

Open Education: One Perfect Storm Yields Three Revolutions.



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Frustration is rampant in today's education world. Sybil has dropped out of college, because her textbook costs exceed her tuition bill. Sammy has a biology textbook, but it's ten years out of date and lacks contemporary findings and debates. David's parents can't help her with her homework, because they don't read English. Jeff, a science teacher, wonders whether Pluto will be reinstated as a planet by the time it's removed from his school's science textbooks. Neelsh wants to become an astronomer, but there are no astronomy classes offered at his high school, let alone the local college. Juanita keeps getting turned down for jobs, because she's two courses short of a degree. Maria wants to demonstrate that she's mastered web design in her job as a graphic artist but has neither the time nor the money to go back to school.



The din surrounding the high cost, limited access, static nature, and often low quality of the world's education systems is reaching a crescendo, with many claiming a serious threat to the future of our youth, the training of workforces worldwide, and ultimately the democratic process in society. Our current predicament lowers the quality of education everywhere; even worse, it puts education out of reach for many in the developing world, which will only widen the gap between rich and poor. The statistics are alarming. A recent California study revealed that, due to rapidly rising prices, 6 out of 10 college students now choose not to purchase a textbook. Adjusted for inflation, tuition costs at US colleges rose over 25% in the past decade. Student loan debt now exceeds credit card debt in the US – over US\$1 trillion total or US\$23,300 per student in 2011. And last year, 11,000 desperate applicants vying for 800 openings at a South African University induced a stampede that left one person dead and 22 injured.

Now, imagine a world that has forestalled this crisis: A world where textbooks and other learning materials are free for all on the Web and low-cost in print, adapted to many backgrounds and learning styles, interactive and immersive, translated into myriad languages, continually up-to-date and corrected, and never out-of-print.

A world where computers assist in teaching so that instructors can spend more time teaching concepts and values, giving insights, and providing inspiration. A world where courses can be taken from anywhere at any hour of the day or night. A world where a student's study group encircles the globe. A world of living certifications and degrees that continuously documents students' and lifelong learners' accomplishments.

While this world was just a dream even a decade ago, the Open Education (OE) movement that aims to create it is coalescing and gaining momentum. The OE movement is based on a set of intuitions shared by a remarkably wide range of academics and students: **that knowledge should be free and open to use and re-use; that collaboration should be easier, not harder; and that people should receive credit for what they've learned and demonstrated.**

The OE movement is rapidly gaining momentum because of a "perfect storm" comprising two factors. First, the global financial downturn is forcing education systems worldwide to dramatically reduce costs on every front by updating their business models. Second, powerful telecommunication and information technologies are providing new, cost-effective ways distribute content, support personal interactions, and store information.

In this article, we will study how this "perfect storm" is powering three revolutions that promise to reinvent the way educators produce and disseminate educational materials and fundamentally change the relationship students have with content. While the timescale of education transformation has until now been measured in decades, even centuries, OE has the potential to fundamentally change the way authors, instructors, and students interact worldwide virtually overnight.

Revolution 1: Textbooks

The textbook was the answer to the educational challenges of the 19th century, but it is the bottleneck of the 21st century. The textbook of today remains static, linear in organization, time-consuming to develop, soon out-of-date,

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and expensive. Moreover, a textbook provides only “off the rack” learning that doesn’t cater to the background, interests, and goals of individual students. Communication and information technologies give us a golden opportunity to reinvent the textbook.

Open Educational Resources (OER) include text, images, audio, video, interactive simulations, problems and answers, and games that are free to use and re-use in new ways by anyone around the world. The key elements of OER are:

- **Open copyright licenses** (like the Creative Commons licenses¹) that turn educational materials into living objects that can be continuously developed, remixed, and maintained by a worldwide community of authors and editors.
- **Information technologies** like the Internet and Web, which enable easy digital content re-organization and virtually free content distribution.

The OER approach to textbooks provides several key opportunities, including:

- **Bringing people back** into the educational equation. Those who have been “shut out” of the traditional publishing world, like talented K-12 teachers, community college instructors, and scientists or engineers in industry that can add tremendous diversity and depth to the educational experience.
- **Reducing the high cost** of teaching materials. In many US states, community college students now spend more on textbooks than tuition.
- **Shortening time lags** between producing learning materials and getting them into students’ hands. Many books are already out-of-date by the time they are printed. This is particularly problematic in fast-moving areas of science, technology, and medicine.
- **Enabling re-use, re-contextualization, and customization** such as translation and localization of course materials into myriad different languages and cultures. This is critical if we are to reach the entire world’s population, where clearly “one size does not fit all” for education.

Several OER projects are already attracting millions of users per month. Some, like MIT OpenCourseWare² and its OCW consortium³, are top-down-organized institutional repositories that showcase their institutions’ curricula. Others, like Wikipedia⁴, are grassroots organized and encourage contributions from all comers.

¹ www.creativecommons.org

² www.mit.edu/ocw

³ www.ocwconsortium.org

⁴ www.wikipedia.org

⁵ www.cnx.org

⁶ www.siyavula.com, www.cnx.org/lenses/siyavula

⁷ www.voer.edu.vn

⁸ www.ieee.cnx.org

⁹ www.openstaxcollege.org

In 1999, I founded Connexions⁵ with three primary goals: to convey the interconnected nature of knowledge across disciplines, courses, and curricula; to move away from a solitary authoring, publishing, and learning process to one based on connecting people into open, global learning communities that share knowledge; and to support personalized learning (more on this below).



Over the last thirteen years, Connexions has grown into one of the largest and most used OER platforms; each month millions of users access over 20000 educational “building blocks” and 1200 e-textbooks (April 2012). Contributions come from authors worldwide in over 40 languages, including Spanish, Chinese, Vietnamese, and Afrikaans. Siyavula⁶ is developing a complete K-12 curriculum for South Africa. Vietnam is using Connexions as a faculty development too⁷.

Professional societies like the IEEE are advancing their global educational outreach and inreach through content development and peer review⁸. In addition to web and e-book outputs, a sophisticated print-on-demand system enables the production of inexpensive paper books for those who prefer or need them at a fraction of the cost of conventional publisher books.

To help more busy instructors adopt OER and save more students more money, Connexions recently launched OpenStax College⁹ to provide turn-key textbook solutions for today’s highest impact college courses. This library is being written by professional domain experts and peer reviewed by practicing college instructors; the library comprises textbooks, lecture slides, image libraries, and test banks.

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The more students gain access to tablet computers and smart phones, the closer we approach the end of static, paper textbooks. The launch of large-scale e-book platforms will only speed the transition. By weaving together related concepts, instructors and students can now personalize the educational experience to enable learning and exploration in ways that best suit their needs (and not “off the rack”).

Moreover, **e-textbooks have a capability that no paper textbook can match: the ability to use data analytics and machine learning algorithms to learn about a student as they learn from the book¹⁰. Indeed, by not only delivering interactive content to students, but also monitoring and analyzing their interactions with that content, we can provide automatic, targeted feedback to students, their instructor, and the content authors.** In short, the textbook has the potential to become a personalized tutor. Significantly improved learning will result.

Revolution 2: Courses

A student transported from 1900 to the present would feel quite at home at one of today's typical course lectures. Lectures remain a primarily passive experience of copying down what an instructor says and writes on a board (or projects on a screen). Such “teaching by telling” is effective for conveying information, but ineffective for imparting knowledge. Using communication and information technologies, we can do much more. Schools and colleges have offered “distance learning” courses for decades. New technologies now make it straightforward to replace in-person lectures with YouTube videos, paper-based homework with web pages, and graders with computer algorithms. OE is taking the concept even further by opening access to any student, anywhere.

A key leap in this regard was the Khan Academy¹¹, which demonstrated the power of freely distributing short 10-minute videos of mini-lectures and worked problems. Khan Academy enables anyone anywhere to learn a new subject, solidify their understanding, or clear up their misconceptions. **Moreover, the videos enable teachers to “flip the classroom” by having students view the lecture materials online on their own and then using the valuable lecture time to discuss and work problems. The flipped classroom aligns with the philosophy of Confucius, who famously remarked: “I hear and I forget. I see and I learn. I do and I understand.”**

Massive Open Online Courses (MOOCs) transports all of the components of a course (not just lectures and examples, but also the homework, tests, and office hours) to the Web. The canonical success story of a MOOC is the Fall 2011 Stanford University Artificial Intelligence course¹² that enrolled over 160,000 students from 190 different countries. Over 23,000 students completed the course, volunteers translated it into 44 languages and thousands of study groups formed spontaneously via social networking sites, locally and globally.



The success of this initial experiment has spawned a menagerie of non-profit and for-profit educational MOOC enterprises, including:

- Coursera¹³ and Udacity¹⁴, Stanford University spin-offs from the Fall 2011 experiment, which are partnering with a variety of US colleges and faculty to offer MOOCs.
- edX¹⁵, founded in Spring 2012 to engage both formal, on-campus students at MIT and Harvard and informal learners worldwide.
- TED-Ed¹⁶, a new education arm of the fantastically successful TED franchise that enables the re-mix of video lectures.

¹⁰ www.openstaxtutor.org

¹¹ www.khanacademy.org

¹² www.ai-class.com

¹³ www.coursera.com

¹⁴ www.udacity.com

¹⁵ www.edxonline.org

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Like OER, MOOCs democratize access to high-quality learning experiences, provide a massive potential audience for talented instructors and enable students to form long-lasting social bonds with students from around the world, which bodes well for our increasingly global economy.



As more and more learning takes place online via MOOCs and other online courses, we will have an unprecedented opportunity to observe and analyze student learning experiences. Also, the massive amounts of data collected can be used to improve and eventually personalize the learning process. And, since online course material can be replayed as many times as needed, we can move away from a world of competition in education (competition for access to courses, for the instructor's time, against each other due to curve-based grading) and towards a world where everyone eventually masters the material and gets an A grade.

Revolution 3: Certification

OER and MOOCs enable flexible new ways to learn, but how does one get credit for what they've learned? Today, in order to get credit, one typically still enrolls in a rigid, often multi-year program that measures learning achievement in

terms of "seat time". Such rigidity is no longer practical in the modern knowledge economy, as more and more careers require constant training on new knowledge and skills. As John Seely Brown puts it, "As [workers] move from career to career, much of what they will need to learn won't be what they learned in school a decade earlier. They will have to be able to pick up new skills outside of today's traditional educational institution¹⁷". Clearly, **both students and life-long learners need a more flexible system for certifying their skills obtained both inside and outside of school. Again, communication and information technologies offer a solution.**

Recently, much progress has been made on developing "stacked credentials" that record and track learning achievements, like web design, welding, or calculus. In particular, Mozilla's Open Badges project¹⁸ has developed tools to make it easy to issue, earn, and display "badges" (a simple kind of credential) on the Web. Badges allow people to provide a more complete picture of their skills and competencies to potential employers, mentors, peers, and collaborators. They acknowledge the fact that learning happens everywhere (and not just in school) and document much more than a report card about what relevant skills and competencies people have developed along their way. The beauty of badges is that, like OER, they are modular and thus enable learners to build a career ladder that grows over time.

Badge-based certification is nascent but picking up momentum. Current examples include:

- EdX from MIT/Harvard¹⁹ plans to offer an electronic certificate of accomplishment for students who successfully complete their courses online.
- Industry associations, such as the Manufacturing Institute²⁰, are developing badges that recognize skills highly sought after by manufacturers.
- Peer-to-Peer University (P2PU²¹), a grassroots OE project, is offering badges for completing online courses.

In essence, badges transform the learner from a passive consumer in a constrained system to an active participant in a lifelong process.

¹⁶ www.ed.ted.com

¹⁷ www.johnseelybrown.com/newlearning.pdf

¹⁸ www.wiki.mozilla.org/Badges

¹⁹ www.edxonline.org

²⁰ www.bit.ly/GFH6B5

²¹ www.p2pu.org

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Conclusions

We live in an increasingly connected world²², yet our educational systems cling to a disconnected past. The OE movement provides new mechanisms to democratize education by interconnecting ideas, learners, and instructors in new kinds of constructs that replace traditional textbooks, courses and certifications. My personal experience over the past thirteen years has convinced me that **OE has real potential to realize the dream of providing not only universal access to all of world's knowledge but also all the tools required to acquire it. The result could be a revolutionary advance in the world's standard of education at all levels.** And, because of the “perfect storm” –resulting from the combination of the global financial downturn and powerful new communication and information technologies–, the future might arrive much sooner than we think.

OE is clearly a disruptive force in the academic world ; OER promises to disintermediate the scholarly publishing industry –and in the process rendering some current business models unviable and inventing new viable ones– and MOOCs and badges have the potential to integrate new models of education and University, with this simple equation:

OER + MOOCs + Badges = University

However exciting, the OE movement leaves open many questions, with most revolving around how to maximize the impact of OE while mitigating the undesired, unintended consequences. For example, how to ensure the quality of teaching and education; how to maintain the low cost that enables OE to be implemented on a massive scale; how to integrate badges in the academic certification system; how to safeguard a student's electronic learning record; or how to sustain OE enterprises in the long term while at the same time keeping them as accessible as possible.

The next decade will certainly be an exciting one for education!

Links:

Creative Commons: www.creativecommons.org

MIT OpenCourseWare: www.mit.edu/ocw

OpenCourseWare Consortium: www.ocwconsortium.org

Wikipedia: www.wikipedia.org

Connexions: www.cnx.org

Siyavula: www.siyavula.com, www.cnx.org/lenses/siyavula

Vietnam Open Educational Resources: www.voer.edu.vn

IEEE/Connexions quality review project: www.ieeecnx.org

OpenStax College: www.openstaxcollege.org

Apple iBooks 2: www.apple.com/education/ibooks-textbooks

OpenStax Tutor: www.openstaxtutor.org

Khan Academy: www.khanacademy.org

Stanford AI MOOC: www.ai-class.com

Coursera: www.coursera.com

Udacity: www.udacity.com

EDX: www.edxonline.org

TED-Ed: www.ed.ted.com

John Seely Brown: www.johnseelybrown.com/newlearning.pdf

Mozilla Open Badges: www.wiki.mozilla.org/badges

Manufacturing Institute: www.bit.ly/GFH6B5

Peer to Peer University: www.p2pu.org

C. Christensen and M. Horn. “Colleges in Crisis” Harvard Magazine, July-August 2011. www.harvardmagazine.com/2011/07/colleges-in-crisis.

²² C. Christensen y M. Horn. “Colleges in Crisis” Harvard Magazine, Julio-Agosto 2011. www.harvardmagazine.com/2011/07/colleges-in-crisis.