

OPEN TEXTBOOKS: WHY? WHAT? HOW? WHEN?

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ABSTRACT

This paper is based on the recorded proceedings of a conference held in Newport Beach, California, on August 22 and 23, 2007. This conference was attended by educators, authors, administrators of open-source based organizations, and entrepreneurs, all of whom had a stake in the concept of open textbooks. The goals of the conference were to summarize and assess the current development of open textbooks, and to describe a possible direction for future development and funded support of open textbook projects. This paper has the same goals, and provides at least partial answers to the four fundamental questions: Why do we need open textbooks? What are open textbooks (how are they defined)? How will open textbooks be produced and then used? And finally, when will open textbooks be available in sufficient quantity and quality to have a positive impact? In addressing these questions, other dimensions relevant to the Open Education Resource (OER) movement emerge for discussion.



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INTRODUCTION

In late August 2007, with funding support from the William and Flora Hewlett Foundation, twenty-four people gathered in Newport Beach, California, for a day and a half to discuss the current and projected future state of efforts to produce open textbooks. The participants included educators, authors of open textbooks, foundation officials, administrators of organizations offering services based on the open education resources movement, and publishers/entrepreneurs (see Attachment 1 for a complete list of participants).

The initial questions posed to the group were these:

1. What is currently produced and in process in the open textbook “space?”
2. How are open textbooks distinguished from open courseware (that is, how do we define an open textbook)?
3. How can open textbooks be created at a cost low enough to make them widely available?
4. Who are the relevant stakeholders in open textbooks?
5. How can quality in open textbooks be achieved?
6. How (through what technologies) can open textbooks be created and situated for reuse?
7. What, if any, are the important gaps presently existing that need to be filled by Foundation funding?

As the discussion proceeded, these were refined into four basic questions:

1. Why do we need open textbooks?
2. What are open textbooks (how are they defined)?
3. How will open textbooks be produced and then used?
4. When will open textbooks be available in sufficient quantity and quality to have a positive impact?



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This paper will summarize the conversations and findings of the group by systematically addressing these four questions. First, however, it is important to understand the context in which open textbooks exist.

The Context for Open Textbooks

Today's technology makes possible the widespread low-cost distribution of high quality intellectual property. The first notable expression of this openness, known as the open source movement, took place in computer software. The concept of openness, applied to intellectual property related to teaching and learning, has been expressed through open education (or educational) resources (OER), opencourseware (OCW), and open knowledge. These terms are more than just words; they are concepts actively being advanced by serious people. And these concepts are beginning to converge.

For instance, several conference participants attended a conference sponsored by the Shuttleworth Foundation held in South Africa on September 14 and 15, 2007, to consider how OER might be defined and standardized.¹ Later that month, some members of the group attended the Fall OpenCourseWare Consortium and annual meeting in Logan, Utah (also supported in part by the William and Flora Hewlett Foundation). The overlap of participants, the commonality of funding and the communication between funding agencies, and a common goal of openness is beginning to bring these efforts together.

In this paper, we use the term OER to encompass both OCW and open textbooks. Later, we will discuss the differences and similarities between OCW and open textbooks, and explore the notion of convergence.

International Trends

The consideration of open textbooks takes place in a world that is fast becoming more aware of the possibilities presented by the Internet and web technologies. Catherine Casserly, Program Officer in the Education Department of the William and Flora Hewlett Foundation, is

¹ See http://opened.shuttleworthfoundation.org/wiki/Main_Page.



an involved observer of the individual expressions of the OER movement and the recipient and reviewer of proposals for funding. Casserly listed four trends she sees as the most important and pressing: indigenous knowledge, teacher training, networks, and mobile platforms.

The pressure for the expression and teaching of **indigenous knowledge** is becoming more evident as people and governments in developing nations react negatively to what they view as “academic colonialism.” They fear that their indigenous knowledge will be erased as it is supplanted in formal schooling by high quality but foreign educational materials—including open textbooks—that do not translate or “localize” information. Thus there is a strong push for funding to create and share OER that deals with and considers indigenous knowledge.

Another trend is an emphasis by foundations and governments on **teacher training**. Improving teaching in all countries is seen as a necessary accompaniment to any form of OER, and one with a high impact that provides a high return on patron investment.

This same search for leverage is the reason that **existing, effective networks** need to be identified and supported. No funding source, private or governmental, can achieve its goals alone or without the effective “institutionalization” of the effort: a sustainable infrastructure dedicated to carrying forward initiatives beyond the funding term.

Finally, the emergence of **mobile platforms** in general, and cell phones in particular, is another clear trend. As the “\$100 laptop” idea fades, and cell phone technology and use becomes more ubiquitous, even in the poorest countries, OER transmitted over cell phones becomes a real possibility.

Goals for OER

Marshall (Mike) Smith, Educational Program Officer of the William and Hewlett Foundation and architect of the Foundation’s \$65 million (to date) investment strategy in OER, describes “openness” and open material as having six important dimensions:

1. Free
2. Made very available
3. Of high quality
4. Modifiable



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5. Adoptable worldwide
6. Useful to teachers as well as students

Let's look at these more closely.

Free

Free simply means “at no cost to the user.” It should not be confused with “open.”

Made Very Available

Made very available, also expressed as **open**, has degrees of meanings. The notion of openness of intellectual (copyrightable) property is often described in terms related to the Creative Commons (CC) license. Although the CC license is being challenged by other license forms, its standard terms are known widely enough to provide some commonality of reference.

The four most common CC provisions, by their inclusion, add restrictions to the use of “open” material:

- *Attribution* requires any subsequent user, upon publication of the work, to attribute the work to its original author(s).
- The inclusion of the *non-commercial* clause prohibits any commercial (as opposed to nonprofit) subsequent user from financially benefiting from the work.
- Prohibiting *derivative works* (the original work altered in some way, for instance, translated into another language or “localized” for another country) is a significant departure from some people’s notion of openness.
- Finally, *share and share alike* means that if any derivative work or use of the work in another context is accomplished, the new work should be shared with everyone in the same way (that is, with the same restrictions but no more) as the original work.

Each of these provisions, when invoked in a license, provokes objections from those who advocate openness. Even the strongest advocates of openness (the foundations) will reluctantly accept the attribution provision, because they know how strong and how motivating is the desire for recognition among most authors. But the other provisions present real problems. Even the



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non-commercial provision, which seems reasonable on the surface, would prevent or deter the propagation of useful material. And there are some internal conflicts in the common CC clauses. Theoretically, for example, you don't need the share and share alike provision if you prohibit derivative works. More importantly, there is a conflict between the attribution provision and the derivative works provision. If the attribution clause is invoked but then derivative works are permitted, there is the possibility that some objectionable version of the work would bear the original author's name. This difficulty might be handled by some sort of disavowal clause, but it remains a gray area.

Ultimately, the notion of "open" means freely available on the web for printing, use for any purpose, and carrying the uninhibited right to modify, translate, or repackage. Even a requirement that users register with a website, providing their name and other personal information, inhibits the openness of the material. The addition of restrictions to this vision not only decreases the social utility of open material but seriously obscures the notion of "open," which is often used to describe even the more restrictive of licenses.

Availability is also influenced by factors other than provisions governing intellectual property. The technological platform (both hardware and software) must be highly interoperable and compatible with a diversity of users' technology capacities. This is particularly an issue when high quality material, using the latest technology, is made available to developing countries whose technology base may not be sufficiently advanced to be able to take advantage of the material. There may be a trade-off between the richness of the media, for instance, and its availability.

Of High Quality

The idea of high quality implies that standards of quality have been established and, in any situation over time, maintained through some process. In fact, there are no well-established standards of quality, and there is considerable debate over the effectiveness of any current or proposed process for maintaining them. This lack of agreement over quality issues is a major impediment in the OER movement and a constant subject for debate and consideration.

The fact that standards can be applied to both content and pedagogy is a complicating factor. As applied to content, systems of both peer review and the so-called "trusted source" have been used and promoted. Peer review involves the reviewing of the material by those supposedly



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knowledgeable about the content. A trusted source might be either a well-known individual or an institution (MIT for instance) possessing and protective of its reputation. Both peer review and trusted source quality assessments are usually made before the issuance of the content. Once material is issued, quality can be assessed and maintained through continuous user feedback of the kind utilized by commercial firms such as Amazon.com. An assessment of the quality of the pedagogy (the ability for students to learn the material as opposed to the accuracy and richness of the content) can also be subjected to peer review. However, the Internet technologies combined with computing power can now be used to assess and measure learning on a continuous and highly automated basis. In one way or another, however, the attainment of high quality requires significant action and, usually, cost.

Usefulness and Adoptability

Some notions of **usefulness** and **adoptability** are related to availability but unrelated to intellectual property issues. For example, the technological platform (both hardware and software) used in OER must be highly interoperable and compatible with a diversity of user technologies. This is a particular issue when high quality material, using the latest technology, is made available to developing countries that do not have the technological capacity to take full advantage of the material. This means that (1) the open material must be receivable on multiple platforms (e.g., cell phones); (2) the underlying technology must be flexible (e.g., XML) and designed to provide a wide range of capacities (e.g., plug-ins); and (3) the user interface should be simple, friendly, and intuitive simultaneously, for a diverse audience that commonly consists of content users and producers (reproducers, or co-producers) of new material.

A very important attribute of usefulness, which we will touch on at some length later in this paper, is *modularity*, particularly as it relates to the way learners use the material.

Finally, usefulness for some audiences might be mandated. For instance, in the United States, educational material in some cases must be made available to handicapped people under the Americans with Disabilities Act or removed from distribution entirely.



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Other Contextual Factors

Other elements of the context for the discussion of open textbooks emerge upon examination.

The field of OER is strongly in need of strategic sharing—of ideas, knowledge, skills, information, and, above all, resources. It needs to take into account the very strong desire for colleagues to connect with one another, and to address the endemic lack of coherency and lack of consistency in understanding and discovering both content and the elements that move that content into the human mind. Students who are just encountering these new modes of thought and educational experiences need to be brought directly into the process of developing OER. The needs of faculty, teachers, and instructors for professional development need to be addressed by any OER activity.

Finally, we should not lose sight of the ultimate context for all this openness: the positive impact on student learning and outcomes.

1. WHY OPEN TEXTBOOKS?

The cost of traditional textbooks has skyrocketed. The effect of this increase in cost, and the reasons for it, are somewhat different in higher education than in K-12 education. The cost of textbooks in higher education is usually borne directly by the students and their parents, and it is now a noticeable fraction of the total and rapidly increasing cost of higher education. The average cost of textbooks per year at one California community college is over \$900—about 75 percent of community college tuition!

At the same time the cost of textbooks has risen, their usefulness in the teaching and learning process in higher education is declining as more material is available for free on the Internet or at a lower cost in self-published “course packets.” There is evidence that even where instructors require textbooks, neither the pedagogical approach nor the learning assessment process is well tied to them.



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The anger over the cost of textbooks is exacerbated by some economic realities in the textbook publishing industry. The development and maturation of the market for used textbooks has eaten into the sales of textbook publishers, who have responded by issuing frequent revisions to standard textbooks. As students compare revisions with their used books, they see very little change, and view most of those changes as simply attempts by the publishers to rip them off.

To preserve their margins in the face of reduced sales, publishers often increase textbook prices to protect their investment. The very large investment required for developing and producing a new textbook is increasing all the time, as students expect ever richer and more elaborate materials and higher production values. Often, this cost is in the neighborhood of \$250,000 (printing, production, initial distribution, and marketing).

Costs are also a factor in the K-12 market, but the issues are different than in higher education. K-12 textbooks are adopted through a highly politicized, bureaucratic, and sometimes idiosyncratic process. This process takes many months and requires the full production of sample copies of books for distribution to a multitude of reviewers. These texts must conform to state standards, which can be hard to interpret. Although success in securing an adoption assures the publishers of a return, the risk in developing new K-12 textbooks is highly concentrated in the adoption process and must be compensated for in the cost of the text—thus raising the price.

State governments are also aware of the rising costs and of the potential of the Internet in reducing such costs. In several Southern states, funding has been forthcoming for the creation of online high school courses that were intended to serve those schools lacking in resources to offer their own courses, and for students who did not have access to regular classes. The consequence, however, has been the proliferation of “virtual high schools” nationally. 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. Usually, for a fraction of what school districts spend annually on textbooks, very high quality and easily distributed material can be offered online.

In developing countries, the case for open textbooks is different. Usually, it is not the textbook price set by a publisher that is the obstacle to textbook adoption in the schools, but the economic situation of the schools. Publishers simply don't see much of a return from selling to developing nations that can't afford to keep buying books. Short on resources, these governments don't have the budgets to continuously replace the texts they use in schools. In



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some cases, in an effort to reduce costs, low quality books are produced. This reduces the life of the book, which necessitates further investment in replacements.

This lack of good textbooks worsens an already bad situation in developing nations. With teacher cadres at lower levels of content-matter and pedagogical preparation, textbooks play a much more important role in the education process here than in many developed countries. Thus the need for high quality, low-cost textbooks is crucial to the improvement of education. This situation is clearly understood by funding agencies, which are fully aware of the potential of the OER movement. They are poised to invest if the right supporting institutional and technological infrastructure can be developed.

On a positive note, most developing countries do not have some of the barriers to textbook adoption developed countries do. For example, they usually do not have an entrenched, politically active publishing industry ready to pounce on any proposal that would knock them out of business. And opposition from the educational bureaucracy is less developed and sophisticated than it may be in countries with higher economic well-being. Further, there is a drive in developing countries to leapfrog over entrenched technologies into relatively sophisticated telecommunications systems, driven in part by the widespread and rapid adoption of wireless communication systems.

The answer to the question “Why open textbooks?” has several answers, depending on the economic and social context. Many of these answers, but not all, have to do with costs. Whether the costs are met by students and their parents, by governmental bodies and their taxpayers, or by developing countries and their patrons, there is beginning to be a groundswell of interest in OER. When the promise of improvement in learning is added to lower cost, the argument for OER is powerful indeed. We will explore this promise later in this paper.

2. WHAT ARE OPEN TEXTBOOKS?

The many dimensions and expressions of the word “open” as it relates to OER provides an insight into the difficulties the group had in understanding what the combined term “open textbooks” really means. When we add to that the slippery notion of “textbook” in the context of the digital age, defining just what an open textbook is becomes open to discussion.



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In common usage, a *textbook* is a physical book, printed on paper and transportable only through physical means. When we talk about *open textbooks*, most of us can agree that the physical and fixed attributes of the term textbook are absent. And once we add the digital and changeable attributes included in our conception, our imaginations are free to extend the concept almost infinitely. Our challenge, as participants, was to come to some sort of shared understanding.

The Open Textbook Continuum

To do this, we found it useful to imagine a continuum: On one end of the continuum we placed a physical textbook that has simply been digitized and put on the web for anyone to view. On the other end, we placed the most wonderful open course we could imagine. We saw that to move along that continuum from left to right—from the static, digitized textbook to the open course—one could add discrete but interacting features. Each time a feature was added, both the complexity of the supporting infrastructures and the barriers to its production were increased. In effect, added features pushed the concept to the right, but then met barriers that pushed the concept to the left. At some point—designated on the figure as Point A—so much of the traditional definition of a textbook will be discarded that the term will have been changed.

Figure 1 illustrates this continuum:

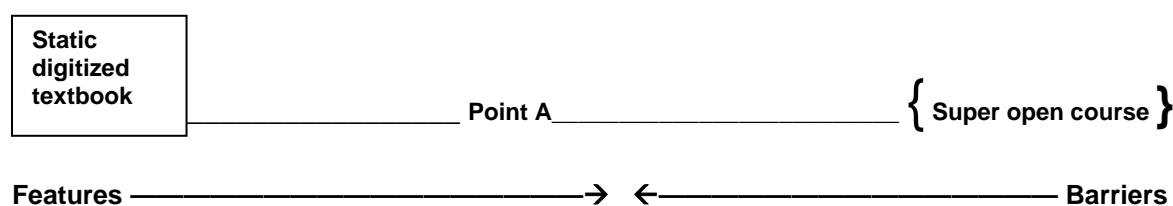


Figure 1. The Open Textbook Continuum

This conceptual model initially created some confusion, but it also had the advantage of providing that point of convergence that we were all looking for: the coming together of the concepts of open textbooks and opencourseware. Let's examine briefly the features that erode our definition of what a textbook is, and some of the barriers that may inhibit the realization of our ideal.



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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 be easily altered. The alteration of a static textbook 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 used it and developed 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.

Another way of expressing the customizable nature of dynamic material is to imagine the same material being presented in multiple ways so that learners could look at it through different lenses. For instance, a course could be modified to suit the learning needs of an autistic student, or a student who learned better through mathematical analysis. It could be **added to** or **extended** to incorporate a deeper treatment of the material, to include new examples or learning aids, or to extend the subject matter into a longer course. And finally, 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, textbooks that are modular in organization will find the most users and reusers.

Increased student engagement is another element that might fit under the category of dynamic material, but is significant enough to stand by itself. Static textbooks cannot respond to students, nor can students engage with the learning material in an 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 engagement with other students are all logical extensions of the static model.

Open courses available on the web can also be the center of **communities of students and teachers**, either temporarily (as, for instance, students in a particular class) or long term (say, 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.

From open courses can flow information in **meta** data form (results over large groups of students), which can be used to **measure student outcomes** and **improve teaching practice**.



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They, and the communities of teachers that they generate and support, can engage in **teacher 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 (at an appropriate place in a learning cycle) take a personality inventory test on the web, have it scored, and then write an interpretation of the test. Or a student studying Shakespeare could be prompted to visit the Globe Theater website. This “just-in-time” easily embedded linking ability is an often unrecognized benefit of online education. And, of course, it takes advantage of a huge and growing store 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, to localize 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 the material and keep it up to date.

The main barriers to adding almost all of these features are the **initial cost and sustaining resources** required. This is very important if we want to incorporate the feature of **community development and maintenance** into our model. Those who assume that the public good and the power of the ideas surrounding open textbooks/courseware will attract enough volunteers to work for free (as seems to be the case in some of the open course software products) are probably off-base. A movement of this size cannot rest on volunteerism over a long period.

Other daunting barriers to the development and sustaining of open textbooks/courseware also exist. Overcoming these barriers is easier in some settings (higher education vs. K-12) than others, but all of them come into play in all settings to some extent.

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 in the K-12 domain, are slow to change and slow things down.



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Technology presents its own barriers. We have already mentioned how developing countries frequently simply **lack technological infrastructure** (the most serious of which is lack of Internet access) or possess an outdated **embedded infrastructure** that makes it impossible for them to take advantage of OER. But even in developed countries, the lack of interoperability and technical standards makes the distribution of materials difficult. Along with a lack of infrastructure or the wrong infrastructure often comes a lack of end user skill, particularly in students and those developing content.

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 so often think of the web as an all-encompassing distribution method. But if we want users to download and use open material, we will have to consider how and in what form it is delivered to them.

We have mentioned the **lack of quality standards** as a problem, but it is also a barrier to adoption. If we can't even define what quality in open resources is, let alone 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?

Certainly, we also have not resolved all of the issues around **intellectual property and digital rights management**. These can be both costly and a barrier.

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.

Choosing a Path

If we follow the logic of the diagram and the narrative above, the way forward 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 quite that tidy.

First, we are not talking about striking only one such balance but many. Each balance will depend on the context and the domain within which it falls (for instance, higher education or K-12). Also, there are likely to be many efforts at developing open textbooks, each effort at best



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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, as we will note in the conclusion of this paper, “connecting the dots” may be one place that foundations can be of help, particularly where that 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. At a minimum, it helped our group to get on with the discussion and discover further layers of the issues before us.

New Dimensions Revealed

As the discussion in our group proceeded, we engaged in both analysis and synthesis of the topics discussed and the perspectives represented. This process revealed the framework of the topic in ways we could not discern at the outset. We expressed them as a set of pairs:

- K-12/Higher Education
- Developed Countries/Undeveloped Countries
- Top Down/Bottom up
- Course/Reference
- Core Content/Service Model
- High Tech/User Capabilities

Let’s look at each pair individually.

K-12/Higher Education

As we have already seen, K-12 textbooks are usually tied to specific state standards and designed to be a part of prescribed lesson plans. They are adopted through a lengthy and bureaucratic process involving politics and even, unfortunately, religion. Funding for the texts comes from state budgets; and adoption periods are prescribed and as infrequent as possible to reduce costs. Pressure in favor of open textbooks comes from government offices seeking to



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reduce costs to the taxpayer. The configuration of openness is likely to be quite different in K-12 than in other realms because of the desire to create a uniform treatment across schools and not bar unapproved instruction.

In higher education, on the other hand, adoption is generally decided by individual instructors who decide course by course and year by year what texts to adopt, if any. On the one hand, these instructors have a stake in sticking with the same text all the time to avoid having to revise their course syllabi each year. On the other hand, they also often have an impulse to reduce costs to the students and their parents, who pay the bill for textbooks. Publishers seek to avoid the used textbook market by frequently revising texts. Pressure for open textbooks is coming from students and faculty who view the publishers as increasingly rapacious and out of touch with the digital age.

These two realms are so different that any discussion of open textbooks requires that the context of the discussion be defined as being in one or the other of these domains.

Developed Nations/Developing Nations

As we have already discussed, developed nations generally have the resources to develop and use open textbooks; but they also have an establishment around traditional texts that makes adoption complex and politicized. Developing nations, in contrast, generally do not have the resources required to develop or use open textbooks but have relatively open fields to do so.

The need of developing countries for low-cost, high quality education material is great and quite apparent. Issues of localization, the recognition of indigenous knowledge, the use of textbooks as a mainstay of instruction, and teacher development are all much more important in developing countries than in developed countries. Given these factors, the pressure for open textbooks will be strong, and it will inevitably be recognized and funded by governments and private organizations.

Top Down/Bottom up

Just as the adoption process for K-12 texts might be considered top-down and the higher education process considered bottom-up, so the development of open textbook initiatives will have differing directionality. Top-down efforts will be characterized by those in authority, such as governments or ministries, or those with resources at their command, such as foundations



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pushing the development and adoption of open texts. Bottom-up efforts will be initiated by individual authors, who are likely to be instructors or faculty members seeking to provide high quality (in their estimation) and inexpensive learning materials to their students and who then seek some institutional sponsorship (private or public) for their efforts.

A simplistic expression of this difference is that the top-down model is interested in “I’ll tell you what is good for you,” while the bottom-up is interested in “Let me tell you what I want.”

Course/Reference

Perhaps the most interesting and profound set of dimensions we discovered had to do with how we expected users to actually use materials. As we went forward in our discussion, it seemed that a highly strategic choice had to be made: the creation of a coherent and complete text/course/learning pathway that led students from point A to point B, or the creation of material that could be used in reference fashion with modules that could be extracted from the whole and used independently from other parts. Although we did not conclude that this was a necessarily disjunctive decision—that is, that it was necessary to decide in advance which way to go—it nevertheless called into question the overall conception and strategy for open textbooks.

There is a long-held notion that learning is contextual, and that textbooks provide a context for learning that presents material in a logical, linear fashion (based on the belief that students, particularly young students, learn best that way). However, we know that the textbook context is not the only context employed in learning. Many instructors—often the best instructors—create their own context and rely on textbooks for only a part of that context. We also know that learners must create or adopt learning contexts for themselves.

Many of the participants in this meeting spent most of their learning lives without the benefit of the Internet. But as they observe their children, who have always used the Internet, they began to suspect that kids are learning differently now. The linear model, in which one concept builds on another, is being supplanted by the *montage* model. In this model, meaning is splashed almost randomly on the canvas of the mind. It is not made coherent step by step; rather, coherence is achieved near the end of the learning process.

As the typical grammar school child multitasks her way through the day, mixing social interactions (much of which might be mediated by technology), the consumption of



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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 instead just be concentrating on producing large-scale learning object repositories that our montage-minded children, using an ever-improving search engine technology, can easily cut and paste into their own context for knowledge?

Core Content/Service Model

In one sense, the left side of the continuum shown in Figure 1 is concentrated on content, while the right side has content embedded in some form of service model. Discussions often do not take into account this transition in thinking. Too often, we focus on one side or the other as the goal, making logical give and take difficult.

The content people often seem to be trying to avoid complexity, feeling that “If we build it, they will come.” The service people tend to take the side of the user, and feel that the best measure of success is the extent of the ultimate use of the content, not the content itself—however well constructed and presented. Having proposed this continuum from the beginning of the discussion, we largely avoided this impasse; but the contention between the content side and the service side cropped up now and again. The conceptual model we developed, in setting as its goal the finding of the right point on the continuum (Point A) for any particular project, is one way of dealing with these opposing views.

High Tech/User Capabilities

Planning to implement an open textbook project pulls one away from the conceptual and philosophical realms into the practical and real. The richness of available media and learning material beckons educators and instructional designers toward the latest technology so that the full potential of online education can be realized. However, creating OER that exploits the new technology may also severely limit the number and categories of potential users of the material. When the potential audience is spread worldwide, this problem is magnified. There are always “workarounds” in any given situation, but these drive up the cost and complexity of any project.

An extension of this tension is the potential conflict between current technology and projected future technology. With the advance and sophistication of technology happening so



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rapidly and with some degree of predictability, planning an open textbook project becomes more complex. For instance, projections now indicate that perhaps only a small percentage of people in the developing world will have access to personal computers anytime soon, whereas as much as 70 percent will have cell phones. Should open textbooks immediately focus on mobile technology, even with all its limitations?

The listing of these pairs or choices added dimensionality and complexity to our conceptual model of the continuum, but better prepared us to address the next question concerning open textbooks: How?

3. HOW OPEN TEXTBOOKS?

We investigated the “how” of open textbooks right from the beginning of our conversation. We benefited in particular from the experience of two members of the group, John Page and Alfred (Ken) Mulzet, both of whom had authored or were in the process of authoring open textbooks. Page is the author of a Mathematics Open Reference project.² He demonstrated his effort, which has a linear structure and is intended as a reference book. It has wonderful interactive diagrams for learners to explore geometry concepts. Mulzet has also produced a textbook in mathematics, with the intention of distributing it free by any method available.

These two authors represent a growing number of instructors who are impatient with the current state of textbooks and who are seeking to benefit students with free, high quality, and tested material. Both face a common issue: how to get their individual efforts in front of their intended audiences. Clearly, these individuals need to form strategic alliances with organizations to achieve their goals, a fact that led us to the conclusion (explored in the final section of this paper) that there needs to be some overall effort to “connect the dots” of the open textbook movement.

² Available at <http://www.mathopenref.com/>.



Production Issues

In preparation for the meeting, we had identified several efforts directed at producing open textbooks, and during the discussion several more were mentioned. (A list of these initiatives appears in Attachment 2.) Some of these efforts are sincere and serious, but no outstanding or successful initiative has yet come to full fruition. More relevant may be the many efforts to produce “virtual courses” (the right side of the continuum), but that connection has not yet been made.

Although we did not expect to answer the “how” question with a detailed plan for the production of open textbooks, we did expect and were able to forecast a number of important elements that will need to be considered in the production process. Discovering these elements then led us to a gap analysis—a discovery of what is needed to facilitate more open textbook projects and objects for consideration of future funding. The major elements of the “how” of open textbooks were a partial refrain from the preceding parts of this paper: quality, accessibility, sustainability, and community or convergence.

The How of Quality

One stumbling block that stands in the way of implementing an open textbook project is the issue of quality. The question of how quality is to be determined and maintained must be addressed before the project can begin. First, funding agencies need to be assured up front that what is produced will meet high standards. High quality is also a deciding factor for significant numbers of potential users.

We had the advantage of the experience of several of the members of the group as they approached this question. For example, Gary Lopez of the Monterey Institute for Technology and Education (MITE) and the National Repository of Online Courses (NROC) met this challenge by first establishing criteria by which quality is determined, and then employing instructional designers and technologists to evaluate existing material and alter it to meet those standards.³ The product of these projects is advanced placement high school courses, which must meet national standards and prepare students for national tests. The criteria, while still difficult to

³ The standards adopted by MITI and examples of materials meeting those standards are published on the web (<http://www.montereyinstitute.org/pdf/OCEP%20Evaluation%20Categories.pdf>).



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articulate, at least had a rational boundary. This method is basically a “filter” for quality placed on the front end of the process and presumes that those applying the filter know what quality is in the eyes of the user.

Another approach, termed the “Wikipedia” approach by some group members, depends on the user community to provide the quality control. It uses “market forces” to determine quality, often simply counting “hits” to the material. Although perhaps not sufficiently structured for academic material, this approach does take into account user preferences.

Somewhere in between these two approaches are several other examples. The Connexions project of Rice University employs an initial filter but then seeks to segment offerings into different “lenses” through which different types of users can view the material. For instance, a secondary school teacher might search for all material between the sixth and ninth grades.

Another way of dealing with quality issues is to be sure that user information is “fed back” into a revision process so that materials are continually improved from some established starting point. Examples were provided by the Free High School Science Text project ⁴ and the Carnegie Mellon “scorecard” of student behaviors and learning achievement that educators can use to modify the next offering (Candace Thille). ⁵

Accessibility

Any plan for producing OER of any source has to have as its base the notion of accessibility for its intended users. Most concerns over accessibility have to do with platforms and software. The platform on which OER resides is crucial for users. Of course, users fall into many categories, and any OER project will likely include in its intended users students and teachers, as well as content developers who may want to incorporate the offered OER in other works. Clearly, these diverse users will seek different kinds of access and use for the materials.

This means that the platform chosen for the OER—that is, the complex of hardware and software that is used to store and offer the resources—should have some if not all of the following characteristics:

⁴ See <http://www.fhsst.org>.

⁵ See <http://www.cmu.edu/oli/>.



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- First, the platform must be **open**. That is, it must be available to users without impediment. It should not be proprietary in the sense that users would have to pay for it or for any “plug-ins” or other services.
- Second, it should be **modular**. Generally, this means that its features should be configured in such a way that different elements of the material can be extracted from the whole without limit. For instance, a course may be divided into lessons, topics, pages, and different media on any page. The most accessible configuration would allow a user to access, abstract, and change any of these elements individually.
- Third it must be **flexible**. That is, the platform should be usable at different levels of embedded infrastructure, from dial-up low bandwidth technology to mobile devices.
- Fourth, it also should be useful at **varying levels of capacity**, from single users only periodically to perhaps thousands of simultaneous users.

Platform-related accessibility is very important, but other elements of accessibility are also important. Accessibility for special populations, particularly disabled people is not only highly desirable, but may be mandated by law. Perhaps the highest standards of this kind of accessibility are presented in the US law titled the Americans with Disabilities Act (ADA), which sets forth requirements and ways in which online material must be created to maximize its use for those with disabilities. It is clearly easier and cheaper to incorporate accessibility standards into material as it is being created than after it has an established form.

Sustainability

It does little good to create high quality OER only to have it deteriorate in usefulness, become obsolete, or be removed from circulation completely because of a lack of sustaining funding. Even the most carefully produced material is subject to these factors. Even though it may be relatively inexpensive to maintain content once it is produced, there are always requirements and costs beyond the initial development that must be taken into account.

Certainly, development of material according to the criteria listed under accessibility (particularly modularity and flexibility) will help hold maintenance costs down, but there will always be some cost of carrying the material. Simply keeping the servers operating is a cost even



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with the least service dependent business model. Thus the “how” of OER is tied very tightly to the issue of sustainability. Don’t even begin a project without a clear sustainability plan.

Community and Convergence

Sustainability is closely associated with community in every OER project. Where will the energy for starting and sustaining an OER project come from? Most likely, it will come from one of two sources—institutions or community.

One example of institutional energy is the MIT OpenCourseWare project, in which the development of opencourseware is now a part of the institutional practices of MIT—it is in the bloodstream of the institution. Without this kind of institutional support, a sustaining force must come from a user/sponsor community of sufficient critical mass and motivation. Of course, this community must be convinced that the OER will ultimately be useful for their own purposes—by serving defined populations, lowering the cost of education to taxpayers, or advancing an individual toward a learning or career goal. Thus the “how” question needs to address the source of initial and sustaining energy of the project, and take steps to enhance either the institutionalizing or community development aspects of the project.

Earlier in this paper we outlined a very strong aspect of the convergence between the open textbook movement and the OCW efforts underway exemplified by the OpenCourseWare Consortium (OCWC), which grew out of the MIT OCW initiative. This convergence is likely to take place on many levels. Certainly, this convergence will also result in the development of a community around the whole of OER. Thus the concepts of community and convergence of the many elements of OER are intertwined. It is clear that almost any initiative in any part of the OER “space” (open textbooks, OCW) will have to connect strategically with some other part of the OER movement, and that the advancement of the overall movement will depend significantly on strategic partnership formation. For instance, no single course author, operating alone, will be able to achieve all of the elements listed under this “how” section. Further, it is clear that any institutional effort, even one as integrated with institutional practices as is MIT’s program, will be well enhanced through strategic connections with other similar or complementary efforts. The most obvious elements of convergence are the creation of quality standards, the interoperability of systems, the combining and coordination of resources, and the cross-use of developed assets.



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4. WHEN OPEN TEXTBOOKS?

This question is posed in affirmation of the inevitability that something will happen with regard to open textbooks or the evolution of open textbooks into OCW. The question is not “If?” but “When?”

The dynamics in favor of some development that affects the way we think of and use educational material as individuals and teachers are too strong for us to tolerate the status quo for very long. In some sense, the “when” is already upon us—as the list in Attachment 2 attests—but these efforts remain isolated and with very small impact so far. When will the full impact and potential of open textbooks be apparent? Our guess is that within five years, we will be able to see some very significant use of OER where such material actually replaces textbooks at demonstrably lower cost. Once these demonstrations are evident and publicized, the movement—whether it is called open textbooks, or OCW, or OER—will expand quickly, changing the textbook publishing industry dramatically and pushing the for-profit segment more clearly into the service sector. That is, rather than providing products (physical textbooks), for-profit firms (whether former publishers or newly developed businesses) will be providing more learning and teaching related services, only a segment of which will actually be the content itself.

In the transition to this new model of openness and for-profit activity, educational institutions and society itself will face the possibility that the production of trusted learning material will be disrupted. However vilified, textbook publishers have become a provider trusted to supply high quality and current material. Their replacement will require that new not-for-profit organizations and communities be formed, dedicated to openness principles. As we go into this transition period, we will not be well served by what, in some circles, seems to be an “us and them” attitude on the part of either the publishers or the openness community. Rather, we need to find as much grounds for cooperation as we can, with the publishers actively seeking and respecting the advice of educators, and educators seeking to reward those companies and individual entrepreneurs who seek reasonable returns for valuable contributions.



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Next Steps

Although the group did not expect to be able to come up with a detailed plan for the next steps in advancing the notion of open textbooks, we did expect—and were able to at least suggest—some activities worthy of foundation or government support that we felt would result in more rapid progress. These activities derive mainly from the informal gap analysis that we engaged in, and from a simple end-of-meeting exercise: We asked each participant what, from their own perspective and that of the project in which they were engaged, most needed to go forward. Of course, the answer usually boiled down to more funding for what they were already doing. However, from a list of what that funding would be used for, we gained further insight. The next steps came down to a fairly simple, but highly interrelated set of activities:

- Infrastructure capacity building
- Clearinghouse, network facilitator
- Community formation
- Funding and publicizing demonstration projects
- Research

Let's look at these individually.

Infrastructure Capacity Building

The efforts of patrons of the open textbook movement to improve the supporting and enabling infrastructure are crucial. This infrastructure has many aspects. We have already spoken about the importance of establishing **standards of pedagogical and content quality** as highly important. All classes of the user community must be assured that quality standards are in place and that some mechanism for maintaining those standards is in operation.

Standards for technological interoperability and compatibility are also important. Users should not have to employ widely different technologies or methods for gaining access to material, and developers should understand what technology standards they should use to produce material.



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The development of enabling tools should also be supported, and these tools should conform to quality and technological standards. For instance, a tool flagging material that does not meet ADA standards might be developed with Foundation funding.⁶

Funding in support of **discoverability of material** would also qualify as infrastructure building. This means tagging keywords in a consistent manner, such as the Library of Congress Subject Heading List. Material that is produced needs to be made available to users. The several efforts in the OCW movement to create portals and to connect members of the OCW movement through reciprocal web links is an example, one which might well be used for open textbooks.

Efforts at **increasing institutional involvement** would also build the movement. Earlier we suggested that institutionalization of OER efforts was one means of attaining sustainability. Such involvement by institutions includes not only financial support of effort but also non-financial support, including simply endorsing the idea of openness. Foundations and other traditional patrons of educational institutions can have a positive effect on gaining institutional involvement.

Marketing the movement is another way of building capacity. The more that people and institutions understand about the open textbook movement, the more support there is likely to be for it. Yet there are relatively few sources of funding for such a public relations campaign.

Clearinghouse, Network Facilitator

We have mentioned several times the necessity of convergence in the open textbook movement and between the open textbook, OCW, and OER movements. We need a “connect the dots” effort. We also need some way to coordinate efforts so that, for instance, no more than a few people are working on an algebra open textbook. Such a diffusion of effort may be wasteful in an atmosphere of scarce resources.

The work on an algebra text might also usefully be coordinated with the development of other material in the teaching and learning of mathematics. Individual authors of open textbooks, such as the two that joined our group, need to be connected with organizations or resources that can help them develop, evaluate, and make available their material. For instance, perhaps an

⁶ See this site for standards of web page construction that is ADA/section 508 compliant: <http://www.access-board.gov/sec508/guide/1194.22.htm>.



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individual author could have her material placed on the OCWC site of an OCWC member, thus making the material available through the discoverability processes of OCWC.

All of these functions and many more would be facilitated if there were some kind of central clearinghouse of information, where actors in the various OER movements could register and describe their projects for others to learn about. To such a registration system could be attached a project evaluation process, by which selected projects could be supported or incubated in the manner of start-up businesses, and connected with talent and other resources that would be helpful.

To this rather formal process could be added the opportunity for the various players in the movement to network with one another. Foundations have already been facilitating such networking by sponsoring meetings and convocations around various aspects of the OER movement, but such efforts could be expanded and given greater direction.

Community Formation

Related to the networking notion, but distinct from it, is the forming of communities. We noted that motivated communities of users are one way in which sustainability can be achieved. However, the formation of communities sometimes needs a catalyst, before the sustaining “lift off” position can be achieved.

Patrons can help communities identify their common interests and take the first steps toward a more formal organization. Something like this may be happening in the OCW movement—the William and Flora Hewlett Foundation has supported the formation of the OCWC, which is just now gaining its existence as separate from MIT.

User communities, of course, may be quite informal and still be a sustaining force. We see scholarly communities developing around both very broad but sometimes very abstruse and narrow topics. Smaller, informal communities can be highly effective and often take very little help to form.

Funding and Publicizing Demonstration Projects

We have indicated that within five years, we will probably be able to identify some highly effective projects that will demonstrate both the efficacy and cost efficiency of open textbooks. Patrons could fund some carefully and strategically selected demonstration projects,



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and then make sure they are described for others to emulate. The selection of these projects would be aided by the clearinghouse function mentioned above as projects and potential projects identify themselves and connect with incubation services.

The notion of “best practices” for open textbook projects could be developed and articulated as both successful and unsuccessful projects are studied. Also through the clearinghouse function, successful efforts funded by governmental agencies (the Southern states, for example), might be identified and then evaluated with Foundation help so that they, too, can be included in an inventory of efforts. Particularly important will be efforts to compare the cost of open textbook projects with the cost of traditional textbook acquisition and adoption methods. As indicated earlier, it is expected that just a few successful and well-publicized and documented projects will fuel the movement.

Research

Finally, in the interest of underpinning the movement with evidence of effectiveness, patrons of the OER movement can fund valid research. For many potential adopters—universities, for instance—scientifically based and valid published research will be important in securing their commitment and involvement. Foundations can convene practitioners and academics to develop a research agenda designed to answer the most important questions raised by these new opportunities, and then select the most important for investigation.

CONCLUSION

The OER movement, which includes efforts to provide open textbooks or supplant textbooks with OER material, is in a state of consolidation and convergence. The “let many flowers bloom” stage, well funded by several private foundations and joined by a growing number of state governments, is now heading toward the “connect the dots” stage, in which the lessons and expertise and the products of the earlier stage now need to be brought together. In effect, there needs to be a return on the earlier investment, which will result in self-sustaining practices that bring the full economic and pedagogical benefits of the new technology to learners and teachers everywhere.



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The highly compelling economic rationale behind open textbooks can add fuel to the growing power of the OER movement. Open textbooks, which now exist as a separate special case of OER, can join the OCW movement in highly complementary ways. Relatively small additional strategic investments will result in a rapid expansion of OER by bringing people and technology and organizations together toward the end goal of making the entire sum of human knowledge and access to it through the teaching/learning process available to everyone, everywhere, at any time for free.



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ATTACHMENT 1
LIST OF ATTENDEES

The following people attended The William and Flora Hewlett Foundation Open Textbook Meeting, August 22-23, 2007, in Newport Beach, California.

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ATTACHMENT 2
OPEN TEXTBOOK INITIATIVES

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

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

Global Text Project
<http://globaltext.org>

Open Textbook
<http://www.opentextbook.org>

Wikiversity
<http://en.wikiversity.org>



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