# CHAPTER 19

# The Emerging Meta University

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## INTRODUCTION

The 21st century is an age when we cannot compete nationalistically based on geography, natural resources or military might. Nations can only prosper and compete based on brainpower and innovation. Because brainpower and innovation know no political or geographic boundaries, the fact is we must all cooperate as well as compete. In my view, there is no domain of human activity in which global cooperation is more desirable than in education. It is in the interest of all people that education be available and effective worldwide. This includes the kind of "high-end" education found in research universities.

In Asia, the Middle East and elsewhere, major investments are being made to elevate the quality of existing research universities or to create new ones. Most are based on western models that have been enormously successful, especially during the last 60 years. But hopefully, new and evolving institutions will also innovate by bringing new ideas and developing modifications of this model.

As we seek to advance research universities, new and old, the role of information technology is an immediate question. The advent of the Internet and the World Wide Web, together with ever-decreasing costs of computing power and digital memory, create new opportunities and raise fundamental questions.

How will the use of so-called educational technology play out? What will be the nature of globalization of higher education? Will the Age of the Internet and what lies beyond it fundamentally reshape education and research? Are residential universities dying dinosaurs or models to be propagated further?

My personal assessment of these matters is made in the context of two admitted biases. First, I remain hopelessly in love with the residential university. Teaching is fundamentally based on personal interaction, and it is difficult for me to envision anything better than the magic that happens when a

group of smart, motivated, and energetic young men and women live and learn together for a period of years in a lively and intense university environment.

But I am cautioned in this assessment by my second bias, which has to do with the rate of technological development. Years ago I read a book by Princeton's Gerrard O'Neil (O'Neil, 1981) in which he looked back over the centuries at what futurists of each period had predicted, and then compared their predictions with what turned out to be the realities. The primary lesson from this study is that the rate of technological progress was almost always dramatically under-predicted, and the rate of social progress is almost always dramatically over-predicted. I share this view.

What I envision, therefore, is a way in which relatively stable and conservative institutions will develop enormous synergies through the use of ever-expanding technological tools. Indeed this is already happening in profound ways. The views I present in this chapter draw extensively on a small book I recently authored (Vest, 2007).

## INFORMATION TECHNOLOGY AND HIGHER EDUCATION

Computers, of course, have had a strong influence on higher education since the 1960s, starting out as specialized tools in science, engineering and mathematics, and then propagating across the humanities, arts and social sciences, as well as to business, law and medicine. During the late 1990s, following the development of the World Wide Web, and accelerated by ever decreasing prices of storage and processing, educators everywhere began to recognize information technology as a transformative force. This coincided with the dot-com era in the world of business, so attention quickly turned to how universities could teach large numbers of students at a distance, and how they could realize financial profits by doing so. Journalists, critics and many of our own faculty concluded that classroom teaching in lecture format was doomed. Economies of scale could be garnered and many more people could afford to obtain advanced educations via digital means. For-profit distance education was assumed to be the emerging coin of our realm. University faculty and administrators across the country wrestled over the ownership of intellectual property when a professor's course was made available electronically.

The model that was proposed over and again for higher education was "find the best teacher of a given subject, record his or her lectures and sell them in digital form". There is an appealing logic to this proposition, and I very much believe that there are important roles for this kind of teaching tool, but the image of students everywhere sitting in front of a box listening to the identical lecture is one that repels me. It struck me as odd that many of the same critics who decried the lack of personal attention given to students on our campuses seemed eager to move to this model. Nonetheless, the dominant proposition

was that a university should project itself beyond its campus boundaries to teach students elsewhere.

But, in the meantime, many other teaching and learning innovations were introduced on campuses. Increasingly effective computer-based tools for language learning were developed. On-line journals were published. Computer simulations were used in subjects ranging from fluid mechanics to theatre stage design. Studio style instruction with heavy use of computational tools was refined. Multiple institutions shared large scientific databases. Massive search engines made information available to anyone with a web browser, and this quietly and rapidly revolutionized the work of many students and faculty. (It also introduced new complexities and issues of ethics by blurring definitions of "original work", and plagiarism.) Informal electronic learning communities formed, both within and among universities.

In other words, information technology, usually through increasingly large accumulations of modest, local activities, was transforming much of what we do on our campuses. Information technology was bringing the world to the students on our campuses, as well as projecting campus activities outwards.

At the Andrew W. Mellon Foundation, William C. Bowen and his colleagues developed ideas about how to empower large numbers of scholars and institutions through a combination of technology and economy of scale that in 1990 coalesced in the establishment of JSTOR. JSTOR makes available digital copies of scholarly journals in the liberal arts, sciences and humanities for modest annual fees scaled to institutional size. JSTOR currently serves 3,700 institutions, almost half of which are outside the United States, and archives 730 scholarly journals from more than 440 publishers. It helps individual scholars conducting advanced study and research at major universities. It also enables small liberal arts colleges with very modest resources to collectively or individually mount courses and research programmes in areas of the arts and sciences for which they could not have afforded appropriate library collections. In 2001 the Mellon Foundation launched a second major venture, ARTstor that uses a similar approach to develop a huge, carefully developed archive of high-quality digital images of great works of art. ARTstor archives more than 500,000 images, 100,000 of which are available in 1,024 pixel resolution.

In my view, JSTOR was a particularly important development in bringing the power of the Internet, and of sharing large digital archives, to humanistic scholars and students in a wide array of colleges and universities. It pointed toward a new type of "openness" in higher education.

## MIT OPEN COURSEWARE

In 1997, with generous financial support from the Mellon and Hewlett Foundations, the Institute pledged to make available on the web, free of charge to

teachers and learners everywhere, the substantially complete teaching materials from virtually all of the approximately 2,000 subjects we teach on campus. For most subjects these materials include a syllabus, course calendar, well-formatted and detailed lecture notes, exams, problem sets and solutions, lab and project plans, and in a few cases, video lectures. The materials have been cleared for third-party intellectual property and are available to users under a creative commons licence so that they can be used, distributed and modified for non-commercial purposes.

OpenCourseWare is a new, open form of publication. It is not teaching, and not the offering of courses or degrees. It is an exercise in openness, a catalyst for change, and an adventure. It is an adventure because it is a free flowing, empowering and potentially democratizing force, so we do not know in advance the uses to which it will be put. Indeed, users' stories and unusual paths are almost as numerous as our users.

At this stage, we have mounted the materials for 1,800 subjects from 33 academic disciplines in all five of our schools — almost every subject taught at MIT. Visitors are located on every continent and average over one million visits per month, with the average visitor to the site using almost 10 HTML pages per visit. Although the primary content of OCW is the notes for more than 25,000 lectures, it also includes more than 40 complete texts, and over 1,000 hours of video.

The OCW site receives 43% of its traffic from North America, 20% from East Asia, 16% from Western Europe. The remaining 20% of the users are distributed across Latin America, Eastern Europe, the Middle East, the Pacific Region and Sub-Saharan Africa. International usage is growing rapidly. Roughly 15% of OCW users are educators, and almost half of their usage is directly for course and curriculum development. One third of the users are students complementing a subject they are taking at another college or university, or simply expanding their personal knowledge. Almost half of the users are self-learners.

The uses which teachers and learners worldwide have made of OpenCourseWare are astounding, and could not have been predicted.

OpenCourseWare seems counterintuitive in a market-driven world, but it represents the intellectual generosity that faculties of great American universities have demonstrated in many ways over the years. In an innovative way, it expresses a belief that education can be advanced around the world by constantly widening access to information and pedagogical organization, and by inspiring others to participate.

## AN OPEN COURSEWARE MOVEMENT

As MIT's faculty had hoped, today there is an emerging open courseware movement. Indeed, there are over 60 OCW initiatives in the US, China,

Japan, France, Spain, Portugal and Brazil. Thirty more initiatives are being planned, in South Africa, the UK, Russia and elsewhere. Consistent with our open philosophy, MIT OCW has actively worked to encourage and assist this movement.

In the US, the University of Michigan, Utah State University, the Johns Hopkins University School of Public Health, and Tufts University's Health Sciences and Fletcher School of Diplomacy all have established OCW efforts. Here I use the term open courseware to denote substantial, comprehensive, carefully managed, easily accessed, searchable, web-based collections of teaching materials for entire courses presented in a common format.

In this emerging open courseware movement, it is not only the teaching materials that are shared. We have also implemented and actively encouraged the sharing with other institutions of software, "know how", and other tools developed by MIT OCW. The primary mechanism for doing this is the OCW Consortium, that includes more than 120 institutions worldwide.

The China Open Resources for Education (CORE) translates MIT OCW courses into Mandarin and is making them available across China. In return, CORE is beginning to make Chinese courses available and translate them into English. Another partner, Universia, a consortium of 840 institutions in the Spanish-speaking world, translates MIT OCW subjects into Spanish and makes them available. Finally, Utah State University's Center for Open and Sustainable Learning is a partner that does outstanding research on open learning, materials and software.

My point here is that openly accessible resources can be used in their entirety, in part, at any pace, and can be added to, deleted from, or modified to fit a teacher's or learner's purpose and context.

How will OpenCourseWare evolve in the future? Will its evolution continue to be largely by replication in other institutions? Will it grow Linux-like into a single entity with continual improvements by educators and learners around the world? Or will it be replaced by other developments? I do not know the answer to this question beyond the next few years, but I do consider the OpenCourseWare movement to be part of a broader class of open access materials.

## OPEN ARCHIVING, INDEXING, AND PUBLISHING

The seminal development of JSTOR has been followed by several other open access projects for archiving, indexing and publishing scholarly work. Examples include the Google Library Book Project, Carnegie Mellon's Million Book Project and Dspace.

Google has engaged several of the world's great libraries, those of Harvard University, the University of Michigan, the New York Public Library, the University of Oxford and Stanford University. The stated goal of its Library

Book Project is to "digitally scan books from their collections so that users worldwide can search them in Google". This is a book-finding initiative, not a book-reading initiative. If a book is out of copyright, the entire book is accessible. Otherwise, one can view snippets of the book, or a few of its pages, on line and obtain information about purchasing it.

Another major digital archiving initiative is the Million Book Project, a collaboration of Carnegie Mellon University, the Online Computer Library Center (OCLC), as well as government and academic institutional partners in China and India. Its goal is to create a free-to-read, searchable digital library. This initiative is notable for its highly international collection. As of last fall, it included more than 600,000 books, of which 170,000 are from India, 420,000 are from China, and 20,000 are from Egypt; 135,000 of the books are in English.

DSpace at MIT has a different goal than the archiving projects discussed above. Its goal is to develop a digital platform to make available the scholarly output of a single university. It includes preprints, technical reports, working papers, theses, conference reports, images, etc. This is at the opposite end of the spectrum from out-of-copyright books and journals; this is the stuff of working scholarship. MIT has worked in alliance with the Hewlett-Packard Corporation to create this archive and establish a DSpace Federation to promote and enable institutions to establish such repositories using freely available open source software. Dspace has been adopted by at least 150 institutions located on every continent except Antarctica, many of which contribute to the on-going improvement of the open-source Dspace platform code.

There is an additional and potentially very important dimension to the open movement — open-access journal publication. The first major foray into this domain is the Public Library of Science (PLOS), founded in 2000. This initiative, spearheaded by Dr Harold Varmus, CEO of the Sloan-Kettering Memorial Cancer Center, and Professors Patrick Brown and Michael Eisen of Stanford and Berkeley, respectively, publishes open-access journals in biology and medicine, and promotes open access within the scientific community.

The Howard Hughes Medical Institute and the Welcome Trust encourage the open-publication movement by providing publication costs for researchers whose work they have sponsored if it is published in open-access journals.

## ISSUES FACING THE OPEN ACCESS MOVEMENT

There are at least four fundamental issues to be addressed if open source materials are to reach their full potential for use by scholars, teachers, students and self-learners: Intellectual Property Rights, Quality Control, Cost and Bandwidth.

Intellectual property (IP) issues are clearly inherent in archiving projects because the publishers of books and journals mostly own the copyrights. The

resolution usually is some variant of a time delay, such as open access to a book only after the copyright has expired, or open access to a journal issue only after some fixed number of years has elapsed since its publication. In the case of open courseware projects, nettlesome third party IP issues arise when a professor makes use of a graph or certain types of excerpts from books or journal articles. Crediting a figure or excerpt from a publisher's product would seem to me to be great free advertising. After all, companies pay huge amounts of money for a glimpse of their product to appear in a movie or television programme. Some publishers agree, but many do not. In any event, publishers' approaches vary, and careful screening of materials for IP is a time-consuming and expensive aspect of creating and sustaining open courseware projects.

Of course, some faculty may be reluctant to have their teaching materials freely available on-line because they plan to use them as the basis for a textbook or other commercial dissemination. It was extremely satisfying for me to observe that this was a very minor issue when the MIT faculty undertook to establish MIT OCW.

Quality control, i.e. certification of the accuracy and appropriateness of scholarly and teaching materials on the Web, is a fundamental issue. The Web is a Wild West of information that has little or no vetting or peer review. The imprimatur and standards of leading universities, professional organizations and scholarly oversight groups therefore are of great value when they establish open publication and archiving organizations.

The production, maintenance and distribution of materials on the Web have very real costs. The more sophisticated the material and distribution are, the greater the cost in general. The societal value of freely available materials and indeed the value of sharing materials among institutions, are substantial, but there still is a bottom line. I am passionate about keeping my own institution's OCW without cost to users, but that is possible only through the generosity of foundations in the first instance, and of corporate and individual partners and supporters in the longer run. MIT also has pledged to meet a fraction of the sustaining costs itself.

Most major archives have a business plan in which there are user fees, but strong efforts have been made thus far to keep these as modest as possible, and to scale them to the size of the user institution.

Bandwidth is a very serious obstacle to one of the most attractive potentials of the open and non-profit movements for scholarship and education, namely its impact in the developing world. Institution building and scholarship in these countries can be given a terrific boost from access to these materials. Yet to take the best advantage of the materials, easy access and interactive participation via broadband is very important.

Hopefully open access activities will provide further stimulus for governments and NGOs to increase the availability and lower the costs of high-band-

width connectivity. This is key to bridging the digital divide. In the meantime, MIT OCW has deployed 76 mirror sites on local university networks throughout the developing world as a promising alternative. A single mirror site at Makerre University in Uganda generates more traffic than the total traffic from Sub-Saharan Africa to the MIT OCW site on the World Wide Web.

The ease of use and interactivity of the Internet and World Wide Web make it the most attractive option for open courseware and archive access. However, it is not necessarily the only option. Delivery of CDs could work in some instances, although the ease of updating, maintenance and interactivity would suffer. The rapidly dropping cost of computer memory suggests another option. The amount of iPOD memory per dollar is approximately doubling each year. In round numbers, in 2004 a 20 Gigabyte device cost $400. In 2005 that cost had dropped to $250, and one could purchase 60 Gigabytes for $450. Should this continue, by 2025 $400 might purchase 40 Petabytes! In any event, this suggests another mechanism for delivering courseware and archival materials. Indeed, there are a number of current initiatives using educational podcasts, and using iPods as primary delivery media.

I believe that it is likely that iLab, a project initially conceived and implemented by Professor Jesus del Alamo of MIT is a harbinger of the next stage of open content — the on-line laboratory. The principle is simple. Computers today control most experiments. Therefore they can be controlled from any distance through the Internet. This is not new in the world of research. There is a lot of experience, for example, in operating telescopes and other research instruments from great distances. The idea behind iLab is to apply this concept to experiments used in teaching.

Now iLab has expanded to partner institutions around the world, e.g. students in Britain, Greece, Sweden, Singapore and Taiwan have accessed iLab. Furthermore, the MIT group makes available iLab Shared Architecture, a toolkit of reusable modules and a set of standardized protocols for developing and managing on-line laboratories.

## THE META UNIVERSITY

Day-to-day communication and data-transfer among scholars and researchers are now totally dominated by Internet communications. Large, accessible scholarly archives like JSTOR and ARTstor are growing and heavily subscribed. The use of OpenCourseWare is developing in the US, Asia, and Europe. I believe that openness and sharing of intellectual resources and teaching materials — not closely controlled point-to-point distance education — should emerge as a dominant ethos of global higher education.

In my view, a global Meta University is arising that will accurately characterize higher education a decade or two hence. Like the computer operating

system Linux, knowledge creation and teaching at each university will be elevated by the efforts of a multitude of individuals and groups all over the world. It will rapidly adapt to the changing learning styles of students who have grown up in a computationally rich environment. The biggest potential winners are in developing nations.

This will happen because nation after nation is committed to enhancing and expanding their higher education, and because there are global efficiencies and economies of scale to be had by sharing high-quality materials and systems that collectively are too expensive for each institution develop independently. It will happen because this kind of sharing is not prescriptive. It is not paternalistic, and it need not be politically or culturally laden, because each individual institution, professor or learner is free to use only those parts of the material he or she chooses, and may adapt, modify or add to it in fulfilment of the local needs, pedagogy and context. Campuses will still be important, and universities will still compete for resources, faculty, students and prestige, but they will do so on a digital platform of shared information, materials and experience that will raise quality and access all around.

## CONCLUSION

The Age of the Internet and inexpensive information storage presents remarkable opportunities for higher education and research in the United States and throughout the world. The rise of a Meta University of globally created and shared teaching materials, scholarly archives and even laboratories could well be a dominant, democratizing force in the next few decades. It could come to under girding and empower campuses everywhere, both rich and poor.

## REFERENCES

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