An Overview of Open Education Resources for Higher Education

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Abstract. Since adopted in early 2000's, open education resources (OER) have evolved as a major source of learning materials for higher education. In general, there are four categories of OER, namely, open textbooks, open courseware, open online courses, and open-source software and tools to support teaching and learning. This paper attempts to characterize these four categories of OER with representative examples, and elaborates various commonly adopted open licensing options for OER.

Keywords: open education resources, higher education, open textbook, open courseware, online open courses, open license.

1 Introduction

With the advent of information and communication technologies and the prevalence of digital cultures together with the open licensing practices, open education resources (OER) have evolved as a major source of educational materials at various levels. Open textbooks and open courseware are good examples. OER are broadly defined as freely and openly accessible resources which are useful for educational purposes. These resources are usually delivered by electronic means via the Web, taking the forms of electronic books, courseware, streaming videos, learning objects, or software and tools to support learning. OER are formally defined as the "digitized materials offered freely and openly for educators, students and self-learners to use and re-use for teaching, learning and research." (OECD, 2007).

OER range from the user-generated contents such as Wikipedia (2013) and Wikibook (2013), and institution-led open courseware and online courses (OCW, 2013; OUUK, 2013; EdX, 2013; Coursera, 2013), to digital repositories of learning objects, materials and textbooks (CCOTC, 2013; FDLC, 2013; FlatWorld, 2013; CNX, 2013) and open-source software and tools to support teaching and learning (Moodle, 2013; Sakai, 2013). At present, vast amount of OER have been developed and are available from the Web. For example, Wikipedia (2013) has accumulated 26 million articles in 286 languages. Opencourseware has made 2,150 open courseware (OCW, 2013). Coursera (2013) has offered several hundreds of open online courses. Connexions has hosted more than 17,000 learning objects and modules for open access and adaptation (CNX, 2013). Wikibook (2013) has accumulated over 2,600 open textbooks.

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Widely adopted in universities and colleges, OER have become a major source of educational materials for higher education. This paper investigates the OER for higher education. Four categories of OER are defined. They are open textbooks, open courseware, open online courses, and open-source software and tools to support teaching and learning. In this paper, we attempt to characterize different categories of OER in accordance with the nature, purposes and usage. Their distinctive features are highlighted, and some representative examples are cited. As OER are open for use, revision, adaptation and distribution, licensing is an important concern in developing, deploying and re-distributing OER. This paper also elaborates a number of open licensing options defined by Creative Commons, which have been commonly adopted by the OER community (CC, 2013).

The rest of this paper is organized as follows. Section 2 defines the four categories of OER for higher education, with representative examples. Section 3 focus on the licensing issues of OER, and elaborates a number of open licensing options defined by Creative Commons. Section 4 then concludes this paper with a discussion on the prospect of OER for higher education.

2 Open Education Resources

In general, there are four categories of OER for higher education, namely, open textbooks, open courseware, open online courses, and open-source software and tools to support teaching and learning. In the following, we characterize each of them in accordance with the nature, purposes and usage, highlight their distinctive features, and illustrate with some representative examples.

2.1 Open Textbooks

Open textbooks are by nature self-contained electronic books that can be accessible online and downloadable for offline usage. They invariably consist of digital contents which can be delivered in different formats, including texts, images, audio, video and other multimedia versions. They are coherent in contents and aligned to particular textbook guidelines and standards, and can be customized to meet individual needs. Open textbooks can be used as traditional textbooks for classroom-based teaching, as well as for self-learning, in universities and colleges. They are self-contained in the sense that the textbook contents are substantial enough and well organized as a single volume on a special subject or topic.

Open textbooks have a number of advantageous features over traditional textbooks. They are free and openly available. Revisions and updates of textbook contents can be made efficiently. Instructors and students need not wait long for the revised textbooks, as the revisions and updates can be made online for instant accesses. Moreover, open textbooks allow easy adaptation and modification to cater for the learning difference, where instructors may select and customize the textbooks to fit specific teaching and learning needs of individual groups.

There are many examples of OER, taking the form of open textbooks for higher education. Some representative examples are cited as follows.

- College Open Textbooks aims at driving awareness and advocacy for open access textbooks, training teachers to adopt open resources, conducting peer review, and growing online professional networks which support authors to share the resources (CCOTC, 2013). It provides hundreds of tertiary-level open access textbooks. A detailed guide for adopting open access textbooks and creating associated teaching and learning materials is also provided.
- The Open Access Textbooks project is an initiative to create a sustainable model for the discovery, production and dissemination of open access textbooks (FDLC, 2013). Funded by a grant from the Fund for the Improvement of Post-Secondary Education, this project builds on lessons learned in open access textbook efforts across the United States and seeks to create a collaborative community to further sustain the implementation of open access textbooks. At present, a digital repository of hundreds of open access textbooks has been deployed.
- Flat World Knowledge claims to be the world's largest publisher of free and open college textbooks. Its books are written by leading experts and are peer-reviewed, edited and highly developed (FlatWorld, 2013). They are supported by test banks, slides, instructor manuals, print desk copies, and knowledgeable service representatives. Its whole stock (with over 100 college-level textbooks) is completely free online. The textbooks come with integrated audio, video, interactive features, and powerful search capabilities.
- Project Gutenberg offers over 33,000 free electronic books to download on PC, iPad, Kindle, Note, Sony Reader, iPhone, iPod Touch, Android or other mobile or cell phones (Gutenberg, 2013). No fees are required. All of its electronic books are quality assured, and previously published by bona fide publishers. The project has digitized and diligently proof-read them with the help of thousands of volunteers.

2.2 Open Courseware

Open courseware are by nature courseware or self-contained course materials that can be accessible online and/or downloadable for offline usage. An open courseware invariably consists of a collection of learning objects and modules which are organized for a course of study. They are coherent in contents, and are aligned to particular syllabus and requirements, but can be customized to meet individual needs. Open courseware can be used as course materials for classroom-based teaching, as well as for self-learning and distance-learning, in universities and colleges. Indeed, many open courseware are the distance-learning course materials being used by open universities and distance-learning institutions.

Some representative examples of open courseware for higher education are cited as follows.

- Opencourseware was initiated by the Massachusetts Institute of Technology to make the educational materials of its undergraduate and postgraduate courses openly and freely available to everyone via the Internet (OCW, 2013). The Opencourseware Consortium was formed in 2008, and is now a community of over 250 universities and associated organizations committed to courseware sharing. Opencourseware has offered materials of 2,150 courses, attracting 125 million visitors.
- iTuneU was launched in 2007 by Apple Inc. to deliver university educational materials (mainly audio and video content) for university and college students (Apple, 2013). They are lectures, language lessons and lab demonstrations, provided by universities over the world. Free download of these materials is allowed. The iTuneU has maintained over 75,000 collections from more than 800 institutions, attracting over one billion downloads.
- OpenLearn is offered by the Open University in United Kingdom that aims to break the barrier to education by reaching millions of learners around the world (OUUK, 2013). It provides free educational resources for distance learning. They are identical to the distance-learning course materials used in the Open University. Up to now, OpenLearn has offered free education resources of over 650 courses, spreading across a variety of subject areas.
- China Open Resources for Education was established in 2003 by a group of universities in China to offer free courseware in Chinese medium, principally for students in China (CORE, 2013). These courseware are provided by both China universities and oversea universities, where courseware are written in or translated to Chinese. The China Open Resources for Education has provided hundreds of free courseware, attracting over 10 million visits.
- Khan Academy is an educational platform created in 2006 by a Bangladeshi American educator, Salman Khan (Khan, 2013). It aims to provide high quality education to anyone, by offering a wide range of educational materials which are mainly audio and video in nature. These educational materials cover a wide range of subjects at K-12 as well as college and university levels. At present, 4,200 sets of materials are available.

2.3 Open Online Courses

Open online courses are by nature online courses with interactive participation and online access through the Internet. These courses are freely and openly available to all for enrolment. In addition to courseware and course materials such as lectures, readings and problem sets, which are freely provided to students, open online courses allow interactions among the instructors and the students, thus building up a strong community for them. At present, open online courses are largely university-level and college-level courses.

In recent years, open online courses have grown tremendously. Large-scale open online courses, called massive open online courses (MOOC), are offered by many universities. Interestingly, these universities are mostly world-class universities, such as Harvard University, Massachusetts Institute of Technology, Stanford University,

and the University of Toronto. Time magazine described MOOC as opening the door to the "Ivy League for the Masses" (Time, 2012).

Some representative examples of open online courses in higher education are cited as follows.

- EdX (2013) is a MOOC platform launched in 2012, by Massachusetts Institute of Technology and Harvard University. With a strong emphasis on the quality of education, EdX aims to offer the best higher education opportunity to anyone who wants to achieve, thrive and grow. At present, 27 world-class universities have joined EdX consortium to provide a variety of MOOC under 24 subjects to the general public.
- Coursera (2013) is an organization found by two professors at Stanford University in 2012. Coursera partners with a number of world-class universities to offer open online courses for anyone to take for free. It aims to empower people with world-class education that would improve their lives, and the communities they live in. It emphasizes that the courses are designed on a sound pedagogical foundations. At present, 71 world-class universities have joined Coursera to provide near 400 MOOC.
- OER University or OERU (2013) was established in 2011. It is a virtual collaboration of like-minded institutions, aiming to provide free learning opportunities to all using OER materials with pathways to gain credible qualifications from recognized educational institutions. At present, there are 34 universities and colleges joining OER University. Many of them have a strong base in offering open education and distance-learning education, such as Athabasca University in Canada, Open Polytechnic in New Zealand, and University of South Queensland in Australia.
- Udacity (2013) is an educational organization established in 2012, following the success of free computer science classes at Stanford University in 2011 where an enrolment of 160,000 students was marked. Now, it offers 25 online courses, mainly in computer science and mathematics.

2.4 Open-Source Software and Tools

Open textbooks, open courseware and open course materials provide the educational contents for teaching and learning. There is a different category of OER – software and tools that support teaching and learning. They are by nature open-source software that allow free downloading, configuration and customization. These open-source software and tools are typically online learning platforms or learning management systems. There are also platforms for open online courses, and platforms for hosting open textbooks and courseware.

Some representative examples of these open-source software and tools are cited as follows.

- Moodle (2013) or Modular Object-Oriented Dynamic Learning Environment is an open-source online learning platform that supports hosting of educational materials, and allows interaction and collaboration among

instructors and students. It also supports the administrative activities, such as submission of assignments, online quiz, and data interface with student information systems. Since launched in 1999, Moodle has continued to evolve as a comprehensive learning management system with multi-language supports. At present, it has a strong user base of over 70 million users.

- Wikibook (2013) is an online platform for hosting open content textbooks. It allows open accesses of these textbooks in the wikipedia style. These textbooks are free to use, revise and remix subject to the open license "share-alike" defined by Creative Commons (CC, 2013). Wikibook provides functions to support contribution of new textbooks and review, revision and modification of existing textbooks. Authors of open textbooks can use tools provided by Wikibook to prepare their books for dissemination. Wikibook now becomes a platform hosting over 2,600 open content textbooks.
- Rhaptos (2013) is an open-source content management software that can be freely used for creation and configuration of an open textbook platform or educational content platform. Rhaptos supports many types of educational contents, including textbooks, course materials, multimedia, and game-based contents. It provides a rich set of authoring and editing tools to support the creation, revision, modification, adaptation and customization of educational contents. Rhaptos also features a powerful lensing system for quality control, customized tagging and community-based search and discovery.
- Google apps is a bundle of several web applications provided by Google (2013). These applications include electronic mail facilities, calendar, word processing, spreadsheet and presentation tools, document management system, free online storage, online forum, and website hosting. Google apps is offered to any educational institution (K-12 schools, colleges and universities with) up to 30,000 users, for free. The applications provided by Google apps support different teaching and learning activities, especially for mobile learning and collaborative learning. At present, there are over 20 million registered users from various educational institutions.

3 Licensing Options for OER

In this section, we describe various licensing options defined by Creative Commons – a non-profit organization established in 2001, aiming to enable the sharing and use of creativity and knowledge through free legal tools (CC, 2013). It defines a set of licensing options, called Creative Commons licenses, to provide a standardized and simple way to give the public permission to share and use creative work.

There are 6 types of Creative Commons licenses, which differ by the combination of the following conditions of use and distribution.

- Attribution (BY). This allows users to copy, distribute, display and perform the work and make derivative works based on it, as long as the author or licensor is given the credits for the original creation.

- Share-alike (SA). This allows users to distribute derivative works only under a license identical to the license that governs the original work.
- Non-commercial (NC). This allows users to copy, distribute, display and perform the work and make derivative works based on it, only for non-commercial purposes.
- No derivative work (ND). This allows user to copy, distribute, display and perform the work, but not to make derivative works based on it.

The 6 types of Creative Commons licenses are defined, based on the combination of these conditions.

- Attribution (CC BY). This allows users to copy, distribute, display and perform the work and make derivative works based on it, as long as the author or licensor is given the credits for the original creation.
- Attribution and No derivative work (CC BY-ND). This allows users to copy, distribute, display and perform the work, as long as it is passed along unchanged and in whole, and the author or licensor is given the credits for the original creation.
- Attribution and Share-alike (CC BY-SA). This allows users to copy, distribute, display and perform the work and make derivative works based on it, as long as the author or licensor is given the credits for the original creation, and the derivative works are distributed only under a license identical to the license that governs the original work.
- Attribution and Non-commercial (CC BY-NC). This allows users to copy, distribute, display and perform the work and make derivative works based on it, only for non-commercial purposes, and as long as the author or licensor is given the credits for the original creation.
- Attribution and Non-commercial and No derivative work (CC BY-NC-ND). This allows users to copy, distribute, display and perform the work, only for non-commercial purposes, and as long as it is passed along unchanged and in whole, and the author or licensor is given the credits for the original creation.
- Attribution and Non-commercial and Share-alike (CC BY-NC-SA). This allows users to copy, distribute, display and perform the work and make derivative works based on it, only for non-commercial purposes, and as long as the author or licensor is given the credits for the original creation, and the derivative works are distributed only under a license identical to the license that governs the original work.

4 Conclusion

In the past decade, we witnessed the rapid development of OER for higher education, especially on open courseware and open online courses. There are at least three factors contributing to the success. First, the recent advances in information and communication technologies have made the accesses to the Web well available and affordable by the public. Second, there is a prevalence of digital media in teaching

and learning, where multimedia elements have been effectively used in many learning materials. Third, people gradually welcome the idea of openness, and accept the sharing and collaborative development of knowledge.

The adoption of OER in higher education is inevitably a revolutionary change in teaching and learning. OER aims not only for open learning and self-learning but also for classroom-based and instructor-led learning. Although open textbooks, open courseware and open online courses are primarily designed for self-learning, they can also be used together with traditional textbooks and course materials for classroom-based learning. The advantages and benefits of OER have been recognized, and there are great potentials for OER to evolve as a powerful and influential means to transform the teaching and learning practices.

This paper briefly reviews the OER for higher education, and defines four different categories of OER, namely, open textbooks, open courseware, open online courses, and open-source software and tools to support teaching and learning. It attempts to characterize them in accordance with the nature, purposes and usage. Their distinctive features are highlighted, and some representative examples are cited for illustration. This paper also describes Creative Commons licenses, which are commonly used for deploying OER. Unarguably, OER has made an impact to the teaching and learning practices in higher education. It is time for the educators to re-think how the teaching and learning process can be transformed with OER.

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