

# **Open Educational Resources: A Review of the Literature**

## **Defining Open Educational Resources**

While a large number of competing definitions of the term “open educational resources” exist, with each focusing on different nuances of the copyright permissions structure or the different motivations for sharing open educational resources, a review of these definitions reveals a common baseline understanding. Educational materials which use a Creative Commons license or which exist in the public domain and are free of copyright restrictions are open educational resources. A rich collection of work and writing underlie this common understanding.

As an emerging construct, a significant amount of the existing literature is dedicated to defining the term open educational resources and clarifying the motivations underlying this body of work (Hylén (2006), OECD (2007), Geser (2007), Atkins, Brown, and Hammond (2007), Baraniuk and Burrus (2008), Gurell and Wiley (2008), Brown and Adler (2008), and Plotkin (2010)). Mike Smith, Director of the Hewlett Foundation Education Program which provided much of the early funding for work in the area of open educational resources, wrote, “At the heart of the open educational resources movement is the simple and powerful idea that the world’s knowledge is a public good and that technology in general and the World Wide Web in particular provide an extraordinary opportunity for everyone to share, use, and reuse that knowledge” (Smith & Casserly, 2006, p. 10).

Writing in 1975, MacKenzie, Postgate, and Scupham said, “Open Learning is an imprecise phrase to which a range of meanings can be, and is, attached. It eludes

definition. But as an inscription to be carried in procession on a banner, gathering adherents and enthusiasts, it has great potential” (p. 15). Rumble (1989) added, “Nearly 15 years later, one has to ask oneself whether there is a greater degree of clarity” (p. 29). In fact, the situation with regard to this word “open” is largely unchanged almost 40 years later.

The most frequently used definition of “open educational resources” comes from the report of the meeting where the term was first coined. In 2002, UNESCO convened the Forum on the Impact of Open Courseware for Higher Education in Developing Countries. It was in this Forum where Saul Fisher from the Andrew W. Mellon Foundation recommended that the group adopt the phrase “open educational resources” to describe the new model of sharing educational materials that had brought the group together. The group agreed and offered the following definition:

The open provision of educational resources, enabled by information and communication technologies, for consultation, use and adaptation by a community of users for non-commercial purposes (UNESCO, 2002, p. 24).

Forum participants set an idealistic goal for the idea of open educational resources later in this same document, inadvertently providing a second definition for the term: “a universal educational resource available for the whole of humanity” (UNESCO, 2002, p. 28). Since 2002, many other definitions have been offered. While none can be considered authoritative, a review of the definitions provides a more nuanced understanding of the term’s meaning.

*Defining the Term “Open”*

Rather than try to define the entire term open educational resources, some researchers split the term up in order to define its components separately. Hylén (2006) problematizes each of the three concepts in the name, questioning what is meant by “open,” “educational,” and “resources,” as do Mulder (2007) and OECD (2007).

Wiley (2010) assumes common understanding of the term educational resources, and argues that open is a matter of (1) cost and (2) copyright licensing and related permissions. For Wiley, open means that a resource is available free of cost and that four permissions (called the “4Rs”) are also made available free of cost. These permissions include:

- Reuse: the right to reuse the content in its unaltered/verbatim form (e.g., make a backup copy of the content)
- Revise: the right to adapt, adjust, modify, or alter the content itself (e.g., translate the content into an- other language)
- Remix: the right to combine the original or revised content with other content to create something new (e.g., incorporate the content into a mashup)
- Redistribute: the right to share copies of the original content, the revisions, or the remixes with others (e.g., give a copy of the content to a friend)

Wenk (2010) repeats the definition put forth by FreedomDefined.org in defining openness:

- The freedom to use the work and enjoy the benefits of using it.

- The freedom to study the work and to apply knowledge acquired from it.
- The freedom to make and redistribute copies, in whole or in part, of the information or expression.
- The freedom to make changes and improvements, and to distribute derivative works (p. 435)

Both the 4Rs framework established by Wiley and the “Freedom Defined” framework promoted by Wenk focus on granting permissions regulated by copyright. This is the reason many definitions of open educational resources include open licenses as a critical component. For example, Patricia, del Rocio, and Elizabeth (2010) define OER as “resources that provide educational content with an open license that facilitates their use, adaptation and modification.”

Tuomi (2006) takes another approach to defining openness, though one still focused on permissions. Tuomi describes OER as “sources of services” that:

- (a) provide non-discriminatory access to information and knowledge about the resource (level I openness)
- (b) the services of which can be enjoyed by anyone with sufficient non-discriminatory capabilities (level II openness)
- (c) can be contributed to (level III openness) (p. 34)

Because definitions of OER place such an emphasis on copyright permissions and licensing, a basic understanding of the most commonly used open licenses, the Creative Commons licenses, is critical to understanding what OER are.

### *Creative Commons Licenses*

In practice, an open educational resource is any educational material that uses a Creative Commons license or resides in the public domain (i.e., outside of copyright regulation). The Educause (2010) report, *7 things you should know about open educational resources*, states that “such materials are generally released under a Creative Commons or similar license that supports open or nearly open use of the content.”

The Creative Commons licenses are comprised of several components which can be mixed in a number of ways. The “Attribution” component (BY for short) requires individuals and organizations that use the openly licensed material to give credit to the original creator of the material. The “ShareAlike” component (SA for short) requires any revised or adapted versions of the material to be licensed under exactly the same Creative Commons license as the original material. The “Noncommercial” (NC for short) component prohibits individuals and organizations from using the material for commercial purposes. These components can be mixed in a number of ways to make different licenses. The most popular licenses for OER include the BY license, the BY-SA license, and the BY-NC-SA license. Creative Commons also provides a “No Derivatives” component (ND for short) which prohibits individuals or organizations from making any changes to materials, but because revise and remix are critical components of all definitions of OER, the ND clause and licenses containing it are not used by the OER community and excluded from the discussion below. A detailed legal overview of the Creative Commons licenses is provided by de Rosnay (2010).

The Creative Commons licenses (Lessig, 2003) used for OER guarantee that (1) users will enjoy no-cost (free) access to the materials and that (2) users have permission to engage in the 4R activities. The Creative Commons license guarantees both *in perpetuity*

(see Section 3., “License Grant,” in any Creative Commons license). In theory, educational materials using other, similarly architected open licenses can be considered OER, but the overwhelming majority of openly licensed material in the world uses the Creative Commons licenses – over 400 million resources as of 2010 (*Creative Commons*, 2011). By comparison, a Google search for the two licenses most commonly used before Creative Commons reveals almost no modern usage - the Open Publication License and GNU Free Documentation License combine for fewer than 5,000 inbound links.

### *OER Definitions Operationalized in Policy*

As the requirement to produce and use OER becomes common in grant policies and programs, a bright line definition of OER becomes necessary for compliance and reporting purposes. The Washington State Board of Community and Technical Colleges’ (2010) policy on Open Licensing on Competitive Grants states that all “digital software, educational resources and knowledge produced through competitive grants, offered through and/or managed by the SBCTC, will carry a Creative Commons Attribution License” (p.4).

At the federal level, the 2010 Trade Adjustment Assistance Community College and Career Training Grant Program (TAACCCT) committed \$2 billion in federal grant funding over four years to “expand and improve their ability to deliver education and career training programs” (p.1). The intellectual property section of the grant program description requires that all educational materials created with grant funding be licensed under a Creative Commons BY license.

### *Summary of OER Definitions*

Educational materials which use a Creative Commons license or which exist in the public domain and are free of copyright (thus providing permission for users to engage in the 4R activities) are open educational resources. Consequently, OER is an overarching term that encompasses open textbooks, opencourseware, and other designations. Open textbooks are simply OER organized as a textbook. Likewise, opencourseware are simply OER organized as online courses.

## **Major Categories of OER Research**

OER research clusters into four categories: models of sharing OER, models of producing OER, the benefits associated with OER, and the challenges associated with OER.

Research in each of these categories is reviewed below.

### *Different Models of Sharing OER*

Open educational resources can be structured and shared in a number of different ways, including being shared as individual OER, being compiled and shared as open textbooks, and compiled and shared as open courseware.

First, like the learning objects that came before them, open educational resources can be tagged with metadata and stored individually in databases or repositories for later discovery and reuse as individual components. Sites such as OER Commons (<http://oercommons.org>) and MERLOT (<http://merlot.org>) take this approach to sharing OER.

Second, open educational resources can also be created or located and then aggregated into more familiar structures like textbooks before distribution. These collections are called “open textbooks.” Flat World Knowledge (<http://flatworldknowledge.com/>) and CK12 (<http://ck12.org>) publish Creative Commons licensed textbooks that can be broken down into individual OER for revising and remixing. Connexions (<http://cnx.org/>) is a Wikipedia-like site that allows users to create individual modules and compile these with modules created by other users to make textbooks (using a “one module equals one chapter” model). PediaPress (<http://pediapress.com/>) allows users to aggregate Wikipedia articles into printable books as well, where each Wikipedia article appears as an individual chapter in the printed book.

Third, open educational resources can be created or located and then aggregated into familiar structures like courses before distribution. These collections are called “open courseware” (OCW). This is the model pioneered by MIT OCW (<http://ocw.mit.edu/>) which created new OER and organized these as courses. This model has since been adopted by the over 200 member institutions of the OpenCourseWare Consortium (<http://ocwconsortium.org/>, Abelson, 2008).

Aggregating individual open educational resources into larger, familiar looking clusters can be key to enabling their reuse, especially among faculty with lower levels of comfort with technology. Open textbooks, for example, have seen adoption at several levels of formal education (Petrides, Jimes, Middleton-Detzner, Walling, & Weiss, 2010). There are successful open textbook initiatives at the high school level in the US (Wiley, 2011c) and South Africa (Petrides and Jimes, 2008), at the community college level (Petrides et al., 2010), and the university level (Hilton and Wiley, 2011).



### *Different Models of Producing OER*

Two primary models for producing open educational resources emerged during 2001. These are the institutional production model (e.g., models used by MIT OCW) and the commons-based peer production model (e.g., the model used by Wikipedia).

The institutional production model of creating open educational resources involves converting or transforming materials used to teach formal classes (either face-to-face or online) into a format appropriate for open sharing. Experts with traditional academic credentials create these materials.

Lane (2006, p.12) describes three variations on the institutional production model: the “integrity model,” where the OER are very similar to the original material and as complete as possible; the “essence model” where the source material is cut back to the essential features before publication as OER; and the “remix model” where source material is used as a starting point for OER that are designed specifically for web based delivery.

While proponents value the expert authorship of institutionally produced OER, critics claim that the model is unsustainably expensive. MIT OCW reports that the original cost to openly publish a course ranges from \$10,000–\$15,000 for courses without video to \$20,000 - \$30,000 per course for which video was published (MIT OCW, 2011a). MIT OCW (2011b) now reports a current average cost of about \$8225 per course for ongoing maintenance-oriented activities.

Johansen and Wiley (2010) report the costs of running other institutionally-based OER programs: approximately \$5,000 per course for Utah State University’s OCW, about

\$34,000 per course for the Open University of the Netherlands' OCW, about \$6,000 for the Open University of the UK's OpenLearn program, and about \$250 per course for Brigham Young University Independent Study's OCW program. Contextual factors including how much content is published and what format the content was originally produced in contribute to the wide variation in costs to publish institutionally created OER.

### *Commons-based Peer Production*

Benkler (2002) describes a new method of creating products, including educational resources, which he calls commons-based peer-production, in which “groups of individuals successfully collaborate on large-scale projects following a diverse cluster of motivational drives and social signals, rather than either market prices or managerial commands” (n.p). Benkler is describing large-scale projects like Wikipedia whose contributors are volunteers that are not motivated by financial interests or employment requirements.

Benkler (2007) later explained that this new means of production is “radically decentralized, collaborative, and nonproprietary,” meaning that an undertaking like Wikipedia has no central coordinator who assigns tasks or tracks their completion and that the results of the group's work are made available to the public under an open license (p. 60). A variety of open educational resources are created and improved using this model. The creation and ongoing improvement of encyclopedia articles in Wikipedia operate on this principle. Benkler (2005) discusses the Wikipedia example at length. The creation and ongoing improvement of open educational resources in the Connexions repository, which is much like Wikipedia, operate on these principles as well (Baraniuk & Burrus, 2008).

Institutional production and commons-based peer production fall at opposite ends of a spectrum. On one end, open educational resources are created and vetted by a highly respected institution like MIT, Stanford, or Yale and published with the institution's imprimatur. On the other end, open educational resources are created and vetted by a decentralized group of individuals who may or may not be credentialed or formally qualified to participate in their creation and vetting and are published under the brand of a website like Wikipedia or Connexions. Several hybrid models exist between the polar institutional and commons-based models. For example, Burgos and Ramirez (2011) describe a model encouraging students to share their homework as OER, which might then be used by other students.

### *Benefits of OER*

Education institutions have mixed incentives for engaging in open educational resources initiatives (Smith, 2009). Some of these incentives are mission-aligned. Hylén (2006) and D'Antoni (2009) provide good overviews of these mission-aligned motivations for producing and sharing OER, including the public outreach mission of publicly-funded universities to educate the entire public whose funding supports their operation.

There are several self-interested reasons institutions and faculty choose to create and share open educational resources that may or may not articulate clearly with the mission of the institution. The majority of the benefit claims in the literature fall into this category. For example, Caudill (2011) claims that access to OER makes the course development process quicker and easier – a claim that is echoed elsewhere (e.g., Hylén, 2006). Describing the Open University of the UK context, Hodgkinson-Williams (2010)

notes the significant international attention, improved public relations, improved relationships with strategic partners, and improved internal publishing and production capabilities that come from well-publicized OER projects. Steve Carson (2006) describes these same benefits in the MIT OpenCourseWare context, while also demonstrating that MIT OCW positively influences freshmen decisions to attend MIT.

Lynn, Muzellec, and Burton (2010) explain from an economic perspective how “hybrid message and product (brand) placement concepts could be applied to open education resources by HEI [higher education institution] brands and be used to justify investment by HEIs in OER development on marketing grounds” (p.8). They go on to demonstrate an applied instance of this concept, showing that distance learning programs can actually increase revenue using OER as a marketing channel. This particular form of cost recovery for OER programs has been the subject of a growing amount of research, as reported by Johansen and Wiley (2010). Almost 2% of Open University of the UK enrollments over a two year period came from OCW users who became paying university students. The Open University of the Netherlands reported 18% of users of its OCW site were “inspired to purchase an academic course.” The University of California-Irvine (UCI) also reported that their OCW site consistently generates more sales leads for their online courses than any other form of advertising. After reviewing this literature, Johansen and Wiley (2010) demonstrate in financial detail an empirically validated model for increasing distance education enrollments using open educational resources – enough revenue to more than pay for the cost of the open sharing efforts.

The financial benefits that accrue to students who use open educational resources has been the subject of study as well. Hilton and Wiley (2011) received full access to the sales records of Flat World Knowledge, a commercial publisher of open textbooks. These

textbooks are both available to be read online for free under a Creative Commons BY-NC-SA license and are available for purchase in print, audio, and other formats. After reviewing the sales database, Hilton and Wiley report that about 30% of students whose faculty formally adopted a Flat World Knowledge textbook purchased a printed copy of a Flat World textbook, while about 20% purchased a digital product through the company's web store. With approximately 50% of students opting to read the assigned texts online for free and not purchase anything, and the average purchase amount for the other 50% being around \$30, Hilton and Wiley report that students clearly save a significant amount of money under this model compared to the typical \$150 college textbook.

## **Challenges for OER**

In addition to ongoing research in sharing models, production models, and the benefits of OER, a number of unresolved issues remain open for future researchers to tackle. These include making OER easier for people to find (the discovery problem), making OER programs financially self-sustaining (the sustainability problem), dealing with the pervasive perception that, because they are free, OER are necessarily of inferior quality (the quality problem), improving our understanding of how to make OER more useful in a wide range of contexts (the localization problem), and understanding why people don't exercise their revise and remix permissions in OER (the remix problem). These five difficulties structure the discussion of research challenges that follows.

### *The Discovery Problem*

Like the learning objects that came before them, OER can be difficult to find. Learning objects researchers undertook a significant amount of technical work on metadata and

other standards and specifications in order to make learning objects easier to find (e.g., the IEEE Learning Objects Metadata standard). OER researchers build on top of this work with efforts like the Learning Resource Metadata Initiative (LRMI, 2011) which maps IEEE Learning Objects Metadata and Dublin Core fields focusing on licensing information and educational outcomes (like the Common Core standards for US K-12) into the Schema.org metadata framework to be used by major search engines like Bing, Google, and Yahoo. Being enabled to search the internet by license and learning outcome would be a significant step forward for making OER easier to find.

Researchers try to make OER easier to find by implementing both conventional and advanced discovery solutions. Traditional approaches like referatories, sites that index and provide links to OER across the web (e.g., <http://oercommons.org> or <http://ocwfinder.org>), are quite common. Minguillón and Rodríguez (2010) show how conventional social networking features, like tagging, rating, and commenting, can be integrated into open educational resources collections in order to make finding OER easier.

More advanced services, like recommender systems, have also been created to help user find the “right” open educational resources. Duffin and Muramatsu (2008) describe an OER recommender service that provides content-based recommendations along the lines of ‘if you like this OER, you might also like that OER.’ Kalz, Drachsler, van Bruggen, Hummel and Koper (2008) describe another OER recommender service created in the context of the EU TENCompetence program.

Despite ongoing research in the area of discovery, finding the right OER remains a challenging task (Kalz, Drachsler, van Bruggen, Hummel and Koper, 2008) that needs significant additional effort from researchers.

### *The Sustainability Problem*

Numerous articles have been dedicated to the topic of the sustainability of open educational resource programs, attempting to answer the question ‘how does one continue to fund, on an ongoing basis, a program whose goal is to give things away for free?’ Dholakia, King, and Baraniuk, (2006), Downes (2007), Koohang and Harman (2007), Wiley (2006a) have all written at length on the topic, each proposing overlapping taxonomies of sustainability or business models such as the public radio model (voluntary user contributions) and the “give away the razor, sell the blade” model.

The concern with sustainability is well grounded. For example, after the US economy entered a recession in the late 2000s, at least one major opencourseware initiative was forced to close (Parry, 2009). Pegler (2010) writes, “evidence of sustainability, or the potential to achieve this, is increasingly a pre-requisite for engaging in OER activity, whether imposed by funders, by institutions requiring a ‘business case’, or practitioners themselves” (p. 2).

Some of the business model-related writing about OER has been conceptual, lacking specific financial data (e.g., (Pegler, 2010)). Dholakia, King, and Baraniuk (2006) argue that “unless the OEP site is able to *first* gain and maintain a critical mass of active, engaged users, and provide substantial and differentiated value to them in its start-up and growth phases, then none of the available and/or chosen revenue models will be likely to

work for the OEP in the long run.” In other words, if a site can’t engage and keep users, there is no need to worry about sustaining it in the long term.

Other research has focused more on the finances of OER, exploring specific impacts on institutional revenue. For example, (Hilton and Wiley, 2011) describe the income and costs associated with operating the for-profit publisher Flat World Knowledge in detail, examining the potential sustainability of the venture. Helsdingen, Janssen, and Schuwer (2010) also provide specific financial detail about the cost and impact of an opencourseware initiative on an online course provider, as do Johansen and Wiley (2010). These authors identify promising models that appear to work at relatively small scale and in a single context. Many more scaling up and verifying iterations of this work need to be conducted before the field can claim to have robust knowledge in the area of sustaining OER initiatives.

### *The Quality Problem*

There are two aspects to the quality problem faced by OER researchers. The first is related to the common saying “you get what you pay for.” Although the no significant difference phenomenon evident in media comparison studies is well documented (e.g., <http://www.nosignificantdifference.org/>), proponents of OER sometimes struggle to demonstrate that these freely available materials can be of equal or greater instructional effectiveness when compared to more expensive alternatives. The discovery problem relates to the quality problem. One can easily find 2,840,000 OER in Google relating to “biology,” but which of these are high quality? When it is difficult to find high quality OER, it is difficult to argue persuasively that they exist.



Computational approaches to automatically assessing the quality of resources have shown promise (e.g., Bethard, Wetzler, Butcher, Martin, & Sumner, 2009; Custard and Sumner, 2005), though these techniques necessarily work only for a very specific operationalization of the construct “quality.” Other sites allow users to assign a 1-5 star rating to OER in order to signal the quality of materials to future searchers (e.g., <http://merlot.org/>). Whether the quality of an open educational resource is assessed by a human or machine, one-size-fits-all quality ratings fail to recognize that quality is not a property of an open educational resource alone. The quality of an open educational resource is a joint property of a resource-and-user, the way that item difficulty and learner ability are linked in item response theory (Kelty, Burrus, and Baraniuk, 2008). An OER that is very high quality for an English-speaking community college student may be poor quality for a German-speaking university student.

### *The Localization Problem*

Localization is one of the most important and least understood aspects of open educational resources. Once a user succeeds in finding appropriate resources, those resources likely need to be adapted before they are used. Lane (2006) defines localization as “re-contextualisation of content for the particular situation in which it is experienced by the learner” (p. 16). Smith (2009) describes how “the act of modifying an OER to meet language, cultural, or readiness requirements increases useful access and may be a creative learning endeavor” increases the usefulness of OER (p.89). However, while one of the primary goals of openly licensing materials is to enable any future users to refactor the materials to meet their needs, this does not guarantee that eventual reusers will be sufficiently competent in the technical or pedagogical skills necessary to make needed changes. The possibility of changing open educational resources so that they function

worse for the intended users is always present. Ivins (2011) examines the Nepalese context to determine the factors most salient to the process of localizing open educational resources in the developing world, concluding that “only a local can localize.” Westerners simply do not possess the religious, cultural, and other local knowledge necessary to customize open educational resources for optimal use in Nepal. Building local capacity to engage in what are essentially user-design activities is necessary before OER can provide meaningful educational opportunities for the Nepalese.

### *The Remix Problem*

While authors and creators go to great lengths to correctly license open educational resources, there is little empirical evidence that people actually exercise the additional 4R permissions granted by the Creative Commons licenses. Lane and McAndrew (2010) list several types of reuse – as-is reuse, technical adaptations, linguistic adaptations, cultural adaptations, pedagogical adaptations, and annotation as a form of reuse, but concludes, “the idealised cycle of adoption, reworking and retribution has only had limited success” (p. 8).

Duncan (2009) found that, in the entire collection of over 5,000 modules in the Connexions OER repository, only 15 had been used, translated, or modified more than five times. Examining the same collection, Petrides et al. (2008) also found that significant modification or revision of materials created by others happened very rarely. The Connexions repository may be a best-case research context because the site provides users with tools for revising and remixing OER inside the system, where data can be collected and analyzed.

Reuse can be extremely difficult because pedagogical and other design assumptions are rarely visible. Conole, McAndrew, and Dimitriadis (2010) describe tools that encourage people to separate their designs or pedagogical patterns from specific educational artifacts and upload these designs to a repository for examination and reuse. However, this approach has yet to yield significant uptake by users.

## **Future Directions for Open Educational Resources**

Open educational resources research will likely continue in the areas identified above. However, open educational resources are also influencing neighboring areas of educational research and these crossover efforts are likely to play an important role in future research. Two areas that merit particular attention include open education policy and open assessment.

A number of nations and states have formally adopted or announced policies relating to the adoption of OER and open textbooks. The Open Policy Registry (<http://oerpolicies.org/>) lists several dozen national, state, province, and institutional policies relating to OER, including policies like a national open licensing framework and a policy explicitly permitting public school teachers to share materials they create in the course of their employment under a Creative Commons license. The overwhelming majority of these policies were implemented in 2009 or after. During June 2012, UNESCO convened a World Open Educational Resources Congress and released a 2012 Paris OER Declaration “calling on Governments to support the development and use of OERs” (UNESCO, 2012). The creation, adoption, and impact of OER policies will warrant ongoing research.

Surprisingly little work has been done in the area of open assessment. As of early 2012, there does not appear to be a single initiative dedicated to creating and sharing openly licensed assessment items in standard formats (like the IMS Question and Test Interoperability format) for use with existing open educational resources. However, if open educational resources are ever to reach their potential, they will need to be paired with open assessment resources that can serve formative and summative assessment roles for learners. This should be an area of intensifying activity and research over the next decade.

## **Conclusion**

While the idea of open educational resources is relatively young, a vibrant literature is growing up around the concept. While no single definition is universally accepted, the literature reveals a broad consensus regarding the central features characterizing an open educational resource. A small but growing body of evidence is substantiating claims made by proponents of OER, but many obstacles remain to be overcome if this latest educational technology is to fulfill its potential.

## **References**

- Abelson, H. (2008). The creation of opencourseware at MIT. *Journal Of Science Education And Technology*, 17(2), 164-174. doi: 10.1007/s10956-007-9060-8
- Allen, N. (2010). A cover to cover solution: How open textbooks are the path to textbook affordability. Retrieved from <http://www.studentpirgs.org/textbooks-reports/a-cover-to-cover-solution>

- \* Atkins, D. E., Brown, J. S., & Hammond, A. L. (2007). *A review of the open educational resources (OER) movement: Achievements, challenges, and new opportunities*. Report to The William and Flora Hewlett Foundation (pp. i-84). Retrieved from <http://www.educause.edu/Resources/AReviewoftheOpenEducationalRes/162444>
- Baraniuk, R. G., & Burrus, C. S. (2008). Viewpoint - Global warming toward open educational resources. *Communications of the ACM*, 51, 30-32.
- Benkler, Y. (2002). Coase's penguin, or, linux and "The nature of the firm". *The Yale Law Journal*, 112, 369-446. Retrieved from <http://www.benkler.org/CoasesPenguin.html>
- \* Benkler, Y. (2005). Common wisdom: Peer production of educational materials. In D. Wiley (Ed.), *Advancing the Effectiveness and Sustainability of Open Education*, Instructional Technology Institute (p. 28). Utah State University: COSL Press.
- Benkler, Y. (2007). *The wealth of networks: How social production transforms markets and freedom*. New Haven and London: Yale University Press.
- Bethard, S., Wetzler, P., Butcher, K., Martin, J., & Sumner, T. (2009). Automatically characterizing resource quality for educational digital libraries. In F. Heath, Rice-Lively & R. Furuta (Eds.), *JCDL '09: Proceedings of the 9th ACM/IEEE-CSK Joint Conference on Digital Libraries* (pp. 221-230). Austin, TX: ACM Press.
- Bonk, C. J. (2009). The world is open for a reason: Make that 30 reasons! *eLearn*, 7. Retrieved from <http://elearnmag.acm.org/featured.cfm?aid=1595436>  
doi:10.1145/1595389.1595436
- Bossu, C. (2010, November). *Analysing the development of institutional policies for sustainability and quality of OERs with a focus on the Australian context*. Paper presented at the Pan-Commonwealth Forum on Open Learning: Access and Success in Learning: Global Development Perspectives, Kochi, India.

- \* Brown, J. S., & Adler, R. (2008). Minds on fire: Open education, the long tail, and learning 2.0. *Educause Review*, 43, 16-32.
- Buckingham Shum, S., & Ferguson, R. (2010, November). *Towards a social learning space for open educational resources*. Paper presented at the Seventh Annual Open Education Conference, Barcelona, Spain.  
<http://oro.open.ac.uk/23351/1/OpenEd2010-SocialLearn.pdf>
- Burgos, J. V., & Ramirez, M. S. (2011). *Academic knowledge mobilization to promote culture change towards openness in education*. Manuscript submitted for publication.
- Carson, S. (2006). *2005 Program Evaluation Findings Report*. Cambridge, MA: Massachusetts Institute of Technology.
- Carson, S., & Forward, M. (2010). Development of the OCW Consortium. *Education Engineering (EDUCON), 2010 IEEE*, 1657-1660. doi: 10.1109/EDUCON.2010.5492401
- Caswell, T., Henson, S., Jensen, M., & Wiley, D. (2008). Open content and open educational resources: Enabling universal education. *The International Review of Research in Open and Distance Learning*, 9(1), 1-11.
- Caudill, J. (2011). Using OpenCourseWare to enhance on-campus educational programs. *TCC worldwide online conference refereed proceedings* (43-47).  
<http://etec.hawaii.edu/proceedings/2011/>
- Christie, A., Pollitz, J. H., & Middleton, C. (2009). Student strategies for coping with textbook costs and the role of library course reserves. *portal: Libraries and the Academy*, 9(4), 491-510. doi: 10.1353/pla.0.0077
- Conole, G., McAndrew, P., & Dimitriadis, Y. (2010). The role of CSCL pedagogical patterns as mediating artefacts for repurposing Open Educational Resources. In F. Pozzi & D. Persico (Eds.), *Techniques for fostering collaboration in online*

- learning communities: Theoretical and practical perspectives* (206-223). Hershey, USA: IGI Global.
- Creative Commons Corporation. (2011). *The power of open*. Retrieved from <http://thepowerofopen.org/>
- Custard, M., & Sumner, T. (2005). Using machine learning to support quality judgments. *D-Lib Magazine*, 11(10). Retrieved from <http://www.dlib.org/dlib/october05/custard/10custard.html>  
doi:10.1045/october2005-custard
- D'Antoni, S. (2009). Open educational resources: Reviewing initiatives and issues. *Open Learning: The Journal of Open and Distance Learning*, 24(1), 3-10. doi: 10.1080/02680510802625443
- Davis, H. C., Carr, L. A., Hey, J. M., Howard, Y., Millard, D., Morris, D., & White, S. (2010). Bootstrapping a culture of sharing to facilitate open educational resources. *IEEE Transactions on Learning Technologies*, 3(2), 96-109. doi: 10.1109/TLT.2009.34
- de Rosnay, M. D. (2010). *Creative commons licenses legal pitfalls: Incompatibilities and solutions*. Amsterdam, Netherlands: Institute for Information Law. Retrieved from [http://www.ivir.nl/creativecommons/CC\\_Licenses\\_Legal\\_Pitfalls\\_2010.pdf](http://www.ivir.nl/creativecommons/CC_Licenses_Legal_Pitfalls_2010.pdf)
- Dholakia, U., King, J., & Baraniuk, R. (2006). What makes an open education program sustainable? The case of connexions. *Connexions/OECD*. Retrieved from [www.oecd.org/dataoecd/3/6/36781781.pdf](http://www.oecd.org/dataoecd/3/6/36781781.pdf)
- Dimitriadis, Y., McAndrew, P., Conole, G., & Makriyannis, E. (2009, December). *New design approaches to repurposing open educational resources for collaborative learning using mediating artefacts*. Paper presented at ascilite 2009: Same Places, Different Spaces, Auckland, New Zealand.  
<http://oro.open.ac.uk/id/eprint/19378>

- Downes, S. (2007). Models for sustainable open educational resources. *Interdisciplinary Journal of Knowledge and Learning Objects*, 3. p. 29-44.  
<http://www.ijello.org/Volume3/IJKLOv3p029-044Downes.pdf>
- Duffin, J., & Muramatsu, B. (2008). *OER recommender: linking nsdl pathways and opencourseware repositories*. Paper presented at the Proceedings of the 8th ACM/IEEE-CS joint conference on Digital libraries, Pittsburgh, PA. Retrieved from <http://doi.acm.org/10.1145/1378889.1378994>
- Duncan, S. M. (2009). *Patterns of learning object reuse in the Connexions repository*, PhD Thesis, Utah State University, USA. Retrieved January 6, 2010, from <http://www.archive.org/details/PatternsOfLearningObjectReuseInTheConnexionsRepository>
- Duval, E., & Wiley, D. (2010). Guest editorial: Open educational resources. *IEEE Transactions on Learning Technologies*, 3(2), 83-84. doi: 10.1109/TLT.2010.11
- Educause. (2010). 7 things you should know about open educational resources. Retrieved from <http://www.educause.edu/Resources/7ThingsYouShouldKnowAboutOpenE/205913>
- FWK. (2011). Flat World Knowledge website. <http://flatworldknowledge.com/>
- Friesen, N. (2009). Open educational resources: New possibilities for change and sustainability. *The International Review of Research in Open and Distance Learning*, 10(5). Retrieved from <http://www.irrodl.org/index.php/irrodl/article/view/664/1388>
- Fulantelli, G., Gentile, M., Taibi, D., & Allegra, M. (2008). The open learning object model to promote open educational resources. *Journal Of Interactive Media In Education*, 2008(1), 1-11. Retrieved from <http://jime.open.ac.uk/article/2008-9/344>



- Geith, C., & Vignare, K. (2008). Access to education with online learning and open educational resources: Can they close the gap? *Journal of Asynchronous Learning Networks*, 12(1), 105-126. Retrieved from [http://sloanconsortium.org/publications/jaln\\_main?page=2](http://sloanconsortium.org/publications/jaln_main?page=2)
- Geser, G. (2007). Open educational practices and resources: OLCOS roadmap 2012 (1-149). Retrieved from <http://www.olcos.org/english/roadmap/download/>
- Gourley, B., & Lane, A. (2009). Re-invigorating openness at The Open University: The role of open educational resources. *Open Learning: The Journal of Open and Distance Learning*, 24(1), 57-65. Retrieved from <http://www.tandfonline.com/doi/abs/10.1080/02680510802627845>  
doi:10.1080/02680510802627845
- Green, C. (2011). SLOAN Conference - OER Track. Retrieved from <http://blog.oer.sbctc.edu/2011/03/sloan-conference-oer-track.html>
- Gurell, S., & Wiley, D. (2008). OER Handbook for Educators (pp. 1-284). Retrieved from [http://wikieducator.org/OER\\_Handbook/educator\\_version\\_one](http://wikieducator.org/OER_Handbook/educator_version_one)
- Hawkridge, D., Armellini, A., Nikoi, S., Rowlett, T., & Witthaus, G. (2010). Curriculum, intellectual property rights and open educational resources in British universities—and beyond. *Journal of Computing in Higher Education*, 22(3), 162-176. Retrieved from <http://hdl.handle.net/2381/9073> doi:10.1007/s12528-010-9036-1
- Helsdingen, A., Janssen, B., & Schuwer, S. (2010). *Business models in OER, a Contingency Approach*. Paper presented at the Open Ed 2010 Conference, Barcelona, Spain. <http://openaccess.uoc.edu/webapps/o2/handle/10609/5039>
- Hilton III, J. L., & Wiley, D. (2011). Open access textbooks and financial sustainability: A case study on Flat World Knowledge. *The International Review*

- of Research in Open and Distance Learning*. Retrieved from <http://www.irrodl.org/index.php/irrodl/article/view/960/1869>
- Hilton III, J., & Wiley, D. (2010a). The creation and use of open educational resources in Christian higher education. *Christian Higher Education*, 9, 49-59. doi: 10.1080/15363750903181906
- Hilton III, J., & Wiley, D. (2010b). A sustainable future for open textbooks? The Flat World Knowledge story. *First Monday*, 15(8). Retrieved from <http://www.firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2800/2578>
- Hodgkinson-Williams, C. (2010). *Benefits and challenges of OER for higher education institutions*. Paper presented at the Open Educational Resources (OER) Workshop for Heads of Commonwealth Universities, Capetown, South Africa. Retrieved from [http://www.col.org/SiteCollectionDocuments/OER\\_BenefitsChallenges\\_presentation.pdf](http://www.col.org/SiteCollectionDocuments/OER_BenefitsChallenges_presentation.pdf)
- \* Hylén, J. (2006). *Open educational resources: Opportunities and challenges*. Paper presented at the Open Education 2006: Community, Culture, and Content, Logan, UT.
- ICDE. (2011). Definition of Open Educational Practices. [http://www.icde.org/en/resources/open\\_educational\\_quality\\_initiative/definition\\_of\\_open\\_educational\\_practices/](http://www.icde.org/en/resources/open_educational_quality_initiative/definition_of_open_educational_practices/)
- \* Iiyoshi, T. & Kumar, V. M. S. (Eds.). (2008). *Opening up education*. Cambridge, MA: The MIT Press. Retrieved from <http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=11309&mode=toc>
- Ivins, T. Z. (2011). *Localization of Open Educational Resources (OER) in Nepal: Strategies of Himalayan Knowledge-Workers*. Brigham Young University.

Retrieved from

<http://contentdm.lib.byu.edu/cdm/singleitem/collection/ETD/id/2651/rec/1>

- \* Johansen, J., & Wiley, D. (2010). A sustainable model for OpenCourseWare development. *Educational Technology Research and Development*, 59, 369-382. doi: 10.1007/s11423-010-9160-7
- Johnstone, S. (2005). Open educational resources serve the world. *Educause Quarterly*, 28(3), 15-18.
- Kallonis, P., & Sampson, D. G. (2010). *Examining learning object repositories from a knowledge management perspective*. Paper presented at the 2010 IEEE 10th International Conference on Advanced Learning Technologies (ICALT), Sousse, Tunisia.
- Kalz, M., Drachsler, H., van Bruggen, J., & Hummel, H. (2008). Wayfinding services for open educational practices. *International Journal of Emerging Technologies in Learning*, 3(2), 24-28. Retrieved from <http://online-journals.org/i-jet/issue/view/11>
- Keats, D. (2009). The road to free and open educational resources at the university of the western cape: A personal and institutional journey. *Open Learning: The Journal of Open and Distance Learning*, 24(1), 47-55. doi: 10.1080/02680510802627829
- Kelty, C., Burrus, C., & Baraniuk, R. (2008). Peer review anew: Three principles and a case study in postpublication quality assurance. *Proceedings of the IEEE, special issue on Educational Technology*, 96(6), 1000-1011. Retrieved from <http://cnx.org/news/news/peer-review-anew-ProcIEEE-june08.pdf> doi:10.1109/JPROC.2008.921613
- Klebl, M. (2010). *Dissecting open educational resources: An exemplar for the technological blind spot of educational science*. Paper presented at the EASST 2010 Conference, Trento, Italy.

- Koohang, A., & Harman, K. (2007). Advancing sustainability of open educational resources. *Issues in Informing Science and Information Technology*, 4, 535-544. Retrieved from <http://www.oercommons.org/community/advancing-sustainability-of-open-educational-resources/view>
- Lane, A. (2006). *From pillar to post: exploring the issues involved in re-purposing distance learning materials for use as Open Educational Resources*. OpenLearn working paper. Retrieved from <http://kn.open.ac.uk/public/document.cfm?docid=9724>
- Lane, A., & McAndrew, P. (2010). Are open educational resources systematic or systemic change agents for teaching practice? *British Journal of Educational Technology*, 41(6), 952–962. doi: 10.1111/j.1467-8535.2010.01119.x
- Larson, R. C., & Murray, M. E. (2008). Open educational resources for blended learning in high schools: Overcoming impediments in developing countries. *Journal of Asynchronous Learning Networks*, 12(1), 85-103. Retrieved from [http://sloanconsortium.org/publications/jaln\\_main?page=2](http://sloanconsortium.org/publications/jaln_main?page=2)
- Lessig, L. (2003). *The creative commons*. Dunwoody Distinguished Lecture in Law. Gainesville, FL: Florida Law Review.
- LRMI (2011). Learning resource metadata initiative. Retrieved from <http://www.lrmi.net/>.
- MacKenzie, N., Postgate, R., & Scupham, J. (1975). *Open learning - systems and problems in post-secondary education*. Paris, France: UNESCO.
- Mackintosh, W., McGreal, R., & Taylor, J. (2011). *Open Education Resources (OER) for assessment and credit for students project: Towards a logic model and plan for action*. Athabasca University.

- Minguillón, J., & Rodríguez, M. (2010). Extending learning objects by means of social networking. *Lecture Notes in Computer Science*, 6483/2010, 220-229. DOI: 10.1007/978-3-642-17404-0\_23
- MIT OCW (2011a). About MIT OCW. Retrieved from <http://ocw.mit.edu/about/>
- MIT OCW (2011b). Why Donate? Retrieved from <http://ocw.mit.edu/donate/why-donate/>
- Mulder, F. (2007). The advancement of Lifelong Learning through Open Educational Resources in an open and flexible (self) learning context. *Accessed on March*. Retrieved from [http://www.ou.nl/Docs/Campagnes/SCOP/OER\\_paper\\_by\\_Fred\\_Mulder.pdf](http://www.ou.nl/Docs/Campagnes/SCOP/OER_paper_by_Fred_Mulder.pdf)
- National Knowledge Commission. (2009). *National knowledge commission report to the nation 2006-2009*. Government of India, New Delhi, India. Retrieved from <http://www.knowledgcommission.gov.in/reports/report09.asp>.
- \* OECD. (2007). Giving knowledge for free: The emergence of open educational resources. Retrieved from <http://www.oecd.org/dataoecd/35/7/38654317.pdf>
- Parry, M. (2009). Utah State U.'s OpenCourseWare closes because of budget woes. *The Chronicle of Higher Education*. Retrieved from <http://chronicle.com/blogs/wiredcampus/utah-state-us-opencourseware-closes-because-of-budget-woes/7913>
- Patricia, C. C. S., del Rocio, R. M. G., & Elizabeth, R. P. A. (2010). OER's production cycle with social authorship and semantic tools. *Education Engineering (EDUCON), 2010 IEEE*, 121-128. doi: 10.1109/EDUCON.2010.5492588
- Pegler, C. (2010). *Building a manifesto for OER sustainability: UK experiences*. Paper presented at the Open Ed Conference 2010, Barcelona, Spain. <http://hdl.handle.net/10609/5141>
- Petrides, L., & Jimes, C. (2008). Building open educational resources from the ground up: South Africa's free high school science texts. *Journal of Interactive Media in*

- Education*, 2008(1). Retrieved from  
<http://jime.open.ac.uk/jime/article/view/2008-7>
- Petrides, L., Jimes, C., Middleton-Dezner, C., Walling, J., & Weiss, S. (2010). Open textbook adoption and use: Implications for teachers and learners. *Open Learning: The Journal of Open, Distance and e-Learning*, 26(1), 39-49. doi: 10.1080/02680513.2011.538563
- Petrides, L., Nguyen, L., Jimes, C., & Karaglani, A. (2008). Open educational resources: Inquiring into author use and reuse. *International Journal of Technology Enhanced Learning*, 1(1/2), 98-117. Retrieved from  
<http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.177.3589>  
doi:10.1504/IJTEL.2008.020233
- Piedra, N., Chicaiza, J., Lopez, J., Tovar, E., & Martínez, O. (2009). *Open educational practices and resources based on social software: UTPL experience*. Paper presented at the Euro American Conference on Telematics and Information Systems: New Opportunities to Increase Digital Citizenship (EATIS '09), Prague, Czech Republic.
- Pirkkalainen, H., Thalmann, S., Pawlowski, J., Bick, M., Philipp, H., & Ha, K.-H. (2010). *Internationalization processes for open educational resources*. Paper presented at the Workshop on Competencies for the Globalization of Information Systems in Knowledge-Intensive Settings, 1st International Conference on Software Business, ICSOB 2010, Jyväskylä, Finland.
- Plotkin, H. (2010). *Free to learn: An open educational resources policy development guidebook for community college governance officials*. San Francisco: Creative Commons. Retrieved from  
[http://wiki.creativecommons.org/Free\\_to\\_Learn\\_Guide](http://wiki.creativecommons.org/Free_to_Learn_Guide)

- Remmele, B. (2011). Degrees for open learning? *eLearning Papers*, 1-11. Retrieved from <http://www.elearningpapers.eu/en/article/Degrees-for-Open-Learning%3F>
- Rumble, G. (1989). 'Open learning', 'distance learning', and the misuse of language. *Open Learning: The Journal of Open and Distance Learning*, 4(2), 28-36.
- Schuwer, R., Wilson, T., & van Valkenburg, W. (2010). *Production of OER, a quest for efficiency*. Paper presented at the Open Ed Conference 2010, Barcelona, Spain. Retrieved from <http://hdl.handle.net/10609/5103>
- Silveira, I. F., Mustaro, P. N., & Pimental, E. P. (2011). *Palimpsest: mass-collaborative media creation and sharing through crowdsourcing and its implications to Courseware and Open Educational Resources*. Paper presented at the 3rd International Conference on Web Science, Koblenz, Germany. Retrieved from [http://www.websci11.org/fileadmin/websci/Posters/171\\_paper.pdf](http://www.websci11.org/fileadmin/websci/Posters/171_paper.pdf)
- Smith, M., & Casserly, C. (2006). The promise of Open Educational Resources. *Change: The Magazine of Higher Learning*. Retrieved from <http://www.icde.org/The+Promise+of+OER.9UFRzIXH.ips>
- Smith, M. S. (2009). Opening education. *Science*, 323(5910), 89-93. doi: 10.1126/science.1168018
- \* Tuomi, I. (2006). Open Educational Resources: What they are and why do they matter (1-44). OECD. Retrieved from [http://www.meaningprocessing.com/personalPages/tuomi/articles/OpenEducationalResources\\_OECDreport.pdf](http://www.meaningprocessing.com/personalPages/tuomi/articles/OpenEducationalResources_OECDreport.pdf)
- UNESCO. (2000). *Dakar framework for action, education for all: Meeting our collective commitments*. Paris, France: UNESCO.
- UNESCO. (2012). 2012 World Open Educational Resources Congress. Retrieved from [http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CI/CI/pdf/CI\\_Information\\_Meetings/2012\\_world\\_oer\\_congress\\_en.pdf](http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CI/CI/pdf/CI_Information_Meetings/2012_world_oer_congress_en.pdf)

- \* UNESCO. (2002). Forum on the impact of open courseware for higher education in developing countries: Final report. Retrieved from [www.unesco.org/iiep/eng/focus/opensrc/PDF/OERForumFinalReport.pdf](http://www.unesco.org/iiep/eng/focus/opensrc/PDF/OERForumFinalReport.pdf)
- Washington State Board for Community & Technical Colleges. (2010). *Open Licensing on Competitive Grants* (Resolution 10-06-30). Retrieved from [www.sbctc.edu/general/admin/Tab\\_9\\_Open\\_Licensing\\_Policy.pdf](http://www.sbctc.edu/general/admin/Tab_9_Open_Licensing_Policy.pdf)
- Wenk, B. (2010). *Open educational resources (OER) inspire teaching and learning*. Paper presented at the IEEE EDUCON Education Engineering 2010 – The Future of Global Learning Engineering Education, Madrid, Spain. Retrieved from <http://www.ieec.uned.es/Investigacion/Educon2010/SearchTool/EDUCON2010/papers/2010S02G04.pdf>
- Wikiwijs (2009). Wikiwijs website. <http://www.wikiwijs.nl/task/international.psml>
- Wiley, D. (2006a). On the sustainability of open educational resource initiatives in higher education (1-21). OECD's Centre for Educational Research and Innovation (CERI). Retrieved from <http://www.oecd.org/dataoecd/33/9/38645447.pdf>
- Wiley, D. (2006b). Open source, openness, and higher education. *Innovate: Journal of Online Education*, 3(1). Retrieved from <http://innovateonline.info/>
- Wiley, D. (2007). Openness, localization, and the future of learning objects. BCNet Presentation. Retrieved from <http://opencontent.org/presentations/bcnet07/>
- Wiley, D. (2009a). Impediments to learning object reuse and openness as a potential solution. *Revista Brasileira de Informática na Educação*, 17(3), 8-10. Retrieved from <http://hdl.lib.byu.edu/1877/2153>
- Wiley, D. (2009b). Openness, disaggregation, and the future of schools. *TechTrends*. Retrieved from <http://hdl.lib.byu.edu/1877/2109>



- \* Wiley, D. (2010). Openness as catalyst for an educational reformation. *Educause Review*, 45(4), 15-20. Retrieved from <http://www.educause.edu/EDUCAUSE+Review/EDUCAUSEReviewMagazineVolume45/OpennessasCatalystforanEducation/209246>
- Wiley, D. (2011a). Openness, Socialism, and Capitalism. Retrieved from <http://opencontent.org/blog/archives/1775>
- Wiley, D. (2011). Utah Moves to Open Textbooks. Retrieved from <http://opencontent.org/blog/archives/2134>
- Young, J. (2008, September). When professors print their own diplomas, who needs universities? *The Chronicle of Higher Education*. Retrieved from <http://chronicle.com/article/When-Professors-Print-Their/1185/>