



International Institute for Educational Planning

INTERNET DISCUSSION FORUM

**OPEN EDUCATIONAL RESOURCES** OPEN CONTENT FOR HIGHER EDUCATION

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## **PERSPECTIVES OF THE PROVIDERS AND ISSUES RELATED TO PROVISION**

### Background note

#### **OPENCOURSEWARE MASSACHUSETTS INSTITUTE OF TECHNOLOGY**

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##### **WHAT IS MIT OPENCOURSEWARE?**

MIT OpenCourseWare (OCW) is a free and open web site offering high quality teaching and learning materials organized as courses. MIT faculty create these materials for their classroom teaching and then offer them for worldwide publication on OCW. For any given course, the materials convey the parameters of the course's subject matter and pedagogy, and ideally represent a substantially complete set of all the materials used in the course.

The purpose of OCW is to advance education by making these materials available to educators, who may draw on them for teaching purposes, and to students and self-learners, who use them to supplement their studies or to enhance their personal knowledge.

OCW was initiated in 2001. In September 2002 MIT OCW published the first 32 courses, which were built manually using rudimentary web development technology. Today, OCW has grown into:

- A deep and rich web site that now contains 1,100 MIT courses. Work is underway to publish an additional 150 new courses and 100 updates in October 2005. The goal is to publish materials for virtually all MIT courses (approximately 1,800) by September 2007. MIT OCW:
  - Covers every discipline taught at the Institute and represents all five MIT schools and 33 academic departments in approximately the same proportion as the total course offerings of these schools and departments. Over 2,200 individuals have contributed materials, including 70% of MIT's tenured and tenure-track faculty.
  - Includes video materials for approximately 75 courses, including 16 courses that offer complete videos of the entire course lecture series.
  - Is supplemented by dozens of alternate distribution sites making published course materials more accessible internationally. Translators now make selected MIT courses available in five languages besides English. In addition, there are about 70 independent web sites (that we know of) around the world that "mirror" OCW by providing a complete copy of the entire MIT OCW publication to regional or local users in their areas where Internet access is limited.
- A movement that has begun to resonate with other institutions that share a commitment to open knowledge and that:

- At this writing counts over 100 institutions around the world in the process of adopting the OCW model, including 36 domestic and international institutions offering live, publicly accessible OCW sites.
- Among them offer about 700 published courses (so far) in addition to MIT's 1,100. These courses largely cover complementary disciplines, representing materials from leading institutions known for their work in their respective fields.

### **WHY IS MIT DOING THIS?**

Access to high quality educational materials is too often limited to those who can afford to attend an institution of higher learning or buy published materials outright. Indeed, some educators regard their primary course materials as the “crown jewels” of the instructional program—the essence of what they offer to students, the products that generate tuition revenues, and the substance of what they publish in textbooks. As a result, they sometimes treat these materials proprietarily, guarding them from exposure and use except by registered students and paying commercial publishers.

In contrast, a trend toward *open* knowledge and *free* availability of high quality teaching and learning materials will equalize access. Educators, including those in less-advantaged areas where resources are at a premium, can capitalize on such materials to enhance their courses and improve their teaching, benefiting many students at a time. Individual students and self-learners may take direct advantage of the materials to develop their knowledge and intellect. At MIT most faculty and academic leaders subscribe to the belief that openly publishing the teaching materials used at the Institute will bring people of all backgrounds together and promote mutual understanding. MIT's OpenCourseWare initiative supports the growing movement toward balancing the legitimate interests of intellectual property owners with society's need for open information sharing, learning, and debate. The overarching long-term goals of open sharing of courseware are to:

- create a freely accessible body of exemplary course materials for teaching and learning;
- jump start higher education in less advantaged parts of the world, and
- ultimately raise the standard of education generally.

MIT faculty have a passion for teaching and believe that by contributing their course materials freely to the world they will help to advance education around the globe, further the teaching and public service missions of the Institute, and fulfil their own commitment to the advancement and dissemination of knowledge. Building on these ideals, OCW's dual missions are to provide free access to MIT course materials for educators and learners around the world and to extend the reach and impact of MIT OCW and the OpenCourseWare concept.

### **WHAT IS THE USAGE AND IMPACT OF OCW AROUND THE WORLD?**

MIT OCW has been visited more than 12 million times since October 1, 2003. Average traffic to MIT content has grown to over 20,000 visits per day. About two-thirds of this traffic originates outside the US.

Visitors to OCW fit these profiles: educators 15%, students 31%, and self-learners 48%. About 85% of educators say OCW has improved their courses or their teaching. Some 84% of students say OCW has aided their learning. And 91% of all visitors say they have been successful in achieving their goals for visiting OCW. Overall, 94% of users indicate they would recommend OCW to others. MIT has received thousands of emails from educators, learners, and alumni praising OCW and expressing thanks for this resource.

### **WHAT ARE THE KEY CHALLENGES WE FACE?**

In one way or another, all of the challenges relate to ensuring the long-term vibrancy and sustainability of OCW. Key considerations include:

- **FINANCIAL SUPPORT:** MIT strives to balance its own investment of limited funds with external funding from organizations interested in the *open knowledge* and *open educational resources* movements. As OCW begins to transition to a steady-state operation in 2008, we expect ongoing funding to become even more challenging.
- **VALUE TO WORLDWIDE USERS:** Publication of MIT's course materials is worthwhile only if our users continue to find it useful and usable for their teaching and learning purposes. To this end, we respond to user feedback with continuous improvement to OCW materials and services to maximize relevance and impact. And we maintain a rigorous evaluation program to ensure that we are fulfilling the OCW mission and meeting user needs and expectations.
- **VALUE TO MIT:** It is vitally important that OCW continue to deliver meaningful value back to the Institute, its faculty and students. By making OCW a valuable internal resource, we will foster continued faculty participation and encourage them to keep their published materials up-to-date.
- **STAFF MOTIVATION:** As OCW subtly transitions from a start-up innovation to a steady-state maintenance operation, it will be important to sustain the excitement of the OCW idea and keep staff motivated and challenged.
- **INTEGRATION OF OCW WITH MIT'S TEACHING AND LEARNING PROCESS:** There are three elements to this issue—integration of the concept of OCW into the culture and fabric of MIT, integration of the processes for course and teaching materials development, and integration or interoperation of the technologies that enable this. Right now, OCW runs parallel but separate to the instruction process. We continue to work toward a model in which OCW becomes more and more a natural by-product of the teaching process. This will come slowly, but ultimately will help to reduce costs, simplify processes, and make OCW more transparent to faculty.

## CONNEXIONS RICE UNIVERSITY

**RICHARD BARANIUK** DIRECTOR, CONNEXIONS, RICE UNIVERSITY

Connexions (<http://cnx.rice.edu>) is a unique web-based teaching and learning environment that aims to change the way we develop and use course materials. Connexions is based on a set of intuitions that are shared by a remarkably wide range of academics: that knowledge should be free and open to use and re-use; that collaboration should be easier, not harder; that people should get credit and kudos for contributing to research and education; and that concepts and ideas are linked in unusual and surprising ways.

### CONNEXIONS: WHY AND WHEN?

The Connexions Project was launched in 1999 in response to my frustrations with the status quo of developing and publishing educational materials, in particular the:

- difficulties illustrating the *interconnections* between ideas and concepts in a curriculum (in spite of research indicating that it is the connections that make much of the education process meaningful);
- difficulties engaging students in *interactive exploration* of concepts;
- difficulties *building communities* and economies of scale for developing and continuously improving educational materials.

As an engineering professor, I was influenced by the burgeoning open-source software movement (Linux, for example) and aimed to do a similar thing for books and courses. The key enabling ideas behind Connexions followed immediately from their lead:

- **Modularize** the content (break a course or book into small chunks) so that it can be quickly authored, easily manipulated and updated, pulled into different customized courses, translated into different languages, and so on.
- **Open up the intellectual property** so that anyone worldwide can access, use, and re-use the content.

From the outset, Connexions was intended to be a **content** project (building a commons of free educational content), a **community** project (building communities of students, instructors, and authors worldwide), and a **software** project (building open-source tools to help people exploit the commons).

While we planned to develop our own open-content licenses for Connexions content, we have been fortunate to work with Larry Lessig and the Creative Commons (CC) since their inception, and today all of our content carries a CC license. After an incubation phase funded by Rice University and several friends of Rice, the project secured major funding from the Hewlett Foundation in 2002.

### CONNEXIONS: WHERE ARE WE?

Connexions has grown tremendously since 1999. Today, Connexions is being used in traditional college, community college, and primary and secondary school settings, in distance learning, and by lifelong learners around the globe. Demand is surging: in the month of September 2005 alone, the Connexions servers handled over 15 million hits representing 1,000,000 page views from 450,000 users from 157 countries. Volunteers are translating modules and courses into a range of different languages, including Spanish, Japanese, Chinese and Thai.

Connexions content development is grass roots organized and inter-institutional. Our most active content development areas at present include music, engineering, physics, chemistry, bioinformatics, nanotechnology, and history. For example, a vibrant community of electrical engineering faculty from Stanford, UC-Berkeley, University of Illinois, Michigan, Wisconsin, Ohio State, Georgia Tech, Rice, Cambridge, and TU Norway is developing a customizable digital signal processing (DSP) curriculum in Connexions. Austin, Texas-based National Instruments is contributing DSP training materials as well as developing a free “player” version of their popular LabVIEW signal processing tool that will make the materials come alive with sights and sounds, adding much needed interactivity to engineering curricula. Cambridge University Press is contributing a number of DSP textbooks to Connexions for free access.

In other content projects, the University of California-Merced is developing their Introduction to Biology and College Algebra courses in Connexions. The National Council of Professors of Educational Administration (NCPEA) is developing a Connexions knowledge base in school leadership and administration. They are also developing a community-based peer review process to identify and direct readers to high-quality materials.

### CONNEXIONS: LESSONS LEARNED AND MAIN CHALLENGES

We have learned many lessons along the way that have helped us tune the Connexions vision and toolset, including that:

- **DEMAND:** There is a great demand from around the world for quality educational content, and it continues to accelerate.
- **IMPACT:** Many authors are realizing that they can make a bigger impact with their educational materials by open-access publishing through a system like Connexions.
- **REUSE:** Many course instructors do not merely want to “use” open educational resources, but they also want to customize them to their own context (by modifying them, translating them etc.). Connexions appears to be an ideal repository for these re-contextualized open resources.

- **COST AND EASE:** More and more authors, instructors, and institutions in the developing world are using Connexions to house their educational materials because there is no need to deploy any local infrastructure.

Many challenges remain, however, including:

- **TOOLS:** It is critical to ensure that our tools are as easy to use as possible. And there is currently a significant need to make open-access tools and content interoperate across different repositories.
- **INTELLECTUAL PROPERTY:** How should we best educate potential authors about open access and the Creative Commons licenses? How can we best mingle content with different open licenses, for example Connexions content with MIT OCW content? What do we do with pre-existing content that is not open licensed?
- **QUALITY ASSESSMENT:** How do we best peer review and credential open educational content? (In response we are developing a system of lenses to enable communities to develop their own customized peer review systems.)
- **ACCESS:** How do we ensure that everyone has access to Connexions' content, including those with limited or no Internet connectivity? (We are working with a number of book and CD publishers to reach out to these users.)
- **SUSTAINABILITY:** How will we develop revenue models to sustain Connexions' free content and open-source tools into the future?

More information on Connexions is available at <http://cnx.rice.edu> and <http://cnx.rice.edu/about>.

## OPEN LEARNING INITIATIVE CARNEGIE MELLON UNIVERSITY

**CANDACE THILLE** PROJECT DIRECTOR, OPEN LEARNING INITIATIVE, CARNEGIE MELLON UNIVERSITY

### WHEN AND WHY THE INITIATIVE WAS UNDERTAKEN

The Open Learning Initiative (OLI) started at Carnegie Mellon in 2002, funded by a grant from The William and Flora Hewlett Foundation. OLI is a project devoted to developing “cognitively informed”, openly available online courses and course materials. “Cognitively informed” means that the course design is based on *current theories* from the cognitive and learning sciences and is informed by data gathered from both experts and novices through cognitive science and human computer interaction methods. The Open Learning Initiative was launched in the hope that online learning environments might constitute an alternative to traditional classroom teaching by promoting greater student-content interaction and by providing students with greater and more frequent feedback on their performance and understanding. The design of OLI courses has been guided by cognitive principles of learning that stress the importance of interactive environments, feedback on student understanding and performance, authentic problem-solving, and efficient computer interface. Unlike other varieties of online education that rely on synchronous or asynchronous learning networks, the OLI courses are stand alone and do not require the mediation of an instructor for the provision of feedback and evaluation of student performance.

The objectives of the OLI project are to:

- develop exemplars of “cognitively informed” online courses and course materials that both *enact instruction* and support instructors;
- *document the methods* of course development and the assumptions underlying the application of results and methods from the cognitive and learning sciences;
- establish and implement procedures for *routinely evaluating* the courses and use that formative evaluation for iterative improvement;

- feed information from these evaluations back into the research communities that have postulated the theories on which we have based our designs;
- develop *communities of use* for OLI courses that contribute to the evaluation, iterative improvement, and ongoing growth of the courses and materials;
- *explore economic models* for the combination of open access and sustainability.

We are working on a model to effectively transfer scientific knowledge developed in research contexts into online learning practices. Course development has been an iterative process in which we have structured many kinds of feedback loops to determine where applications of theory have worked and where alternatives must be tried. The expectation of educational quality stems from the close collaboration, throughout the development of the OLI courses, among cognitive scientists, experts in human-computer interaction, and experienced faculty who have both deep expertise in their respective fields and a strong commitment to excellence in teaching. Out of this collaboration, we have developed courses and principles for effective online course design. The result has been a dual focus that incorporates both product delivery in the form of online courses and research on how to make such courses effective in facilitating learning.

### WHAT HAS, AND IS BEING DONE

As of the beginning of the fall semester of 2005, there are seven subject areas for which there are either full courses or substantial course materials available through the OLI web site (<http://www.cmu.edu/oli>): Causal and Statistical Reasoning, Statistics, Economics, Logic, Biology, Chemistry and Physics. We have begun the process of adding courses in Calculus, French, Statics, and Research Methods. Material from these additional courses will begin to appear during the current Fall 2005 semester.

We have developed an integrated technology to deliver these courses and their many highly interactive features. Those features range from online interactive laboratories in Causal and Statistical Reasoning, Biology and Chemistry, to multi-user market simulations in Economics, to intelligent tutoring system in Statistics and Physics, to scenario-based learning environments in Chemistry.

In addition to these more complex features, OLI courses include standard online testing that accommodates both frequent comprehension checks for students and tests to be used for performance assessment. The project continues to develop increasingly robust student performance reports so that instructors who are using OLI courses to support their teaching can easily monitor student progress and focus their instruction on those areas that their students need most.

We have conducted, and are in the process of conducting, several studies aimed at describing the nature of student learning and documenting the process of development and implementation of the online courses. Several of the studies substantiate the relative effectiveness of the courses, their underlying pedagogical rationality, the soundness of the assessment strategies and tools, and their unique features. The studies provide usable information concerning the context of teaching and learning, and the socio-cultural conditions that favour an adequate implementation of the courses. Our evaluation process goes beyond a simple validation of the courses' effectiveness, and becomes the telling of an educational experience, for both professional and scientific audiences.

### MAIN CHALLENGES AND LESSONS LEARNED FROM THE EXPERIENCE TO DATE

Our current challenges and areas of focus are:

- **BUILDING AND SUPPORTING VIRTUAL COMMUNITIES OF LEARNERS:** OLI courses are currently being used in two different types of learning environments: in instructor-led classes at both the high school and college level to complement and support the instruction, and by individual learners who are not affiliated with any formal learning cohort or institution. It is in this latter environment that we believe we need to focus more of our efforts. OLI courses are highly

interactive and the individual learner receives quite a bit of feedback and support from the system in the problem-solving context. The amount and depth of material taught in each OLI course, however, is comparable to a full, fifteen-week semester at Carnegie Mellon or a full-year course at the high school level and we believe a virtual cohort would provide the support individual learners need over that extended period of time.

- **SCALING THE PROCESS FOR BUILDING A COMMUNITY OF USE AND ADAPTING AND EXTENDING THE COURSES TO SERVE VARIED POPULATIONS:** Each summer we host one or two three-day workshops for faculty who wish to use and extend OLI courses and be involved in our evaluation studies. While the experience is a rich one that often affords faculty an opportunity to participate in a community of practice, it is a process that does not easily scale, so our reach is limited. OLI also provides faculty with tools and support for adapting, localizing the courses and this process is also quite resource intensive.
- **CREATING AN ECONOMIC MODEL FOR THE COMBINATION OF OPEN ACCESS AND SUSTAINABILITY.**

## **CENTER FOR OPEN AND SUSTAINABLE LEARNING UTAH STATE UNIVERSITY**

**DAVID WILEY** DIRECTOR, OSLO RESEARCH GROUP, UTAH STATE UNIVERSITY

In this note I will describe three projects we are undertaking with the COSL, hopefully exposing different provider perspectives with each. Through our projects we are providing content as well as software tools that add value to our content and others.

### **WHEN AND WHY THE INITIATIVE WAS UNDERTAKEN**

After the launch of MIT OpenCourseWare, we became concerned about how much actual learning a student would be able to accomplish using the MIT OCW materials alone; that is to say, without access to other students. In 2003 we started work on a new piece of software called “Open Learning Support” with the goal of enabling what we felt were critical social interactions necessary to support learning with MIT OCW materials.

In 2004 we decided to pilot an OpenCourseWare at Utah State University, due to our belief that access to educational opportunity is a key means to the end of improving quality of life. In talks with MIT OCW, we discovered that they were using a proprietary infrastructure to support their project, which they were not really capable of sharing. Thinking that OpenCourseWare should run on an open platform we also launched the “eduCommons” project, and with help and information from MIT OCW began developing an open source infrastructure capable of supporting OCW initiatives.

### **WHAT HAS, AND IS BEING DONE**

Our “Open Learning Support” social software, which allows users to ask and answer questions around OCW content has been integrated with select MIT OCW courses since early 2004. MIT OLS currently has 1,878 registered users who have exchanged 450 messages (see <http://mit.ols.usu.edu/>). We have more recently integrated OLS with the Connexions collection at Rice. OLS is currently being extended with additional features to support interaction in the absence of any teacher or moderator (e.g. a reputation management system).

Our OpenCourseWare currently has released 14 courses from nine academic areas. We are working consciously to insure that many of the courses provide content that enables users to build local capacity in key areas, including irrigation engineering, instructional design and agriculture (see <http://ocw.usu.edu/>).

Our eduCommons software is currently deployed in production in support of USU OCW. We are also supporting 15 pilot OCW projects running eduCommons at universities in the US and Europe. In

addition to English and German versions of the software, we are currently preparing Chinese and Japanese versions in response to request from these users (see <http://sourceforge.net/projects/educommons/>).

## **MAIN CHALLENGES AND LESSONS LEARNED FROM THE EXPERIENCE TO DATE**

With Open Learning Support the main challenge is understanding how to best support informal social interactions, without any mentor or moderator, in order to facilitate meaningful learning with OCW content. These are instructional design and human-computer interface issues. One lesson we have learned is that learning communities without the clear leadership of a teacher or teaching assistant need lots of participants. That is, they behave opposite to the normal classroom – the experience improves significantly as you add more learners to the mix.

With OpenCourseWare the main challenge is integrating the OCW production as far into standard university processes as possible, so as to reduce the cost of producing OCW as much as possible. This is a financial issue. One lesson we have learned is that being involved in the production of a course from the beginning of the process is an excellent way to lower the costs associated with intellectual property (IP) issues later down the road. We work closely with another centre on campus that helps faculty design online courses (USU is a land grant university<sup>1</sup> that offers over 100 online courses each year). When a faculty member begins designing a course for online delivery, if they can be encouraged at that point to think in terms of IP-clean materials (rather than assuming fair use of IP-encumbered materials behind password protection), the conversion from formal online course to OCW is mainly a technical (and inexpensive) proposition. Scrubbing IP-encumbered material out of an existing course is a person-intensive (and expensive) proposition.

With eduCommons the main challenge is balancing the desire to make the OCW production process as easy as possible against the functionality needed to provide a robust platform for managing metadata, rights and publication. This is a usability issue. One lesson we have learned is that when a course is already being offered online from an LMS, offering tight integration with the learning management system makes this balance easier to maintain. For example, Sakai<sup>2</sup>/eduCommons integration is advancing to the point where course content along with associated metadata (including rights metadata) can be exported from Sakai and imported into eduCommons. Preserving rights metadata across the import/export process means that less people time is spent trying to determine the IP cleanliness of any given piece of content.

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<sup>1</sup> A public US college or university that has been designated by its state legislature or Congress to receive unique federal support – initially, in 1862, in the form of federal land.

<sup>2</sup> A community source software development project to design, build and deploy a new Collaboration and Learning Environment for higher education. See <http://www.sakaiproject.org/>.