Open Learning: What Do Open Textbooks Tell Us About the Revolution in Education?[1]

March 2009

Gary W. Matkin[2]
Dean of Continuing Education, University of California, Irvine, and
CSHE Research Associate

ABSTRACT
This paper provides a summary and assessment of the current development of open textbooks and describes a possible direction for future development and funded support of open textbook projects. This paper provides answers to the following questions: Why do we need open textbooks? What are open textbooks (in their various forms)? How are open textbooks developed and distributed? And finally, when will open textbooks be produced? As these questions are addressed, other dimensions relevant to the Open Education Resources (OER) movement are also revealed and discussed.

Where are we in terms of the evolution of the traditional textbook? I believe it is inevitable that the extensive use of openly available digitized educational resources will rapidly replace printed textbooks and the teaching processes based on them. This replacement will be spurred by both cost concerns and pedagogical efficiency. State and local governments, now primarily responsible for adopting textbooks, are aware of textbooks' rising costs and of the potential of the Internet to reduce such costs. For instance, in several southern states, funding has been forthcoming for the creation of online high school courses that were intended to serve those schools without the resources to offer their own courses, and for students who did not have access to regular classes.

---

[1] This article originally appeared in the Spring 2008 edition of *Threshold Magazine*, published by Cable in the Classroom. Reprinted/reproduced with permission.

[2] Gary W. Matkin, Ph.D., is dean of continuing education at the University of California-Irvine, a position he has held since March 2000. Prior to that, he was associate dean of extension at the University of California-Berkeley. Matkin has been involved in distance education for more than 20 years and recently has been deeply involved in the Open Education Resources (OER) movement. Matkin is a certified public accountant. For more information and a selection of his publications, visit unex.uci.edu.

One consequence of expanding digital education resources has been the proliferation of national virtual high schools. These online courses use high-level instructional design and media-rich learning materials, so it is not too big a step to use these same courses to serve classroom-based students. For a fraction of what school districts spend annually on textbooks, high-quality and easily distributed material can be offered online. In fact, a few high schools are already using fully digitized, rather than printed, textbooks.

However, the full consequences of a shift away from traditional textbooks and the highly politicized, bureaucratic, and sometimes idiosyncratic adoption process may not be apparent to K–12 administrators. The seemingly innocent and vaguely optimistic phrase "open textbook" hides the most profound challenge that educators have ever faced.

Describing the Challenge

Educators are facing the challenge of moving the foundations of education and pedagogy from the spoken and printed word to the digitized word; from the real, time-limited, and spontaneously perceived image to the digitized, mediated, and constantly available image. It is the challenge of moving from a linear organization of information and knowledge (e.g., books and the Dewey Decimal System) to the keyword- or phrase-based-search presentation of information (e.g., Google search). This movement — prompted by new technologies — deeply infiltrates not only teaching and learning, but all aspects of our lives. It is happening so quickly that the way the brains of our children are conditioned to handle data is fundamentally different than in the past, and very different from the brains of those currently responsible for formal education.

Once K–12 administrators understand this movement, they can better understand common problems in education that currently appear to be dissociated and are treated in isolation. As an exercise, as you read this article, consider the effects of open educational resources on educational finance, curriculum, the role of the teacher, the organization of formal education and its manifestation in institutions, and — most profoundly — pedagogical methodology. The lens of the technological imperative provides an essential perspective. This article serves administrators by projecting the immediate future of the open-textbook movement, but then expands the discussion to some immediate, practical steps that can be taken to open today's schools to the technology-driven future they must face.

Defining Open Education

As an exercise in understanding this new perspective, let's examine the idea of openness in education with a focus on the notion of open textbooks.

Perhaps the most comprehensive concept of openness is open knowledge. The open-knowledge movement has an ambitious goal of making the entire sum of human knowledge available to everyone, everywhere, at any time, for free. Upon analysis, this idea quickly makes the distinction between knowledge and information. We know instinctually that, while information may be necessary to acquire knowledge, knowledge is really the ability to use information in humanly meaningful ways. But knowledge is acquired by learning, and learning is accomplished through mental processes. These processes can be facilitated by formal education in the form of courses. This situates the OpenCourseWare (OCW) movement in relation to open knowledge — OCW helps us

use information to acquire knowledge. The Open Educational Resource (OER) movement might include open courseware, but also makes open resources available at a granular level lower than the course.

The Open Textbook Continuum

So, what about open textbooks? Where does this concept fit? As printed form meets digitized form, the current vocabulary becomes inadequate. At first, open textbooks appear to be a species of OER, but logical extensions of the term "open" change according to context.

It is more useful to imagine a continuum than to define the term. On one end of the continuum, we might imagine a physical textbook that has simply been digitized and put on the Web for anyone to view. On the other end, we can conjure the most wonderful open course anyone can imagine. To move along that continuum from left to right — from the static, digitized textbook to the open course — we could add discrete but interacting features. Each time we add a feature, both the complexity of the supporting infrastructure and the barriers to its production increase. In effect, added features push the concept to the right as barriers push it to the left. At some point, so much of the traditional definition of the textbook has been discarded that we have to find a new concept — the open course.

Features of Open Textbooks and Courseware

The first big step along the continuum would take advantage, in different forms, of the dynamic nature of digitized assets. Given the right infrastructure, digitized assets can easily be altered. The alteration of a static textbook, then, could be prompted by a number of purposes. The material could be updated, say, to incorporate new knowledge. It could be improved as students and teachers develop better ways of expressing concepts or ordering learning objects. It could be localized or customized for a variety of learners, whether in different cultures or at different levels of education.

The customizable nature of dynamic material can allow the same material to be presented in multiple ways so that learners can look at it through different lenses. For instance, a course could be modified to suit the learning needs of a student with autism or a student who learns better through mathematical analysis. It could be supplemented, or it could be extended to incorporate a deeper treatment of the material, to include new examples or learning aids, or to expand the subject matter into a longer course. Its components could be unbundled and used in many different teaching and learning contexts. It could be remixed or combined with other material to produce a new learning pathway or perhaps even an entertainment object. In order to accomplish this, educational materials that are modular in organization will find the most users and reusers.

Increased student engagement is a positive result of the use of dynamic material. Static textbooks cannot respond to students, nor can students engage with the learning material in the same active fashion. In courseware, such engagement is often a prominent feature of instructional design. Self-scoring examinations that loop students back to the material they didn't learn, complex simulations, and even interaction with other students are all logical extensions of the static model.

Open courses available on the Web also can be the center of communities of students and teachers, either temporarily (students in a particular class) or long-term (teachers working toward the continual improvement of a particular course). Social-interaction software can be added to the open repository of courses to facilitate these communities.

The technology of OCW permits the flow of information in metadata form, capturing results across groups of students that can be used to measure student outcomes and improve teaching practice. OCW, and the communities of teachers it generates and supports, can facilitate professional development in ways not possible or not as easily attainable with static texts.

Finally, open courses can incorporate supplemental learning resources easily and quickly through permanent links to Web-based material. For instance, a student studying personality tests could take a personality-inventory test on the Web, have it scored, and then write an interpretation of the test. A student studying Shakespeare could be prompted to visit the Globe Theatre Web site. This just-in-time embedded linking is an unrecognized benefit of online education. And, of course, it takes advantage of a huge and growing repository of open-learning material.

Barriers to Open Textbooks and Courseware

As wonderful as all these potential benefits are, they come at a cost. Generally, they are services rather than aspects of a product — and services often require both an initial investment and an ongoing outlay of resources. For instance, localizing a given set of material for a particular country (say, Brazil) would require some outlay of funds and probably some continuing funding to help Brazilians find that material and keep it updated.

It is tempting to revert to the traditional textbook model when considering both the initial and ongoing costs. Like the traditional textbook, the open course does require an initial outlay of funds to develop the product. However, as we have seen, a primary advantage of a digital form is its capacity to be changed at any time. Even easy changes cost something. Financial models associated with open resources need to factor in the costs of maintenance of material, whether the maintenance is simple updating, or the expansion of its usability for new audiences or purposes. This is crucial to incorporating community development and maintenance into our model, lest we assume incorrectly that the public good and the power of the ideas surrounding open textbooks and courseware will attract enough volunteers to support a movement of this size over the long term.

Other daunting barriers to developing and sustaining open textbooks and courseware also exist to varying degrees in different environments.

Inertia — both in individuals and institutions — is a significant barrier. It takes energy and commitment to change the way we do things, and what we are facing here are major and disruptive changes. For instance, adoption procedures, particularly within K–12, are slow to change.

Technology presents its own barriers. Developing countries often lack technological infrastructure or possess an outdated infrastructure that makes it impossible to take advantage of OER. Even in developed countries, a lack of interoperability and technical

standards can make the distribution of materials difficult. Along with infrastructure issues often comes a lack of end-user skill, particularly in students and content developers.

Even if all technological barriers were removed, we still face the issues of distribution and discoverability. How are users going to learn about the availability of material and then gain access to it? We often think of the Internet as an all-encompassing distribution method. But if we want users to download and use open material, we have to consider how and in what form it is delivered to them.

The lack of quality standards is a problem as well as a barrier to adoption. If we can't define quality in open resources, or describe the methods we will use to assure its maintenance, how can we convince governments and individuals to consume OER even if it is free?

Issues of intellectual property and digital-rights management also remain. These can be both costly and a barrier. The use of the Digital Learning Commons license has helped clarify some issues and created a pathway for those who want to make their material freely available, but even the lightest restrictions can cause problems, including the burden of maintaining records and clearing material for use.

Finally, we cannot ignore the influence of politics on the OER movement as a whole. OER, and especially those parts of it that threaten economic interests, are in a political vortex that cannot be avoided. The publishing industry and the relationships with educators it has developed are entrenched in the status quo. This is especially true in the K–12 sector, with its complicated adoption processes.

Choosing a Path

If we follow the logic of the open-textbook-continuum narrative above, forward progress involves selecting a point along the continuum where the benefit and cost lines intersect, and where the value of the set of benefits or features added equals the cost of overcoming the barriers associated with the features. Of course, real life is not that tidy.

First, we are not talking about striking only one such balance, but many, each in the context and the domain within which it falls, such as higher education or K–12. Also, there are likely to be many efforts at developing open textbooks, each effort at best only loosely associated with others in the same domain. Efforts in California to develop open textbooks in algebra are not likely to have much interaction with efforts in the southern states to produce open textbooks in history. Each will have significantly different contexts, including resources. However, connecting the dots may be one place that foundations can be of help, particularly where connection results in wider use of the material. Nonetheless, this conceptual framework seems to be a useful way of capturing some of the many variables involved.

A New Dimension Revealed

As we extend our examination of OER in the form of open textbooks, an issue emerges: the difference in use between OER in the form of extended educational pathways or courses and smaller, more granular forms such as individual learning objects. At all levels, but particularly in K–12 settings, the most interesting and profound set of dimensions deals with how we expect materials to be used. In any context, a highly

strategic choice has to be made: 1) create a coherent and complete text/course/learning pathway that leads students from point A to point B, or 2) develop reference material with modules that can be extracted from the whole and used independently from other parts. Although this is not necessarily a disjunctive decision — in that it is not necessary to decide in advance which way to go — it calls into question the overall conception and strategy for open textbooks.

Each of these choices has rationales and special issues associated with them. The complete-pathway model is based on the belief that learning is contextual; textbooks provide a context for learning that presents material in a logical, linear fashion; and students, particularly younger students, learn best that way. If the complete-pathway model — a model that is the most consistent with current text-adoption processes and the insistence of uniformity of instruction guided by state standards — is chosen, what leeway do individual teachers have to modify instruction in their classrooms? How is the canonical version of the course maintained and modified in the face of great ease in changing it? Can different versions of the course be maintained and used and, if so, how are these versions brought into alignment with the officially adopted version?

We know that the textbook-pathway context is not the only context employed in learning. Many instructors create their own context and rely on textbooks to supplement that context. We also know that learners must create or adopt learning contexts for themselves. This montage model, where more extensive learning pathways or courses are made more modular or unbundled, is supplanting the linear model, where one concept builds upon another. In this model, material is organized in such a way that new and different contexts can be built from individual learning objects that can be separated from the larger whole and reused in other organizational schemes. Rather than a learning pathway, our goal in the montage model is to build a learning environment where creative individual teachers and learners can be accommodated.

Perhaps the world of learning has changed in favor of this more modular approach? As the typical elementary-school student multitasks her way through the day, mixing social interactions mediated by technology with the consumption of entertainment, again using sophisticated technology and telecommunications and learning, is her brain making new connections that older generations didn't make? If so, are we building OER for her, or for the three generations before her? Instead of thinking of textbooks and courses, should we be concentrating on producing large-scale learning-object repositories that our montage-minded children and their creative teachers can easily cut and paste into their own contexts for knowledge?

Next Steps

In the face of such a daunting inevitability of changes in teaching and learning, what are administrators to do? While the next steps depend significantly on the local and temporal context for administration, there are some reasonable suggestions of wide applicability. Administrators can:

Identify and seek to overturn artificial barriers to the appropriate use of open digital resources. Examples of such artificial obstacles are the laws in some jurisdictions requiring materials to be printed on paper, or adoption processes that put limitations on the period in which materials can be updated.

Wherever possible, encourage the use of digitized materials to improve instruction. Already, much digitized material — often supplied along with print materials from textbook publishers — is available for teachers and learners. Teachers and learners should be encouraged to become familiar with and use these materials. Where possible, they should negotiate for the ability to use digital enhancements to print materials in an open format under broad licenses for use.

Invite groups of parents, teachers, students, and others to study the use of digitized materials. The more the key stakeholders become informed about the nature and extent of digitized and open-learning resources, the easier it will be to insert these resources effectively into the teaching/learning process.

Encourage and reward demonstration projects, innovation, and cooperation. Administrators should be alert to early enthusiasts and grassroots impulses to experiment with open resources and provide some institutional expression and recognition to such efforts.

Develop formal and informal digital communities. Groups of teachers cooperating on developing material in their subject areas, parents active in searching for instructional resources, or cross-sectional teams assigned specific goals are all examples of groups that might be formed in anticipation of a convergence on digital technologies in schools.

Clarify costs of adoption and purchase of current material to all stakeholders. Inevitably, the adoption of new practices or materials will be compared on a cost basis with current practice. Administrators should be clear about what current costs are so that new possibilities have a clear and fair standard to meet. Ideally, these costs should be established in advance of any real proposal for change in order to establish an unbiased stance in cost comparisons. Make sure that financial models using open and digitized materials provide for adequate support of ongoing maintenance and enhancement.

New instructional technologies, combined with the OER movement, will permanently and radically change education. Just as warnings of global warming are now gaining public recognition, so too will the early effects of experiments in open education penetrate the consciousness and practice of dedicated educators. Those who recognize this new set of technology-driven imperatives and are able to take effective action will be winners. Those slow to recognize and act — and their students — will lose out. According to the recent writings of Thomas Friedman, the most open societies will win.

REFERENCES

California Open Source Textbook Project. http://www.opensourcetext.org

Connecticut Virtual Learning Center. http://www.ctvirtuallearning.com

Digital Learning Commons. http://www.learningcommons.org

FHSST: Free High School Science Texts. http://www.fhsst.org

Global Text Project. http://globaltext.org

MIT OpenCourseWare. http://ocw.mit.edu/OcwWeb/HowTo

OER Commons: Open Educational Resources. http://www.oercommons.org

OpenCourseWare Consortium. http://ocwconsortium.org

Open Text Book. http://www.opentextbook.org

"Beyond the Textbook: Learning in a Digital World." *Threshold Magazine* Fall 2005. http://www.ciconline.org/thresholdfall05

Wikiversity. http://en.wikiversity.org