and organizations with different motives to participate in OER (governments, institutions, etc.).

Value networks will emerge when there are externalities (Eriksson, 2010). Marshall-Arrow-Romer indicates that firms will cooperate when there is differentiation and segmentation, leading to specialization (Eriksson, 2010, p. 14). The aim of cooperation is then cost reduction. Jacobs's externalities appear when there is a congestion of similar firms, leading to co-production and integration (Eriksson, 2010, p. 15). These

kinds of externalities explain the appearance of Florida's creative cities and Silicon Valley. Verna Allee (as cited in Eriksson, 2010) sees the reason for cooperation in the realization of value through tangible relationships (formal, contracts) and intangible relationships (informal learning, knowledge sharing).

Of course, money should enter the system somewhere. The question is why organizations should cooperate within an OER-system. By restating the motives in terms of the products wanted and supplied, we can try to express the reasons for exchanges within this system. The financial relationships could then be minimized in volume if not in importance.

Based on the motives of the participants in the OER-process, as described above, we can distinguish several products supplied and demanded by the participants in the total OER-system (Table 2).

Table 2

Products Supplied and Demanded by the Participants in the OER-System

Products demanded	**Participant**	**Products supplied**
Testimonials Efficiency (materials) Knowledge economy (degrees and informal learning)	Government	Finances
Reputation Altruistic motives Comments	Individual supplier	Materials
Materials Comments Reputation Knowledge about OER and e-learning	Institutional suppliers and users	Efficiency (materials) Degrees
Materials: content and knowledge Degrees	Individual users	Testimonials Comments Informal learning
	OER-organization as intermediary	Knowledge about OER and e-learning Reputation and altruism Degrees

In our future research we will extend this model, providing an abstract business model to analyze existing business models of OER organizations, using value networks: the value of partnerships. We will tackle the question: If a sustainable business model is dependent on the way the partnerships are modeled, what will be the role of value networks in the sustainability?

By incorporating these topics and using research on actual behavior (as has been done in OERNED), the model above will be extended and improved. Using this model it should be possible to describe the organizational consequences of sustainability, using Osterwalder's Canvas (Osterwalder & Pigneur, 2009).

Value networks are used to analyze different business perspectives, as of cloud computing (Leimeister et al., 2010; Ojala & Tyrväinen, 2011), open source software (Morgan et al., 2010), open access (Rieger, 2011), and organizations in general (Vanhaverbeke & Cloodt, 2006; Oksanen et al., 2010). The conclusions of this research can be used to develop a model for OER. This article concludes with the do's and don'ts resulting from these network analyses.

Morgan et al. (2010) describe the role of value networks in open source software (OSS), where OSS is seen as a community-based model, in which geographically dispersed programmers collaborate to produce software. Success is described to depend on

1. a high level of commitment,
2. the volume and frequency of knowledge exchange, and
3. the alignment of the goals of network participants.

From Rieger (2011) we can learn the importance of

1. a network of stakeholders, the integration in the academic community, and mandate/governance system;
2. the systematic development of content;
3. the importance of stability versus innovation;
4. user-based strategies and feedback cycles, user central.

The organizational research starts from the customers' needs, which (according to Okasanen et al., 2010, p. 381) defines "the features and attributes of its production." In this case, a group of organizations will link together in a sense that "all the participants of the consortium benefit." The value network is seen as an extended enterprise (Okasanen et al., 2010, p. 384). However, in their view the reason for participating in a network and the success factors do not only differ over firms and sectors, but also, over the four stages of development, they differ in the dynamics of value networks. However, a "collective view on the dynamics" is important in all stages of the value network (Okasanen et al., 2010, p. 394).

From the analysis of value constellations Vanhaverbeke and Cloodt (2006) found instances of inter-organizational networks linking firms with different assets and competencies together in response to or in anticipation of new market opportunities. However, depending on the sector in which the collaboration takes place, it also seems to be the case that almost identical firms find it easier than other firms to cooperate. Yet, creating and capturing value neither happens spontaneously nor is it the result of an adaptation process of firms to changes in the business environment. It requires a central firm that explores the potential to create value for customers in radically new ways and shapes the external environment accordingly through acquisitions, licensing agreements, non-equity alliances, joint ventures, contracting, and other types of relations that go beyond arm's-length relations.

Also important is the perception of a fair value distribution in a value constellation, because some actors are automatically better off in the new constellation compared to the old value creating system, but others might be worse off and have to be compensated to get/stay committed to the value constellation.

In conclusion, there seem to be some common requirements for the success of networks in different constellations. Most studies stress the importance of alignment in the strategy/goals of participants, of fairness as the distribution over the supply chain can change, and – in some cases – leadership within the network.

The emergence of an OER-value network should take into account that the different participants should be "seduced" to participate. In this sense the OER-organization should take the lead, whereas towards other participants (other institutions or the government) taking the lead would be counter-productive. A conceptual model should be developed, based on the conclusions of the value network models in other sectors and industries, to analyze the existing OER-organizations before more definitive conclusions can be drawn.

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Government Support for Open Educational Resources : Policy, Funding, and Strategies

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Abstract

Foundations like Hewlett, Mellon, and Gates provided start-up funding and support that nurtured the field of open educational resources (OER) from infancy to a robust early adolescence characterized by energy and idealism (Casserly & Smith, 2008). However, foundation grants typically focus on establishing exemplars and cannot be relied on for sustaining ongoing operations or generating widespread adoption. One strategy for sustaining and expanding OER is for governments and public funding to take over from the early stage funding foundations provided (Stacey, 2010).

Keywords : Open education resources; policy; funding; strategies

Introduction

There is a growing awareness of the potential role government and public funds can play in the OER field. The UNESCO-COL *Guidelines for Open Educational Resources* (OER) *in Higher Education* provide a set of guidelines to support governments, teaching staff, higher education institutions/providers, and quality assurance/accreditation and recognition bodies.

The guidelines for government include the following:

a. support the use of OER through the revision of policy regulating higher education,

b. contribute to raising awareness of key OER issues,

c. review national ICT/connectivity strategies for higher education,

d. consider adapting open licensing frameworks,

e. consider adopting open format standards,

f. support institutional investments in curriculum design,

g. support the sustainable production and sharing of learning materials,

h. collaborate to find effective ways to harness OER. (Daniel, 2011)

This set of guidelines is complementary to and more tightly focused on government than the 2007 Cape Town Declaration. The Cape Town Declaration is a statement of principle, strategy, and commitment meant to spark dialogue, inspire action, and help the open education movement grow. The full declaration describes OER as a global revolution in teaching and learning with educators worldwide developing a vast pool of educational resources on the Internet, open and free for all to use. The declaration defines three strategies:

1. encourage educators and learners to actively participate in the emerging open education movement;

2. call on educators, authors, publishers and institutions to release their resources openly;

3. encourage governments, school boards, colleges and universities to make open education a high priority. (Shuttleworth, 2007)

The declaration invites all individuals and institutions to join in signing the Cape Town Open Education Declaration, and, in doing so, to commit to pursuing the three

strategies listed above. As of October 30, 2011, 2,283 individuals and 242 organizations had added their names to the declaration.

Policy

OER will flourish when bottom-up grassroots OER development takes place in an environment supported top-down by policy. Government support for OER can happen at the policy and guidelines level without any additional funding. The UNESCO-COL guidelines identify several zero sum strategies. Revision of policy and the adoption of open licensing frameworks are two areas that have early adoption.

In parallel with the emergence of OER there is growing government interest in making resources produced through tax dollars publicly accessible. Whether it be the UK national government or the author's own provincial government of British Columbia (BC) open government initiatives are using policy and legal frameworks to open up access to publicly held information, promoting transparency and enabling wider economic and social gain. Initially, these efforts have been focused on openly releasing data to promote creative and innovative activities, which will deliver social and economic benefits; make government more transparent and open in its activities, ensuring that the public are better informed about the work of the government and the public sector; and enable more civic and democratic engagement through social enterprise and voluntary and community activities (UK Government, 2011) (BC Government, 2011).

Release of open data is being done by open government licenses. While initially focused on data sets, these efforts to make government more open and transparent have potential applicability to education. The rationale being used to support open data equally applies to education, and all governments could establish policy that requires public funds for education to result in education resources openly accessible to the public. Some governments have provided funding for development of educational resources under agreements that have the IP and copyright for those resources resting with the government. Governments could easily convert all these legacy educational resources to OER by simply using an open license.

One example of a government going a step further is the New Zealand Government's Open Access and Licensing framework (NZGOAL) which focuses not just on data sets but on the vast quantities of copyright works, research reports, statistics, photographic images, educational resources, and archive film produced through State Services agencies. New Zealand changed the policy to standardize the licensing of government copyright works for reuse using Creative Commons licenses (New Zealand Government, 2010). From the perspective of schools, the copyright of all teaching materials produced by educators vests with the Board of Trustees. NZGOAL encourages boards of trustees to use the least restrictive of licenses with Creative Commons Attribution as the default.

Policy requiring open licensing of education resources can also be implemented at the city or institutional level. The city of Sao Paulo in Brazil has decreed that all educational resources paid for by the city need to be OER licensed using a Creative Commons license (CC-BY-NC-SA) (Sao Paulo, 2011).

At the policy level there is growing interest in seeing tax dollars used to create education materials that are openly licensed for public use. The default policy should be open not closed, collaborative not proprietary, and accessible not restricted (Carlyle, 2011).

Education demand far exceeds supply and all public governments are seeking ways to provide more and better education for more people. The biggest potential for immediate gain is to adopt a policy that publicly funded education materials be openly licensed and available to the public that funded them. Publicly funded educational resources would become open educational resources by default. OER would become outputs of normal every day work. This policy could apply not just to new educational resources, but to legacy resources where copyright and intellectual property is held by the government.

While many governments are still considering guidelines, others are already taking an active role and have launched publicly funded OER initiatives. This paper examines three publicly funded OER initiatives already underway in three different countries. The strategies and tactics of these OER case studies show how some public funders have pioneered government support and funding for OER programs. These early government OER examples provide an interesting baseline of activity to compare against the UNESCO-COL OER guidelines. By making existing publicly funded OER strategies and practices more visible it becomes easier to see how these guidelines translate into practice which in turn supports other public funders in designing and launching their own OER initiatives.

The three government funded OER initiatives explored in this paper are

1. Canada, BCcampus Online Program Development Fund;

2. United Kingdom, Joint Information Systems Committee (JISC) and the Higher Education Academy (Academy) Open Educational Resources Program;

3. United States, Department of Labor Trade Adjustment Assistance Community College and Career Training Grants Program (TAACCCT).

Funding

In parallel with adoption of guidelines and revision of policies most public funders are providing OER incentive funding.

The BCcampus OER program is being funded by the British Columbia provincial government's Ministry of Advanced Education. It has been deployed as an annual Online Program Development Fund call for proposals issued to BC's public post-secondary institutions. To date there have been eight annual rounds, 2003-2010, totaling $9 million dollars.

The JISC OER program is being funded by The Higher Education Funding Council for England (HEFCE). The Higher Education Funding Council for England (HEFCE) distributes public money to universities and colleges in England that provide higher education. Most of this goes to the 130 universities and higher education colleges in England. There have been three phases of the JISC OER program : Phase one (2009-2010) £5.7m, Phase two (2010-2011) £5m, and Phase three (2011-2012) £2.8m totaling £13.5m or roughly $21 million US dollars. Funding in each of these phases has been made available via a "call for projects" issued to institutions.

One of the interesting things about the Trade Adjustment Assistance Community College and Career Training (TAACCCT) Grants Program is that it is being initiated out of the US Department of Labor as opposed to the education ministry as in the other two examples. The first round of TAACCCT grants made available and awarded in 2011 totals $500 million but a total of $2 billion over four years has been committed. Funds are being made available through a Notice of Availability of Funds and Solicitation for Grant Applications announcement targeted to eligible institutions of higher education in the 50 states, the District of Columbia, and Puerto Rico.

The dollars invested in OER through these three publicly funded initiatives varies from $9 million to $2 billion. One way of comparing the relative magnitude of these investments to one another is to factor in size of the target population served and the duration of the investment.

Table 1

OER Funding Comparison

OER initiative	**OER funding investment**	**Funding years**	**Number of years**
BCcampus	$9,000,000	2003-2010	8
JISC	$21,000,000	2009-2012	3
TAACCCT	$2,000,000,000	2011-2014	4

OER initiative	**Jurisdiction**	**Population**	**Per capita investment**	**Per capita/ Per yr investment**
BCcampus	BC, Canada	4,419,974	$2.04	$0.25
JISC	England, UK	51,456,400	$0.41	$0.14
TAACCCT	US & Puerto Rico	316,085,789	$6.33	$1.58

Per Capita Investment = OER Funding Investment/Population

Per Capita/Per Year Investment = OER Funding Investment/Population/Number of Years

Population Count Sources:

British Columbia http://en.wikipedia.org/wiki/British_Columbia (2009 population count)

England http://en.wikipedia.org/wiki/Demography_of_England (2008 population count)

United States http://en.wikipedia.org/wiki/Demographics_of_the_United_States (2011 population count 312,360,000)

Puerto Rico http://en.wikipedia.org/wiki/Puerto_Rico (2010 population count 3,725,789)

The BC per person investment in OER is about five times larger than the UK investment but a third of the size of the US. The US is investing over six times more than BC and eleven times more than the UK on a per person per year basis.

Public funders must determine how to complement policy and guidelines with funding investments in OER. Other publicly funded government initiatives who, after considering the COL-UNESCO guidelines, decide to initiate OER programs should be considering investments in the range of a low of $.14 per person/per year to a high of $1.58 per person/per year. Whether you invest at the high end or the low end depends on the importance of your strategic goals.

This per capita/per year analysis of public funding for OER can be complemented by a deeper analysis. Additional comparisons could be done based on numbers of post-secondary students enrolled in each jurisdiction rather than total population. It's also worth looking at the actual products generated through these funds.

The BCcampus funds have been targeted exclusively to the development of OER programs, courses, and course components. The main outcomes to date are:

- 144 grants awarded (2003-2010);
- 100% participation across the post-secondary system;
- 83% partnerships – mostly inter-institutional but also with K-12, health authorities, not-for-profits, professional associations, e-learning companies, First Nations, foundations, amongst others;
- 47 credentials developed in whole or part via OPDF;
- 355 courses, 12 workshops, 19 Web sites/tools, and 396 course components (learning objects, labs, textbooks, manuals, videos) developed across almost all academic fields of study;
- 100% licensed for open free sharing and reuse by all post-secondary. (BCcampus OPDF, 2011)

The JISC OER program focuses not just on generating OER academic resources for use by teachers and students but on exploring a whole range of issues related to OER. A quantitative count of product outputs coming out of the JISC OER program is not readily available, but in addition to actual curricula the outputs include research reports and guidelines around

- developing, managing, and sharing OER;
- business cases and benefits;
- guidance and support;

- cultural issues;
- institutional issues;
- legal issues;
- technical and data management;
- quality issues;
- pedagogy and end use issues. (JISC, 2010)

The US Department of Labor TAACCCT initiative is just getting underway so there are no product outputs yet but the focus is on curricula resources not research studies.

The longest OER publicly funded initiative of these three is the one in BC, which has been underway for eight years. To date, public funding for OER development is one time only funding not built in to ongoing operational budgets. How long incentive public funding for OER should continue and what form that funding should take is a matter of government policy and action. Each of the initiatives in this paper has to show results and impact against strategic goals yearly to convince public funders that ongoing investment is worthy.

The US Department of Labor TAACCT program has met with some resistance. The House Appropriations Committee just released the draft fiscal year 2012 Labor, Health and Human Services (LHHS) funding bill. The legislation includes funding for programs within the Department of Labor, the Department of Health and Human Services, the Department of Education, and other related agencies. Included in this bill is the following provision, which would appear to strip the ability of the DOL to support any further OER investments:

> SEC. 124. None of the funds made available by this Act for the Department of Labor may be used to develop new courses, modules, learning materials, or projects in carrying out education or career job training grant programs unless the Secretary of Labor certifies, after a comprehensive market-based analysis, that such courses, modules, learning materials, or projects are not otherwise available for purchase or licensing in the marketplace or under development for students who require them to participate in such education or career job training grant programs. (US Congress, 2011)

It will be interesting to see whether this language remains in the bill as it moves through subcommittee to full committee for approval.

The language in this bill asserts that government funding should not be made in areas where there is an established industry with product already existing for purchase or already under development. While this may bolster the traditional publishing industry's position it does so at the expense of the entire public and sacrifices the goals of providing more and better education for more people. It also impedes the new business model opportunities that OER brings.

OER change education and by extension change the industries that support education. All governments must decide for themselves the best use of public funds. At the core of this decision must be the benefits to all citizens not just industry. The implications affect not just the education of citizens of a particular country but the education of all around the world. NOTE : In the months after this article was written the LHHS funding bill was defeated.

Strategic Goals

All three of the OER case studies being explored in this paper are making incentive funds available through calls for proposals targeted at post-secondary institutions. In addition to specifying funding priorities and funding award amounts, calls for proposals are used by public funders to describe eligibility, information on the application and submission process, and the criteria against which applications will be reviewed, and to provide additional resources of interest to applicants.

Public funders have strategic goals for the incentive OER funding they provide. Strategic goals establish a focus and purpose for OER and are usually tied to meeting the needs of the nation, state, or province providing the funds.

Here are strategic goal samples from the three OER initiatives this paper is focused on.

BCcampus

There are three strategic goals associated with the BCcampus OER Online Program Development Fund (OPDF).

1. Partnerships

   The OPDF is primarily focused on supporting multiple public post-secondary institutional partnerships for development of online learning resources that fulfill a mutual academic need. Partnering involves pooling of expertise and developing online resources that all partner institutions subsequently use.

2. Credentials

A goal of the BCcampus OPDF is to increase credential opportunities available to students throughout the province. The focus is on developing resources that are for credit and contribute to a credential. Credentials are developed through the BCcampus OPDF in four ways.

a) A single round of funding for development of all the courses required for a complete credential.
b) A complete credential is built out gradually through multiple rounds of funding.
c) The OPDF provides funding needed for development of the last few courses required to make the complete credential online.
d) The OPDF creates a number of online courses used across multiple credentials or serving as building blocks for creating credentials.

A summary of credentials the OPDF has contributed to the development of so far can be found at http://opdf.pbworks.com/OPDF-Outcomes-Analysis.

3. Sharing and Reuse

All resources developed through the OPDF are licensed for free reuse, revision, remix, and redistribution. All resources are openly licensed.

When OPDF resources are fully developed they are put in the BCcampus Shareable Online Learning Resources (SOL*R) repository (http://solr.bccampus.ca) where they become available for review and download.

The OER movement to date is characterized by a lot of development of new OER resources but not a lot of reuse of OER developed by others. The OER field needs to move from not invented here to proudly borrowed from there. To help make this happen the 2010 round of BCcampus OER funding incentivized reuse by requiring applicants to show how new online learning resources developed through 2010 OPDF funding will be integrated with previously funded OPDF resources, or other OER from around the world. The OPDF is seeking to minimize duplication and maximize sharing and reuse. (BCcampus, 2011)

JISC

The joint JISC/Higher Education Academy Open Educational Resources Pilot Program has been designed to support institutions, consortia, and individuals to release open educational resources for use and repurposing worldwide, by assisting the development

of appropriate processes and policies to make this process an integral part of the learning material creation workflow.

Strategic goals for the pilot year were to understand the most effective ways of supporting this aim, as a precursor to a longer program to promote the embedding of these processes across institutions.

JISC's objectives in investing in this area are to promote the sharing and reuse of learning resources and to provide a reputational benefit to UK higher education through the promotion of high quality learning resources world wide.

JISC expects to see benefits to the institutions involved and the UK higher education sector as a whole in terms of overseas recruitment and academic reputation as a result of the work started by this program (JISC, 2008).

The pilot phase was followed by a second phase (2010-2011) which built on and expanded the work of the pilot phase through research and technical work examining the discovery and use of OER – specifically by academics.

In October 2011 JISC announced a third phase. The JISC OER phase three strategic goals are around identified priority areas that will have the greatest impact and reach. These are:

a. develop post-graduate certificates to incorporate open access approaches,

b. embed development of open practices into accredited continuing professional development for academics,

c. embed OER through institutional change models,

d. employ innovative approaches to extend OER beyond traditional HE practice. (JISC, 2011)

US Department of Labor Trade Adjustment Assistance Community College and Career Training (TAACCCT) Grants Program

TAACCCT provides eligible institutions of higher education with funds to expand and improve their ability to deliver education and career training programs that can be completed in two years or less, and that result in skills, degrees, and credentials that prepare program participants for employment in high-wage, high-skill occupations, and are suited for workers who are eligible for training under the TAA for Workers program. TAACCCT funds are capacity building grants strategically targeted to assist workers adversely affected by trade agreements.

There are four strategic priorities for the TAACCCT program: 1) accelerate progress for low skilled and other workers, 2) improve retention and achievement rates to reduce time to completion, 3) build programs that meet industry needs including development of career pathways, and 4) strengthen online and technology enabled learning.

Grant recipients are expected to use data and evidence in identifying areas of development and in assessing what course designs work or don't work. At least one employer must be involved in the program to ensure it is something industry wants. Retention, accelerated time to completion, credential attainment, and job placement are key outcomes sought.

All TAACCCT initiatives are expected to meet accessibility and interoperability standards and to produce OER licensed using Creative Commons (CC-BY) (US Department of Labor, 2011).

Conclusion

Early OER developments supported by foundations have established a large pool of educational resources and a growing understanding of OER potential and benefits. Grassroots development of OER generated declarations of principle that articulate those benefits. In parallel to foundation-supported initiatives a small number of public governments initiated OER support via policy and incentive funding. Having established a strong OER foundation there is a growing awareness that government can generate significant public benefits by supporting OER through policy, guidelines, and incentive funding. UNESCO, the Commonwealth of Learning, and others are pushing for widespread government endorsement of OER.

As more governments adopt the UNESCO-COL OER guidelines, participation and engagement of the global education community in the OER starts to take place and OER practices become integrated into every day operations, the source and form of public support and funding will diversify. Funding allocated to OER will not just come as grants from government but will come from time investments of individuals, standard educational practices of faculty and students, and strategic goals set not just by government but by schools, colleges, and universities of all kinds. Coalitions and collaborations will form among education providers globally. These international OER partnerships will be the norm and require new models of funding based on collaboration as opposed to current models, which foster competition.

By describing policy, funding, and strategic goals associated with three public OER initiatives this paper helps others in governments, municipalities, and institutions understand their role and the steps they can take to implement and operationalize OER.

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Athabasca University

IRRODL
THE INTERNATIONAL REVIEW OF RESEARCH IN OPEN AND DISTANCE LEARNING

Open Access Scholarly Publications as OER

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Abstract

This paper presents the rationale, common practices, challenges, and some personal anecdotes from a journal editor on the production, use, and re-use of peer-reviewed scholarly articles as open educational resources (OER). The scholarly and professional discourse related to open educational resources has largely focused on open learning objects, courseware, and textbooks. However, especially in graduate education, articles published in scholarly journals are often a major component of the course content in formal education. In addition, open access journal articles are critical to expanding access to knowledge by scholars in the developing world and in fostering citizen science, by which everyone has access to the latest academic information and research results. In this article, I highlight some of the challenges, economic models, and evidence for quality of open access journal content and look at new affordances provided by the Net for enhanced functionality, access, and distribution.

In the 17 years since I graduated with a doctorate degree, the climate and acceptance of open access publishing has almost reversed itself. I recall a conversation with my PhD supervisor in which he argued that publishing online was not a viable option as the product would not have permanency, scholarly recognition, or the prestige of a paper publication. His comments reflect the confusion between online resources and those described as open access, but as well illustrate the change in academic acceptance and use of open access products during the past decade. The evolution from paper to online production and consumption is a disruptive technology in which much lower cost and increased accessibility of online work opens the product to a completely new group of potential users. In the case of OER these consumers are primarily students, but certainly access to scholars from all parts of the globe and the availability to support citizen science (Silvertown, 2009) should not be underestimated.

Keywords: Open education resources; scholary publications; open access

What is Open Access Scholarly Publication?

Open access (OA) scholarly works usually assume the same formal definitions as other open access works. The most common definition is that agreed to in 2001 and referred to as the Budapest Open Access Initiative. This agreement defines open access as

> free availability on the public Internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the Internet itself. (http://www.earlham.edu/~peters/fos/boaifaq.htm#openaccess)

The focus of this definition on access and redistribution rights has tended to conflate OA resources and thus limited OA to materials available only on the Web. Although the vast majority of open access scholarly works are published on the Web, scholarly works can be published and distributed in any medium. For example, the millions of texts whose copyright has expired can be, and many are, published in print, online text, and audio formats. However, it is certainly not true that all scholarly content distributed on the Web is open access. This becomes obvious when a reader is presented with a subscription login or an invitation to add the article to the "shopping cart". To add confusion, some scholarly content is distributed with no barriers on the open Net, even though all copyrights are retained by the publisher.

This confusion between ready access and legal use results in a serious challenge to educational and research efficacy. This is underlined in a 2008 study of American K12 teachers that concluded

> The major finding of the study was that the key goals of teaching media literacy were "comprised by unnecessary copyright restrictions and lack of understanding about copyright law" (p. 1). Because of participants' lack of knowledge and understanding about the law's protections, their ability to share, teach, and have students produce media-rich texts was severely circumscribed. Not only that, but the researchers found that teachers' lack of knowledge was passed on to students as well as colleagues, perpetuating "copyright folklore" that often characterized the law as much more restrictive than it is. (Rife, 2008)

Thus, it is apparent that the educational community needs both a better understanding of copyright and adoption of practices that harness these resources for maximum education and scholarly benefit. A first step is to understand the licensing that must accompany open access publications.

Licensing Open Access Scholarly Work – Creative Commons Licenses

Unlike open source software, scholars generally have more concerns about allowing their work to be modified. The licensing model most often used was created by Creative Commons and retains copyright by the author or, if copyright has been surrendered, by the publisher. However there are a number of additional rights that are detailed in the particular license attached to the work.

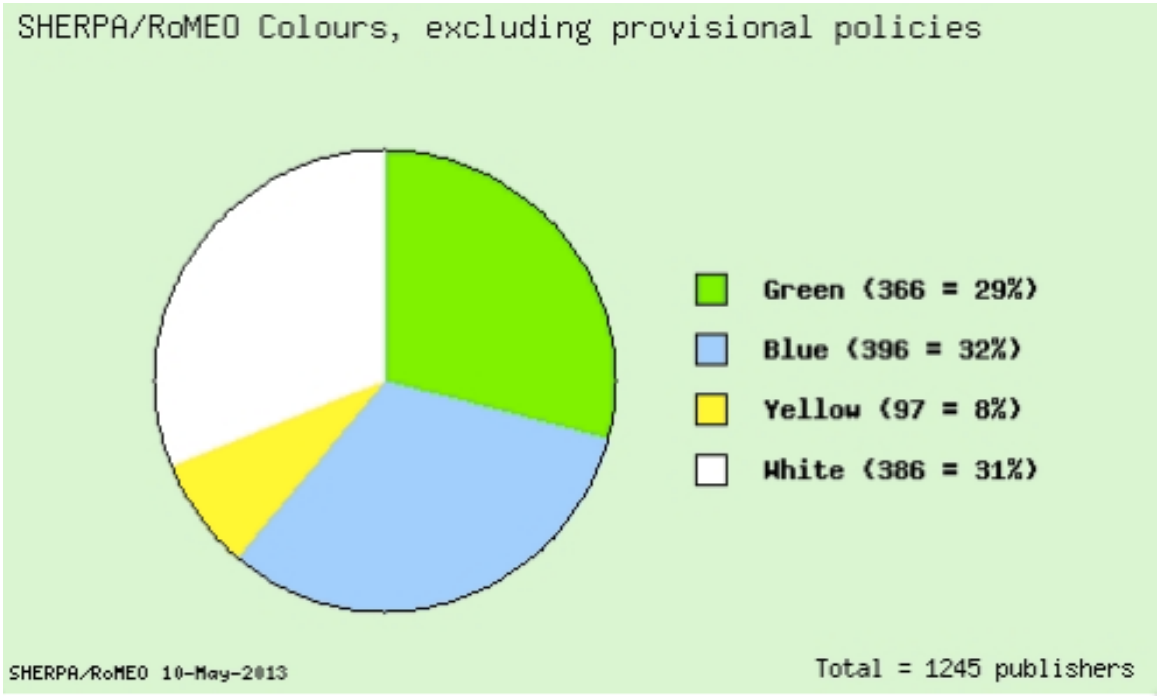
> **CC BY**: The most permissive, and thus open license, restricts rights to copy and share and only requires attribution to the copyright owner – owned BY. The CC BY license allows for reuse of the content including modifying, adding, or deleting portions and redistributing in any format. Content licensed with only the Creative Commons attribution restriction, the CC BY license, is sometimes referred to as open content.
>
> **CC ND :** Some authors and publishers use an additional restriction that stipulates *no derivatives* such as edits and additions.
>
> **CC NC :** The copyright owner can also include a *noncommercial* restriction that prohibits others from selling or bartering the copyright product.
>
> **CC SA :** This *share alike* restriction allows the user to share the copyright material, if it is relicensed under the same licensing agreement adopted by the copyright owner.

All of these rights retained can be added together to create a legal license (linked to at http://creativecommons.org/) that has many combinations, for example CC BY-ND-NC.

In my work as editor of *The International Review of Research in Open and Distance Learning* (http://www.irrodl.org), we initially adopted a CC BY-ND license as we felt that the tradition associated with scholarly publication was to quote sections (with attribution) rather than add to or make derivative products. However, the widely respected Scholarly Publishing and Academic Resources Coalition (SPARC) required use of the CC BY to win its “OA gold seal”. Upon reflection we considered that removing restrictions likely was in the interests of both our readers and our authors and thus changed our licensing requirements to attain the gold OA seal.

Gold and Green Standards of Open Access

A long time open access evangelist, Stephen Harnad, argues that there are two roads to OA: the "golden" road or standard (publish an article in an OA journal) and the "green" road (publish your article in a non-OA journal but also self-archive it for access by all in an OA or institutional archive, such as those listed at http://www.opendoar.org/). He contends that 90% of journals allow self-archiving and thus are in effect "open access" – however data from the more definitive RoMEO database from the University of Nottingham refutes that claim (Figure 1) and shows that in May 2013, of 1,245 publishers publishing over 18,000 journals, only 69% allow some form of self-archiving.



RoMEO colour	Archiving policy	Publishers	%
green	Can archive pre-print and post-print	366	29
blue	Can archive post-print (ie final draft post-refereeing)	396	32
yellow	Can archive pre-print (ie pre-refereeing)	97	8
white	Archiving not formally supported	386	31

Figure 1. RoMEO Database summary figures of journal publisher self-archiving policy (from http://www.sherpa.ac.uk/romeo/statistics.php CC-BY-NC-SA).

The RoMEO Project with a mandate to help create an "environment in which Open Access will become the norm for distributing research" proposes and endorses an

"Immediate Deposit, Open Access policy" by which institutes that employ scholars require an archive copy of any publication be stored in a content repository, immediately upon publisher acceptance. They argue that "This IDOA policy is greatly preferable to, and far more effective than a policy that allows delayed deposit (embargo) or opt-out as determined by publisher policy or copyright restrictions" (http://www.eprints.org/).

To enable champions of OA to review OA policies from other institutions, the Eprint project sponsored by the University of Southampton hosts a repository of institutional access policies (http://roarmap.eprints.org/). Thus we see a growing institutional acceptance and a variety of tools to manage open access distribution, even for scholarly works published in proprietary and closed publications. However archiving policies, such as the IDOA policy, allow for academic access, but preclude re-publication in course guides or other forms of educational content.

Rationale for OA

The growing interest by scholars, librarians, funders, and foundations in OA is motivated by a variety of sometimes divergent interests. I briefly overview these motivations in the following section.

Citizen science.

Citizen science is perhaps as old as human knowledge itself and consists of ordinary people working alone or together to resolve problems using basic or increasingly sophisticated tools and techniques of science. Silvertown (2009) lists three reasons for the explosion of citizen science in the last decade. The first is the availability of powerful new tools allowing everyone to participate and contribute to "real science" projects. The second is the growing awareness of the value in work produced by distributed volunteer labor pools and the associated ingenuity of these diverse networks. The third is a growing government and sponsor interest in disseminating or translating science and its results to the citizenry. Open journals facilitate and support citizen science in all three areas listed by Silvertown. The free distribution of results in open access scholarly publication allows citizens to become informed, educated, motivated, and in other ways engaged in cutting edge scientific research. Second, open access provides a tool for recruitment and training of potential citizen scientists and, finally, funders are realizing and in some cases requiring that grant funded science be returned and repaid to the taxpayers partially through open distribution of results.

Open science.

The vision of open science "is to make clear accounts of the methodology, along with data and results freely available via the Internet" (Wikipedia, Oct. 2011). Too often data sets, detailed descriptions of both successful and failed projects and the results of scientific work, are never made public, resulting in much waste and unnecessary duplication of scientific effort. Thus, there is growing support for a variety of open data

projects (see for example the Open Science project, www.openscience.org, and the Open Students network, http://www.openstudents.org/). There is also increasing evidence of the value of students participating in, instead of watching and summarizing, the work of others (Pascarella & Terenzini, 2005). Open science projects aim to make this process easier and more accessible by not only disseminating the results of student work, but also by making the process by which science is conducted more visible to learners.

Expanding access.

Many academics receive all or the vast majority of their personal income from the educational institution that employs them or from a related research grant. Unlike commercial authors, these creators are not primarily motivated by the prospect of financial return, partially because they benefit from a substantial institutional economic security blanket. For most academics publishing is motivated by peer recognition that is translated into institutional raises and promotions, opportunities for travel, and occasionally small fee for service contracts. Thus, the prospect of tens or hundreds of thousands of online readers is more attractive than tens or hundreds of readers of print-based journal products.

Special needs of developing countries.

The case for extending access to academics in developing countries and to those amateurs and professionals throughout the world who are not associated with a university or government research library is both compelling and obvious. Even a small university such as my own (Athabasca University), with fewer than 150 full time academics, spends over $350,000 annually on subscriptions to commercial journal data bases. The more widely knowledge is circulated, the more likely it will be applied to solve problems and enhance quality of life on this planet. The gap between demand for higher education opportunity and provision by the public education systems or at affordable rates from the private sector is large and growing (Altbach, Reisber, & Rumbley, 2009).

Other articles in this special issue overview the opportunity and remaining challenges of both improving quality and decreasing costs through the use of open educational resources for teaching and learning. But there is an equally compelling need for publication opportunities for scholars in the developing world. Unless these countries are actively producing as well as consuming knowledge, they will be relegated to new forms of colonial dependency. Open access solutions that require large author fees for publication will also act as a disincentive for scholars from developing countries.

None of the rationales above fuel the profits that publishers have enjoyed from proprietary models of academic publishing, thus I turn next to a more detailed look at the business case of open access scholarly publication.

Business Case

Many years ago Karl Marx argued that those who produce the goods should benefit the most from their production. Obviously in the neo-capitalist world in which we live there are many exceptions to this principle. However, the case of academic publishing is especially egregious.

The normal academic publishing model for scholarly work sees the academic submitting his work to a publisher (at no charge to the publisher), the article being reviewed by a team of volunteer editors and reviewers (again, at no charge to the publisher), and then the author (or his or her educational institution) having to pay large fees to access the published work. In the UK the cost of these journal subscriptions now represents 65% of the total library budget ("Academic publishing: Of goats and headaches," 2011). Given the real work of copyediting and electronic distribution, a case can be made for a fair return on investment and profit for scholarly publishers. However, the journal publishing sectors of the major publishers are their most profitable divisions. For example, the world's largest publisher Elsevier made "£724m ($1.1 billion) on revenues of £2 billion — an operating-profit margin of 36%" (see http://www.economist.com/node/18744177).

It seems obvious that reform within this industry is long overdue and that excessive profit-taking on the part of the commercial publishers in this sector must be challenged and eliminated.

Who Pays for Open Access

OA publication is nearly always done electronically and thus is usually cheaper to produce than print production; however, it is not cost free. The Budapest Open Access Initiative FAQ puts it succinctly:

> *Free* is ambiguous. We mean free for readers, not free for producers. We know that open-access literature is not free (without cost) to produce. But that does not foreclose the possibility of making it free of charge (without price) for readers and users.

There are a number of models for generating revenue to cover the cost of production including both supply side funding (payment by procures) and demand side funding that is accrued in some form through the readers' use. A detailed list of revenue models for publishers is provided by SPARC at http://www.arl.org/sparc/publisher/incomemodels/. I describe briefly the most commonly used in 2012:

- charging authors a publication fee (for example, 2011 PLOS fees range from $1,350-$2,900 US/article (http://www.plos.org/publish/pricing-policy/publication-fees/);

- sponsorship by a society, institution, government, or foundation (for example the American Educational Research Association distributes freely the full text of articles published in *Educational Researcher*, even though they pay Sage for publishing these articles);
- additional products or services sold, with the OA content given away as a sort of "loss leader" or as an inducement to purchase enhanced goods; in a 2010 study of open access text books published by Flat World Publishing, Hilton and Wiley (2010) report that 39% of students purchased hard copies of assigned texts, even though electronic versions were available at no charge;
- advertising – by far the most significant source of funding for all services delivered at no charge on the Internet, but a model as yet not often used in conjunction with OA publishing;
- fund raising – many open source software projects raise funds through solicitations from users; Wikipedia has resisted both charging and advertising, but expends considerable efforts on fund raising.

But within the question of appropriate cost and funding lies the question of value. Are OA publications of as high a quality as those published under proprietary models?

Effectiveness of Open Access Publication

There have been a number of studies carried on over the last decade to attempt to determine if open access articles are cited more often than those distributed under closed publication models. Many of these studies have focused on a particular discipline or upon a wider aggregation of related journals (such as all physical sciences). The results of these examinations have not been consistent.

In many studies that compare the citation rates for articles published in open access versus proprietary journals, the proprietary journals are significantly older. Since publication longitivity is related to prestige and acceptance on library shelves and in publishers' databases, it is not surprising to find that closed articles will be cited more often – simply because they are assumed to be of higher worth, given the older and more prestigious publications in which they appear. Despite this bias, a study conducted by Zawacki-Richter and me in (2010) found a small, but not significant, increase in average citations per article published in open access journals. There was however a significant trend showing a growing citation advantage for OA publications in recent years.

To reduce this potential bias a number of researchers have compared articles in which the authors have purchased the freedom of their articles by paying the fee to the publisher that is often paid by the university, grant, or commercial sponsor of the research. In a study of 4,388 biology papers published between May 2004 and March 2006 in the *Proceedings of the National Academy of Sciences* (PNAS) Gaule and Maystre (2011) found that there was an increase in citations for open access papers (OA

was available as an option for authors for a fee of $1,000 US). However they argued that the reasons for this increase are not obvious. They noted that open access publication is a result of self-selection and diffusion effects – "open access is relatively more attractive to authors of high quality papers and thus open access papers tend to be of higher quality on average" – thus explaining their higher citation rates.

However Davis (2011) conducted a study of 3,245 science, medical, and social science and humanities journal articles of which 712 articles were randomly assigned to an open access treatment group. Interestingly this study compared both the downloads (in a variety of formats) and the citation rates. The results showed that

> Articles placed in the open access condition (n = 712) received significantly more downloads and reached a broader audience within the first year, yet were cited no more frequently, nor earlier, than subscription-access control articles (n = 2533) within 3 years. (p. 2129)

Davis argues that the increased readership is a result of consumption from a much wider community of amateur, professional, industry, and government readers who do not have access to the funds and laboratories to conduct their own research, but are nonetheless a significant stake holder in the dissemination community. I would argue that in professional and applied communities this non researching but critical group of appliers and translators of research knowledge is in fact more important in implementing change than the elite research community who produce new knowledge and the citations that accompany its dissemination.

Davis's (2011) study alerts us to the challenges of equating impact with citations, however the issue is even more complicated when one looks at the means by which citation rates and resulting impact factors for journals are calculated. Most contentious is determining what literature to index. The most well known and prestigious citation indexer is Thompson/Reuters World of Science (WoS). I've written earlier (Anderson & McConkey, 2009) (note how easy it is to gain a citation – even a self-reference!) about the bias of commercial publishers against open access publishers and their reluctance to include new open access journals in their citation indexing systems. But not withstanding this bias is the challenge of finding all the relevant materials. Some publishers make this easy by indexing only publications from a subset of journals that they have determined are of high quality. This seems a sound rationale as citation in a web-based high school term paper hardly qualifies as evidence of a contribution to new knowledge production. But there are many scholarly contributions often cited as *grey literature* (conference proceedings, white papers, key note speeches, etc.) or that appear in monographs and textbooks – and none of these citations qualify in most of the major indexers. However Google Scholar and other automated search engines do traverse the grey literature and produce citation rates that are normally higher but arguably more accurately representative of true academic dissemination. Kousha and Thelwall (2008) argue that the wider coverage should be "considered to be an advantage

of Google Scholar, since it could be useful for citation tracking in a wider range of open access scholarly documents and to give a broader type of citation impact." In a 2008 study Vaughan and Shaw searched a sample of 1,483 publications from the American Library and Information Academics journals and compared citation ratings among open Google searches, Google Scholar, and WoS. As expected Google Scholar had higher levels of citation and an examination of the citing articles or Web sites resulted in 92% of them being classified as "having intellectual impact" (excluding those that were advertising promotions, extracts, student papers, blogs, etc.). Interestingly, Vaughan and Shaw (2008) found an average of 3.1 citations from proprietary journal articles in WoS and only 1.0 citations/article from those published in open access journals, implying that the proprietary articles were cited more often. However, Google Scholar with its wider source of foraging of scholarly works found an average of 4.9 citations for proprietary articles compared and an average of 6.4 citations for open access journals, leading to the opposite conclusion in regard to article impact. They further found that the number of citations on the open Web (via Google search) showed even greater impact of open access publication.

As we see OA articles are distributed much more widely and have equal or better likelihood of being cited by other scholars. But are there other differences? In an interesting study Verspoor, Cohen, and Hunter (2009) compared the linguistic, grammatical, and textual characteristics of a large sample of science articles and concluded, "We did not find structural or semantic differences between the Open Access and traditional journal collections."

The data above confirms that, typical of emerging disruptive technologies (Christensen, 1997), open access journal publications have been relentlessly increasing in use and as importantly in quality as attested to by impact factors assigned to open access journals. This wider distribution and citations have many positive effects. The open access books that I have edited in the Distance Education Series for Athabasca University Press continue to generate 100's of thousands of downloads while retaining print sales that are equivalent to closed books (McGreal & Chen, 2011). I am convinced that the increasing number of requests for visits and keynote talks that find their way to my email box is, in large degree, related to the accessibility of my openly published academic work.

Beyond Open Access Publishing

With the increasing power and sophistication of web-based tools, a number of authors and journals have attempted to further exploit the affordances of networks and the benefits of openness by expanding the review and commentary process. This expansion typically takes a variety of forms including making the names of peer reviewers public (eliminating anonymity), allowing public or community review before publication, and allowing commentary or review after publication. In his evangelical style Harnard wrote

in 1991, “I am convinced that once scholars have tasted it” (open scholarship or *skywriting* as Harnard refers to it),

> they will become addicted for life, as I did. And once word gets out that there are some remarkable things happening in this medium, things that cannot be duplicated by any other means, these conditions will represent for the scholarly community an "offer they cannot refuse. (p. 53)

Harnard was instrumental in the founding of Pscoloquy which incorporated open commentary, hyperlinking, and other new tools available to online journals for 12 pioneering years. Ironically Wikipedia notes in its stub article on Psychology that “Psycoloquy is currently suspended and will restart when open access prevails” (Wikipedia, Sept. 3, 2011). In the decade that Harnard and other visionaries have been waiting for open access supremacy, a number of other journals have picked up the innovators torch.

Our own attempts at allowing public, post publication commentary of articles in *The International Review of Research in Open and Distance Learning* (IRRODL) have largely failed. Opening the door to public commentary or review also opens access to spammers and to those with their only goal being to create a link to their own site for pecuniary interests. These challenges can be overcome, but more challenging is the simple dearth of useful comments. It seems that both readers and authors consider published articles to be finished artifacts, to be discussed (if at all) in private circles, classrooms, and as subject of later articles or reviews. There seems (at present) to be little appetite for engaged conversation using the traditional published article as a focal point. It should be noted that there are many other forums, from MOOCs to email lists, Google Circles to Linked In and Facebook, that provide potential venues for such conversations.

Nonetheless individual efforts by publishers continue and are often celebrated by early adopters. Figure 2 charts the typical two prongs (expert peers and the broader scientific community) that have input into preprint manuscripts of articles being assessed for publication using “interactive open access publishing” in the journal *Atmospheric Chemistry and Physics*. Although Pösch (2010) makes a strenuous case for the value of community input, he notes that only 25% of articles receive any peer review, which, though small, is (he argues) by an order of magnitude higher than commentary from post publications.

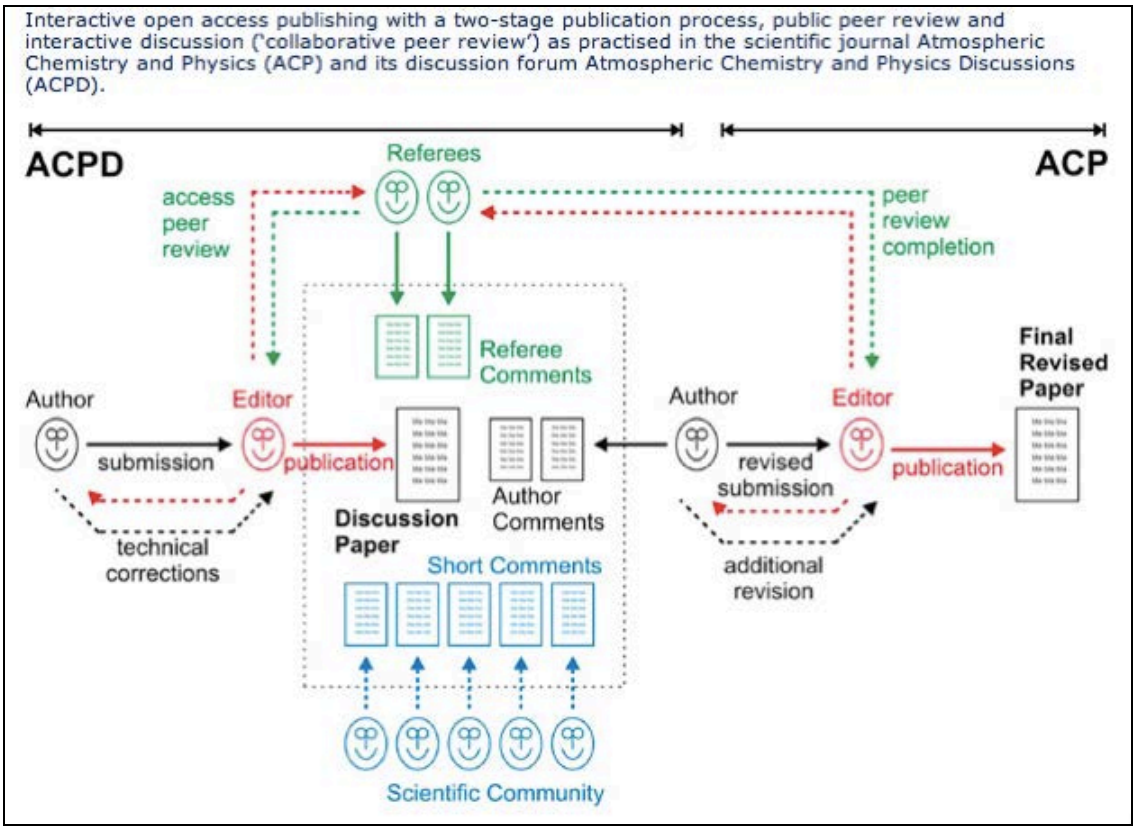


Figure 2. Model of peer and public review of scholarly articles from Pösch (2010).

Finally, there are a number of other benefits that are more associated with electronic publishing in general than strictly open access publishing. These include hyperlinks to full data sets, automatic updates to data presented in publications, and the ease of retraction or correction to published articles. For example, at IRRODL we have also been able to expand special issue collections by linking articles in the table of contents to works published later on the topic but after the special issue has " gone to press".

Conclusion

The arguments and examples detailed in this article point to the disruptive nature of OA publishing of scholarly works. Christensen (1997) described low-end disruptive technologies as ones that initially provide inferior product to that of the existing product, but at a much lower cost and much higher accessibility. The new product is typically not initially valued nor desired by established customers, but the disruptive innovation opens a door to whole new groups of consumers. Over time, the disruptive product becomes more functional and attractive until it replaces the traditional product.

Classic examples include steamships, hydraulic elevators, desktop publishing, electronic watches and cameras, and many others.

Although academics are not known for their speed in adopting any new product, and, correspondingly, publishers are loathe to give up profitable products, we are in the midst of a rapid transition from closed to open access publishing. This disruptive transition benefits ordinary citizens and scholars in both developed and developing countries and is a major contributor to the openness and transparency associated with our networked society.

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The LOGIC of National Policies and Strategies for Open Educational Resources

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Abstract

In its first decade (2001-2010) the OER movement has been carried by numerous relevant and successful projects around the globe. These were sometimes large-scale but more often not, and they were primarily initiated by innovating educational institutions and explorative individual experts. What has remained, however, is the quest for a sustainable perspective, in spite of the many attempts in the OER community for clear-cut solutions to the problem of sustainability. This is a major barrier for mainstreaming the OER approach in national educational systems.

At the end of the first decade, and more so at the beginning of the second decade (2011-2020), we are witnessing in a few countries emerging efforts to develop and establish a national OER approach. That is required in order to break down the barrier for mainstreaming OER. Making the OER approach sustainable cannot be left to the educational institutions only, but should be facilitated in a national setting.

Keywords: Open educational resources; national policies; strategies

National Initiatives

India was the first country to adopt OER in its *Report to the Nation 2007* and with its launch of the National E-content and Curriculum Initiative (National Knowledge Commission, 2007; Vijay Kumar, 2009). The Netherlands followed in 2009 with their Wikiwijs Program which aims at mainstreaming OER in all educational sectors, from primary through university education. It has been running from 2009 until 2013 with a total budget of 8 million euros and OUNL is one of the two leading partners. In 2011 the US Departments of Labor and Education started a four-year 2 billion dollar program in which among other activities OER will be developed for community colleges and career training.

Many other countries (for example, Brazil, China, Indonesia, Japan, Korea, Poland, South Africa, Turkey, UK, Vietnam) have introduced specific measures or subsidies in order to stimulate OER. Some of these countries are considering a national OER approach.

The Dutch Case: Wikiwijs

Wikiwijs is a rather ambitious and complex program, which is at the forefront of emerging national policies and strategies. It was launched by the Dutch minister of education in December 2008 and received broad support from all political parties in Parliament by April 2009, starting in the summer of 2009, a remarkably fast process! The intended effects on society are improved quality, efficiency, and services in teaching and learning.

Wikiwijs is primarily created for and by educators (teachers and professors), although others (experts, practitioners, students, etc.) can use it and contribute as well. Therefore ownership of Wikiwijs lies in the educational field, that is, in the first place with users. The five-year budget of 8 million euros does not allow Wikiwijs to make payments for the development of content/learning materials, purchasing licenses for software, or for support facilities and tools. The development of content itself is supposed to be done in general by the publicly funded educational institutions and organizations within their regular budgets. The Wikiwijs program is carried by the following areas of activity: content, professionalism, accessibility/technology, communities, research, communication, and program management (Mulder, 2009).

From 2009 until 2011 Wikiwijs was in its initial implementation stage with intense user evaluation, many committed stakeholders, and good progress, but there were also bottlenecks and lessons learned, which informed the Program Plan for the next stage towards a sustainable perspective (Wikiwijs, 2011). This stage is to be characterized by user participation, a differentiation from the generic approach into the specific educational sectors, and the establishment of firm ownership with relevant partners in those sectors.

In Figure 1 we show a tree of objectives derived from the operation and evaluation of Wikiwijs 2009-2011, which have supported the activities and the further development of Wikiwijs 2011-2013.

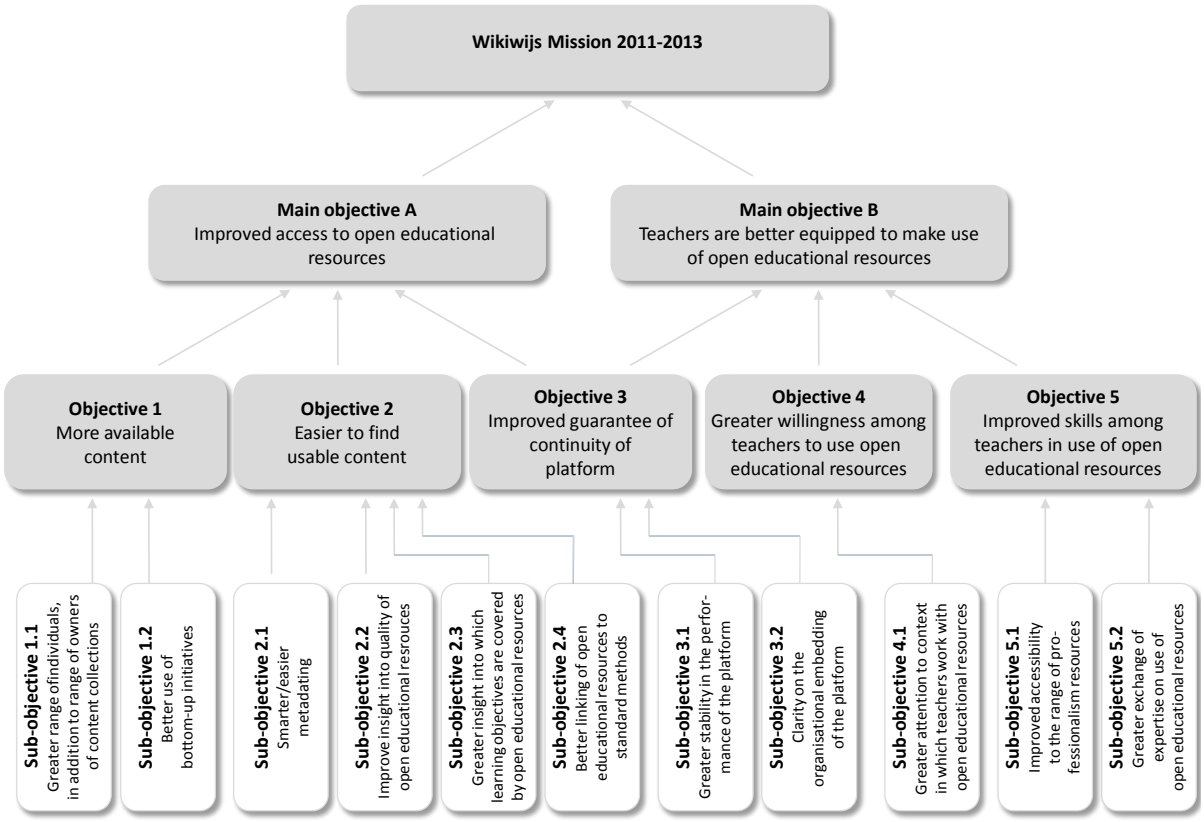

Figure 1. An objectives tree for Wikiwijs 2011-2013.

National OER Strategy According to Wikiwijs

The Program Plan 2011-2013 reaffirms its support for primary to university education and the freedom of teachers to use open (and closed) OER. It calls for the development of a central repository of OER where teachers can develop and share their creations or adapt them to work with closed resources (Wikiwijs, 2011).

"Knowledge is a Public Good"

This almost trivial sounding notion is included as one of the concluding statements in a report published by the Taskforce on OER of the ICDE (International Council for Open and Distance Education). Sustainability should not be taken for granted - it requires public funding (Mulder & Rikers, 2008). Similar statements or implications related to the "knowledge is a public good" notion can be recorded from other sources including

the Cape Town Open Education Declaration (2007) and the US government, which supports opening government content as a cost-efficient method of improving teaching quality (Plotkin, 2010).

Government's Responsibilities

John Daniel has referred to the *iron triangle*, spanned by three sides: one for access, one for quality, and one for cost. It is called an iron triangle because improvement of one of these three performance indicators will inevitably deteriorate one of the two or both other performance indicators if circumstances and conditions are not changed. However, he claims that the use of technology could break down this impasse (Daniel, 2009).

In this paper we present a modification of this model, which is different in three ways.

1. The performance indicators are accessibility, quality, and efficiency. The first two correspond to the first two in the iron triangle, and for both, maximization is the target. As a third indicator we have chosen cost-efficiency rather than cost, giving the advantage that then for all three indicators maximization is the aim (and not - as with cost - minimization).

2. The intervention should not be the use of technology in general but more specifically the utilization of OER. This will reinforce the argument because there will be less doubt with respect to the effectiveness of any specific intervention with OER.

3. Instead of a planar (2-dimensional) triangle, a 3-dimensional representation better fits the modelling with three performance indicators.

Education Performance in 3D

Figure 2(a) shows such a 3D representation of the performance of Dutch education at a certain moment with values along the three axes for accessibility, quality, and cost-efficiency. These are interconnected through a three-point plane. Suppose one wants to improve the performance in efficiency. In Figure 2(b) we see an example (in red), where indeed cost-efficiency is increasing, however at the cost of both quality and accessibility, which are decreasing. Figure 2(c) presents another example where the performance in quality is better, but this goes hand-in-hand with lower cost-efficiency and more or less equal accessibility.

Figure 2 illustrates the deadlock situation (i.e., with unaltered circumstances and conditions).

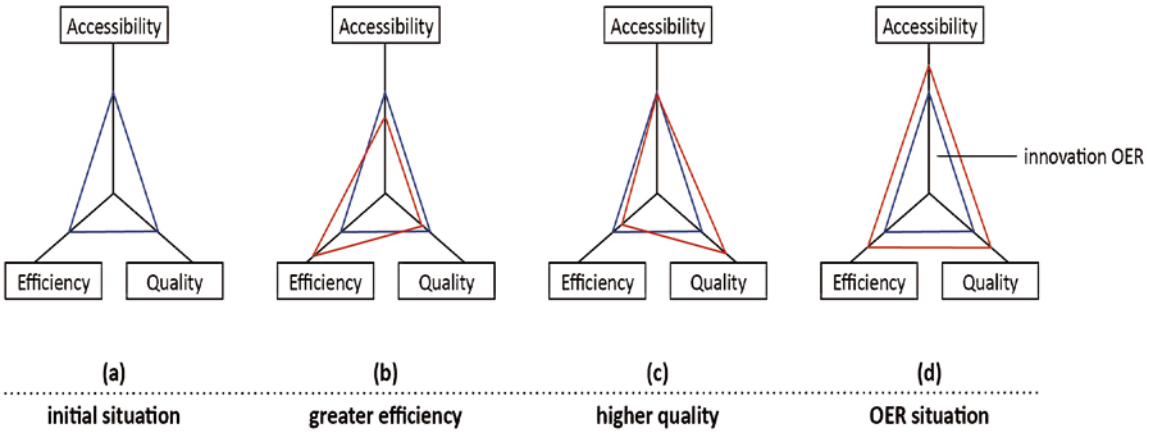

Figure 2. Performance of Dutch education along the three axes accessibility, quality, and efficiency.

If circumstances and conditions do change, the pattern can look different. A radical system intervention with OER (see Figure 2(d)) is an example of an innovation, which can result in simultaneous performance improvement in all three dimensions. Indeed, the accessibility of the learning materials is at a maximum with their full and free online availability. And the quality is being served with OER, because many more experts and users are involved in the development of the learning materials, which moreover are evaluated, corrected, and reviewed. Finally, cost-efficiency is promoted since there is actually no rationale any more for multiple full-scale development of courses on the same subject with similar learning objectives by different educational institutions. And one could add that OER also contributes to an extra (fourth) dimension of innovation.

Conclusions

The title of this paper, The LOGIC of National Policies and Strategies for Open Educational Resources, can now be appreciated.

A. The more or less general institutional OER sustainability bottleneck can be overcome through national OER policies and strategies.

B. In this context, it is appropriate to refer to the three-fold responsibility of governments for education, namely to promote and ensure accessibility, quality, and efficiency.

C. The national performance in these three dimensions is deadlocked, which means that a simultaneous performance improvement in all three is not possible, at least not under unaltered circumstances and conditions.

D. This education 3D performance deadlock can be removed by a radical system intervention with OER.

E. By mainstreaming OER in all educational sectors, as intended in Wikiwijs, the government takes responsibility for the sustainability of such an OER based educational system.

F. OER represents a significant innovation in our knowledge-based society and, for example, offers the European Union (EU) a potent recipe in its 2020 modernization agenda for higher education.

A final remark should be made here, namely that mainstreaming OER through a national approach does not necessarily increase the macro budget for education. A limited reallocation, for example resulting in an OER fund, which is skimmed from the overall education budget, seems sufficient. It's as simple as that.

Epilogue

There is a growing interest in national OER policies and strategies, not only in countries but also in international organizations like UNESCO, OECD, EU, and COL (Commonwealth of Learning).

In 2011, for example, OECD decided to create a survey on OER in the OECD membership by distributing to all OECD countries a questionnaire containing a range of questions on the status of OER involvement and activity with a special focus on national policy matters. The response rate was very high (over 80%) and the response content was certainly relevant and encouraging in that it showed a widespread interest, increasing activity, and a surprising attention to policy matters in OER (OECD, 2012).

In June 2012 UNESCO organized the World Open Educational Resources Congress in its headquarters in Paris in full partnership with COL. This was the finale of a joint

COL/UNESCO project called Fostering Governmental Support for Open Educational Resources Internationally. In the build-up to this congress six regional policy forums were organized, and these were preceded by a two-year COL/UNESCO project entitled Taking OER beyond the OER Community: Policy and Capacity, which included the publication of two documents: *A Basic Guide to Open Educational Resources* and *Guidelines for OER in Higher Education.*

In the first half of 2012 UNESCO sent an OER questionnaire to all UNESCO member countries, which was similar to the OECD OER questionnaire (a few questions were not included). This is important since it is therefore possible to link the data from both questionnaires. The results were presented at the World OER Congress in June and the UNESCO Declaration on OER was adopted at the World OER Congress.

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Exploration of Open Educational Resources in Non-English Speaking Communities

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Abstract

Over the last decade, open educational resources (OER) initiatives have created new possibilities for knowledge-sharing practices. This research examines how, where, and when OER are attracting attention in the higher education sector and explores to what extent the OER discussion has moved beyond the English-speaking world. This study analysed English, Spanish, and Portuguese OER queries over a long-term period (2007-2011). The data retrieval was conducted using four online platforms: two academic journal databases (Web of Knowledge and Scopus), one video-sharing Web site (YouTube), and one document-sharing Web site (Scribd). The number (more than 32,860) of search results collected indicate an increasing interest in online OER discussion across languages, particularly outside academic journal databases. Additionally, a widening "language gap" between OER discussions in English and other languages was identified in several platforms. This research reports some of the cultural and language challenges caused by the expansion of the OER discussion and highlights relevant findings in this field.

Keywords: Open educational resources; education; digital technologies; language gap

Introduction

Open educational resources (OER, see Table 1 for definitions) are an increasingly important part of the current discourse on education. Discussions about OER are generating significant interest regarding how these resources can increase access to and quality of education, reduce educational inequality, and decrease educational costs, particularly in developing countries (Hatakka 2009; Kanwar, et al., 2010; Masterman & Wild, 2011). In this context, the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Commonwealth of Learning have been collaborating to establish global guidelines to promote OER worldwide (UNESCO & COL, 2011).

The three aims of this article are to (1) provide a theoretical overview to contextualise the current discussion about knowledge sharing and open access initiatives within the higher education (HE) sector; (2) identify some critical perspectives on OER in terms of language diversity, particularly addressing English, Spanish, and Portuguese-speaking contexts; (3) present and discuss empirical data collected over time about OER online content in English, Spanish, and Portuguese.

The key questions explored in this paper are the following. Is the OER discussion occurring beyond the English-speaking world? What evidence is there for English, Spanish, and Portuguese online content about OER in both academic and non-academic journals? Finally, is it possible to identify changes over time in online content about OER and in all three languages?

Table 1

Relevant Definitions

The three comprehensive definitions of OER, by Lecercle (OECD), the William and Flora Hewlett Foundation, and the Cape Town Declaration, respectively, are as follows:
1. "[OER are] digitised materials offered freely and openly for educators, students, and self-learners to use and reuse for teaching, learning, and research. OER includes learning content, software tools to develop, use, and distribute content, and implementation resources such as open licences" (Lecercle, 2011). 2. "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" (The William and Flora Hewlett Foundation as cited in Atkins, Brown, et al., 2007, p. 4). This definition has also been adopted in the Cape Town Open Education Declaration (Declaration, 2007) and the *UNESCO Guidelines for Open Educational Resources* (UNESCO & COL, 2011). 3. Open content is defined as "content that is licensed in a manner that provides users

with the right to make more kinds of uses that those normally permitted under the law- at no cost to the user". The primary permissions or usage rights of open content are expressed as reuse (the right to reuse the content in its unaltered/verbatim form); revise (the right to adapt, adjust, modify or alter the content itself); remix (the right to combine the original or revised content with other content to create something new) and redistribute (the right to share copies of the original content, your revisions or your remixes with others). (Wiley 2010)

These definitions share three key similarities: Open Intellectual Property Licences; the permission to use, adapt and replicate content freely; and non-discriminatory privilege (i.e., rights are provided to everyone). The OER definition used in this study is the one coined by The William and Flora Hewlett Foundation in Atkins, Brown, et al. (2007, p. 4).

Knowledge Sharing and Openness in Education

The knowledge economy is a new socio-economic order in which new technologies are the drivers of knowledge production and application. Universities are expected to become a key part of the innovation system in which innovation is understood as product development (Häyrinen-Alestalo & Peltola, 2006, p. 253; Lecercle, 2011). As Hurmelinna, Kyläheiko, and Jauhiainen argued, new "mechanisms of knowledge creation, integration and transfer, play a central role in the evolutionary economics-based dynamic capability" (2007, p. 142).

In 1998, Wiley coined the term *open content* and defined it as the use of open licences applied to licensed information that can be used freely. This concept, which is closely related to the principle of free software, stresses open source movements and applies to content with an open licence, also known as an Open Publication License (Wiley & Gurrell, 2009). In 2001, supported by structured and consistent legal support, Creative Commons created a flexible set of licences that improved the Open Publication License (2001). Both contributions and the support of a growing community helped promote the visibility and credibility of new forms of academic knowledge sharing and content exchange.

Another term that gained increasing relevance was *open access*; it was coined and formally defined by an international group of faculty members, publishers, and librarians that had come together in Budapest in 2002 by the Open Society Institute (Willinsky, 2010; Velterop, 2007). The Budapest Open Access Initiative (2002) defined open access as

> free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of [scholarly or scientific] articles,

> crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited.

Björk and Paetau (2012) clarify that despite the importance of the Budapest Initiative the concept has existed since the earliest days of the World Wide Web : "As soon as the web emerged, many scientists rapidly saw its potential for making the sharing of scientific information, in particular peer-reviewed journal articles, more efficient."

OER Institutionalization and Internationalization

The term open educational resource is the result of a meeting held in 2002 by UNESCO (2002). That meeting discussed three aspects of OER: technology support (standards for dissemination and exploitation); the methodology for organizing international cooperation (frameworks for collaboration); policy issues (institutional commitment, financial support, and intellectual property).

In 2001, MIT introduced OpenCourseWare (OCW), a free and open digital publication of high quality educational materials organised as courses. Four years later, the OCW Consortium became a global organisation that included non-English-speaking countries and regions such as Latin America, Europe, Africa, China, and Japan. Hodgkinson-Williams, Willmers, and Gray (2009) argued that the interest in OER dates back to MIT's initiative to make its course materials available free of charge, which radically changed the traditional model of teaching and learning.

According to the Higher Education Academy and JISC (2011), OER *boosts opportunities for learning* by applying knowledge over a wider context (new opportunities for learning); *improves materials based on open review purposes* (student/user provides open peer review); *contributes to reputational benefits*, providing important exposure for faculty and institutions (visibility and recognition); and *increases the sharing of ideas* (new opportunities for people to exchange ideas about the resources provided).

After adopting OER initiatives, some universities have attracted millions of online visitors. Examples at English-speaking universities are iTunesU at the University of Oxford, with 12 million downloads, and Open Yale Courses, which registered more than 3 million visits between 2008 and 2011 for a combined total of over 15 million visits to their YouTube and iTunesU channels (Yale News, 2011). In 2006, Open University created OpenLearn (OL), which has recorded over 10 million visits.

Ten years later, D'Antoni (as cited in Inamorato et al., 2012, p. 11) offers an overview about the evolution of the OER movement:

> [it] has grown substantially; there are more and more initiatives in more and more countries. In a sector that is sometimes criticized for its slow pace of change, this is a significant development. Using digital technology to create resources and making them available with an open license by means of the Internet and the Web greatly enables the sharing. Yet, being aware of the considerable number and range of Open Educational Resources worldwide remains key to their use.

In the international scene the OER movement has grown consistently with new initiatives, declarations, and guidelines on OER such as the 2007 Cape Town Open Education Declaration, the 2009 Dakar Declaration on Open Educational Resources (UNESCO at al., 2009), and the 2011 Commonwealth of Learning and UNESCO *Guidelines on Open Educational Resources in Higher Education* (UNESCO & COL, 2011), which promotes open resources, technology, and new learning possibilities. This growing phenomenon raises the following question: To what extent are non-English-speaking HE institutions discussing and adopting OER ideas?

Linguistic Diversity, Dominance, and Constraints

In recent years, UNESCO (2012) has stressed that OER can offer a new dynamic of sharing that will provide potential learning benefits for users, particularly in developing regions (Daniel, et al., 2006; d'Antoni, 2008). Conversely, Hatakka (2009, pp. 1–2) noted that the promised benefits of OER for developing regions are not necessarily realistic because "open content is not being used by educational organizations in developing countries (or rather the usage of the free resources is low)." Contextualisation of resources presents significant obstacles to the effective reuse of OER than was originally anticipated (Kanwar, et al., 2010).

Furthermore, Stacey (2007) highlighted that top-down knowledge cooperation flow and OER provision from developed countries to other regions generated a number of cultural barriers. There are still a large number of learners and educators in developing countries who do not have the skills to effectively use, develop, or repurpose OER. In this regard, contextualisation is considered a *conditio sine qua non* for a more culturally grounded understanding of adoption of OER (Willems & Bossu, 2012). While there are particular OER initiatives in developing countries (see OER Africa, www.oerafrica.org, SciELO, www.scielo.org, Redalyc, http://redalyc.uaemex.mx), the immense majority of OER are produced by individuals, organisations, or institutions from developed countries, and this imbalance is problematic (Hatakka, 2009).

Willems and Bossu (2012) critically evaluated the notion of OER because "the rhetoric

around OER is their potential to increase access to education, improve quality, and reduce the cost of education in many developing countries." Nevertheless, these authors claimed that cultural elements such as the language of instruction, contextualisation, and technological infrastructure in remote regions are not sufficiently taken into account. Furthermore, OER cannot be used effectively in many developing countries because of the absence of basic infrastructure, such as internet connectivity, thus potentially widening the inequality gap. Internet penetration is 60% in the EU, 78% in the USA, and 89% in Australia, while internet penetration in Latin America and Africa is only 39.5% and 13.5%, respectively (Internet World Stats, 2011).

Richter and McPherson (2012) added that OER will not lead to radical transformation in developing countries because cultural barriers are much stronger than the access to and influence of online educational content. These authors emphasised the obstacles including the historical effects of colonisation, the language barrier, and the need for basic skills.

The OER debates are focused on top English-speaking universities. By contrast, there is less evidence of OER-HE engagement and long-term sustainability in non-English-speaking regions (Lecercle, 2011). Klemke et al. (2010, p. 75) added that the "language differences, cultural barriers, local relevance of materials, access concerns, and the availability of adequate technical resources (infrastructure)" can hinder a broader adoption of OER. The authors asserted that a "cultural hegemony" based on continuous improvements in the quality of English OER implies that language barriers and cultural differences could consign less developed countries to the role of "consumers" of expanding knowledge – rather than contributors to it. As long as educational materials continue to be based on a few (Western European) languages (Ouane, 2003), the use and repurposing of OER remains limited to people who have had the privilege to learn one of those elite (foreign) languages.

The production of OER in English, therefore, creates a barrier to guaranteeing the universal use or understanding of content. Rossini (2010, p. 21) adds,

> the language barrier should be added as an enormous socio-cultural barrier, since the vast majority of OER is in English and based on Western culture, limiting relevance outside Western culture. This further carries the risk of consigning developing countries to be placed in the role of consumers.

These limitations (i.e., teachers blocked by the language barriers) have been recently documented among the Chinese-speaking community (Huang et al., 2012), as well as among Russian (Knyazeva, 2010) and Italian speaking (Banzato, 2012) groups interested in OER. The problem of linguistic diversity is not only relevant for the OER discussion, as Meneghini and Packer (2007, p. 112) explained: "English has become the modern *lingua franca* [... where] any scientist must therefore master English—at least

to some extent—to obtain international recognition and to access relevant publications." Stankus also noted that "virtually all non-English authors tend to abandon publications in non-English language journals" (Stankus, 1987, p. 82).

In the case of OER, a particular tension exists between the inclusive rhetoric about OER (Daniel, et al., 2006; d'Antoni, 2008) and the reality that most of the academic publications in this field are in English. Willems and Bossu (2012, p. 191) added that "English is considered an international language due to its usage in knowledge dissemination [...] However, the majority of learners worldwide come from non-English-speaking backgrounds."

The Organization for Economic Co-operation and Development (OECD) asserts that "no definite statistics are available, but it [OER] has expanded in terms of number of projects, number of people involved, and number of resources available. It is a global development, although most resources are currently produced in developed countries" (Lecercle, 2011). Masterman and Wild (2011, p. 5) suggested that the lack of comprehensive OER statistics and the adoption of OER practices could be compared to an "iceberg." Above the surface is a limited amount of highly visible licensed OER that bear the name of a well-known institution. However, below the surface is a much greater volume of reused, non-OER digital materials that are used by staff and students and that are often invisible beyond a specific course. The invisible OER are mostly excluded from statistics.

Methodology

This study is a comparative analysis of queries in four major digital platforms to determine the coverage of OER online content. Acknowledging the problem of linguistic diversity, this research provides a comparative analysis that evaluates the evolution of the OER discussion (OER related queries) in English, Spanish, and Portuguese from 2007-2011.

These queries are defined as the words or phrases that a user enters into search engines and directories to find specific results. Eight queries associated with the OER discussion in English, Spanish, and Portuguese were entered into four different online platforms: two academic journal databases (Web of Knowledge and Scopus), one video-sharing Web site (YouTube), and one document-sharing Web site (Scribd). The resources included in the study were the uploaded (or registered) content to these four platforms during the period 2007-2011.

This methodology included the following steps.

Step 1. Selection of queries about OER in three different languages (Table 3).

Step 2. Selection of academic and non-academic online platforms to conduct the comparative analysis.

Step 3. Elaboration of search results on each platform (Table 3). The searches were differentiated by query, platform, and year.

Step 4. Based on the data retrieved by the search engine of each platform, presentation, comparison, and analysis of the results.

According to the information provided by Internet World Stats (2011), the top languages on the Internet are English, Chinese, Spanish, Japanese, and Portuguese (Table 2). Table 2 illustrates that for every Portuguese speaker, there are two Spanish speakers and approximately seven English speakers on the Internet. The reason for choosing these two Western European Languages (Fishman, 1997), Spanish and Portuguese, instead of other highly ranked languages, such as Chinese or Japanese, is attributable to its use among a large number of developing countries with particular predominance in the Latin American region.

Spanish and Portuguese are spoken beyond their countries of origin (Spain and Portugal, respectively). For example, in the United States, 12.8% of the residents speak Spanish (US Census Bureau, 2012). Additionally, these languages are illustrative of other communities where Spanish and Portuguese are spoken with extensive idiom use. Latin America (approximately 600 million people) and eight African countries (Lewis, 2009) are additional examples of regions with Spanish and Portuguese-speaking populations.

Different authors indicate that academic journal databases such as the Web of Knowledge or Scopus provide a limited or under-represented number of publications in languages other than English (González-Alcaide et al., 2012); Meho & Yang, 2006). Larivière et al. added that Thomson ISI "fail(s) to cover a good part of the literature published outside the United States and the United Kingdom, whether the language used is English or not" (2006, p. 998). Despite the clear language imbalance described, these journal databases were included because they are considered sources of academic excellence in non-English speaking countries (Cartes-Velásquez & Aravena Torres, 2012; García-Cepero, 2008). Finally, for this study it was considered that a search of a journal database could demonstrate the language and development of OER content over time. YouTube and Scribd were also included in the sample to provide diversity: Both resources are non-academic platforms largely used by a multilingual community (YouTube, 2012; Scribd, 2012).

Table 2

Top Ten Languages Used on the Web

Top ten languages on the Internet	**Percentage (%) of users on the Internet by language**
1º English	26.9
2º Chinese	24.3
3º Spanish	7.9
4º Japanese	4.7
5º Portuguese	3.9
6º German	3.6
7º Arabic	3.1
8º French	2.8
9º Russian	2.8
10º Korean	1.9
(Rest of the Languages)	16.7
World total	**100**

Source: Internet World Stats, 2011

Objectives of this Study

a) Identify whether content about OER are available outside the English-speaking world. This analysis focused on Spanish and Portuguese content.

b) Use keywords for each language (queries, see Table 3) to compare two academic databases (Web of Knowledge and Scopus) and two user-generated content platforms (Scribd and YouTube).

c) Perform a review over the period 2007-2011 to compare the search results in all three languages.

Method of Sample Selection

The following platforms were included in the study.

*a) The Web of Knowledge (*formerly The ISI Web of Knowledge*):* This database is one of the largest academic citation databases available, with over 46 million records and 11,261 high impact journals (Pleabani, 2010). Records in the Web of Science include a language indicator that categorises documents by the language in which they are written. The platform registers over 40 languages (Thomson Reuters, 2009). For instance, the Journal Citation Report (2010), fully integrated in the Web of Knowledge, registered more than 90 journals in Spanish and 54 in Portuguese (Thompson Reuters, 2012). The queries were searched on the topic field.

b) Scopus: With 46 million records, this platform is also regarded as one of the largest abstract and citation academic databases for peer-reviewed literature (Delasalle, 2012). This database comprises 18,500 peer-reviewed journals. Scopus includes non-English content as long as there are English Language abstracts (Quacquarelli Symonds, 2012). Approximately 21% of titles in SciVerse Scopus are published in languages other than English (SciVerse Scopus, 2011). Searches were made in the article title, abstract, and keywords fields.

c) YouTube: More than 60 hours of video have been uploaded to this video-sharing Web site for each minute in the last 8 years (YouTube, 2012). The site is a free access repository of videos. The results were obtained using a Google specific search, with the query "site: youtube.com," using the following filters: Custom range per year of elaboration (i.e., from 1/1/2007 to 31/12/2007), sorted by date and all results (non-specific type of document). The automatic omission "of very similar entries to the displayed" results was also activated during the search process. Searches were extended beyond a document's title and included text descriptions (excluding video captions). The filters helped narrow the search results provided by this site. YouTube "has been adopted as the facto video sharing site" addressing a broad audience; meanwhile, video platforms such as Vimeo are more popular among communities like filmmakers and creative industries (JISC Digital Media, 2013).

d) Scribd: Writers can upload their documents and share them publicly on this social publishing site. It is a free access repository of documents and similar materials. This platform registers content in 84 languages, and documents are available in English, Spanish, and Portuguese, among others (Scribd, 2012). The results were obtained using a Google specific search, with the query "site: scribd.com," using the following filters: Custom range per year of elaboration (i.e., from 1/1/2007 to 31/12/2007), sorted by date and all results (non-specific type of document). The automatic omission "of very similar entries to the displayed" results was also activated during the search process. Searches were extended beyond a document's title to include the body. The filters helped narrow the search results provided by this site.

Table 3

English, Spanish, and Portuguese OER Queries

English	**Spanish**	**Portuguese**
Open educational resources	Recursos educativos abiertos	Recursos educativos abertos
Open access	Acceso abierto	Acesso aberto
Open science	Ciencia abierta	Ciência aberta
Free educational resources	Recursos educativos libres	Recursos educativos livres
Open resources	Recursos abiertos	Recursos abertos
Open course	Curso abierto	Curso aberto
Open educational practices	Prácticas educativas abiertas	Práticas Educativas abertas
Open scholarship	Academia abierta	Academia aberta

The table includes eight queries associated with OER in the three languages studied. These keywords were used as queries (using quotes in all cases) in this study. This multilingual sample of queries was retrieved from abstract and keywords results associated with OER searches made on Web of Knowledge and Scopus.

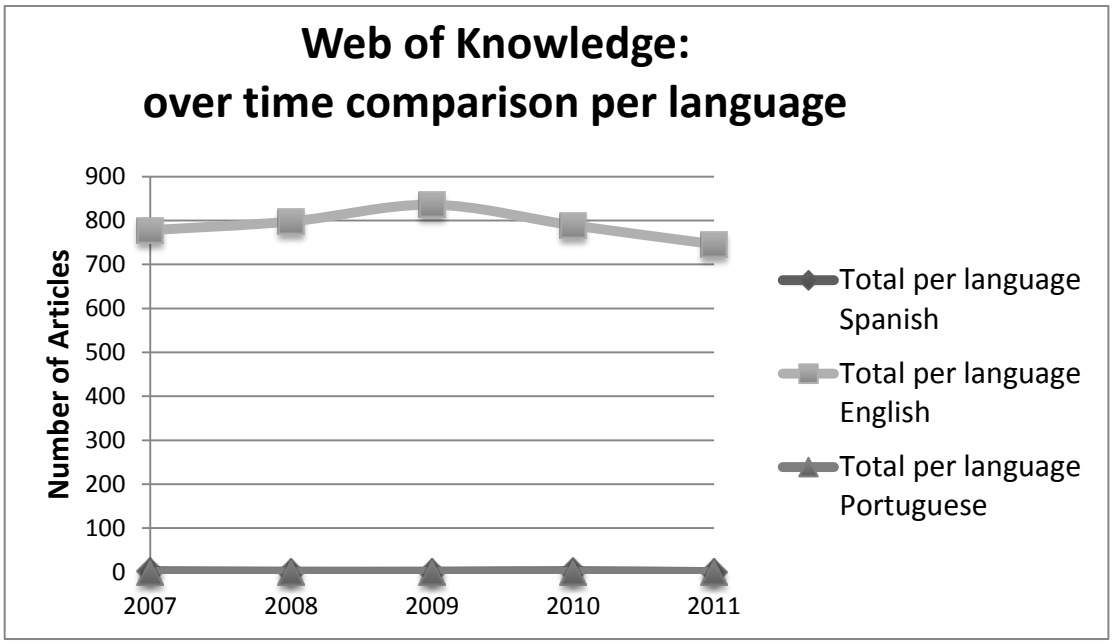
However, in this study, the elements that allowed the comparison of digital resources (videos, documents, and academic publications) available on different platforms (Web of Knowledge, Scopus, YouTube, and Scribd) addressed the following common parameters: digital resources retrieved under the same set of queries (Table 3), published (online) during the same period of time (2007-2011), and offered in at least one of the three languages studied.

Two different types of platforms (academic and user-generated) were included because they made explicit references (in the title, description, abstract, keyword, or body of the text) to one or more of the eight queries associated with OER (Table 3).

Results

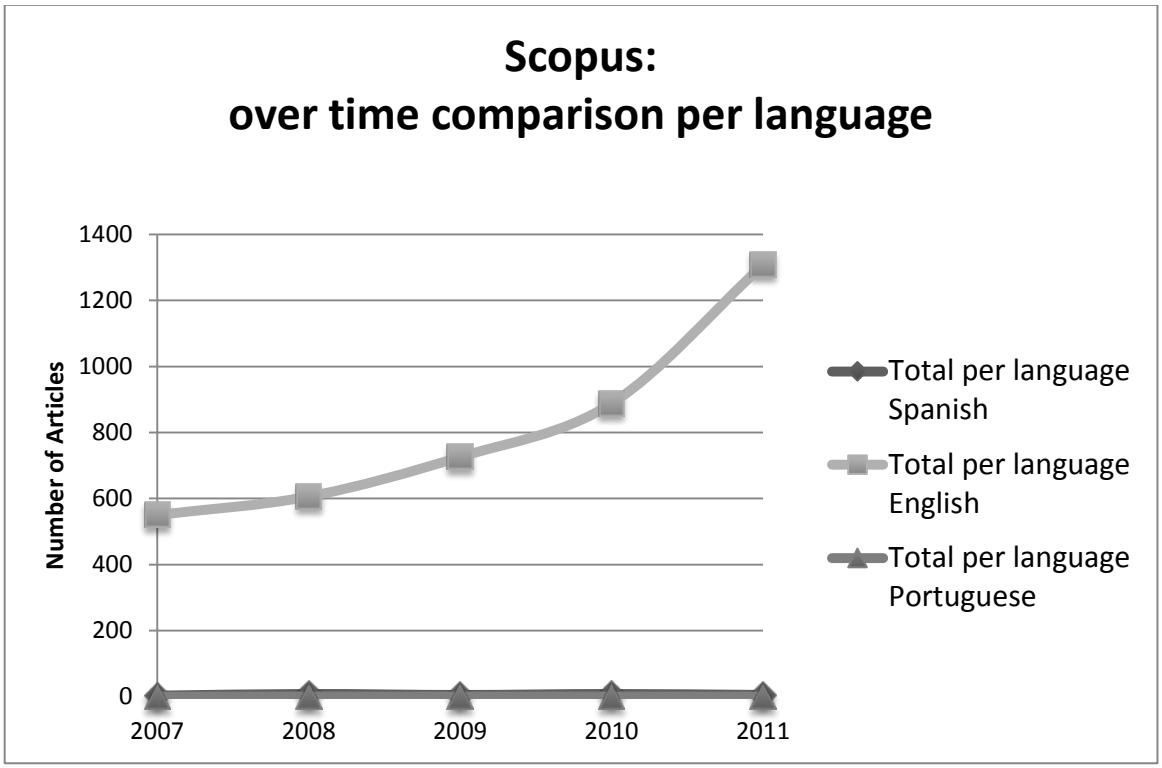
The information was retrieved in September 2012 and the database for the search results can be accessed at the following URL:

https://docs.google.com/spreadsheet/ccc?key=0AmBXUpZP05UodHpqN1RqY2M4YjZnYlZ0VndHR09ud0E



Web of Knowledge	2007	2008	2009	2010	2011
Search results in Spanish	2	1	1	2	0
Search results in English	778	798	836	789	746
Search results in Portuguese	0	0	0	0	0

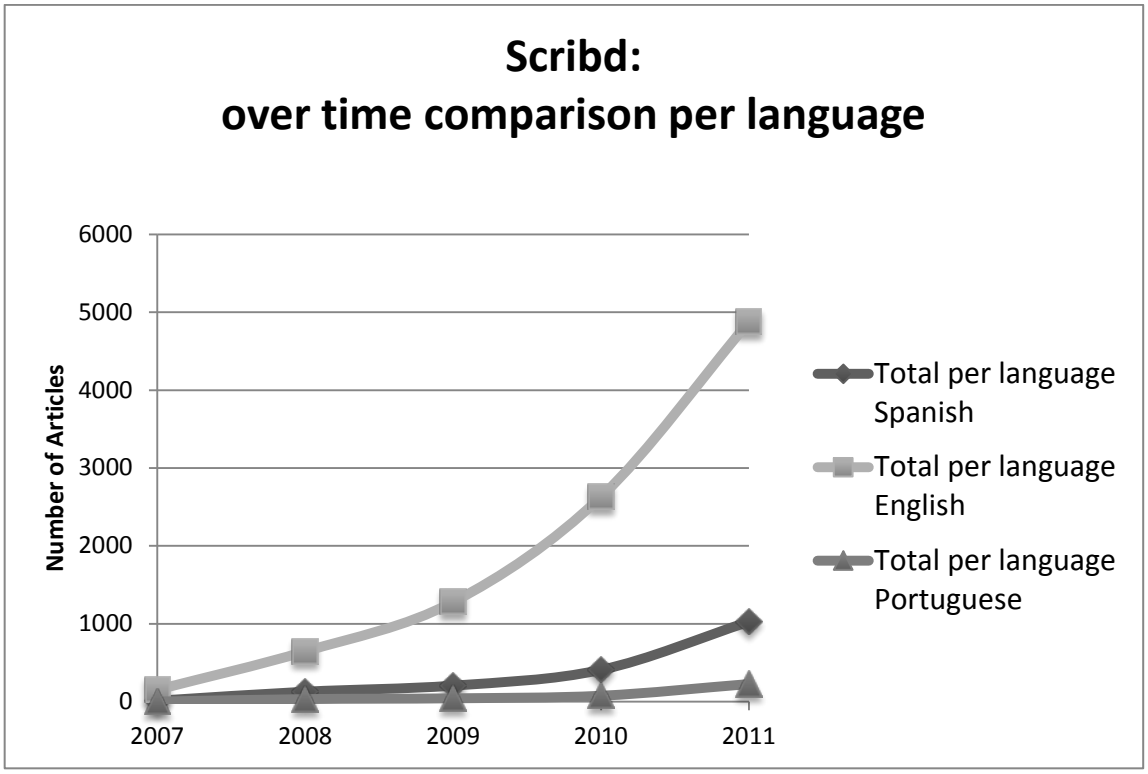
Figure 1. Web of Knowledge: Over time comparison per language.



Scopus	2007	2008	2009	2010	2011
Search results in Spanish	3	8	5	8	5
Search results in English	550	606	726	888	1308
Search results in Portuguese	0	0	0	0	0

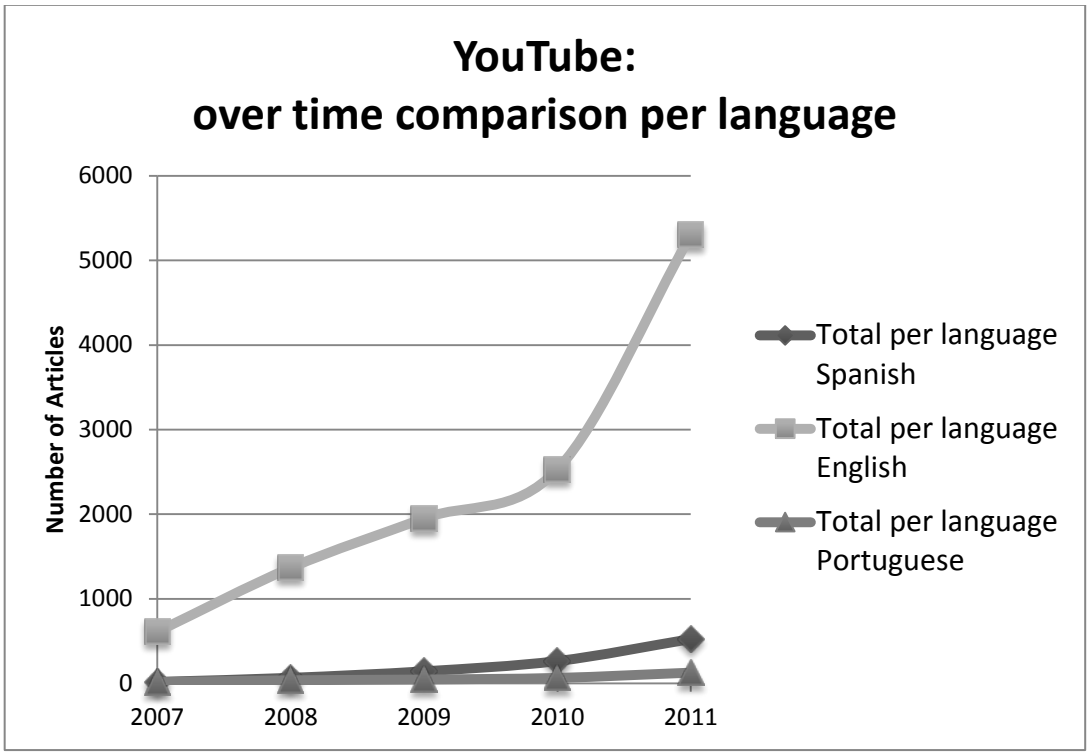
Figure 2. Scopus: Over time comparison per language.

Figures 1 and 2 (academic journal databases) show remarkable difference between the English search results and the equivalent in Spanish and Portuguese. In the case of the Web of Knowledge, the difference between English and Spanish and Portuguese did not change much over time. This information is relevant because it illustrates a consistent interest in this field among the English speaking community. The language imbalance between English and non-English journals (previously described in the Methodology section) is reflected in Figures 1 and 2. The virtual lack of results in Spanish and Portuguese do not provide any conclusive information (apart from the still low presence of these languages).



Scribd	2007	2008	2009	2010	2011
Search results in Spanish	12	128	206	408	1026
Search results in English	153	645	1279	2629	4876
Search results in Portuguese	1	33	43	76	226

Figure 3. Scribd: Over time comparison per language.



YouTube	2007	2008	2009	2010	2011
Search results in Spanish	18	66	143	264	524
Search results in English	611	1366	1951	2530	5302
Search results in Portuguese	15	37	46	65	127

Figure 4. YouTube: Over time comparison per language.

The data gathered from non-academic platforms (Scribd and YouTube) indicates that search results in English were continuously growing during the period studied. Concurrently, the search results indicate that Spanish, followed by Portuguese, grew, but at slower rates.

Nevertheless, in the period studied, the Spanish results grew more on Scribd and YouTube (85.5 and 29.1 respectively) than English (31.8 and 8.6). Similarly, in both platforms, the growth of Portuguese results was higher (226 and 8.4) or was very similar to the English growth (31.8 and 8.6) on Scribd and YouTube.

Contrary to what was observed in Figures 1 and 2, Figures 3 and 4 highlight that all languages (in different scales) registered an increasing interest in OER. Although these

results are not conclusive, they suggest that non-academic platforms are becoming an increasingly relevant space of discussions about OER.

It is important to note that the general trend of search results show a growing language gap between the number of queries about OER retrieved in English and its equivalent in Spanish and Portuguese.

In most of the platforms included in this study, more content about OER was registered in 2011 than in 2007. Furthermore, in Scopus, Scribd, and YouTube, the amount of English content about OER was greater than in Spanish or Portuguese. Clear evidence of this growth can be found in the increase of English search results about OER retrieved from academic publications in Scopus, which increased over 2.3 times within the period 2007-2011.

Noteworthy differences were found in the non-academic platforms (Scribd and YouTube), where Spanish and Portuguese search results increased during the period studied (2007-2011). For both Scribd and YouTube, the language gap between English content about OER and the other two languages (Spanish and Portuguese) was smaller in 2011. For instance, for Scribd, the growth of the Spanish search results was 2.7 times higher than its English equivalent. In addition, during the same period, the Portuguese growth rate was 7.2 times higher than the English growth rate. On YouTube, the Spanish search results registered a growth rate that was 3.4 times higher than its English equivalent, while the growth rate of the Portuguese search results was only slightly lower (less than 1%) than the growth rate of the English search results.

For 2007, 166 search results were retrieved from Scribd for all three languages. In 2011, that number increased to 6,128. Similarly, the total volume of search results retrieved from YouTube for all three languages increased from 644 in 2007 to 5,953 in 2011. The total volume of search results in non-academic platforms (Scribd and YouTube) was considerably higher than the equivalent in the academic journal databases.

The results obtained in Scopus registered a constant growth of English search results during the period studied. By contrast, there was a limited or underrepresented number of academic publications available in Spanish or Portuguese on the Web of Knowledge and Scopus; thus, English was the only language that registered significant changes in the period studied.

Discussion

The main aspect to be highlighted here is the results which provide useful information to analyse OER from the language diversity perspective.

The growing rates of usage for the three languages studied represent an increasing interest in content about OER. The predominance of English in academic journal databases is unmistakable, while the volume of Spanish and Portuguese journals in these databases remains limited. By contrast, in non-academic platforms, Spanish and Portuguese content referring to OER is increasing at a rate that is faster than or similar to English. The results of this study show an increasing existence of resources about open education beyond academic journals. This trend was identified in all three languages studied.

The imbalance between languages can by no means be considered exclusive of OER; nevertheless, this situation is more evident in academic databases rather than in user-generated content platforms.

From the language perspective, the OER discussion has many challenges. A more evenly distributed language-based OER model seems to be a pending issue. A more language-diverse OER discussion will require a more comprehensive analysis of this topic in both the academic and non-academic domains. If these aspects are taken into account, it is likely that non-English speaking communities will receive a higher level of visibility.

The existing OER in English-speaking communities are not sufficient for global adoption and effective use of these resources. UNESCO (Daniel, et al., 2006; d Antoni, 2008) considers the lack of OER adoption in non-English speaking countries as an opportunity. However, the lack of trained users (learners and educators) from non-English speaking countries with the required skills to effectively create and repurpose OER and the absence of technology infrastructures result in a deeper divide between those who can exploit the benefits of OER and those who cannot. As described above, the adoption of OER must operate within contextual factors that vary by organisation, culture, legal, or academic factors. If these factors are not taken into account they can become barriers that challenge the expansion of OER (Hattaka, 2009; Stacey, 2007; Klemke et al., 2010, 75; Lecercle, 2011).

Conclusions

A growing interest in sharing open educational resources has been supported by a number of HE institutions, which, in turn, has promoted the principles of openness and free access as drivers of knowledge exchange. The OER initiatives described in this paper suggest the need for a new understanding of access to content capable of addressing the cultural and linguistic barriers that exist beyond opening the access to resources. This study discusses to what extent the interest in OER is adopted by

different language-based communities, analysing different types of platforms over time. Consistent and increasing evidence was retrieved from non-academic databases (Scribd and YouTube), which indicated that, in most cases, English, Spanish, and Portuguese OER online content was increasing over time. This study can also be utilised to analyse the increasing relevance of technology to facilitate exchange and visibility of knowledge generated in academic and non-academic contexts.

Limitations and Recommendation for Future Studies

The growing volume of digital content about OER in the user-generated content platforms challenges the retrieval and analysis of these resources in statistical studies. The increasing volume of content making reference to OER published in non-academic platforms (not necessarily peer-reviewed in many cases) suggests the importance of identifying and differentiating high-quality OER from the rest. Based on that, the content selection of high-quality resources could become a time consuming process. There are numerous opportunities for further research in this field. Supplementary research is required to analyse how the trends described in this study will evolve in the future. This study only included two non-English languages; future analysis of OER among Chinese, Arabic, or Russian speaking communities could significantly enhance the existing knowledge in this domain. Future studies must incorporate additional languages to determine if, and to what extent, the predominance of English in OER persists.

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Visualization Mapping Approaches for Developing and Understanding OER

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Abstract

Open educational resources (OER) can be described in numerous ways (Creative Commons, 2012). In this visualization based context, however, OER can be defined as

> ...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. (Hewlett Foundation, 2007)

This definition emphasizes some of the aspects highlighted in this article, namely that an OER approach has also been taken to capture and visualize OER materials. In addition reference is made to the forthcoming paper, "How Diagrams Aid Teaching and Learning in STEM Subjects as Exemplified by the Teaching and Learning of Systems Thinking in Practice" (Lane, 2012, in press), which outlines how the educational process often involves a mediated discourse between teachers and learners to aid sense or meaning for both parties.

Keywords : Open education resources; visualization mapping

Introduction

OER have become more widely available through a variety of digital platforms: dedicated repositories, referatories, and numerous, sometimes bespoke, search engines. When seeking OER, however, it is quite noticeable that the presentation of much material is provided as written descriptions with few visual clues or signposts to aid navigation or indeed the discovery of relevant or appropriate resources. Nevertheless, many OER may include media rich assets, for example, video, flash animations that are not necessarily always immediately obvious to the end user. Indeed it could be argued that few of the largest or most popular OER repositories present their wares in any other way than as lists or indexes of stuff. There are many examples of this, for instance, the OpenCourseWare offered by MIT (MIT Open Courseware, n.d.) or indeed the OER listed at OpenLearn (The Open University, n.d.). One general exception to this rule, however, is the adoption of tag clouds by many repositories where the scale of the "words" indicates the popularity of the resource or OER topic and, as such, could be deemed to be offering visual clues to the attractiveness of those OER materials. A good example of this approach can be seen at the JISC Info Toolkit (n.d.).

This article sets out to examine how a variety of visualization mapping methods have been realized in a range of OER scenarios. It examines four specific issues: firstly considering how visualization mapping can be employed at a strategic macro level in terms of OER institutional planning; secondly outlining how visualization mapping can be employed at the meso level concentrating on the design and production of OER materials; thirdly, how visualization mapping can be used at the micro level as a navigating interface to OER assets; and, fourthly, how this can also enable learners and researchers to make sense of published OER materials.

Most examples are drawn from the OpenLearn OER project with some other illustrations, for context, from other OER projects. Whilst the premise of the article is to highlight the visualization mapping methods, a number of examples have been from materials repurposed using the Compendium knowledge mapping software. Compendium is one of many such software packages that are freely available to enable the visualization of knowledge, information, or subjects of interest; it is available from the Compendium Web site for The Open University UK (n.d.). Thus Compendium is a software tool providing a flexible visual interface for managing the connections between information and ideas.

Macro Level: OER for Institutional Planning

A good example of how visualization-mapping methods have been successfully employed both manually and digitally can be seen in the Multilingual Open Resources for Independent Learning (MORIL) project funded by the Hewlett Foundation via and run by the European Association for Distance Teaching Universities (EADTU) in 2008.

Overall the MORIL project wanted to establish and provide a gateway to university education for a broader range of target groups, facilitate international learning experiences, brand open and distance teaching universities, and gain enhanced experience with OER.

One part of the MORIL project thus set out to establish how EADTU members were currently using or considering developing and delivering OER in their institutions (Okada, Connolly, & Lane, 2010). The Okada et al. paper introduces a methodology that integrates ideas for collective sensemaking through knowledge maps based on a designated template or framework. Ostensibly the objective of this work was to identify some of the benefits and challenges that may be faced when using a knowledge mapping tool to help different groups gain a common understanding of issues around a key opportunity. With respect to visualization mapping techniques this gave the participants, representing a diverse group of EADTU membership, for example, both dedicated "open" universities and national associations of open and distance learning (ODL) institutions, the prospect of not only presenting (by drawing) their current OER landscape but also understanding institutional OER strategies from across Europe using a visual medium.

In order to facilitate and capture the information gained from this process, a series of workshops was arranged. During each workshop, the technique of force field mapping (Lewin, 1951) was employed to help participants quantify and then visualize the driving and restricting factors that were encouraging as well as hindering such potential OER developments in the EADTU institutions. Workshop participants were divided into four groups and asked to create a force field diagram (see Figure 1 for an example of the template) to quantify these significant push/pull factors (driving/restraining). Each group had to negotiate the strength of the factors as well as appoint a scribe to draw the diagram. At the end of the workshop, the facilitator synthesized these collaboratively produced diagrams into one visualization "map". After the event the force field diagrams and synthesized visualization map were captured digitally and then re-presented using the knowledge mapping software Compendium. The resulting digital visualization maps were made available for further consultation via the OER study unit "EADTU Multilingual Open Resources for Independent Learning" located in the LabSpace area of OpenLearn (n.d.). LabSpace is the dedicated Web site of the OpenLearn project that enables users to upload, remix, and repurpose OER materials. The MORIL maps were stored in LabSpace as it was accessible to all participants and it offered an excellent medium to disseminate the resulting maps.

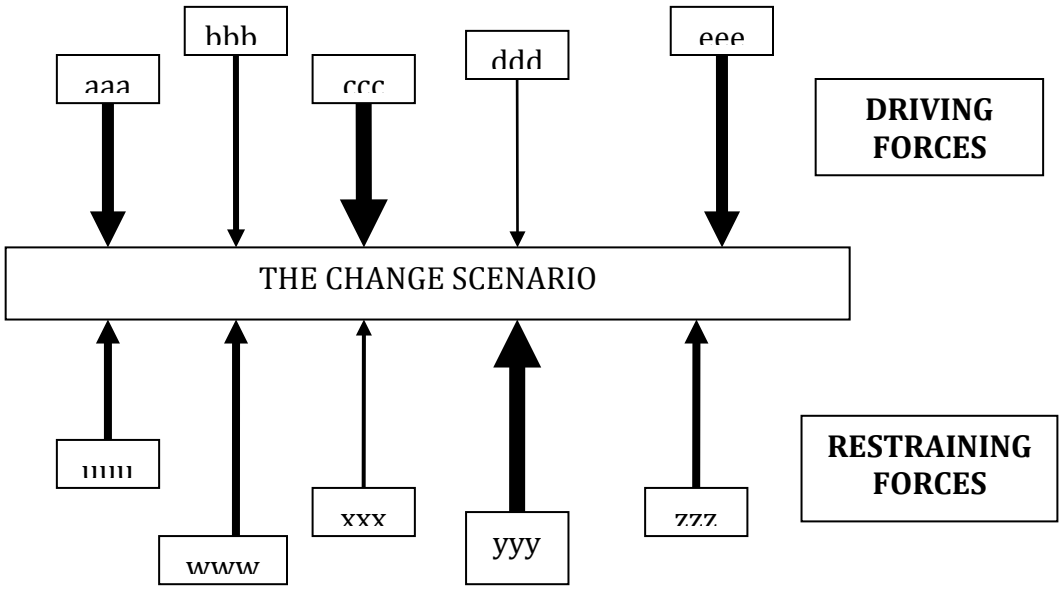

Figure 1. The force field diagram template.

Three workshops were organized, in different locations, to achieve the MORIL project's macro aim of wanting to establish and provide a gateway to university education for a broader range of target groups, facilitate international learning experiences using OER, and so on. Each workshop, held in different countries, therefore, covered specific topics:

- OER strategy implementation, Milton Keynes, UK;
- OER strategy development, Leuven, Belgium;
- OER capacity building resources, Paris, France.

As noted earlier the manual visualization mapping methods used for these workshops involved force field diagrams (see Figure 2 for an output example). These were created collaboratively for each group in the workshops, the premise being that all participants would understand the strategic theme of the OER-based event. As also noted earlier these force field diagrams were later digitized and re-presented using the Compendium mapping software (see example in Figure 3), which enabled further linkages and potential additional analysis of the contents to take place.

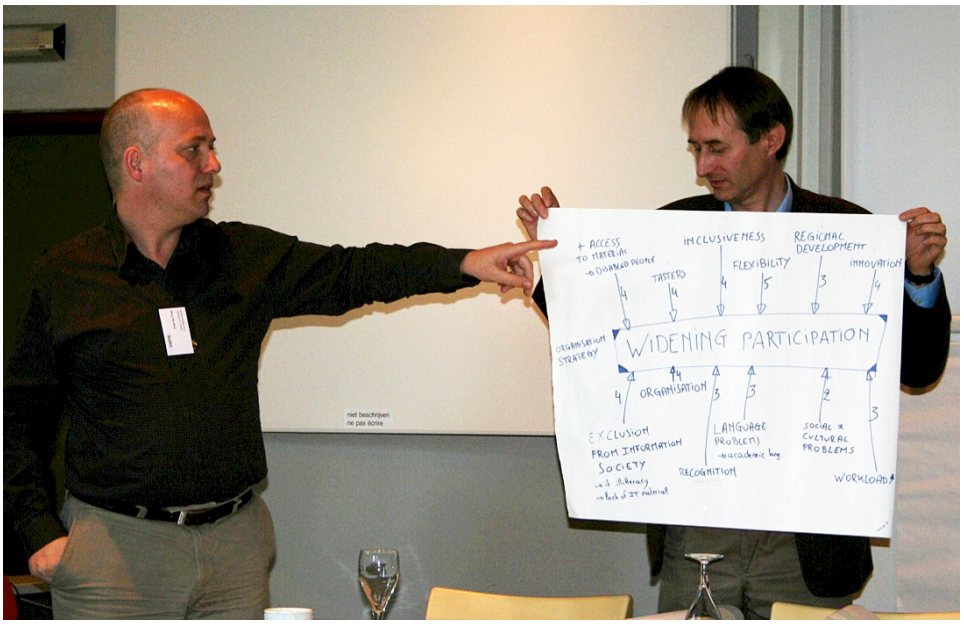

Figure 2. A MORIL workshop force field diagram.

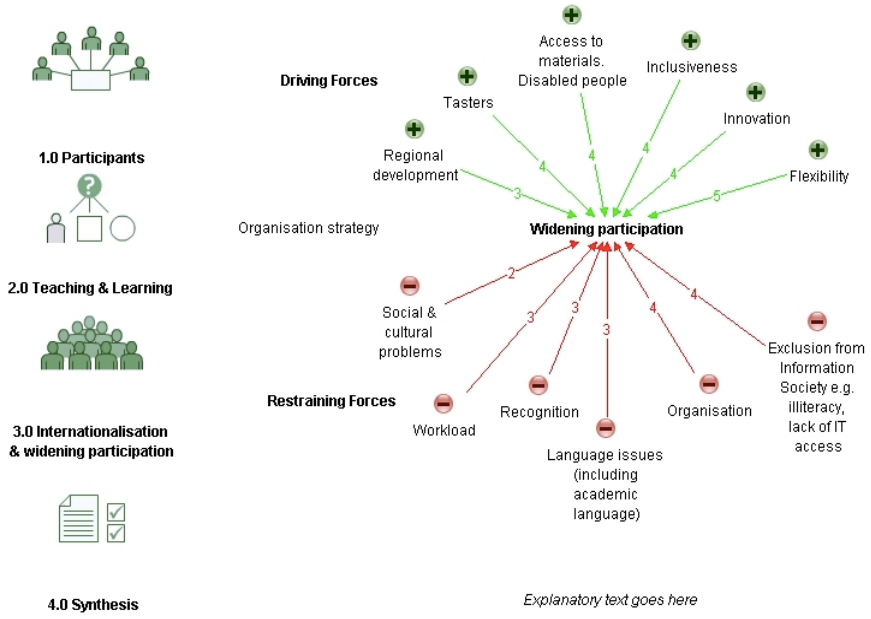

Figure 3. A MORIL workshop Compendium map illustrating widening participation.

The Meso Level: Visualization for the Design and Production of OER

Charting the life story of an OER can be quite challenging as the end product may be varied both in its conceptual design as well as in the ensuing production processes that were required to deliver it. Visualization mapping techniques in this context can help with quantifying these processes by charting that journey (Connolly, 2008) through summarizing, simplifying, and recording it in a relatively straightforward manner. Two examples of this type of diagramming are described here : firstly the creation of a series of flowcharts to capture the production processes of the OpenLearn project and, secondly, some specific uses of the bespoke Compendium LD package, that is Compendium adapted specifically for use in learning design (LD) by way of a different example. The latter software was used to describe the learning design of particular Open University courses and also some OpenLearn study units.

The OpenLearn project, or Open Content Initiative as it was originally called, was established in 2006. A successful bid to the Hewlett Foundation enabled the setting up of a dedicated project team in the Open University, UK that was tasked with the creation of a variety of OER. Initially two OpenLearn Web sites were established, LearningSpace and LabSpace, that effectively enabled the team to present different types and styles of OER materials as well as use associated communication tools. LearningSpace is aimed mainly at learners wanting to study OER and LabSpace is mainly for educators wanting to create or repurpose OER (see McAndrew et al., 2009, for more details).

OpenLearn OER are reproduced from original self study distance learning materials developed at the Open University and are drawn from a vast academic catalogue of resources. Samples of these “chunks” or “units” of these original course materials were offered to the OpenLearn project in a variety of formats: Both paper based and digital, they often comprised of text, images, audio, and video as well as separate book based readings or related journal papers. The majority of such materials, however, were self contained and generally comprised of learning outcomes, subject content, self-assessment, as well as related references and acknowledgements. They were produced, therefore, keeping to their original integrity.

Thus these units fitted what has previously been described as the integrity model of production (full details in Lane, 2008). In brief the content required limited transformation from its original form to that of an appropriate OER delivery. By contrast, however, a number of non-standard (so-called “remix” or “remake” models) units of materials were also offered to the OpenLearn project. These varied in shape and size as well as format. They ranged from software-based solutions (e.g., computer programs, java applets) through materials containing extensive video/DVD footage to collections of subject-based resources that had been presented previously via a CD or DVD platform (Connolly, 2008). It is the latter *potential* OER materials that invited another application of visualization mapping techniques to be explored and developed.

The OpenLearn project established a relatively stable production process that centered on the creation of OER based on the integrity model (see Lane et al. 2009 for full detail) and summarized visually in Figure 4 that shows an overview of this integrity production process presented as a production flowchart. In brief the process followed a pattern whereby original course materials were offered to the OpenLearn project from faculties; they were assessed in pedagogical terms by academics, handed over to the media production team, and then "processed" to fit an existing XML template that allowed the subject content to be rendered into HTML pages that were then delivered as OER on the OpenLearn Web sites.

Initially this OpenLearn OER production process was captured in the form of a series of three Microsoft Visio flowcharts (see Figure 4 that illustrates this idea: Stage 1 only). Each flowchart represented a significant stage of the production process:

1. sourcing and assessment,
2. production process,
3. publishing.

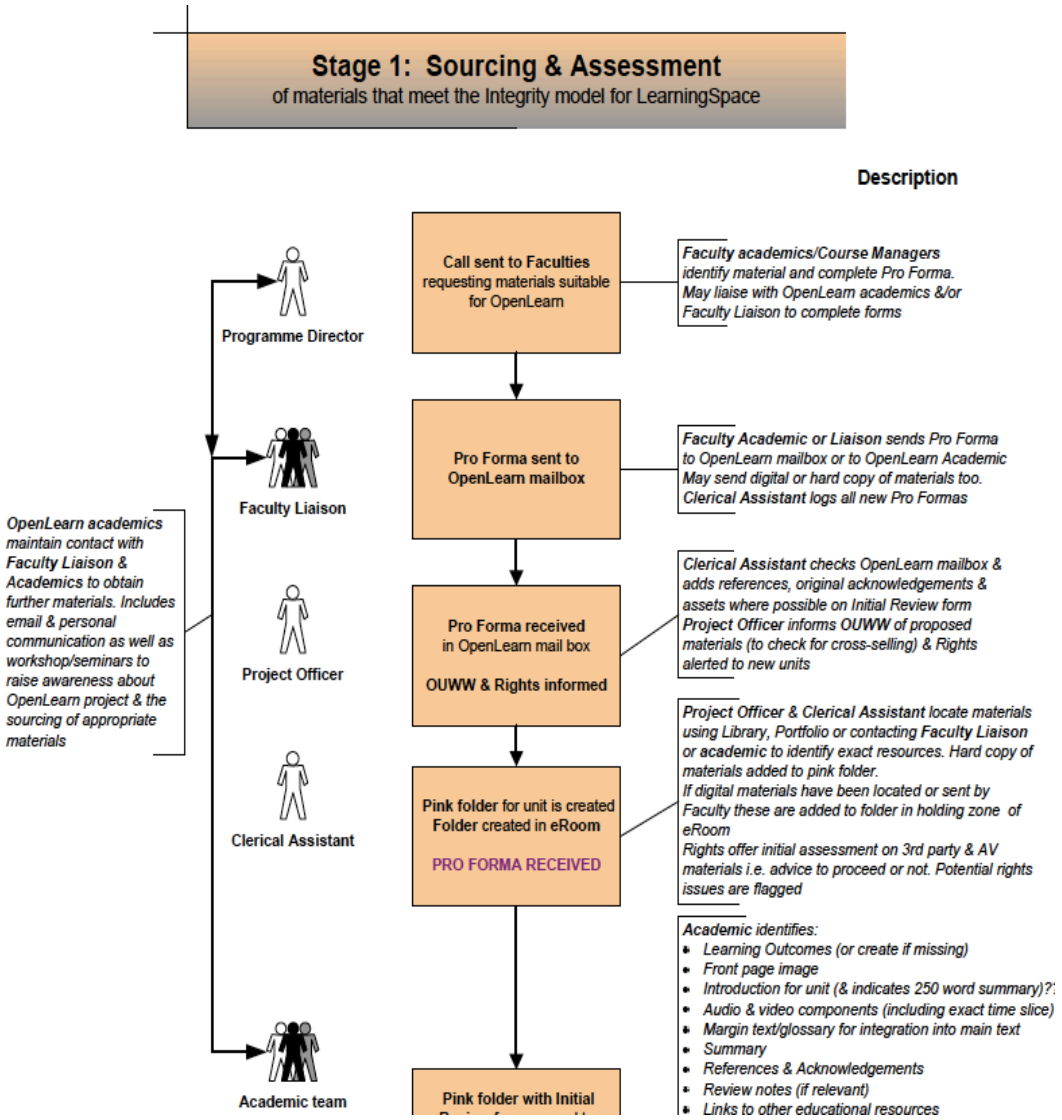

Figure 4. Snapshot of Stage 1 production flowchart (of 3 stages in total).

An academic working with OpenLearn created the flowcharts based on personal and, via interviews with colleagues, confirmed working knowledge of the project (see Schuwer et al., 2011 and OU Knowledge Network, n.d., for further details and for the actual flowchart diagrams). Procedures for each of the stages of the production process had been established between April 2006-May 2007. These procedures ensured that the original materials were carefully assessed academically as well as technically and thus (ultimately) presented as cohesive OER. This also included a thorough rights clearance process in addition to the implicit academic input and media production processes. Technical issues were also considered and if materials did not "fit" the integrity model of production they were labelled as such and did not complete the integrity production process.

Information about each stage of the production process and any significant notes relevant to the project, to groups of materials, or units were also recorded electronically in the Documentum eRoom – an electronic document storage database accessible to all members of the OpenLearn team. This facility produced an overview of the production process (presented as *progress tracking*, see Figure 5) as well as recording details related to the life story of individual units. The latter, however, was presented as a series of indexes or lists that proved to be difficult to interpret for the uninitiated. The development of the OpenLearn Production flowchart took such processes into consideration, alongside information gained from colleagues, and represented them in a diagrammatic form that was simpler to understand (see Figure 4 by way of contrast to Figure 5).

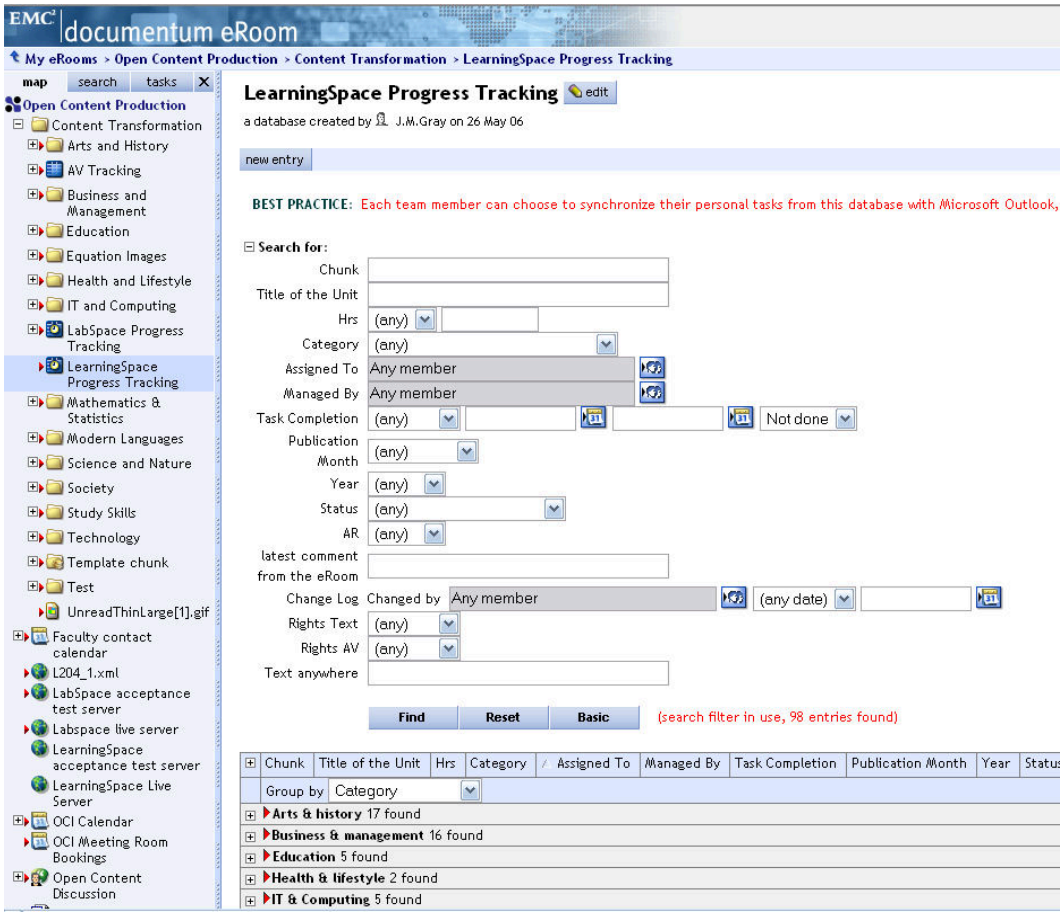

Figure 5. The OpenLearn Documentum eRoom progress tracking screen.

At a later stage the OpenLearn production flowchart was further simplified, in diagrammatic terms, and re-presented using the Compendium knowledge mapping software available from within the project itself. An example of this simpler diagram can

be seen in Figure 6. In essence the Compendium software offered hyperlinking between different elements within dynamic linking of a complex set of processes and also a home grown demonstration of how visualization mapping techniques can be applied to OER developments. Compendium uses a series of basic icons that can be employed to represent a variety of meanings or interpretations. In Figure 6, for example, the "Question mark" icon is used to represent a request or dialogue whereas the "Handshaking" icon is used to represent an agreement or understanding stage of the process. This "Light bulb" icon indicates a decision or choice of route and the final icon, with three dots joined together, indicates that a sub-map or set of processes is available.

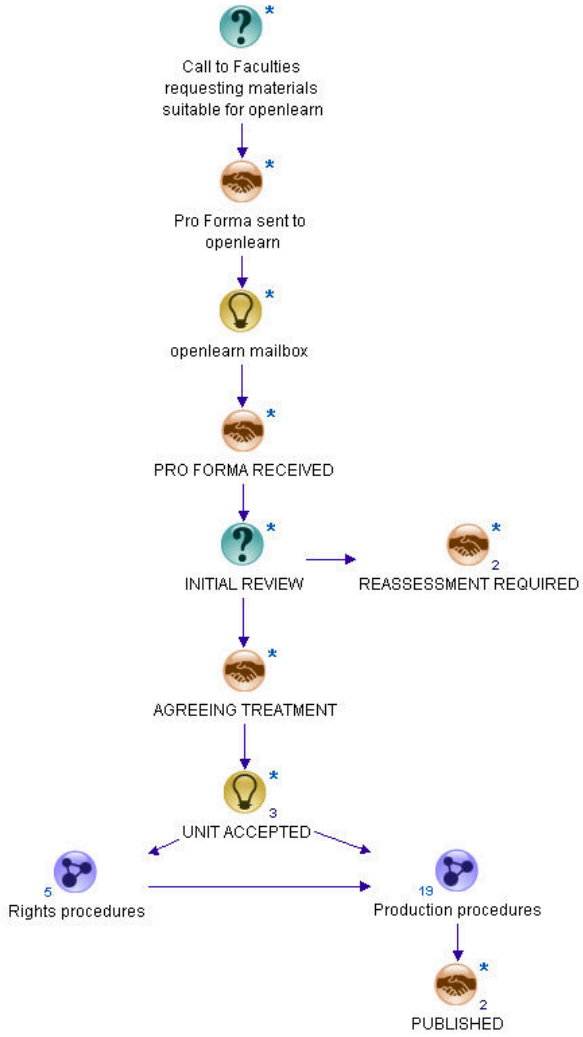

Figure 6. Compendium map of OpenLearn production processes.

It is interesting at this point to contrast the OpenLearn flowchart (see Figure 5) and the OpenLearn production process map (see Figure 6) with similar visualization approaches

developed elsewhere. Two projects appear to have taken a similar visual presentation of their methodology in designing, developing, and planning their OER materials, namely the dScribe and the CORRE projects. These will now be briefly described in order to situate the use of visualization techniques as an approach to presenting OER production methodologies.

The dScribe project was developed by the Open Michigan team (Park, 2009). "dScribe" is short for

> digital and distributed scribes and as a method is based on a participatory and collaborative model for creating open content. In effect dScribe brings together enrolled students, staff, faculty, and self-motivated learners to work together toward the common goal of creating content that is openly licensed and available to the world.

Figure 7 illustrates the project's workflow processes and it is presented as a visualization. Again it uses simple icons to represent various production stages.

The second project is known as Content, Openness, Reuse and Repurpose, Evidence (CORRE) and it is also an approach to creating an integrated workflow framework that has been developed to transform existing materials into OER. It has four main stages, each defined by a set of criteria matched to indicative evidence. Once again this has been visualised and is illustrated in Figure 8. It uses colour blocks rather than icons to represent its distinct stages of production/workflow.

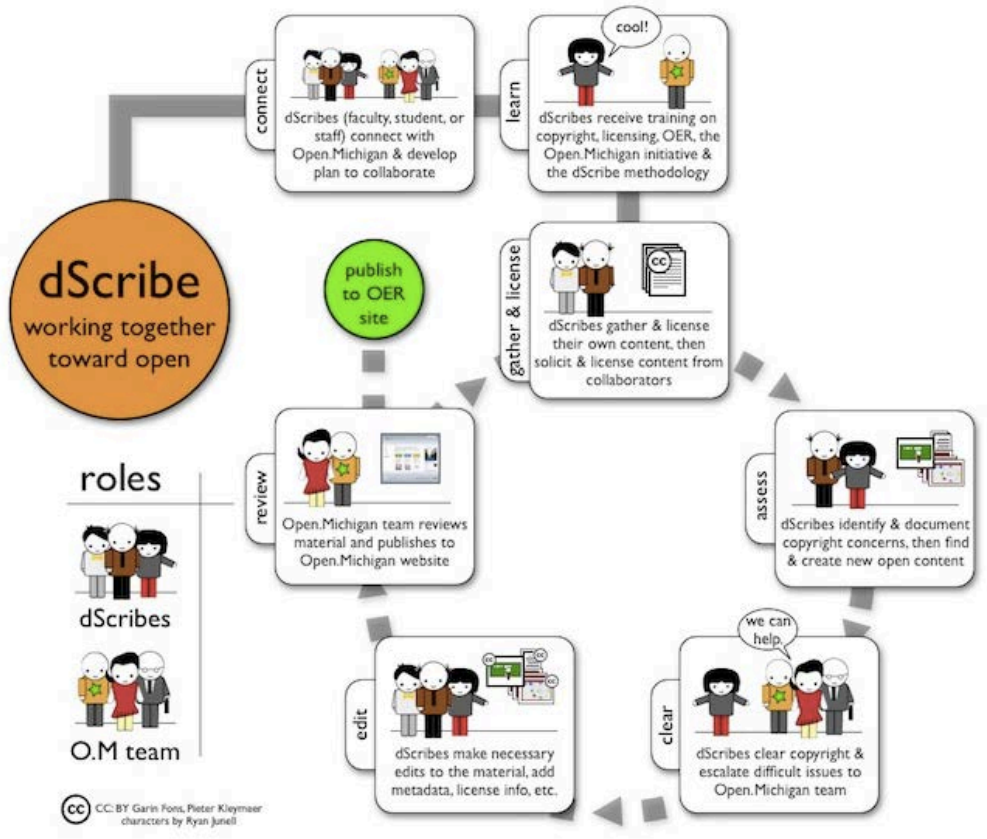

Figure 7. The dScribe workflow (after Fons et al., 2010).

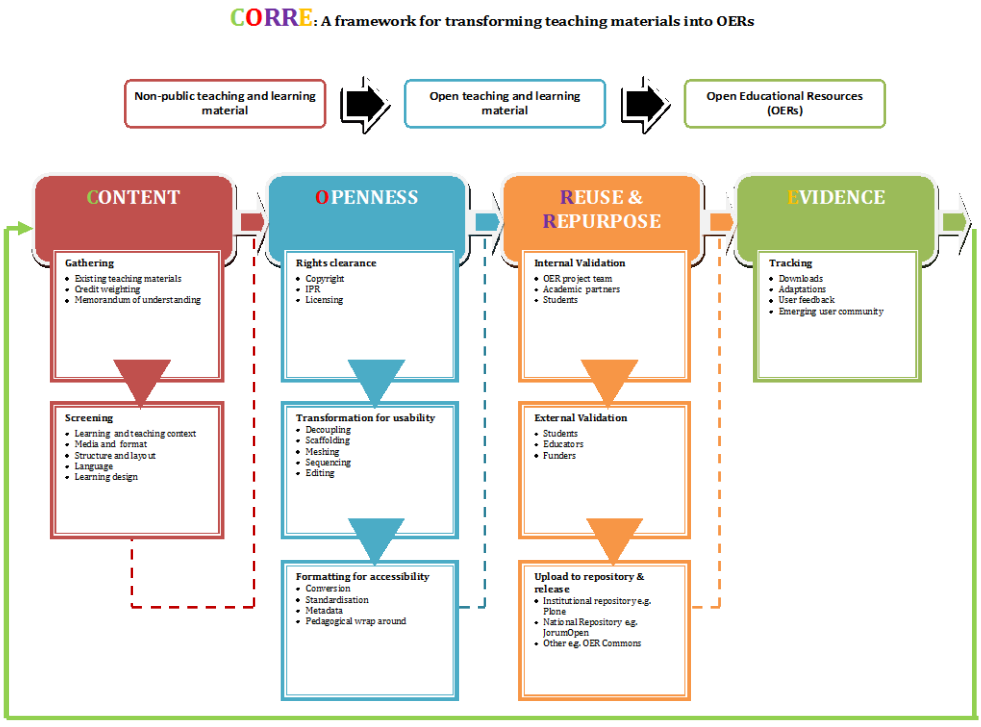

Figure 8. The CORRE flowchart.

The second example at the meso level of employing visualization mapping techniques in the broader area of OER can be seen in the application of a bespoke version of the Compendium software developed for the Institute of Educational Technology (IET) at the Open University known as Compendium LD. This version of the software was developed specifically to support the area of learning design as a tool to support lecturers, teachers, and others involved in education to help them articulate their ideas and map out designs or learning sequences. Effectively Compendium LD provides a set of unique icons that represent the perceived components of learning activities; these are presented as a series of bespoke icons alongside the original or master Compendium icon images and are presented in groups as "stencils" in the form of a

- core learning design stencil,
- sequence mapping stencil,
- conditional stencil.

The example shown in Figure 9 demonstrates how Compendium LD, and its bespoke learning design icons, has been used to create a visual map that models adaptations of OER materials. This is an example of in what way a potential design illustrating how existing OER materials can be included in an activity structure that caters for learners with different levels of skill and knowledge. The illustration in Figure 9 is based upon contrasting existing Open University Spanish materials from two courses: L194 and L140. Visualization mapping in this instance has enabled the two course teams to explore the current learning design of their materials and adapt them accordingly with respect to the incorporation of further OER materials.

The orange icon in Compendium LD represents an idea whilst the blue/grey icon represents an activity, which may, or may not, be linked to other layers of the map. The remaining icon used in Figure 9 represents a link to the Internet and, in this case, a link to a related L140 intermediate Spanish language resource. For further details and additional examples see Compendium LD (n.d.) in action and also the OU Learning Design Initiative (OULDI) (2012) Web site.

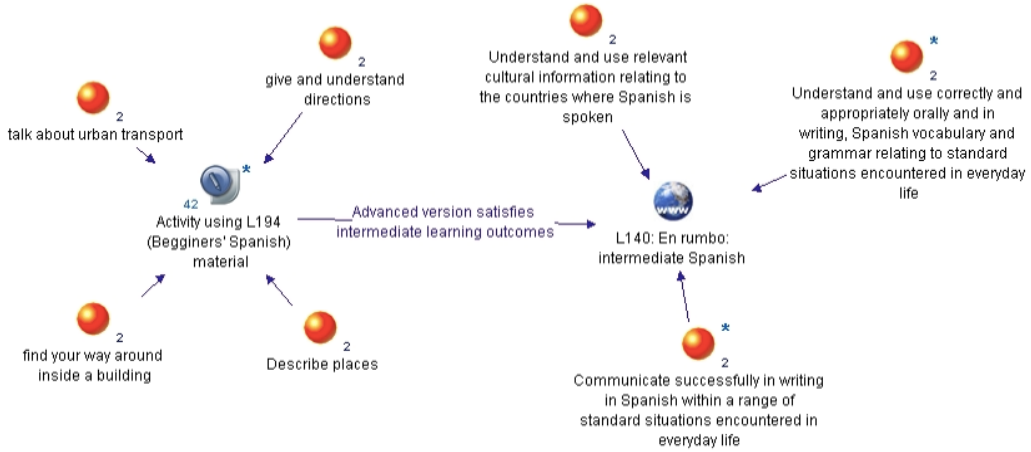

Figure 9. An example of a CompendiumLD map.

Micro Level: Visualization as a Navigating Interface to OER Assets

The third example of how visualizing mapping methods can be applied to OER is a description of using the maps as navigating interfaces to groups of OER assets. In this scenario the illustrations used will be based on two OpenLearn OER study units which, as previously mentioned, formed a small percentage of the materials offered to OpenLearn that did not fit into the "typical" integrity model category described above. These non-integrity Open University materials took many other forms but essentially were labeled supplementary materials (an OU term that describes extra materials that add value to a course but are not necessarily integrated directly into it). Some examples of potential OER sources would be materials such as CDs and DVDs, software, and applets.

An illustration of the first non-integrity or unconventional OER type materials is a CD based resource, offered by the Faculty of Social Sciences, called **E**xploring **P**sych**o**logy's **C**ontext and **H**istory (EPoCH). This was a substantial content-based resource that presented both biographical details of in excess of 100 psychologists as well as descriptions and links between psychology methods, contexts, perspectives, and topics. It was originally offered as a supplement to the Open University course DSE212 Exploring Psychology but withdrawn from the course in 2006 as it did not meet the accessibility requirements of the (then) UK National Special Educational Needs and Disability Act (SENDA) legislation that has now been superseded by the Disabilities Discrimination Act (DDA). Essentially the EPoCH CD contained a substantial set of resources containing extensive psychology based subject information. Figure 10 represents an illustration of the original resource whilst Figure 11 shows the Compendium "visual" map version of the same materials.

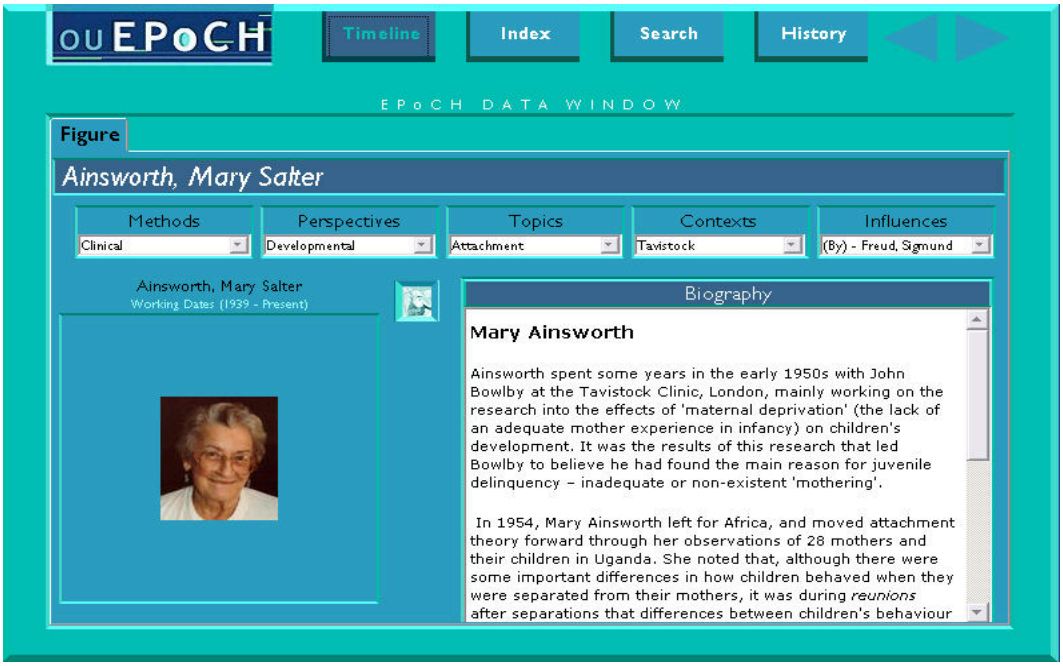

Figure 10. A sample snapshot from the original EPoCH resource.

Essentially visualization mapping techniques offered an excellent method in this case study to act as a navigation interface for what was a complex collection of underlying assets. It also emerged that Compendium offered a more dynamic environment for re-presenting these types of resources. Additional linkages, for example, were made using the hyperlink facilities offered in Compendium. It should, however, be noted that the audio and video contents of the original EPoCH CD were not captured in the new Compendium maps (it was technically possible but financially not feasible because of copyright issues). It can be noted, however, that the challenge of copyright was resolved in the subsequent (second) case study, that focused on Project Management, described later in this section.

A number of factors influenced how the EPoCH assets could be presented as a navigable OER map. This was primarily because it contained content that was akin to an encyclopedia or a family tree (of psychology/psychologists), easily accessible in its original format (images, word files were available), and fully referenced and acknowledged (a comprehensive permissions list existed).

Conversely the EPoCH CD resource was not accompanied by any specific learning materials, that is, a guided pathway of learning through the resource. Whilst this was not a barrier to its use as an OER map it was recognized that such a resource would be enhanced by the addition of some structured learning materials particularly for those unfamiliar with the subject content and/or the use of (Compendium) knowledge maps.

Consequently a structured OER study unit was created to guide the learner through the use of the new EPoCH OER map.

In essence varied source materials (text, images) were captured and represented in the form of a navigable knowledge map (compare the presentation of Figure 10 and 11). The dynamic nature of the software also allowed many further enhancements (in terms of navigation and presentation) to be made to the original materials. From a visualization point of view, access to the materials was certainly perceived to be more pleasing and, indeed, easier on the eye in terms of understanding how to use the resource too. Whilst there was no specific research carried out to substantiate this aspect there were a number of positive feedback responses from both the original course team authors as well as those who then subsequently recommended the new version of EPoCH to current DSE212 Exploring Psychology students. These maps can be accessed directly via the associated OER study unit known as "EPOCH Psychology history timeline" directly at EPOC (n.d.)

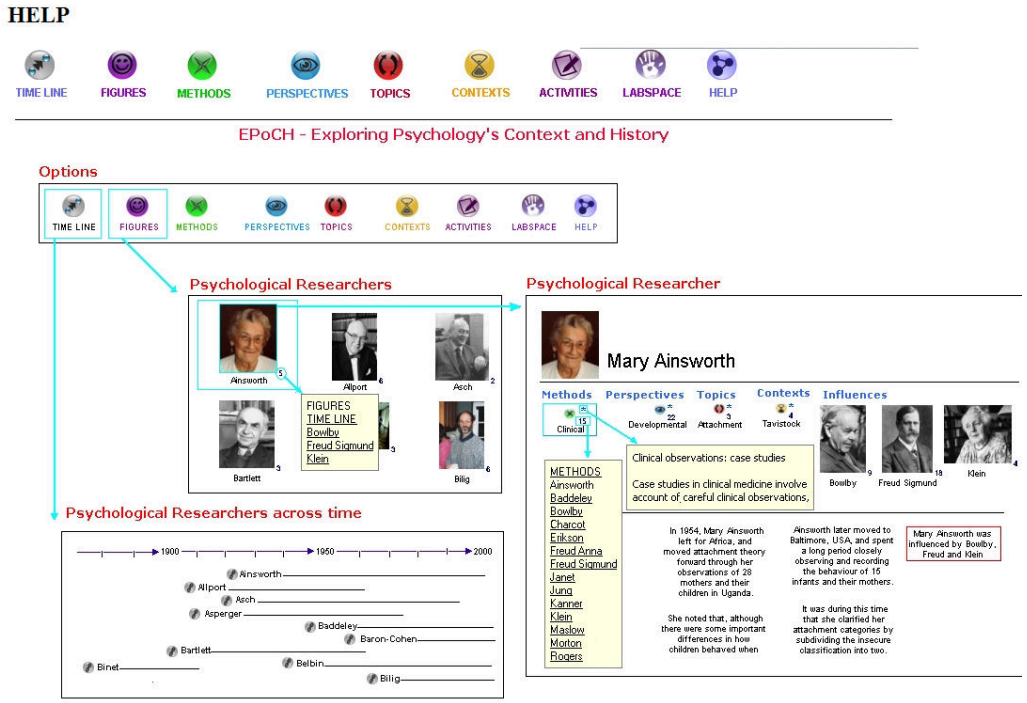

Figure 11. EPoCH delivered as Compendium maps.

The second case study of how mapping methods can enhance the navigation of OER assets focuses on an OpenLearn study unit called Project Management. Once again it required the re-organization of a complex set of original OU teaching materials that delivered large amounts of subject-based information. Similarly to EPoCH, the original Project Management case study materials were supplied internally to the OpenLearn project in the form of a bespoke CD ROM containing the case study resources, along

with extensive associated project management text-based teaching materials. The latter were originally delivered in a print form.

These materials, however, were originally developed by academics from the OU's Business School (OUBS) in conjunction with colleagues in the BBC as part of a practice-centered approach to management education (Fenton-O'Creevy, et al., 2006). They had been previously fully integrated into the MBA program of the OUBS. Both the teaching materials and the CD ROM case study resources had been carefully crafted to match the defined learning design and practice-centered pedagogy of the MBA program.

The Project Management OER, which was reconstructed using Compendium (see Figure 12 for an illustration of the "front page"), comprises a set of maps that present an integrated overview of seven offices and associated staff of the fictitious call-center company called *Y Call*. The main goal of this OER study unit is to develop a business assignment using a particular Project Management approach with the associated Y Call assets that are presented in the various OER maps. Again the Compendium maps can be accessed directly via the associated study unit B713_PM (Compendium, n.d.). The basic Compendium icons were not used for this project and a set of bespoke images were developed to reflect the seven stages of Project Management as well as represent the Project Tools and Help sections.

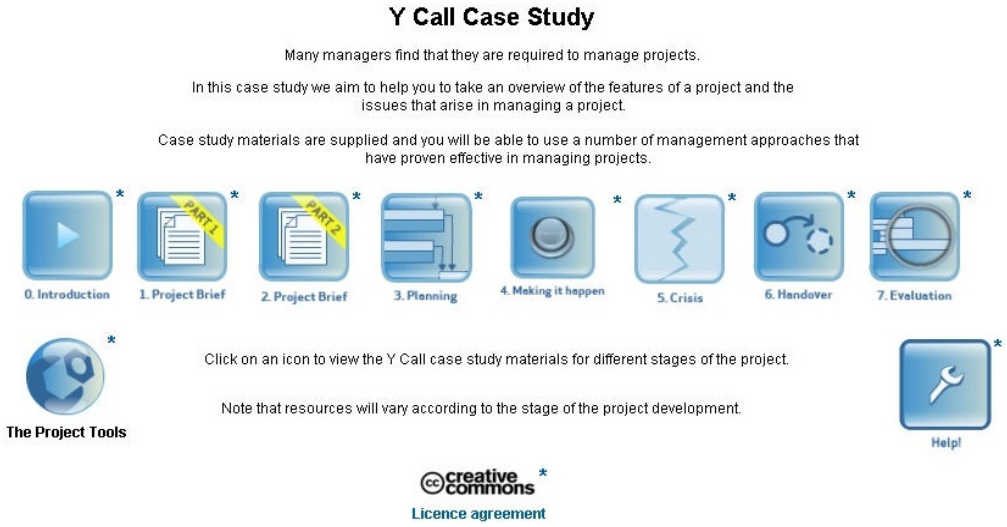

Figure 12. "Front page" Compendium map for the Project Management study unit.

There are seven stages to the Project management case study. The associated assets (described below) are presented *within* the relevant offices of the call center. The navigable maps are based on Y Call's office layout and tailored to each of the seven potential stages of the Project Management assignment. Figure 13 illustrates the Stage 0

introductory map and shows the use of photographs to clarify the relevant staff, their office locations, and the availability of project tools. Each office photo is a "clickable" Compendium icon and selecting any one of them takes the learner into the office revealing further, often media rich, associated assets. The latter vary from office to office and indeed from stage to stage. They take the form of email exchanges, audio messages from answer-phones, short video diaries, or presentations or staff notes.

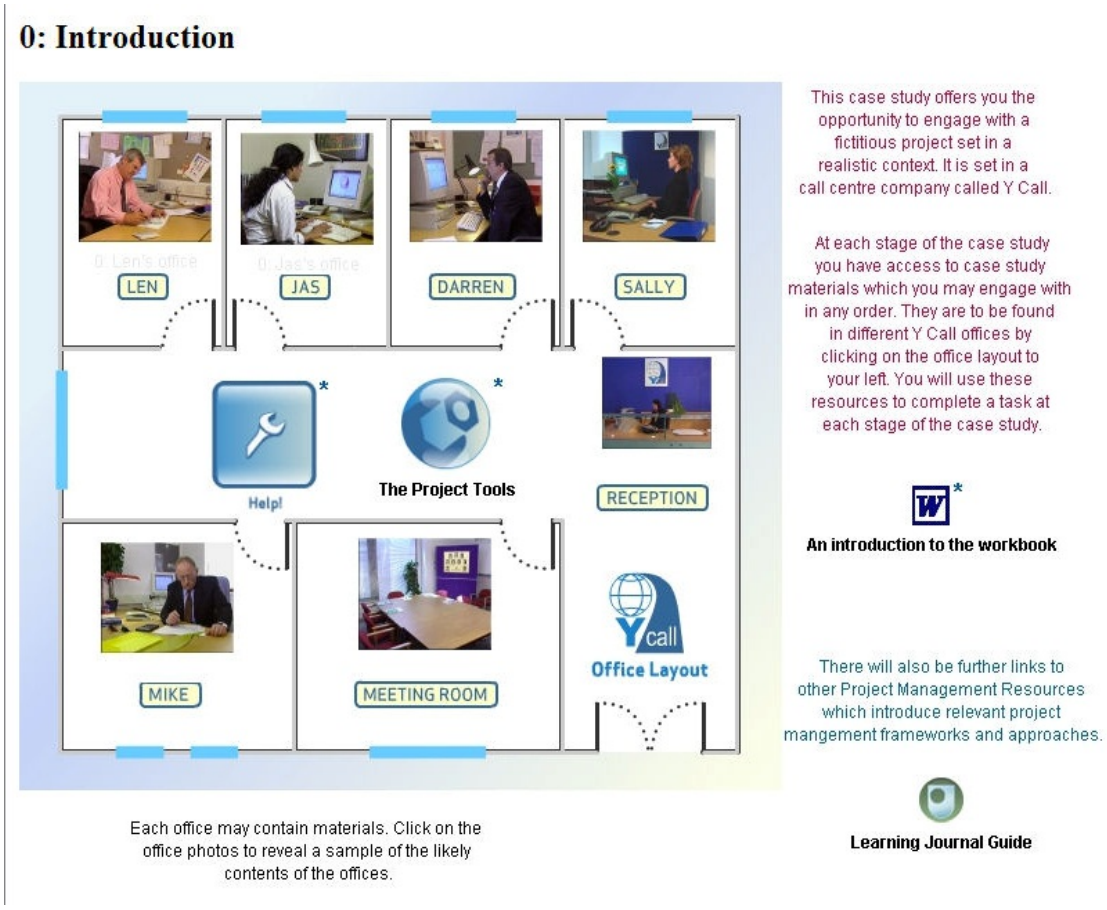

Figure 13. An introduction to the Y Call Project Management stage materials.

As previously mentioned an additional visual aspect of note in this transformation of the original OUBS course materials into a series of dynamic and navigable OER maps, however, was the commissioning as well as use of bespoke Compendium icons to aid the navigation of the assets/resources within the Project Management maps. Figure 14, for example, illustrates the particular icons created to represent the distinct project tools. Each icon represents a snapshot or representation of the associated project tool in a visual form.

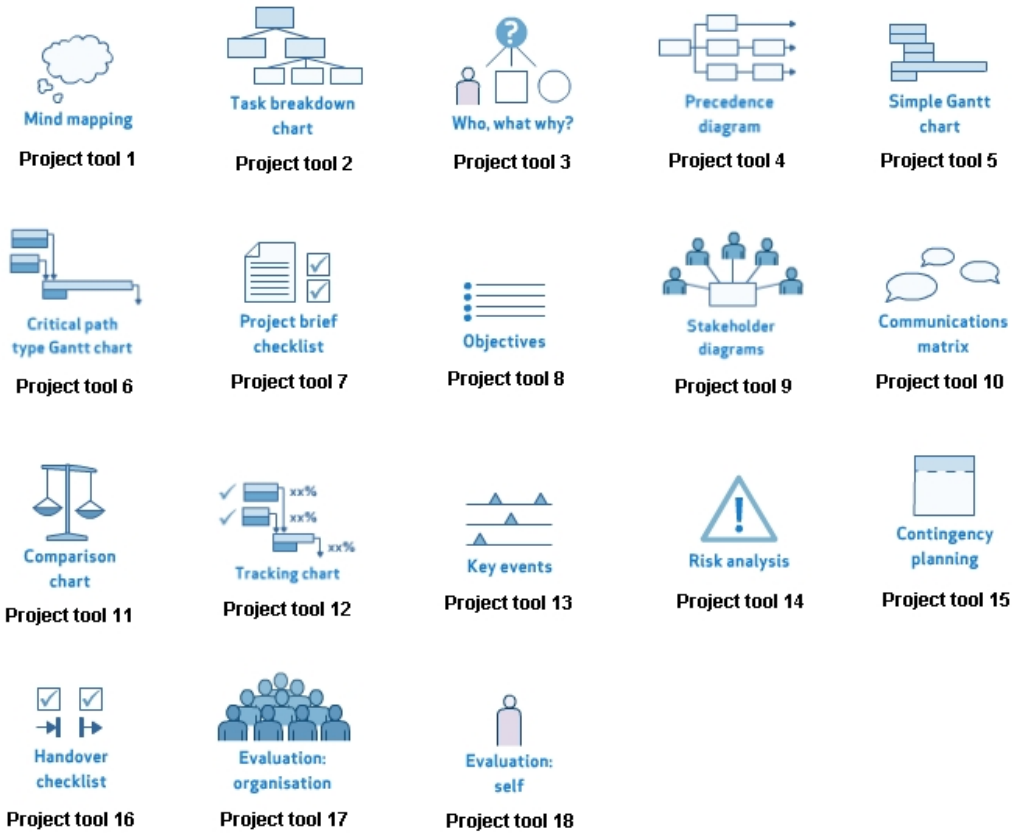

Figure 14. The project tools of Y Call Compendium case study resources.

The development of this bespoke set of visual icons proved to be an invaluable resource as subsequently they were available for reuse elsewhere, invoking the Creative Commons license, such as in further OpenLearn OER projects and in other OU based research projects, for example, the EU funded ICOPER (2012) and OpenScout (2012) projects. Indeed the same can be said for the templates developed for both the EPoCH and Project Management maps also – they lent themselves to repurposing too. In this respect some of the mapping and navigation ideas were also reused in an associated OpenLearn OER unit "Welsh History and its Sources" (See Figure 15 for an illustration of this resource and for access to it, see Welsh History Timeline, n.d.)

The premise of the associated Welsh history timeline was to visualize and map a series of historical events between 1150 and 2010. These events were drawn from the original Open University course "Small Country, Big History: Themes in the History of Wales" and along with other relevant materials offered as a potential OER unit to the OpenLearn project. The Welsh history timeline took the form of a checkerboard map layout with approximately 50-year blocks of historical events being displayed as is illustrated in Figure 15.

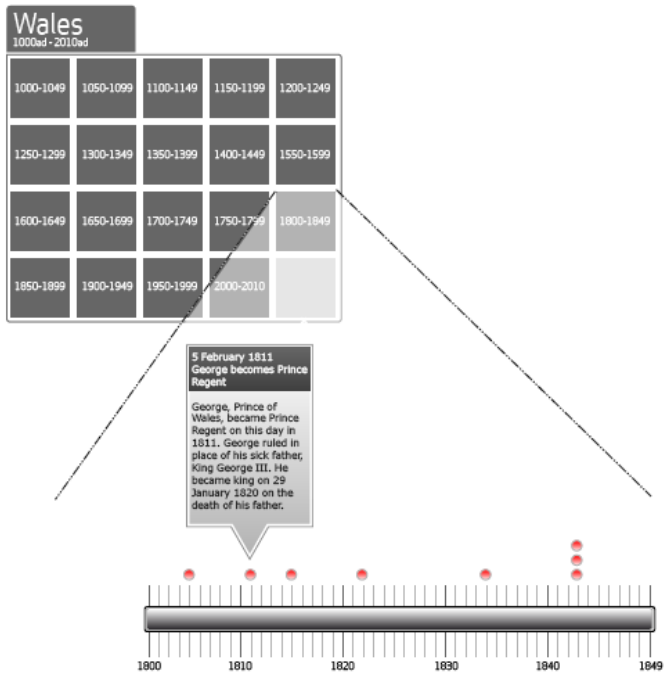

Figure 15. An example of the Welsh history timeline Compendium maps.

Visualization to Enable Learners and Researchers to Make Sense of OER

A further set of visualization mapping approaches had been explored within the OpenLearn team's research report about the project (see McAndrew et al., 2009). These ranged from the use of tools for mapping and talking about research to using the Compendium knowledge mapping software to understand learner narratives. Underpinning this idea was the ability to make sense of such tools in terms of using them to apply/react to action research and activity theory. In the context of the theme of this article, however, one can also see that this work was an application of visual mapping that enhanced these research efforts in terms of offering not only a different view but also, as identified in the report, new ways of thinking, as well as analyzing and describing the research in question. It appeared also that some individual users created their own Compendium maps, for example, one relating to Charles Darwin's natural selection that can be seen at Natural Selection (n.d.). Original Compendium icons were used to represent the Darwinian theory of natural selection in the form of a visual knowledge map.

In this research aspect of OpenLearn the adoption of visualization mapping techniques appeared, once again, to arise out of the opportunity of relevant software (Compendium) not only being actively offered within the actual project but also being a suitable medium to enhance the research and advance the dissemination probabilities

in terms of visualizing findings and results in a map or diagrammatic manner. Output, in terms of a variety of maps, was embedded within the research report and freely available to download under a Creative Commons license. Unfortunately the format of the final report, as presented on the OpenLearn Web site, does not lend itself to reproducing any of those maps here but they can be accessed directly within the report (McAndrew et al., 2009, p. 20).

The knowledge mapping software was also used to understand learner narratives, and, as such, is much clearer to describe. The underlying principle, in this case, being that "mapping allows the user to present in a way that combines text and graphics in a visual dynamic" as well as having the ability to "represent various structures, concepts and their relationships". The researchers go on to argue that the software offered affordances related to editing and molding, thus enabling the multidimensionality, nesting, and layering of information related to OpenLearn as well as offering the possibility of further dynamic links to other interconnected and relevant resources.

Accessibility and Interoperability Issues Arising from these Approaches

The final aspect to consider is the disadvantages related to such visualization methods, especially those that pertain to accessibility and interoperability as these are important issues that may arise from such approaches. Looking firstly at the OpenLearn based visualizations (e.g., MORIL, EPoCH, Project Management, etc.) it was recognized that Compendium is not fully accessible to screen reading software. An Open University's accessibility colleague when examining the EPoCH resource raised this issue. Whilst every effort was made to "label" all icons and linkages it became apparent when the resulting Compendium maps were shared with a wider audience that visually impaired users who needed to employ screen reading software would still have some difficulty in understanding the contents despite best efforts to enhance them with alternative text.

Once again there was not research analyzed work carried out in this respect; rather, a pragmatic approach was taken to try and rectify the identified issues. This took the form of a series of conversations that took place during the re-purposing of the original EPoCH materials into its OER map instantiation. The accessibility colleague offered a number of potential options or avenues to pursue that would enhance the user-friendliness of the resulting Compendium maps and these were followed where possible.

A second, different issue arose when attempts were made to share the Compendium generated maps. It became apparent that there were a number of interoperability issues that also needed to be considered. For example the resulting Compendium maps were created as a downloadable zip file containing a series of linked HTML files. These, it appeared, needed to be imported in a particular order when being shared or installed elsewhere in order that their inherent dynamic links be preserved. In other words a level

of understanding of how the Compendium software functions in respect of import or export was required to preserve the integrity of the resulting maps. Consequently advice pertaining to this issue was offered to any known parties wishing to copy the Compendium maps and reuse them elsewhere.

Accessibility and interoperability were not initially fundamental aspects of any of the described Compendium OER based maps' development but emerged as issues that needed to be considered towards the end of each of the respective projects. In the context of this article only brief details are described here as they appear to influence the openness of the subsequent visualization mapping approaches. This relates directly to the use of screen reader software required by those with visual impairments. It appears that many screen reader software packages are designed to cope with predominantly text-based presentations but likewise appear to be less equipped to do so when working with non-text based materials such as visualizations in the form of map-based illustrations.

Conclusion

This article has attempted to describe the role of visualization mapping approaches in the context of OER developments. The implementation methods were portrayed at a number of different stages, namely, at the macro level, and thus in relation to OER planning and strategy; at the meso level, relating to the design of potential OER study units; and at the micro level, involving the development and display of OER materials for learners and/or educators. In addition some consideration was also given to how such visualization mapping approaches can enable individual learners or educators to navigate through potentially complex collections of often media rich assets and then make sense of the OER published constituents.

It appears that most OER materials tend to be digital in form and often involve the use of multiple media in one form or another. When this is coupled with the increasing availability of mark-up languages and improved access to the Internet, it means that visualization mapping approaches can often be useful to improve OER in many ways. In this respect visualization mapping approaches can enhance the development of, access to, and the navigation of as well as discovery of those OER materials. The majority of OER materials remain heavily text based such that improving the user-friendliness of their content by applying visualization mapping methods can often enhance access to them.

With this in mind one can reflect upon the fact that, in general terms, both teaching and learning are fundamentally about the sensemaking of new information as well as gaining additional subject knowledge. OER can offer access to a wide variety of often-innovative collections of assets and materials frequently presented using open technology. What visualization mapping approaches may add to this OER scenario is an

original method but applied in a way that enables learners and educators to make sense of potentially complex groups of assets and concepts representing information and subjects new to them.

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Specific Visualization Maps and OER Course Links

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http://compendium.open.ac.uk

The DScribe workflow diagram

https://open.umich.edu/wiki/DScribe

The CORRE flowchart

http://projectotter.wordpress.com/2009/08/28/corre-a-framework-for transforming-teaching-materials-into-oers

The MIT OCW course list

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The Y Call Project Management case study materials/map

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