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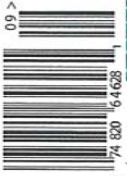
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LEARNING IN CYBERSPACE

*Marshall Smith on Open
Educational Resources*

*John Seely Brown on New
Learning Environments*



THE PROMISE OF OPEN EDUCATIONAL RESOURCES

BY MARSHALL S. SMITH AND CATHERINE M. CASSERLY

In Sauri, Kenya, a fifth-grade schoolteacher looks up ways of explaining the division of fractions, a challenge faced by teachers around the world. Since he is planning at home, he is using his hand-held device to view a free and dedicated Web site written in Swahili. He finds a set of examples that have been written by other Kenyan teachers, as well as videos of excellent teaching from Singapore that are captioned in his language.

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In a small, Native American college, a student is exploring materials on Middle Eastern history that have been digitized and organized into an open collection drawn from the Harvard University Libraries. A student in India is viewing open film and texts describing Martin Luther King's life and examining parallels with Gandhi's. A freshman in Brazil is preparing for a calculus exam by viewing open lectures and multi-media calculus courses from around the world that have been translated or captioned into Portuguese. A junior from Spellman University who is spending the spring semester in Israel contrasts open, Web-based data from archeological digs in Turkey with the findings from her own explorations at Hazor, a recently named World Heritage site in Israel. And in Brooklyn, a sixth-grader is in contact with a fourth grader in Kenya—they are discussing the migration of the wildebeests, both using hand-held computers.

These are examples of the use of open educational resources (OER): teaching, learning, and research resources that reside in the public domain or have been released under an intellectual-property

license that permits their free use or repurposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge or that have an impact on teaching, learning, and research. Based on our five years of work involving OER at the William and Flora Hewlett Foundation, we see great promise for the future in the evolution

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of these resources. (<http://www.hewlett.org/Programs/Education/OER>).

SHARING KNOWLEDGE

At the heart of the open-educational-resources movement is the simple and powerful idea that the world's knowledge is a public good and that technology in general and the World Wide Web in particular provide an extraordinary opportunity for everyone to share, use, and reuse that knowledge. OER materials provide users with the intellectual capital to help them understand and use all of the Web's content. These resources thus connect "education for all," the United Nations' call for everyone in the world to have a basic education by 2014, with the goal of closing the digital divide.

Many prestigious American universities originally applied a capitalist model to the Web, imagining that they would make a great deal of money by selling some part of their knowledge through Internet-based delivery systems. By 2001 this idea had foundered in the face of market realities. With the specter of riches growing dim, there emerged substantial support among academics for using the Web to provide open access to educational materials. After all, most published professors know that they are not going to become rich on their royalties, that their books and articles will probably be out of print within five years, and that academic progress is nourished by the free flow of information. And most faculty, proud of their work and wanting to share it, provide links to their scholarship on their own Web sites. So the Massachusetts Institute of Technology (MIT) boldly changed the model: In late 2001, it announced its OpenCourseWare (OCW) initiative, an ambitious project to share the content of its courses with the world.

Access to knowledge and the capacity to use it are critical to both individual and collective prosperity in a world of knowledge economies and global interdependence. In *The Future of Ideas*, Larry Lessig argues that if some have access to the wealth of information on the Web while others do not, creativity will be constrained and inequalities heightened. And that argument does not simply apply to the widening economic gap between the developing and developed worlds. We only have to compare the resources of the libraries and laboratories

of the top 20 universities in the United States with the thousands of colleges and universities that are not among them to see such inequalities here at home.

Of course, all knowledge cannot be open. Copyright and other intellectual-property laws shelter recently created materials, and privacy laws and regulations protect images of individuals from being exploited by others. And not all academics believe that all potentially eligible scholarly content *should* be open. Some fear that others will appropriate their ideas without permission or credit, while others worry about potential lost revenue to their institutions and themselves and the cost and bother of posting and updating material. But in some institutions and among many individual professors and administrators, the idea of knowledge as a public good has come to outweigh these legitimate concerns.

The road to publication of open content is not easy and can be expensive. We examine some of the challenges later on in this article. But first we wish to explore some of the progress toward open academic knowledge that has been made over the past half decade, as well as where we see it going in the future.

CURRENT STATUS

As we entered the new millennium, the amount of educational content freely available on the Web was large and growing exponentially. With some exceptions, however, the materials were scattered, difficult to find and use, and lacked the guarantees necessary to ensure their quality. But despite the seeming chaos, many university librarians foresaw that digitized collections of materials would be a significant, if not the major, form for future library collections. So the 2001 announcement by MIT struck near-ready kindling.

Then at a 2002 UNESCO-sponsored, Hewlett-supported meeting of participants from both the developed and developing worlds, the term "open educational resources" was coined. The uptake on the OER concept since 2001 by international organizations, colleges and universities, individual faculty, and believers in the open-source concept has been extraordinary. UNESCO, for example, has embraced the implementation of the OER concept as a goal in its recent two-year plan. Some governments and other international organizations—the

FIGURE 1. MIT OPENCOURSEWARE HOME PAGE

The screenshot shows the MIT OpenCourseWare website interface. At the top right, there are navigation links: COURSE LIST | ABOUT OCW | HELP | FEEDBACK. The main header reads "MITOPENCOURSEWARE MASSACHUSETTS INSTITUTE OF TECHNOLOGY". Below this is a welcome message: "Welcome to the MIT OpenCourseWare, an open educational resource publishing MIT course materials, and invite you to [view all the courses](#) available at this time."

On the left side, there is a search bar and a list of course categories: Aerospace and Astronautics, Anthropology, Architecture, Art, History, Physical, Education and Recreation, Biological Engineering Division, Biology, Brain and Cognitive Sciences, Chemical Engineering, Chemistry, Civil and Environmental Engineering, Comparative Media Studies, Earth, Atmospheric, and Planetary Sciences, Economics, Electrical Engineering and Computer Science, Engineering Systems Division, Foreign Languages and Literatures, Health Sciences and...

The main content area includes a "Welcome to MIT's OpenCourseWare" section, a "Partners in Sharing" section, and "Other OpenCourseWare Projects". There are also testimonials and a "Give Now" button.

World Bank, the Organization for Economic Cooperation and Development, the International Association of National Academies of Science, the Commonwealth of Learning, the European Union, and the European Organization of Open Universities—have also acknowledged the potential impact of OER and declared their interest in and support of it.

The growth of two categories of open educational resources demonstrates the promise and challenges of the movement: MIT's OpenCourseWare and portals and repositories. In our work we have been concerned about ways of warranting material as being of the highest quality, so with few exceptions our examples will be taken from settings where there are quality-control mechanisms in place, such as the use of peer review or ways for outsiders or users to assess the usefulness and quality of the material.

OpenCourseWare. MIT uses the term OpenCourseWare (OCW) to refer to the collection of course materials it began to publish in September 2002. Examples include lecture notes, reading lists, course assignments, syllabi, study materials, problems sets and exams, illustrations and simulations, and streaming videos of in-class lectures. Since 2002, MIT has published over 1,400 courses from all five of its schools and 33 academic departments.

In his 2000-2001 annual report, MIT's former President Charles Vest discussed the OCW project:

We now have a powerful opportunity to use the Internet to enhance this process of conceiving, shaping, and organizing knowledge for use in teaching. In so doing, we can raise the quality of education everywhere. . . . In this spirit, MIT has asked itself, in the words of T. S. Eliot, "Do I dare/Disturb

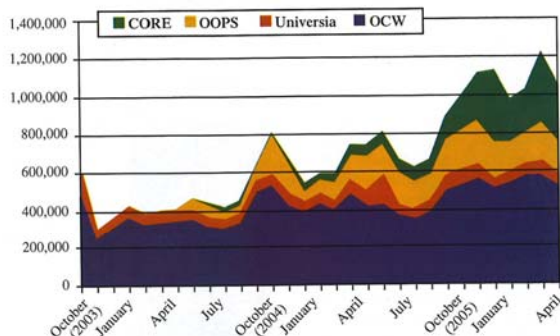
the universe?" Our answer is Yes. We call this project MIT OpenCourseWare (OCW). We see it as opening a new door to the powerful, democratizing, and transforming power of education.

MIT's initiative has attracted national and worldwide attention, garnering awards for creativity, technology, and public service. The MIT-OCW site (www.ocw.mit.edu) and others with translations of the MIT material are visited over 1.2 million times per month (see Chart 1). Universitas (<http://www.universia.net>), a foundation supported by a large Spanish bank, funds the translation of OCW materials into Spanish and Portuguese, thereby facilitating use in Latin America as well as Europe. On the Chinese mainland, Chinese Open Resources for Education (CORE) (<http://www.core.org.cn/en/index.htm>) provides translations and support services for Chinese institutions interested in OCW. In Taiwan, OOPS (Opensource OpenCourseware Prototype System at <http://oops.editime.com>) has developed an innovative strategy for using professional volunteers, often from the Chinese diaspora, to translate materials. As Chart 1 shows, there is especially strong draw to MIT OCW from the two sites that contain Chinese translations.

MIT's OCW content is also provided locally through nearly 80 sites that mirror that content, installed on university campuses around the world. This enables those with limited bandwidth and without strong connections to the World Wide Web to access MIT OCW materials. Locations of these "mirror sites" include Bangladesh, Brazil, Ghana, Indonesia, Pakistan, Sri Lanka, Uganda, and Vietnam. The experience with mirror sites thus far suggests they provide remarkable promise for providing wider access. Usage data from these mirror sites are not included in Chart 1.

The story of OCW does not end with MIT and its translation partners. In total, 52 other OpenCourseWare projects have been launched in the United States, China, France, India, Japan, and Vietnam, offering combined access to more than 2,000 courses. Under MIT's leadership, a voluntary OCW Consortium has been formed to develop shared mission, goals, and priorities to leverage the group's collective impact on teaching, learning, and research. A

CHART 1. MONTHLY VISITS TO MIT OPENCOURSEWARE SITE, OCTOBER 2003 THROUGH APRIL 2006.



Source: MIT

basic comprehensive search engine for those resources is available at <http://ocwconsortium.org>, with a more sophisticated version under development that will enable users worldwide to locate specific courses across the consortium.

We have heard faculty from other institutions say that they have looked at the MIT-OCW site and wondered, "What's the big deal?" They argue that they themselves put course materials online for anyone to view. The "big deal" is that never before has one institution or a number of them placed core instructional materials from a substantial number of courses online, in one place, in a coherent and searchable format, to be used worldwide. This aggregation of content in a predictable format has proven very attractive to users. Now, for example, the whole world knows where to view the sequence of courses for an MIT master's degree in electrical engineering.

The open courseware from institutions other than MIT should also have a substantial impact. For example, content from the Johns Hopkins School of Public Health (<http://ocw.jhsph.edu>) may well influence the development of public-health initiatives throughout the developing world. In these days of global interdependency and competition, who can doubt that researchers, business leaders, and university administrators around the globe will look at what is being taught and how the content

is structured in Chinese universities' courses? Will students taking a college course check in to see what syllabi, lecture notes, and simulations are used in similar courses in Paris and Japan? You bet! And what about life-long learning? Autodidacts make up almost half of the one million visitors per month to the MIT OCW site.

There are both challenges in, and incentives for, adopting OCW. The first challenge is economic: The initial costs of developing and the ongoing costs of maintaining and updating an OCW site can be substantial. For the OCW concept to take root, the practice of publishing course materials must become seamlessly interwoven with the responsibilities of teaching and the mission of institutions and not be viewed as an additional responsibility or task. A second challenge involves sorting out intellectual property rights, so that pertinent barriers can be identified and addressed, as we discuss at length below. Third, faculty members' comfort about freely sharing their intellectual capital and permitting the re-use of their ideas must be addressed. What happens when the content is distorted or its quality is diminished as it is re-used?

With respect to incentives, administrators are beginning to recognize that knowledge-sharing can become part of their institutional branding. Meanwhile, students are appreciative of an easily accessible structure for exploring course alternatives and their own study. Faculty are

TABLE 1. EDUCATIONAL STATUS OF MIT OCW WEB SITE VISITORS

Role	%
Educators	16.4%
Student	32.0%
Self Learner	46.5%
Other	5.2%
Total	100%

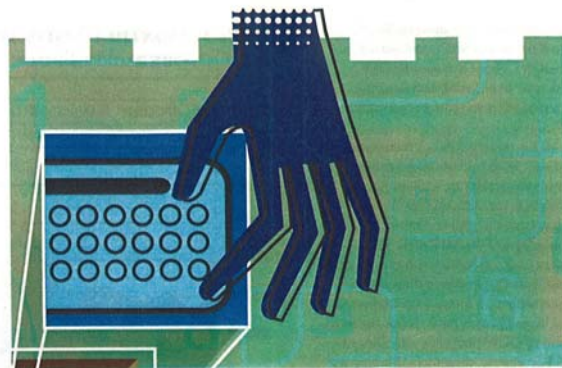
Source: MIT 2005 Visitor Survey

motivated by the idea that their content will have a much larger audience—and the transparency of OCW encourages individual faculty to make sure that their materials are of exemplary quality.

OpenCourseWare is rich with future possibilities. The OCW Consortium is rapidly growing, and the number of languages, fields, and perspectives represented will increase over time. Think, for example, of the varying views represented in the beginning economics courses in U.S. colleges and universities. Other high-quality materials—such as journals, unpublished papers, data and research tools—will be added to the collection and included in the search capability. With attention and imagination, the OCW consortium site could become one of the premier sources in the world for teaching, learning, and research.

Portals and Repositories. The last half-decade has witnessed growth in open-content strategies other than OCW. This open content includes simulations, small modules of content ready for use in courses, scientific journals, book collections, training materials for teachers and other professional and technical workers, and full courses. A critical challenge in using these materials is to be able to find high-quality material quickly. We need reliable aggregation Web sites that we can come back to time and again. This was a problem for higher education in 2000, and it continues to be a problem today.

Unlike a "repository," which contains a coherent collection of materials, a "portal" points to, but generally does not house, materials. Unlike a search engine, it presents a coherent and often vetted set of sites. The OCW consortium Web site is a portal; the MIT OCW site is a repository. Other interesting OER portals and repositories are the National Science Digital Library (<http://nsdl.org/index.php>), the Internet Archive (<http://www.archive.org/details/education>) and the Academy for Educational Development's Global Learning Portal (<http://www.aed.org/glpnetstory.cfm>).



What MIT has done with the OpenCourseWare initiative has clearly manifested the saying that knowledge triumphs in openness. It really opens up a huge vault of knowledge to people all over the world who just want to know or learn something. ...
Terima kasih = Thank you in Malay language.
DR. K.K. CHOONG,
Malaysian educator

org/index.php), the Internet Archive (<http://www.archive.org/details/education>) and the Academy for Educational Development's Global Learning Portal (<http://www.aed.org/glpnetstory.cfm>).

An advantage of a portal is that it can point to large amounts of material across the Web. But to maintain its quality, a portal requires constant attention to ensure that the cited materials continue to be available and valuable. A repository overcomes that problem by controlling the material. This makes it easier to both search and support, but it must also bear the cost of housing and updating the materials. Repositories typically provide access to a narrower scope of material.

The rapid increase in high-quality open educational resources in a variety of fields has made it imperative to establish well-organized and useful portals. Without such sites, users will not be able to take full advantage of open educational resources. Attractive and

I am now currently a student of computer science at BRAC University, Dhaka, Bangladesh and I find it very much useful to learn about my courses. I have always had a dream to study at MIT, since I came to know about the institution, its unique teaching methods, but for many reasons I am not able to do so. This initiative gives me the opportunity to self-teach myself. At least I can reach what MIT teaches to their students. I feel better to access your course materials, to enrich my knowledge. To be truthful, I cannot find words to explain how I feel! Kind of unexplainable feeling, like the feeling one feels when someone falls in love!
MARUF MUQTADIR,
Student in Bangladesh

widely used portals and repositories are coherent, contain a critical mass of material whose quality is guaranteed, add value, and are easy and reliable to use and re-use.

In addition, those that offer the ability to interact with others, for instance through simulations or learning games, strongly motivate people to return. The interaction can be managed through mechanisms that are relatively passive—such as blogs, lists, and instant messaging—or by creating communities of users to solve problems or

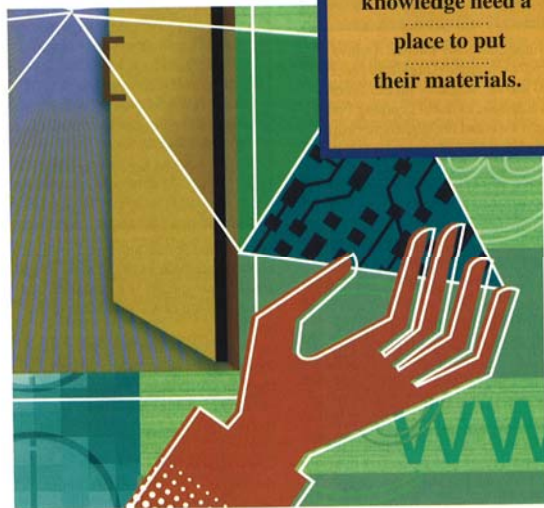
develop new content. Users also want to be contributors. One form of contribution would be for users to place their own content into the public domain or to modify content that they find there. From our discussions with professors and others in the developing world, we are aware that all creators of knowledge need a place to put their materials and that flow of knowledge should be multidirectional and adaptable to the local learning environment. A repository could provide such a space. Another contribution users might make is to provide comments on the quality and usefulness of a site's materials. The key to a Web site's utility is the ability to define the target population of users and then to listen to them continuously.

EMERGING VISIONS

Across the world visions are emerging that would use OER to provide even more powerful support for teaching and learning than we have described here. We are particularly interested in two of the many possible models for enhancing open learning. At the core of the first model would be a coherent sequence of academic or technical content organized into a course module that is roughly equivalent to a university offering. The regu-

larly updated content would be similar to that of a traditional course and could be in the format of multimedia, lecture, or mixed mode; the instruction could be enhanced with student assistants and feedback loops to help with complex concepts. See, for example, the courses in Carnegie Mellon University's Open Learning Initiative (<http://www.cmu.edu/oli/>). The quality of the material would be vetted through peer reviews and testing by users. Moreover, since the content would be free and open, people around the world could review it continuously.

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Think of this model as an interactive and very high-quality free textbook. The lack of a human teacher makes it different from the normal course delivered in a classroom or at a distance. Since this might create difficulties for some students, the model would include tools to guide and support them, including question sets, help buttons, review materials, assessments with feedback, multiple ways of explaining critical issues, and access to other high-quality materials that address the same topics. Communication tools to enable learners in the same course to communicate would also be helpful.

The result would be high-quality, interactive courses that could be taken at any time of the day or night by people all over the world. Now suppose that there are 75 to 100 such courses organized in a portal or repository. They might span the range of college freshman and sophomore core courses and even include Advanced Placement courses for secondary-school students and training courses in areas such as business accounting. The site would have supporting materials to guide potential users to the courses in which they are interested.

This portal could be developed, and the courses translated into key languages other than English, within the next few years. But, critics might say, why would anyone make use of such a set of materials? Students would not receive any credit for the course and, more importantly, the heart of learning is in the human interaction between teachers and students. Surely the learners in these settings will not have the same experience or learn as much as learners in a classroom or even in a conventional online course.

Why would anyone take the courses? For some people, a primary reason would simply be to address an interest—in history, biology, algebra, a foreign language, computer science, statistics, art, music—or to improve their knowledge or skills.

But such courses also could merge seamlessly with credit-bearing instruction. The successful "taking" of a course, as measured by a student's passing an open, on-line assessment, could stimulate some learners to believe that they could go on to a postsecondary institution. Some teachers might suggest that their students use an open course as supplemental material to help them

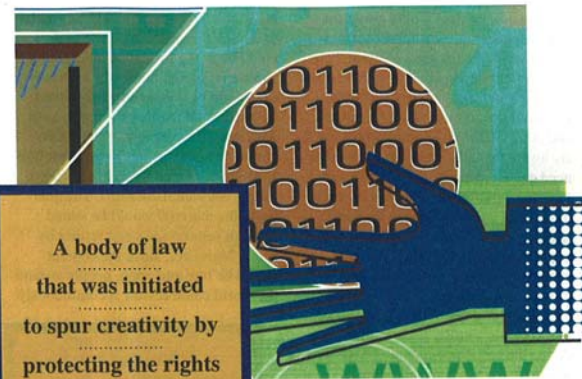
understand a particular calculus lecture or chapter in a textbook. And some institutions could provide credit to students who use these online courses to gain the knowledge they need to demonstrate competencies in specific subject areas that help them progress toward their degrees. Such institutions could charge for their management of the assessments and the certification process.

Whether the student would learn as much in the open education setting without a paid coach or instructor as he or she would in the more traditional setting is an empirical question. Recall that these would be excellent courses, fully vetted for quality and supported by a variety of open-learning tools.

A second model for learning stems from the power of tools that make it easy to manipulate Web-based content. A new educational portal or repository would initially be populated with content from all over the world, including the increasingly large numbers of digitized, open books, open library collections, open courses and modules, education games and simulations, educational videos, journals, lesson plans, designs for projects, assessments, and Web tools. But people everywhere, and especially in the developing world, have told us of their need to create new content to share with the rest of the world and to remake, modify, and improve existing content to meet particular cultural and educational needs. We like the metaphor of a community garden, with a common area whose plants may be reproduced and used while the originals remain. But in addition, each of the gardeners or groups of gardeners has a space where they can grow what will nourish them, something that they can contribute in turn to the common plot.

This vision has elements of MySpace (www.myspace.com) and of Connexions (www.connexions.rice.edu). Such a site would also allow collections of people using Wiki-like software to collaborate on the construction of material. It would have provisions for people to have their materials evaluated by others—perhaps using an Amazon- or eBay-like approach to users' reviews. It could even set out standards for high-quality materials and a place where creators could come for acknowledgement that their material has reached the standards.

Throughout the Web-based world, young and old are participating in the



A body of law
that was initiated
to spur creativity by
protecting the rights
of creators has
morphed into rules
and regulations
that limit access
to important
knowledge
worldwide.

Since then, following passage of various laws and supporting Supreme Court decisions, any piece of work not affirmatively released from copyright restrictions by its creator is automatically copyrighted upon production and may not be used without the express permission of the owner. Moreover, the length of time a copyright protects a work has been repeatedly extended over the past few decades. For works created after 1976, the protection goes forward 75 years after the death of the author. These rules extend to digital content, even though most books go out of print within five years of their publication, and most creators do not even know that their material is automatically copyrighted. (There is a critical partial exception to this provision, the so-called "fair-use" doctrine. It allows professors, for example, to use certain copyrighted materials in their lectures and on their sites as long as the audience is limited.)

The situation is similar in other nations. Consequently, a body of law that was initiated to spur creativity by protecting the rights of creators has morphed into rules and regulations that limit access to important knowledge worldwide. There have been attempts to legislatively or judicially modify some of the restrictions imposed by the various copyright rules, but so far they have failed.

Larry Lessig of Stanford has aggressively pursued an alternative response through an organization called the Creative Commons (<http://creativecommons.org>). It frees materials from the automatically applied copyright

CHALLENGES

Of course, it will not be easy, painless, or straightforward to realize the kinds of outcomes we have described. The many challenges that need to be overcome include questions involving intellectual property, the digital divide, and sustainability.

Intellectual Property. The first challenge has to do with intellectual property. A brief primer: Prior to 1976, in the United States individuals protected their work (writings, art, music) by affirmatively putting it under a copyright (literally to control the right to copy).

restrictions by providing very easy-to-use licenses for creators to place on their digital materials. Flexible licenses, which are available at the Creative Commons site, enable copyright holders to grant some of their rights to the public while retaining others through a variety of licensing and contract schemes. Anyone can “attach” a license that contains no or specific restrictions to his or her work. In this way the Creative Commons, in the words of its site, attempts to solve the problem of “expanding intellectual property protection” that “leaves fewer and fewer creative works in the ‘public domain’”—that is, the body of creative material unfettered by law and “free as the air to common use,” in the words of Supreme Court Justice Louis Brandeis.

The process for attaching Creative Commons rights has only been in place for four years. Yet the estimated number of licensed Web pages already stands at 45 million. Google and Yahoo facilitate searches for materials that have Creative Commons licenses. These licenses are not the sole answer to creating an open environment for educational resources, but they are a necessary and very effective tool for making content freely available in the difficult regulatory environment that persists in this and some other countries. Accordingly, Larry Lesig and his colleagues have expanded

their work to include localized licenses. At last count, 30 nations now have Creative Commons licenses, and other nations are developing them.

The digital divide and “interoperability.” The vision of a world with equal access to knowledge runs up against the reality of the digital divide. Lack of access to the Internet is particularly acute in Sub-Saharan Africa and parts of Southeast Asia, where there often is little or no electricity, much less phone service. The access that does exist is typically low bandwidth and erratic. And when there is high bandwidth, it

Much of the developing world has leap-frogged the desktop-computer era and gone directly to hand-held devices—which now contain as much computing power as the average desktop did in 2000.

is often very expensive. The many new Web-based materials from the developed world that require reliable high bandwidth are thus not accessible to most people in those countries.

In theory, time will solve most of these problems, although progress seems to be slower than it need be. In the meantime, there are strategies to circumvent some of these problems. A simple example is to supply the intranets of institutions in these countries with content, which is then available to faculty and students in a high-speed environment. Of course, even with this kind of support, there are cost and interoperability barriers. Much of the material from the developed world uses software that costs money, such as Microsoft Word, or requires costly bandwidth capacity to view, such as Flash. The alternative is to use open-source software, which only sometimes meets the needs.

Beyond these solutions, there lurks a fascinating possibility. Much of the developing world has leap-frogged the desktop-computer era and gone directly to hand-held devices—which now contain as much computing power as the average desktop did in 2000.

These are truly extraordinary devices, combining phone, Internet, and instant messaging served by satellite transmissions in a tiny, hand-held package. Their very ubiquity in the developing world will serve to increase competition for services and reduce the price for connectivity, and their mobility greatly increases their value. One of the great challenges in using these devices for educational purposes, of course, will be to shape content to the smaller screen. The major providers have been working on these issues for some time. Just recently, Google announced that it has a test in progress for delivering search information to cell phones. It is quite possible that much of the developing world will be in the vanguard of this change. Hand-held devices may well become the primary receivers of OER materials in the developing world.


Sustainability. Two sustainability problems plague open educational resources. One is whether the OER movement will sustain itself in the face of public and private institutions that seek to hoard knowledge in order to protect their investments in its production. This is largely a political and ideological issue that requires thoughtful attention.

The other problem is the inherent contradiction in the idea of sustaining and upgrading a product that is given away. This problem raises a variety of legitimate questions. Who pays for open resources to be created, improved, stored, and transmitted over time? Sustaining, enlarging, and improving collections in repositories or referenced by portals requires stewardship.

Foundations and governments can sometimes help support the creation of content and places to store and distribute it. But foundations are unlikely to maintain their support over long periods of time. In many countries, some government agencies see the creation, maintenance, and improvement of collections as part of their mission. In the United States, the Library of Congress, the Smithsonian Institution, the National Science Foundation and a few other agencies share this commitment, as do a few of our great and relatively rich universities. But for many other institutions, the commitment to create and maintain digitized open collections has not become part of the institutional fabric.

What then can be done? Part of the solution may rest in the development of communities of volunteers who support and maintain useful materials. Innovative professional associations such as the National Science Teachers Association (<http://www.nsta.org>) or the American Association for the Advancement of Science are beginning to play a particularly important role in this effort. These two organizations perceive that they have a stake in developing and maintaining high-quality Web sites that serve their members. They can also organize very knowledgeable and imaginative workforces that care about the quality of the materials. Unfortunately, other professional associations may perceive that the development of such sites is not in their interest because they manage professional journals that account for a considerable share of their income.

Another approach may come from innovative business models designed to provide stewardship funds that flow from transactions that use open material. Imagine a first-rate open curriculum or course in economics or statistics that is adopted by a college that charges tuition. The college would add value to the material by having teach-



We do not wish to reduce the value of a university education. We simply believe that that value is not a function of its scarcity.

OBSERVATIONS

It takes a hardy and callous soul to reject the United Nations’ goal of education for all. We argue that one important step toward this goal is to provide high-quality digitized, free educational materials to everyone in the world. We are not talking about secret information contained in patents. We are simply suggesting that the physics student in Kenya should have access to the same high-quality knowledge that students in the United States do. We do not wish to reduce the value of a university education. We simply believe that that value is not a function of its scarcity.

ers assist the students in their learning, but it would also pay a small amount to the creator for maintaining and upgrading the material. This and other sustainability models are built on the general principle that open educational materials can continue to be open and at the same time generate revenue. A variety of open-resources providers are exploring this possibility.

Finally, some people and organizations in the business of selling content who also place some of their content on the Web for open access have found that instead of destroying their market, the free access increases their sales and revenue. In one example, after the South African Human Sciences Research Council Press (HRSC) embraced open-content publishing and made many products freely available online, print sales increased over 300 percent. Other less dramatic examples abound.

We are unabashed advocates of open educational resources, but we are concerned about the future. Issues of sustainability; the tradition of institutions, colleges and universities included, of protecting their content from all but the elite; and the strains of anti-intellectualism and protectionism that run deep in parts of the world all threaten the open spread of knowledge. These threats can only be offset by the enthusiasm, imagination, and commitment to open knowledge that we see in people as we travel throughout the world.

The real question is, can we continue to tolerate widening and increasingly consequential inequalities in access to knowledge across the nation and world? Can we afford the financial, political, and moral burdens created by such inequalities? Can we afford *not* to share freely what we have in such abundance? ☐