Elliot Maxwell

Harnessing Openness to Improve Research, Teaching and Learning in Higher Education

The rise of the Internet and the digitization of information are affecting every corner of our lives. In a series of reports, we have examined how these two changes are increasing the "openness" of information, processes, and institutions.

The degree of openness of information, for example, can differ dramatically. To the extent that people have access to information, without restrictions, that information is more open than information to which people have access only if they are subscribers, or have security clearances, or have to go to a particular location to get it. But accessibility, quite similar to the concept of transparency, is only one aspect of openness.

The other is responsiveness. Can one change the information, repurpose, remix, and redistribute it?

Information (or a process or an institution) is more open when there are fewer restrictions on access, use, and responsiveness.

The Internet, in particular, has vastly expanded openness. It is changing the nature of information, processes, and institutions by making them more accessible to people next door and around the world. It also makes information more responsive—capable of being enhanced, or degraded, through the digital contributions of anyone interested enough to make the effort, be they experts, devoted amateurs, people with an ax to grind, or the merely curious.

In this report we examine higher education through the lens of openness. Our goal is to understand the potential impact of greater openness on colleges and uni-

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The full report by the same title from which this paper is derived is available at http://www.ced.org/images/library/reports/digital_economy/dcc_opennessedu09.pdf .

versities. Like other service industries such as finance or entertainment, higher education is rooted in information—its creation, analysis, and transmission—and the development of the skills required to utilize it for the benefit of individuals and society.

But finance and entertainment have been transformed by greater openness while higher education appears, at least in terms of openness, to have changed much less. We aim in this report to identify some of the potential gains from making higher education more open. We also make a series of concrete recommendations for policymakers and for institutions of higher education that should help harness the benefits of greater openness.

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Higher education is a complex arena with many different institutions serving many different audiences. Colleges and universities are, in part, the products of their own societies and reflections of hundreds of years of practice in teaching and learning, research, and service to the community. Reasonably slow to adapt, particularly in their core methods of teaching and learning, colleges and universities have been faced in the last decade with significant trends: the rapid increase in globalization, the arrival of students who were "born digital" and who may never have experienced an educational institution without the Internet, and a transformation of the Internet itself from a curiosity to a means for gaining access to information, and now to being a fundamental element of a more "participatory" culture that encourages everyone to make their own contribution. The research function of the university, which aims to produce and disseminate new knowledge, has become so intertwined with the Internet that it is almost difficult to recall what research was like before the World Wide Web. Colleges and universities are also beginning to use the Internet to strengthen ties with their various stakeholders and communities, as well as to improve their internal management.

OPENNESS AND TEACHING AND LEARNING

For hundreds of years, personal interactions between teachers and students and printed texts have been at the heart of teaching in colleges and universities. But

changes in the openness of the educational materials being used and in the vehicles for the delivery of these materials have the potential to fundamentally reshape teaching and learning.

Unlike traditional printed educational materials, digital materials have the valuable characteristics of allowing teachers and students to know what parts of the materials have been reviewed and providing immediate feedback on what the learner has done with the material. One can easily determine how successful the student has been in achieving the learning outcomes that the materials are designed to produce. The potential gains from using digital materials for both learners and teachers—as well as for the authors of educational materials and for the learning-sciences community in general—have often proven elusive. But the development of more open digital materials known as "open educational resources" (OER), combined with our growing experience with digital materials, suggest the possibility of far greater gains in the future.

The most familiar examples of OER are the MIT OpenCourseWare (OCW) materials that were adapted from existing MIT courses and posted on the Web, available free to anyone anywhere who had an Internet connection. MIT's OpenCourseWare initiative was part of the first generation of OER—putting old but highly regarded educational wine into new digital bottles. Like other information available via what has become known as Web 1.0, they were accessible but static. But newer OER reflect Web 2.0 and its participatory nature. As a result, they are far more open. They are created by a far broader range of authors—faculty, students, literally anyone interested—from around the globe. Not only can anyone create an OER, they can come in all shapes and sizes—a course, lecture, game, simulation. They are freely available to all, and anyone can modify an OER in order to customize it for a particular purpose, language, setting, technological platform, culture, or skill level.

With the extraordinary connectivity provided by the Internet, we can, using OER, provide free digital educational materials to millions of people in institutions of higher education and to the many millions more unable to attend such institutions. Everyone has the opportunity to participate in a global effort to improve and extend these materials, to customize, even personalize, them. We can incorporate new knowledge into digital learning materials more quickly and make those materials immediately and broadly available. We have the potential to collaboratively create materials that are student centered and that reflect our growing understanding of the importance of group effort in learning.

Web 2.0 has redefined the relationship between experts and amateurs in, for example, the creation of encyclopedias such as Wikipedia. It has altered the mechanics and economics of the production and distribution of videos as in YouTube. It is altering the way people interact via social networks such as Facebook.

In the world where OER offers the possibility of new relationships between teachers and learners, will the old paradigm of a teacher as the "sage on the stage" remain dominant? We think not.

We do not expect OER to simply replace more closed, proprietary educational materials, which themselves are increasingly becoming digital. And there are many issues that must be addressed if OER is to live up to its potential. OER has been supply driven, with creators posting whatever interests them regardless of how or even whether it is used; to be successful, OER must meet the needs of users. We need to know how OER is actually being used, how effective it is, particularly in comparison with existing materials, and what impact it has on learners. We need to rethink our copyright rules to allow increased non-commercial educational uses of copyrighted materials beyond the traditional classroom in order to facilitate the further development of OER. Just as new approaches to sustainability are being developed to support open-source software and open-access scientific journals, we will need to see if there are ways to sustain the development and distribution of free, high-quality, academically rigorous, and pedagogically sound OER that take full advantage of its digital nature.

We make a special effort to understand the potential implications of greater openness for community colleges.

These institutions face extraordinary challenges. They serve almost half the undergraduate students enrolled in higher education in the United States. Their student bodies are far more diverse than those of four-year institutions, with vastly different aspirations and backgrounds and levels of academic preparation. Yet community colleges are given fewer resources to accomplish more different missions than four-year institutions; they have, until recently, received far less attention and recognition than they merit, given their critical place in the entire scheme of higher education.

How might greater openness benefit community colleges? Access to information is one of the central aspects of openness. But there is far too little data collected and analyzed on the progression of students from high school through college and then into the workforce to allow valid judgments about what works and what doesn't. This is not surprising given that community colleges are often funded based on enrollments, not on their results. Funding mechanisms that reward achievement of specific educational outcomes would provide more appropriate incentives and stimulate efforts to find the most effective ways of achieving these outcomes.

Putting more information about course selection and degree paths online so that students—many of whom work full time and support families—can better understand the requirements they need to fulfill and how they are progressing should be helpful. Providing more support through online counseling and tutoring, including by their peers, would increase openness and be of particular benefit for those who need the most help.

OER could certainly benefit resource-starved community colleges. Using OER and online education would allow them to offer a wider range of courses and meet the needs of students who want more specialized instruction. Online simulations and immersive environments (potentially as OER) could provide educational experiences that would otherwise require expensive laboratory facilities. OER

could also help reduce textbook costs that now rival the cost of tuition at some community colleges.

Community colleges serve today as the focal point in higher education for workforce training. Greater openness would encourage closer relationships between community colleges, students seeking training or retraining, and local employers. Businesses should make clear their expectations in terms of skills and knowledge and alert community colleges to emerging workplace needs; community colleges should develop educational aims and learning outcomes as part of short- and longer-term educational programs that will meet the needs of potential employers and students. Better integration of educational policy and basic skills training with workforce preparation and economic development policy would help students, employers, and the country as a whole, particularly as we struggle through today's trying economic times.

National policy should support increased broadband connectivity for community college computing centers and supplement community college training facilities with new open "fabrication labs" to provide students—and members of local communities such as laid-off workers—with exposure to powerful, and increasingly software-controlled, tools.

OPENNESS IN RESEARCH

Research has been revolutionized by the digitization of information and the continued extension of the Internet. New models of networked research, such as that embodied in the Human Genome Project, are characterized by vastly increased collaboration, often on a global scale, and by the rapid public disclosure of research results rather than holding them for later publication in scholarly journals or by academic presses. This more open model of research is consistent with the research mission of the university to create and disseminate knowledge—and appears to lead to both broader and deeper research while increasing the pace of innovation.

Collaboration is not new to colleges and universities—it is in their DNA. But the scale of today's global collaboration and its pervasiveness were unthinkable until relatively recently. Universities have long had to learn how to recognize the scholarly achievement of research collaborators. Now they (and governmental grant makers) face the challenge of finding ways of evaluating and rewarding more open research, the results of which are publicly disclosed without being subject to a peer-review publishing process (but which are subject to the immediate scrutiny of the global scholarly community). It seems likely that new forms of recognition for tenure, grants, etc., will be required for today's digital age. At the same time, new Web-based, open-access journals, peer reviewed and freely available to all without subscription, are emerging as threats to the business models of even the most prestigious proprietary journals and academic presses.

Another manifestation of greater openness in research is the rise of digital repositories. There is ample precedent in the sciences for researchers to voluntarily deposit their research results in an electronic archive that is accessible by all, but

it is only recently that major research universities have begun to adopt policies requiring researchers to place copies of their research in institutional digital repositories. MIT's faculty, for example, recently voted unanimously for such a policy to make a statement that they stand for the free flow of ideas. These repositories further the research mission and allow scholars everywhere to learn about and build upon previous work. But work needs to be done to ensure that they are interoperable and user friendly.

Congress has greatly advanced openness in research by passing legislation that dramatically increases access to research funded by the National Institutes of Health (NIH). A condition of NIH support now is that results must be deposited into Pub Med Central upon acceptance for publication and be made publicly available within 12 months of publication. This policy is being vigorously opposed by publishers who claim that their intellectual property (IP) interests are being infringed upon by the open access requirements. Not only do we believe that the NIH policy is consistent with copyright law and good public policy—to increase the pace of innovation and avoid making the taxpayer pay twice for taxpayer-funded research—but we believe that the public-access mandate should be expanded. Recently introduced legislation would extend public access to research funded by the 11 federal agencies that each provides more than $100 million in support. We also support increasing access to data collected by the government, such as for regulatory purposes. The National Science Foundation (NSF) has already moved in this direction by establishing a policy that any scientific and engineering data funded by NSF must be made broadly available and useable.

Yet another example of the conflicts between IP rules and greater openness is being played out in a battle over the digitization of the world's books—one of the most exciting opportunities for increased openness since the invention of printing. The Google Book Project, the Internet Archive, and the Open Content Alliance, among others, have been engaged with major libraries, including university libraries, in important and praiseworthy efforts to digitize books and to make them globally accessible. Google has been sued in a class action by publishers and authors who allege that copying and digitizing the books and displaying even small portions of them without the specific permission of the copyright owners are copyright violations. A proposed settlement has been crafted and is being reviewed by the court overseeing the case, as questions have arisen about the impact of the proposed settlement on broader access to "orphan works" (those whose copyright holders are unreachable), on the online marketplace for digital works, and on the privacy of readers. We are not in a position to make a judgment about the proposed settlement but we think the goal of public policy should be to obtain the greatest possible access to copyrighted works, in particular "orphan works," and to stimulate competition, consistent with the need to provide incentives necessary for creativity. We would encourage university libraries to join in these important efforts at digitization and to expand their attempts to preserve surprisingly fragile digital materials.

The intellectual property arguments that have been invoked to oppose public-access mandates for government-funded research and the digitization and partial display of the world's books suggest to us the need to recalibrate our intellectual property rules for the digital age. Intellectual property rules should serve not only those who first create a work (and subsequent rights holders) but should also recognize the needs of users who often are follow-on creators. When the application of existing intellectual property rules appear to regularly have perverse effects—electronic books having text-to-speech capabilities turned off to the detriment of the visually impaired, or university presses, created to increase the accessibility of scholarly materials, invoking copyright protections to have their material removed from the globally accessible Web—it is time to step back and revisit not only the specific applications of the rules but the rules themselves. Given the complexity of these issues, universities should be forceful proponents for greater openness in legislative debates about IP, and should be educating their faculties about their intellectual property rights.

The growing use of e-portfolios by students should facilitate greater openness in teaching and research. Students can use them to deposit their digital work, both finished and in process. This ... provides a mechanism for students to demonstrate their accomplishments to other schools and potential employers.

The drive for greater openness also raises questions about the technology transfer activities that have spread throughout higher education since the passage of the Bayh-Dole Act, which aimed to encourage patenting and commercialization of federally funded university research. The research mission of the university is to create, preserve, and disseminate new knowledge. Technology transfer offices, on the other hand, have been created to spur the commercialization of university research and to generate funds for the support of university activities.

Very few technology transfer activities generate significant funds. Their practices regarding technology transfer can be inconsistent with the research mission, particularly if their drive to maximize revenue results in licensing practices that unnecessarily restrict access to university research. Universities should examine the practices of their technology transfer offices to ensure that there is an appropriate balance between generating funds and the broadest possible dissemination of new knowledge.

In a related area, universities must be vigilant to protect the openness (and quality and integrity) of university research from commercial limitations; a striking example of such threats are licensing restrictions imposed by providers of genetically modified seeds that have prevented land grant universities from conducting research comparing the effectiveness of genetically modified seeds with other seeds. We believe colleges and universities should carefully review the terms of commercially supported research to guard against inappropriate restrictions and maintain sufficient reporting requirements to identify possible sources of conflicts of interest by university researchers.

The growing use of e-portfolios by students should facilitate greater openness in teaching and research. Students can use them to deposit their digital work, both finished and in process. This allows improved faculty review and assessment and provides a mechanism for students to demonstrate their accomplishments to other schools and potential employers. These e-portfolios might be maintained past graduation, serving as a repository for a student's work throughout his or her lifetime and as a life-long link to one's alma mater.

OPENNESS AND RELATIONS WITH VARIOUS STAKEHOLDER COMMUNITIES

Colleges and universities are adopting the open tools of social networks to strengthen relationships with applicants, incoming students, parents, alumni, and other stakeholders—although nowhere as quickly as their students have adopted them. But these tools can also be used invidiously for monitoring the past and present activities of those who participate in these networks. We believe that institutions of higher education should initiate conversations with members of their communities about the privacy implications of online disclosures as well as how the institutions themselves are making use of them.

Increased access to the Internet has created an opportunity for colleges and universities to rethink and expand their role in continuing education—often considered tangential to their mission to teach undergraduates.

The Internet also allows colleges and universities to share the extraordinarily rich array of intellectual activities taking place on campus with local communities, as well as those a world away. Given this potential, we would encourage institutions of higher education to change the "default setting" from "Why should we make this activity available on the Web?" to "Is there any reason why we should not make this activity available electronically to all?" In the same spirit, we are encouraged by new efforts to open students to the global community in which they will work and live via study-abroad opportunities and Internet-facilitated links with institutions beyond U.S. borders.

OPENNESS AND UNIVERSITY ADMINISTRATION

A new form of software development, community-sourced software, has produced some innovative products useful for university administration, such as the SAKAI

course-management system and the KUALI financial systems. Such open-source systems may be particularly helpful in areas where proprietary software is not efficiently and effectively meeting the particular needs of institutions of higher education. Universities should seriously consider using open-source systems like these and establishing information and communication technology procurement requirements that favor greater openness and interoperability.

The rise of the Internet should also lead colleges and universities to reconsider the enormous amounts being budgeted for improvements and expansions of their physical facilities. In a world of constantly expanding bandwidth and connectivity, will "place"—the particular geographic location of a college or university—remain as critical? Should investments in bricks and mortar continue to play such a role on capital budgets? We think there may be a potentially persuasive case for shifting investment over the next decade to less capital-intensive information and communications technology tools that enable greater openness.

We discussed the tensions between openness and IP rules in the context of research, but they are being felt in another area by college and university administrators.

The Higher Education Opportunity Act requires colleges and universities to take steps to diminish unauthorized use of copyrighted materials by students using institutional networks, and to participate in alternative mechanisms for legally obtaining downloadable music, movies, and videos. The potential price is a loss of federal aid.

We believe that institutions of higher education have an obligation to educate their students about their IP rights and responsibilities, including their responsibility not to misappropriate the intellectual property of others. But these institutions that rely so much on openness and trust in their teaching and research missions are ill suited to serve as enforcement agents for private parties in commercial disputes under threat of severe federal penalties.

OPENNESS AND CERTIFICATION, ACCREDITATION AND TRANSPARENCY

There is also important work to be done to provide real meaning for degrees and certificates. We may know how many credit hours are required to obtain a degree or certificate, but we know little about the educational objectives and outcomes that underlie these supposed demonstrations of student competencies. In the absence of such information, it is impossible for employers, for example, to make meaningful cross-institutional and cross-border comparisons.

We need better information to allow individuals to compare the educational objectives and outcomes of different institutions and to measure the value added that an institution provides. The absence of such information inhibits genuine competition among institutions of higher education. At present, potential applicants are asked to make decisions comparing educational institutions around the world using ratings based on inputs, such as the test scores of their matriculates,

Recommendations

This report makes several recommendations that would help institutions of higher education move in the direction of greater openness. The following highlights some of the key initiatives.

Governments should:

- Establish standards for the nationwide collection and reporting of data tracking student progress from high school to post-secondary institutions and then on to the workplace, focusing on educational outcomes and factors that favor or impede student success. Such data should be broadly accessible and useable and subject to rules to protect privacy and security.
- Fund research on the comparative effectiveness of digital educational materials, including OER, and conventional materials as well as on best practices for online and blended online and face-to-face education. Additional research aimed at assessing the accomplishment of learning outcomes would help support improved teaching and learning.
- Review and recalibrate intellectual property rules, recognizing the increasing importance for innovation of users as follow-on innovators. Extend permissible uses of proprietary materials under the educational exceptions for non-commercial educational use beyond traditional classrooms.
- Retain existing requirements for public access to NIH-supported research (public availability within 12 months of publication) and extend the public-access policy to cover non-classified research funded by the 11 federal agencies that each annually provide over $100 million of research support.
- Remove obstacles to federal involvement in efforts with states, colleges, and universities, and accrediting bodies to establish minimum quality standards for, and foster self-improvement by, institutions of higher education. Support efforts to establish clearer learning outcomes at the program and departmental level at institutions of higher education.
- Establish as federal policy the goal of increasing compatibility, comparability, and portability of degrees and certificates and transparency regarding the

student-faculty ratios, and the financial resources of the institution. Wouldn't we be better served by competition based on publicly available educational objectives and the learning outcomes that the institutions achieve, and the value that they add to what their students bring to them?

We currently trail European efforts to make transparent, comparable, and compatible the meaning of degrees and certificates and to describe the educational aims and outcomes that underlie them, but we are seeing some progress. We continue to suffer, however, from the legacy of battles over the federal role in accreditation and the very purpose of the accreditation process itself. We believe that in a world of great student mobility, increasing distance education that transcends state borders, and the critical role of higher education in our national com-

educational outcomes at, and the value-added by, institutions of higher education.

- Support the establishment of "fabrication laboratories" in conjunction with community colleges, businesses, labor unions, and local governments in areas of high unemployment.
- Improve access to "orphan works"—those still under copyright but whose rights holders cannot be reached—by legislatively limiting liability for their good-faith use.

Colleges and universities should:

- Reevaluate faculty recognition policies regarding tenure, advancement, and the granting of awards to acknowledge (and not discriminate against) new practices regarding the dissemination of research results, such as via immediate release, publication in open-access publications, and creation of open educational resources.
- Establish open-source digital repositories and require faculty to provide the institution with a non-exclusive license to the products of their research. Deposit electronic copies of the research into the repository and identify them using standardized metadata to facilitate search and use. Ensure faculty the right to withhold research from general availability while providing metadata to disclose the existence of the research and contact information.
- Reexamine and readjust technology transfer policies and programs, particularly exclusive licensing arrangements, in light of the research mission to create and disseminate new knowledge, while recognizing the need to generate revenues to support the institution.
- Establish e-portfolios into which students can deposit their work while attending the institution, which can be used for assessment and shared with prospective employers and others. Consider making such e-portfolios available for students to continue to use after they leave the institution.
- Be a voice for greater openness in access to information and for a re-examination of intellectual property rules for a new digital era.

petitiveness, that the federal government must play a role in facilitating the portability of degrees and certificates and ensuring their compatibility, comparability, and transparency. Increased federal support for research on assessment and measurement of educational outcomes would help. So too would a change by accrediting agencies from a focus almost entirely on institutions (their members and clients) and inputs to one that pays greater attention to impacts on students. Few accrediting agencies now make public information about the institutions they accredit, beyond the formal accreditation actions that they have taken; greater focus on student outcomes would lead to greater transparency and facilitate more informed choices by potential students.

THE ROLE OF PROPRIETARY INSTITUTIONS

We have focused our research on the impact of openness on not-for-profit public and private two- and four-year institutions. This is not because for-profit institutions are unimportant or unworthy of attention—the for-profit sector of higher education has been growing rapidly and includes many highly successful institutions. It is a function of limited time and resources.

But even in our cursory look at this sector we can identify certain practices that support our conclusion that greater openness can help improve higher education.

We think that the most successful for-profit institutions have learned the importance of defined learning outcomes and appropriate assessment, and the need to produce decision-relevant data. Many have been leaders in experimenting with new technologies in support of their missions; they must prepare their students to meet and exceed the needs and expectations of potential employers, so they have to strive continuously to understand existing and emerging workforce needs. For-profit institutions often provide more support and teacher training to their faculty than do their not-for-profit equivalents, and they have been earlier to recognize and support the positive impacts of student group-learning activities.

CONCLUSION

In this paper and full report from which it is derived, we have only begun to plumb the potential for greater openness to improve higher education. As my colleagues at the Committee for Economic Development and I have made clear in our previous reports, we believe that openness is not a paramount value or an unalloyed good. For example, just as we see opportunities to use greater openness to provide certifications of competence to those around the world who cannot attend institutions of higher education but who need credentials to enter the workforce, we recognize that we will need to find ways that limit openness to ensure the integrity of online testing. Just as new, more open means of electronic distribution for scholarly work should accelerate the dissemination of new knowledge and hasten the pace of innovation, they pose financial challenges to existing vehicles for scholarly publication that have, and are, providing valuable services. The list goes on.

But with all the difficult issues to address, and with all the unforeseen consequences of these new pathways, we are convinced that institutions of higher education should move toward greater openness on their own with support and encouragement from businesses and governments. We are firm believers in the value of higher education, and we are convinced that greater openness will improve colleges and universities. We hope that our analysis will help persuade others that this is the correct approach and that the concrete recommendations we make will help provide a responsible path to the benefits of greater openness. We want to encourage thoughtful experimentation to learn more about the effect of greater openness in practice. And in the spirit of openness, we hope that others who know more than we do will share with us their insights and experiences and correct our mistakes and misapprehensions for the benefit of the global higher education community.