Barriers to Adoption of Online Learning Systems in U.S. Higher Education

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ITHAKA S+R

Ithaka S+R is a strategic consulting and research service provided by ITHAKA, a not-for-profit organization dedicated to helping the academic community use digital technologies to preserve the scholarly record and to advance research and teaching in sustainable ways. Ithaka S+R focuses on the transformation of scholarship and teaching in an online environment, with the goal of identifying the critical issues facing our community and acting as a catalyst for change. JSTOR, a research and learning platform, and Portico, a digital preservation service, are also part of ITHAKA.

Preface

Digital technology has already changed the way colleges and universities function, but no matter how significant those changes feel today, real transformation is just beginning. Every day, a new program in online learning is announced, and on the horizon is the promise of using new adaptive learning technologies —or what we have come to call Interactive Learning Online—to educate more students than ever before at lower cost and with similar or even better learning outcomes.

This Ithaka S+R report is the first in a series that will provide leaders in higher education insight into what has been learned from online learning efforts to date and new research to help them move forward with the development and deployment of more advanced systems in the future.

Many of the lessons in this report can readily be applied locally; that is, they will help leaders make sound decisions for their own institutions. We have also identified two critical issues that if addressed at a system-level, will lead to better outcomes for all: the need for open, shared data on student learning and performance tracked through interactive online learning systems, and the need for investment in the creation of sustainable and customizable platforms for delivering interactive online learning instruction. We hope this report will help to stimulate discussion and planning among leaders on these important topics.

The research and writing of this report was a collaborative effort among Ithaka S+R Senior Advisors Lawrence S. Bacow and William G. Bowen; Kevin M. Guthrie, president of ITHAKA; and research analysts Kelly A. Lack and Matthew P. Long. The work was generously funded by the Bill & Melinda Gates Foundation.

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We hope you find this work valuable, and look forward to collaboration on future research. I encourage you to contact me or my colleagues at Ithaka S+R with comments of any kind.

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This report has benefitted from helpful comments from many people, including members of a specially constituted Advisory Committee (below) and staff members of the Bill & Melinda Gates Foundation. The authors, however, are solely responsible for the ideas presented here.

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Introduction

The purpose of this study is to explore the key obstacles that stand in the way of widespread adoption of highly interactive, adaptive, online learning systems at traditional colleges and universities. Such systems rely heavily on machine-guided instruction to substitute, but usually only in part, for traditional faculty. We believe such systems have the potential to improve faculty productivity and lower instructional costs without sacrificing educational quality. As noted below, there are also many other kinds of less sophisticated online learning systems, some more suitable for certain settings than others. Barriers to adoption vary greatly according to the type of online learning system (especially its complexity), the nature of the institution, and the varied needs that the system is intended to address. For many institutions, increasing access to courses and even entire degree programs is as important as—or more important than—improving learning outcomes for current students or reducing instructional costs. Some institutions are also motivated to provide online learning programs to generate additional revenue. And all institutions are under pressure to serve a generation of students brought up on the internet.

We want to emphasize that our focus in this study is on the impact of these technologies on institutions of higher education. There are also systems being created that are designed to deliver education directly to the user outside the traditional institutional context, or to a K-12 environment. These initiatives are outside the scope of this study.

By Interactive Learning Online we mean highly sophisticated, interactive technologies in which instruction is delivered online and is largely machine-guided.

The Ithaka S+R team conducted interviews with presidents, provosts, and other senior academic leaders at more than 25 different institutions representing public and private research universities, four-year colleges, and community colleges. (A complete list of institutions and individuals interviewed is provided in the Appendix.) We conducted more intensive "deep dive" analyses at five of these institutions: Baruch College, Indiana University, Fayetteville Technical Community College, Montgomery County Community College, and the University of Maryland, Baltimore County.[1] The purpose of these deep dives was to gain a finer-grained understanding of the specific challenges and opportunities posed by these new educational technologies. More generally, we sought to understand how all the institutions in the study (not just the deep-dive institutions) were embracing one form or another of online education, the obstacles leaders encountered in attempting to supplement or even replace traditional methods of instruction with new, technology-enabled instruction, and the strategies being employed to overcome these obstacles.

This is an exciting time in higher education. Literally for the first time in centuries, faculty and administrators are questioning their basic approach to educating students. The traditional model of lectures coupled with smaller recitation sections (sometimes characterized as "the sage on the stage") is yielding to a dizzying array of technology-enabled pedagogical innovations. Virtually every institution we encountered is experimenting with online instruction. The rationale, form, and strategy differ from institution to institution, but change is occurring and, we believe, at an accelerating rate. As with any profound institutional change, skeptics abound and outright resistance exists. That said, we believe that online educational technology will bring about fundamental reform in how teachers teach and students learn in the years to come. Whether these reforms will also significantly lower the cost of education remains an open question.

As we began our research, the first challenge we encountered was the lack of a widely accepted definition of the term "online learning." Specifically, the more sophisticated forms of online learning that we wish to study, made possible by recent advances in technology, have not yet been widely implemented. Methodologically, this poses a challenge to our study because it is difficult to assess barriers to adoption of a technology that remains unfamiliar to most decision makers. Not surprisingly, it was easier for people to tell us what their institution had tried in the past, rather than imagine what might happen when the next wave of instructional innovations arrives.

To help clarify this situation, we invented a new term to describe more precisely the form of online learning we wish to investigate: "Interactive Learning Online" or ILO. By ILO we mean highly sophisticated, interactive technologies in which instruction is delivered online and is largely machine-guided (although of course such technologies may be used in conjunction with more traditional modes of instruction). The best of these systems rely on increasingly sophisticated forms of artificial intelligence, drawing on usage data collected from hundreds of thousands of students, to deliver customized instruction tailored to an individual

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1 The "deep dive" institutions were not chosen to represent a statistically valid sample of our institutional population—but we do believe they represent a reasonable cross-section of that population. The particular institutions chosen were picked in part on opportunistic grounds; they were willing to participate on a tight time schedule, they were known to be well led, and we had worked before with the leaders of several of them.

student's specific needs—a technology often termed "adaptive." These systems also allow instructors to track students' progress through a course of study at a fine-grained level of detail, thereby enabling more targeted and effective guidance. Such systems are far beyond the capability of individual instructors to create on their own, and are typically developed by teams of cognitive scientists, software engineers, instructional designers, and user interface experts. Relatively few ILO systems currently exist, and full implementation of any that do exist remains quite rare.[2] However, the technology is currently in a state of rapid evolution, and we believe it is possible that a wide variety of such systems, of varying quality and sophistication, will proliferate in the next three to five years.

Recognizing that full implementation of ILO remains rare, we sought to learn as much as we could from institutions' past experiences with other forms of online learning. We believe there is much to learn from these experiences, and that we can infer likely future barriers to adoption of ILO systems based on problems encountered in the adoption of these less sophisticated forms of online education. Thus, throughout this report we extrapolate from the present-day experiences of institutions in introducing less sophisticated forms of online instruction as we assess the expected barriers to implementation of ILO systems.

This paper is organized as follows. First, we briefly summarize the many varieties of "online learning" that exist today and explain why traditional institutions are embracing them. Second, we describe the strategies being pursued by academic leaders to encourage their institutions to adopt more technology-enabled education. Third, we summarize what these leaders believe they have learned from their experiences with online education to date. Fourth, we describe what we perceive to be the primary obstacles to the adoption of online instruction. Fifth, we discuss successful strategies institutions have used so far to overcome these obstacles. Finally, we conclude with an analysis of potential strategies for helping to move institutions in the direction of adopting ILO forms of instruction.

The Current State of Online Learning

The diversity of online courses offered for credit by various institutions reflects the diversity of higher education more broadly. Online learning is taking place at just about every college and university in the nation. Even traditionally taught courses routinely utilize the tools of online learning. For example, institutions are capturing lectures through video, archiving them on the web, and making them available to students, and in some cases the public, in an asynchronous format. Homework is routinely being submitted and evaluated online. Students and faculty have embraced learning management systems to distribute digital content, access multimedia material from outside the institution, and facilitate

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2   Carnegie Mellon University's Open Learning Initiative is a prominent example of this approach, albeit not fully adaptive as described here. The evolution of this model, which took considerable time and a large investment of philanthropic funds, is discussed at length in Taylor Walsh's *Unlocking the Gates* (Princeton University Press, 2011), chapter 4. Ithaka S+R is now completing a study of the learning effectiveness of a prototype CMU statistics course on selected public university campuses.

student-to-student and teacher-to-student interaction.[3] This growth in digital distribution of course content is routine, organic, and largely taken for granted on most campuses. The wide variety of types of online learning can lead to a desire for typologies, but it is not easy to identify a set of mutually exclusive "boxes" into which various approaches to online learning can be put; there is too much variation and too much overlap. But there are distinctions that are helpful in characterizing the different types of systems: (1) purely online versus "hybrid" approaches in which there is also face-to-face interaction; (2) self-paced systems versus systems where all students are required to proceed through the course at the same time, on a defined schedule; (3) reliance on social gaming/peer-group approaches versus systems that are oriented toward individual learners; and (4) ILO-style instruction that is largely machine-guided versus approaches that require substantial investments of time and effort from instructors to engage online with their students.

Beyond embracing technology to enhance traditional courses, many institutions have also created a set of courses (and sometimes entire degree programs) that are taught completely online, with little or no face-to-face interaction between students and faculty or among students. However, the vast majority of these courses essentially replicate traditional modes of instruction, with archived lectures streamed over the web, and "sections" and feedback provided by faculty via email and chat rooms. All that differs is that the teacher, rather than appear in a physical classroom, communicates exclusively to students through the use of technology. In this form of online instruction, student-faculty ratios do not differ significantly from those encountered in traditional classroom settings.

Full implementation of sophisticated ILO systems where the instruction is either exclusively or largely machine guided remains quite rare.

While many institutions are experimenting with online courses in the humanities and social sciences, initial offerings tend to concentrate in subjects where mastery can be evaluated in response to questions with demonstrably right or wrong answers. Thus, we see in many (but not all) cases a preference for subjects in business, math, and science.[4] We observed relatively few attempts to teach laboratory subjects online. Similarly, many initial investments in online education are focused on professional, as opposed to undergraduate, education.

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3   For an excellent illustration of a traditional course that makes full utilization of digital content, see Professor Stephen Greenblatt's Harvard General Education Course entitled "Imaginary Journeys" as described in Nannerl O. Keohane's article, "The Liberal Arts as Guideposts in the 21st Century," *Chronicle of Higher Education,* January 29, 2012, http://chronicle.com/article/The-Liberal-Arts-as-Guideposts/130475/?sid=at&utm_source=at&utm_medium=en.

4   Throughout this report we try to broadly characterize the state of online education at the institutions described in Appendix A. However, there are exceptions to most of the generalizations. For example, at a few institutions the humanities have led efforts to embrace online learning. That said, we stand by the broader characterization that at most institutions, early adopters tend to cluster in the subjects described. One exception may be language instruction. For example, Rosetta Stone's digital offerings have been adopted on a number of traditional campuses. See Marc Perry, "In New Partnership, James Madison U. Offers Credit for Online Rosetta Stone Course," *Chronicle of Higher Education*, Wired Campus Blog, October 13, 2011, http://chronicle.com/blogs/wiredcampus/in-new-partnership-james-madison-u-offers-credit-for-online-rosetta-stone-course/33653.

Revenue growth: Far and away the most common rationale for the development of online degree programs among the institutions we studied is the desire to generate new revenue streams by reaching students who would not otherwise enroll in traditional degree programs. In times of budgetary scarcity, many institutions view online education as an important new revenue source. Although not all institutions reported that their online learning programs generate net revenue, the ones that do typically have established a separate program with a different (lower) cost structure, often using less expensive space, adjuncts or other lower cost faculty, and a separate administrative apparatus, while charging tuition equal to or even sometimes greater than the tuition charged for traditional courses. At public institutions, the incremental revenue generated from online education is being used to offset declines in public appropriations or to supplement faculty compensation. In private institutions, revenue generated from online education is being used to either address budgetary shortfalls or, in some cases, to directly support traditional modes of instruction.

Very few institutions are using either the savings from online education or the net incremental revenue to reduce the price of education to students.

Some institutions have completely walled off online degree programs from their traditional students. These institutions are concerned that they will devalue their traditional, residential education if they move instruction online. To put it another way, they are sensitive to criticism from parents and students who believe that the high tuition and fees they are currently paying entitle students to regular, frequent, direct, face-to-face contact with faculty. Online education in a residential setting calls into question this assumption, especially at selective private institutions.[5]

For example, Boston University (BU) has developed a dozen online master's and doctoral degree programs, as well as an undergraduate degree-completion program. However, it has only recently begun to explore the use of "technology-facilitated learning" for its traditional undergraduate students. By contrast, the University of Massachusetts utilizes traditional faculty to teach its extensive online programs (UMassOnline) and makes its online courses available to

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5   Stanford has experimented in a few courses with replacing traditional lectures with streaming video of faculty lecturing online. In these courses, faculty have tried to reserve class time for more interactive forms of engagement with students. While some members of the general public are excited about having access to lectures by renowned professors (see, for example, Steven Leckart, "The Stanford Education Experiment Could Change Higher Learning Forever," *Wired Magazine*, Wired Science Blog, March 20, 2012, http://www.wired.com/wiredscience/2012/03/ff_aiclass/all/1), predictably, such experiments have provoked criticism from Stanford students who have said that they did not come to Stanford to watch their professors perform via computer. (One example of such criticism, from computer science major Ben Rudolph, is described in the *Chronicle of Higher Education's Wired Campus* blog in a January 5, 2012 post entitled "Debating the 'Flipped Classroom' at Stanford," http://chronicle.com/blogs/wiredcampus/debating-the-flipped-classroom-at-stanford/34811.) See also "The Pitfalls of Technology in Education," *Stanford Daily,* (http://www.stanforddaily.com/2012/02/29/the-pitfalls-of-technology-in-education/).

traditional students.[6] However, it charges premium tuition to online students (in exchange for the convenience of taking courses online) and uses the surplus from the online programs to help subsidize the traditional campus experience.

Institutions are pursuing a variety of strategies for rolling out online offerings to students enrolled in traditional degree programs. At some institutions, the "online" and "traditional" portions of a university do not share courses and curricula, and often they do not even share faculty members or technology. For example, at Southern New Hampshire University, the online campus is located five miles from the traditional campus. It employs its own admissions staff, technology platform, faculty, and administration. Other institutions, however, are trying to integrate online and traditional education. For example, Arizona State University (ASU) offers the same courses to students enrolled in its online programs and on its campus, where they are called "iCourses." Northern Virginia Community College (NVCC) has made a similar decision. Rather than creating a new "campus" for its online programs, it has integrated them into the existing curriculum. The school hopes that pedagogical innovations from the online courses will make their way back into the traditional classrooms.

Serving non-traditional populations: Online education is seen as an effective means to broaden access to instruction by serving students who otherwise would not be able to matriculate in traditional programs. These non-traditional students include older students who are attending school while employed, students who are located some distance from campus, including those in rural areas, disabled students, active military students, and students in urban settings with high commuting costs.[7] (In some cases these non-traditional populations receive priority in enrolling in online classes; for instance, Pennsylvania State University's World Campus allows its target audience—adult part-time learners—to sign up for its courses first, before allowing Penn State residential students the opportunity to fill any remaining seats in World Campus courses.) Similarly, some institutions are developing online courses to meet the needs of traditional students who wish to take courses in the summer. Faculty also benefit from the flexibility created by teaching online. Like their students, they are then not tied to a specific schedule or geographic location.[8]

Private institutions are also using online teaching to expand internationally. For example, Georgetown University is using online classes to establish strong links between its main campus and its Qatar campus. BU has used online education as a way to explore opportunities in India, where there is great demand for English-language education.

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6   UMass Online also uses the same curriculum, the same faculty, the same admissions standards and the same degrees as traditional programs. Courses are also approved and developed under the same faculty governance standards as for traditional programs.

7   Henry S. Bienen, chairman of the ITHAKA board, former president of Northwestern, and chairman of the board of a for-profit provider of education, Rasmussen, notes that online education is quite literally the only option for most of Rasmussen's students; otherwise they would have no way of enhancing their skills or seeking a degree.

8   Southern New Hampshire University reports that its most popular math instructor is a full professor at a university in Moscow. He lives and teaches from Moscow.

The tendency of students to repeat courses, and eventually to drop out altogether, leads to wasted resources for both individuals and institutions.

Improving retention: Some institutions are using online courses to improve retention rates by making courses available to students who would otherwise be "closed out" of traditional courses due to limitations on course size or conflicts with other required subjects. At Morgan State University, many of the 35 to 40 courses that are offered online or in a hybrid format for traditional students were chosen specifically because they are required for graduation and therefore are in high demand. These are also courses that students often struggle to fit into their schedule. Improving retention, shortening time-to-degree, and raising completion rates are highly desirable in and of themselves—and they are also an effective way of reducing the costs of achieving higher levels of educational attainment. The tendency of students to repeat courses, and eventually to drop out altogether, leads to wasted resources for both individuals and institutions. Effective systems of online education can be targeted at curbing these tendencies. Institutions are also using online learning to improve retention by focusing specifically on developmental courses that prepare students for college success. This problem is particularly acute at large public institutions that enroll large numbers of students with uneven levels of high school preparation. These institutions often must offer hundreds of sections of developmental classes (especially in math and writing) at enormous expense.

The University of Texas is working on a project called On-Ramps to develop technology-rich hybrid courses in cooperation with other institutions of higher education in Texas.[9] The state legislature is providing special funding for this initiative. On-Ramps will offer courses in computer science, preparation for calculus, physical science, and English composition for both high school and college students with the hope that completion of these online courses will ensure a smooth transition to college.

ASU is working with an external partner, Knewton—a technology company whose adaptive learning platform uses data from each student's past activities to customize his or her learning experience—to create new online developmental and freshman math courses that ASU believes are showing evidence of improved pass rates and reduced instructional costs. ASU faculty have assisted in developing the curriculum for these courses, which draw upon both locally-developed content as well as digital content from Knewton and Pearson. The online system used in the courses gives constant feedback to both the student and instructor, goes into "focus mode" to give students extra practice on key topics, and ensures that the student masters all of the individual concepts in the course.

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9   For more information about On-Ramps, see the presentation by Uri Treisman, Executive Director of the Charles A. Center and Professor of Mathematics and Public Affairs at the University of Texas-Austin, at the 2009 Education Commission of the States National Forum on Education Policy: http://www.ecs.org/html/meetingsEvents/NF2009/NF2009_resources.asp.

Responding to space constraints: Online education is being used by some institutions to avoid constructing new facilities or, alternatively, to avoid having to offer classes or sections at times that are perceived to be unattractive to students and faculty.[10]

Urban institutions face particularly intense demands on space. Baruch College in New York City has seen extraordinarily high usage of its facilities, and hopes to reduce the strain on facilities (and save students commuting time) by moving more classes online. George Washington University in Washington, D.C. is renting extra space for various university programs at great expense, and also faces government-imposed enrollment caps at its urban campuses. Online education is seen as an alternative both to new construction off campus and as a way to grow its enrollment within the enrollment caps at the Foggy Bottom campus.

Suburban institutions face different challenges. At NVCC, heavy traffic and long commutes to the various campuses make attending class a challenge for students and faculty alike. In such a setting, online instruction is attractive for everyone. Many suburban institutions are also struggling with rapid enrollment growth. For example, NVCC is experiencing 8 to 10 percent growth in enrollment at the same time state funding is declining by 25 percent. The institution is under great pressure to serve its growing population more efficiently and lacks the resources to expand its physical campuses fast enough to do so.

Managing costs: Relatively few institutions view online education primarily as a way to reduce the cost of instruction, especially for traditional students. In fact, many of those interviewed believe that online courses are at least as expensive to teach as traditional courses—and that is no doubt true of online systems that do not, in fact, substitute machine guidance for some substantial part of day-to-day faculty guidance.[11] To the extent that managing costs is a consideration, the reduction in facilities expenses is generally seen as the principal benefit.[12] It is also true that first-time costs tend to be higher than recurring costs. Start-up costs include investments in technology, instructional design, and web design, as well as training for instructors in the art of online instruction. Most institutions hope to amortize these costs and expect that online instructional costs will decline over time due to experience and scale economies.

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10 At Bunker Hill Community College in Boston, some sections of popular courses are taught at midnight, in part because that is the only time scarce classroom space is available and in part because that is the only time some non-traditional students who hold multiple jobs can attend (see *The Chronicle of Higher Education,* "At Bunker Hill Community College, Some Classes Will Start at 11:45 P.M," July 16, 2009, http://chronicle.com/article/At-Bunker-Hill-Community/47896/).

11 That is the lesson of some prior research. For instance, see "Teaching at an Internet Distance," report of a 1998–99 University of Illinois faculty seminar, December 7, 1999, www.vpaa.uillinois.edu/tid/report, as well as "Online Nation: Five Years of Growth in Online Learning," by I. Elaine Allen and Jeff Seaman, October 2007, http://sloanconsortium.org/publications/survey/online_nation.

12 While Austin Community College, for example, incurs some savings as a result of having to use less classroom space for online courses, its practice of paying faculty members the same and providing similar support services for faculty, regardless of whether they are teaching online or traditional classes, minimizes the extent of the institution's savings in other areas, such as faculty compensation.

However, we note that very few institutions are attempting to do serious cost accounting for either online or traditional education so, for now, these assumptions remain speculative. Furthermore, those that have attempted to assess relative costs seem to have in mind only the more immediate near-term costs of online education given current assumptions about staffing and facilities; they have not imagined what their cost structure might look like on a long-term basis, assuming that instruction were to migrate to a machine-guided learning environment. Such an environment might require fewer full-time instructors, fewer recitation instructors, and a reduced investment in plant and equipment.

Improving Learning Outcomes: At some institutions, improving learning outcomes and enhancing student-faculty interaction are motivators in pursuing online learning. Bryn Mawr College, for example, is implementing select modules from Carnegie Mellon's Open Learning Initiative in an effort to improve the quality of its introductory STEM courses. It is doing so through a very flexible process deemed to be sensitive to the concerns of the faculty, in which individual professors consult with an instructional designer to use blended techniques to better meet the learning goals of the instructor, students and curriculum. Bryn Mawr does not expect any savings from its use of online learning modules (at least in the short or medium term), though it has offset the costs of its experimentation with a "Next Generation Learning Challenges" grant from EDUCAUSE.

Bryn Mawr's experience is typical of situations at highly selective, elite institutions. In this segment of the market, there are often stronger competitive pressures to increase student-faculty interactions, which also typically increase faculty costs, than there are pressures to reduce costs. Students and their parents are interested in smaller classes, more direct faculty contact, more hands-on learning, more diverse curricular offerings, and more opportunities for students to engage in off-campus field experiences. These are the dimensions along which these institutions compete for the very best students and the very best faculty. The result is relentless upward pressure on instructional costs. At a recent symposium of the Harvard Initiative on Learning and Teaching, one of the authors of this report commented that virtually every initiative discussed at the symposium to improve student learning implied higher faculty instructional costs.[13]

Yet, aside from a few institutions' references to improvements in retention or pass rates, most interviewees did not explicitly mention a desire for better learning outcomes as a main factor behind their decisions to increase their online offerings. While a few institutions cited what they saw as preliminary evidence that their online courses had similar, if not lower, withdrawal rates as their face-to-face courses, the belief that students in online courses may learn the material better than their traditional-format counterparts did not appear to be widely held. This may be partly due to the scarcity of convincing evidence, produced by rigorous evaluations, about the effectiveness of hybrid or online learning compared with that of traditional modes of teaching.

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13 See Mary Carmichael, "At Harvard, teachers get a lesson," *The Boston Globe*, February 6, 2012, http://www.boston.com/news/education/higher/articles/2012/02/06/at_harvard_its_teachers_who_are_learning/.

Institutions have pursued two distinct approaches in developing online courses. First, many have simply empowered and encouraged individual faculty to convert existing courses to an online format targeted at the same students as the face-to-face versions of these courses. Not surprisingly, this approach is relatively easy to implement, but often results in a less-than-thematically-coherent set of offerings. Second, some presidents, provosts, and deans have created special online degree programs often targeted at non-traditional students. These programs are commonly segregated from traditional offerings (treated as "side-cars," as one person put it) and frequently employ instructors recruited specifically to teach in the online program. Segregating the online presence from traditional offerings allows an institution to price discriminate between programs. It may also reduce potential opposition to conversion of traditional modes of instruction to a form that many faculty have yet to embrace, and separate any risks associated with online offerings from the rest of the institution and the institution's brand. There is a danger, however, that (as one of our advisors suggested) a "bi-polar" educational system will develop, with more personalized, higher-quality offerings for a privileged subset of students.

At many institutions, technologically savvy individual professors drive the creation of online content. Administrators often try to build on the work of these early adopters to create a larger online presence. For example, at the University of Maryland, Baltimore County, individual professors have freedom to deliver their courses in a hybrid or completely online format, and can get support from the campus' Center for Instructional Technology and New Media to do so.[14] Once a "critical mass" of instructors emerges, it is far easier for departments and administrators to more actively plan future course offerings.

Many institutions make resources available to individual faculty who wish to either develop online courses from scratch or convert traditional courses to online offerings. Typically, institutions will offer technical assistance in the form of instructional design, web design, and sometimes specific pedagogical assistance in online teaching. In some cases, such as at Pennsylvania State University, the team that assists faculty members in developing online course content also helps specifically with "marketing" the course to prospective students. (ASU Online has a similar program.)

Developing an online course requires significant initial investment of faculty time. To compensate faculty members for this investment, many institutions offer supplemental financial assistance ranging from $500 to $5,000 per course. Indiana University's highly ranked online MBA program, which is offered independently by the Kelley School of Business, pays a course stipend as high as $15,000 for faculty who develop new courses. These incentive programs usually come with conditions: courses must usually meet minimum standards or otherwise be approved through some official process. Moreover, most institutions

14   UMBC has also used a $1,500 summer course redesign grant program similar to what is available at other institutions, but this program is aimed at teaching with technology, not necessarily teaching online. Another example at UMBC is the College of Natural and Mathematical Sciences Active Science Teaching and Learning Environment, which started as a chemistry department initiative to replace lectures with interactive technology sessions.

will only pay for the development of courses that are not already online. Some traditional institutions approach the decision to offer a course or a degree online as a business decision, carefully calculating the necessary initial investment, the potential market for the course or degree, likely incremental revenue, and the impact of the online offering on traditional degree programs. The National Center for Academic Transformation similarly considers many of these variables in the course redesign projects it undertakes, in the contexts of selecting the courses on which to focus its projects, choosing which of several redesign models to use for a particular course on a particular campus, and assessing the costs savings from implementing the redesigns.

Those presidents, provosts, and deans who have developed specific strategies to create a significant institutional online presence (who employ the second of the two approaches outlined above) typically target graduate and professional students or non-traditional undergraduates. In most cases, the goal of these programs is either to generate new revenue for the institution or to reach otherwise underserved populations. Some state systems are also developing system-wide online programs and courses with centralized repositories for online content.

At some institutions, master courses are created centrally by professional staff for distribution online. Rio Salado College has only 23 residential faculty members in the entire college. These faculty members are responsible for overseeing the curriculum and course development process, though they often bring in subject-matter experts to work with instructional designers to create new online courses, and then hire and train adjunct faculty specifically for the purpose of teaching these courses. These master courses are placed in a digital repository to encourage broader use. In North Carolina, the statewide Virtual Learning Community (VLC) develops courses using statewide faculty as well as aggregating approved existing courses from Fayetteville Technical Community College (FTCC) and the state's other 57 community colleges. It provides a central repository for digital materials and entire online courses that can then be adapted and reused elsewhere.

Those courses that are not entirely repurposed from previous curriculum development are sometimes created with content from a commercial publisher or a variety of outside providers. For example, in its introductory math courses, ASU has relied on both a course design partner (Knewton) and a major publisher (Pearson). For both publisher- and vendor-created content and content placed in free repositories, reusability and technological compatibility have become key issues in an environment where tools like learning management systems are constantly changing. Still other companies like Kaplan Global Solutions, 2tor, and Embanet are offering a diverse array of services to colleges and universities that want to outsource instructional design, marketing, hosting, and management of their digital offerings.

All institutions are dependent on learning management systems for content management and distribution. Blackboard remains the most commonly used course management system. Moodle and Sakai are the best-known open-source options. We also see inroads being made by newer course management and delivery systems that promise greater opportunities to capture network effects from mining data generated by student learners. We are impressed by the innovation

taking place in the private sector as new companies compete to develop software that facilitates online learning and instruction. This market continues to evolve at a very rapid pace with new companies and products being announced almost weekly. However, we have yet to encounter a generic software platform that would permit faculty to develop and customize their own online content complete with feedback loops and a high degree of interactive, machine-guided learning.

In sum, virtually every institution seems to be expanding online offerings either as a result of an explicit, centrally-developed strategy or through faculty-driven organic growth. As a result, online education is not going away. It will only grow over time. The private sector is stimulating some of this growth by developing new products that facilitate curriculum development, content management, grading, and delivery of online courses. These products will only become more powerful with online teaching and learning, and as students become increasingly accustomed to incorporating sophisticated technology into more and more aspects of their daily lives, more courses will migrate to the digital classroom and the pace of change is likely to accelerate. However, whether these changes will affect the overall structure and cost of higher education remains unknown.

Observations from Interviews with Academic Leaders

In the course of our interviews, we learned much about how presidents, provosts, deans, and faculty think about the new world of online education. We also gained valuable insights into processes for approving and evaluating online offerings, as well as some understanding of common perceptions about who succeeds and who is challenged by learning in an online environment. This section summarizes some of these insights.

Traditional processes continue to govern approval of online offerings.
Regardless of whether online courses are developed through faculty initiative or centrally by high-level administrators, the formal course approval process is still quite traditional. Very few institutions have created parallel approval processes for online courses that use different metrics for evaluating those courses. In other words, everything must pass through the eye of the same needle, reflecting the view that learning processes and work performed in a virtual environment should essentially replicate comparable processes in a traditional face-to-face classroom. Similarly, very few institutions have attempted systematically to assess the time required by faculty to develop or teach online versus traditionally.

Little data exist to compare learning outcomes for online versus traditional instruction. While many institutions have created metrics to monitor the delivery of their online offerings, these tend to be limited to measures of utilization and response. For example, Southern New Hampshire University monitors how long it takes instructors to respond to student questions, as well as how long both students and faculty are logged in. Few institutions attempt to rigorously assess learning outcomes—which is, to be sure, very difficult research to carry out.

Assessments of online courses tend to mirror those of traditional courses and are based primarily on student evaluations. These evaluations typically provide subjective assessments of student satisfaction rather than objective data about learning outcomes.

Some institutions point to comparable grade distributions for online and traditional versions of the same course to suggest that learning outcomes are also comparable. However, this methodology is flawed for a number of reasons. Students tend to self-select versions of a course that they think best match their abilities, learning styles, and schedules. Without randomized assignment of students to different versions of the same subject, one cannot be confident that differences in learning outcomes (or a finding that there are no differences) are meaningful. Similarly, exams and content are rarely standardized across online and traditional versions of the same course.

A number of institutions have compared online and traditional formats based on student withdrawal rates. Some institutions report higher withdrawal rates for online courses (such as the Kentucky Community and Technical College System); other institutions report no difference or else higher online withdrawal rates in some disciplines but not in others. For instance, at Austin Community College, students in the health sciences are about as likely to withdrawal from online courses as they are from traditional courses, but in some areas of English, the online courses have higher rates of withdrawal. While comparisons of withdrawal rates may be interesting, they fail to account for differences in the student populations that enroll in the different formats, much less whether the reason for withdrawal is related to the course format.

Many students are said to prefer online to traditional instruction but other reports suggest the opposite. Some institutions that offer both online and traditional versions of the same course (such as Ulster County Community College) report that the online versions often fill up faster, suggesting a student preference for online education. Evidence for this proposition is, however, mostly anecdotal, and there are many examples of situations in which students strongly prefer face-to-face instruction.

Mature, highly motivated students seem to outperform others (disproportionately) in online courses. Faculty perceive that highly motivated, independent, organized students excel disproportionately in online

courses.[15] Often these are the most mature students. For example, leaders at the University of Massachusetts believe that graduate students perform slightly better in their online programs than undergraduates simply because graduate students tend to be more highly motivated than undergraduates. Some institutions, in fact, discourage students who may be less academically accomplished from enrolling in online courses. Advisers at Ulster, for example, recommend online courses only for students who have GPA's in excess of 2.5.

Cheating remains a problem in both online and traditional courses. Faculty have developed strategies for addressing cheating in traditional settings but are still developing protocols to address this problem in online environments. A common problem is simply verifying that the person at the keyboard is the actual student registered for an online course. To avoid rampant cheating in online exams, many institutions require online students to come to campus or to an approved testing center to take proctored exams. Some institutions are also experimenting with video proctoring of exams.

Many online courses have moved away from high-stakes testing towards more frequent, informal assessments coupled with longer-term projects. These are seen as less susceptible to cheating.

Experienced online faculty welcome the additional information generated by learning management systems on intermediate student learning outcomes. Many online instructors have the capacity to more closely observe the progress of individual students as they make their way through material. They can tell which students have repeatedly attempted to master material and which have not. They can also determine how much time students have put into specific assignments. This information is useful in counseling students.[16] Instructors at FTCC and other institutions noted that online teaching is pedagogically different from face-to-face instruction because, in online courses, faculty have more frequent opportunities to evaluate student progress over the course of the semester. Thus, it is easier to intervene when students are not performing well.

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15   Although, once again, much of the evidence is anecdotal, the longitudinal study conducted by Xu and Jaggars (2011) at the Community College Research Center is relevant. The researchers followed 18,896 students who lived in Washington State, who were enrolled in the Washington State Community and Technical College system in fall 2004, with the intent to transfer to a four-year college, through the summer of 2009. After collecting information about 126,317 course enrollments, over a five-year period, they found that students with GPAs below 3.0 were significantly more likely to drop out, and earned significantly lower grades, as compared to students with GPAs of 3.0 or higher. However, this study, while large, was not randomized and employed a definition of "online courses" that was very broad, without indicating how much variation existed among those courses (which accounted for 28,000 of the enrollments examined in the study). Without this information, it is difficult to know the kinds of online courses to which the study's findings are most applicable, and at most the study shows that the "average" online course in the sample tends to be correlated with higher drop-out rates and lower grades than the "average" face-to-face course in the sample. See Di Xu and Shanna Smith Jaggars, *Online and Hybrid Course Enrollment and Performance in Washington State Community and Technical Colleges*, Community College Research Center, Working Paper No. 31, March 2011.

16   One instructor, who formerly taught in a traditional format and has more recently begun teaching online, noted that, in the past, students would claim to have spent hours trying to master a particular assignment without success. Now she has the capacity to verify such claims by examining the log to determine how much time a student spent attempting to master a given module.

We expect that, over time, instructors will learn how to make better use of this information to improve the learning process by incorporating real-time assessment into their teaching.

"Learning analytics" is an important emerging field for both online and traditional education, and many colleges and universities are starting to mine the data generated by learning management systems (LMSs) to better understand who succeeds, who fails, and why. The University of Maryland, Baltimore County, for example, examines Blackboard usage statistics to predict student success in traditional courses. Major LMS providers such as Blackboard are integrating increasingly advanced usage analytics into their systems. In the future, such systems should be able to predict, for example, the marginal contribution of a prerequisite course for success in a more advanced subject. Similarly, by gathering data on how thousands of students progress through a common body of material, these systems should be able to help future curriculum planners optimize the sequence and design of courses and modules. Potential advancements such as these could cause universities to rethink the way they offer academic advising and other wrap-around services.

We believe that these data, if widely available, will ultimately prove to be extraordinarily valuable to individual faculty members, curriculum designers, the academy, and society writ large. This approach has the potential to unlock how students learn based upon the experience of literally hundreds of thousands of students. Data of this kind can be used to continuously improve the quality of instruction provided by these systems and network effects can be powerful. (Consider how Google uses behavioral data generated by searchers to improve its product and increase search market share.) To date, educational data of this kind have not been available to researchers, policy-makers, and others interested in improving learning outcomes. Accordingly, we believe it absolutely essential that such data be broadly available to all those interested in how students learn. They should not be privatized.

Obstacles to the Widespread Adoption of Online Education

While online instruction is growing rapidly at most institutions, skeptics and critics abound. Not everyone is enthusiastic about the growth of technology-mediated teaching. This section reviews the basis for this skepticism, especially among the ranks of some faculty, drawing on the experiences institutions have had to date with deploying various forms of online learning.

Online instruction is alien to most faculty and calls into question the very reason that many pursued an academic career in the first place. Most faculty teach as they were taught. They became faculty in large part because they

enjoyed being students, and valued the relationships that they enjoyed with their professors or mentors. In deciding to pursue academic careers, most seek to replicate these close relationships with their own students.[17] Not surprisingly, many of these faculty view online instruction skeptically both because it differs from how they learned and how they were taught, and because they fear it will distance them from their students.[18] In the absence of good data on learning outcomes, these same faculty members are often skeptical that a student can learn as much from participating in the educational process remotely through technology than they can by being physically present with the faculty member in a classroom.[19]

Faculty fear that online instruction will be used to diminish faculty ranks.
A common theme heard on virtually all campuses was that online instruction should not be used to reduce faculty employment. Leaders at private institutions are concerned that students and their families not perceive the increasing use of online education as a way to reduce student-faculty contact. These leaders also are mindful that others (specifically those that rank institutions) closely watch student-faculty ratios, and that it will work to their disadvantage if online education drives these ratios up. Thus, at least some of these institutions are embracing online education as a means to deliver their content to new markets—especially overseas—where there are fewer expectations of direct or frequent student-faculty contact. At public institutions that are experiencing severe financial pressure, the fear by faculty of potential loss of faculty jobs is far more immediate. Leaders of institutions with unionized faculties cite union rules governing staffing of courses as constraints on their ability to utilize interactive learning online to reduce instructional costs.[20]

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17 Robert Kanigel, *Apprentice to Genius: The Making of a Scientific Dynasty*, (Baltimore: The Johns Hopkins University Press, 1993) documents how mentors pass along to their students not only styles of teaching, but advising, organization of laboratories, and approaches to conducting scholarly research.

18 Some proponents of online teaching report that they actually have greater contact with their students because some students are reluctant to participate in class discussions, raise questions in class, or attend office hours, but feel no such inhibitions in asking questions of faculty online. But, of course, greater contact implies higher costs.

19 No less an authority than Professor William Baumol of Princeton notes, in the second chapter of his new book, *The Cost Disease,* Yale University Press [forthcoming], that faculty, like physicians, might have an inflated view of their own worth in the classroom: "This is not to deny that the personal attention of a doctor or a live instructor has important benefits. Live contact permits questions to be asked and answered by doctors and teachers, which is surely important and beneficial. Still, professors and medical doctors often have an inflated view of the benefits of their personal attendance in the lecture hall and the operating room. These attitudes are widely shared by medical patients, students, and others who benefit from such person-to-person interactions. This creates yet another obstacle to labor-saving modifications in stagnant-sector activities, even as labor-saving efforts are constantly under way throughout the progressive sector. Psychological resistance to labor-saving change in the personal services increases the lag in productivity growth that characterizes these services."

20 Some faculty expressed preferences for hybrid courses that employ both online and face-to-face instruction simply because the need to bring students together on campus periodically places physical limitations on the size of sections. By contrast, there are no natural constraints on the size of online sections, as has been demonstrated dramatically by the development of massively open online courses such as those offered through MITx and Udacity.

Preparing a course online requires a much higher initial investment of time by a faculty member than teaching the same course in a traditional format. In addition to the normal process of developing a course (determining the sequence of material, specifying required readings and assignments, preparing exams, etc.), today's online instructor also must migrate all the material to digital form, create or adapt a website, provide for online feedback, and so on. In addition, online instruction requires not just the initial technical training of faculty, but also a much higher level of ongoing technical support. As technology becomes more sophisticated, faculty often need to be retrained in its use. Similarly, institutions need to invest more heavily in their technology infrastructure as they move more of their teaching online, especially given the rate of change and the cost of new technology. A robust technical infrastructure is essential to support online education.

Online instructors incur much higher coordination costs than do faculty teaching in traditional settings. Most institutions pay more attention to how their online offerings are actually presented precisely because they are sometimes more visible to the world than traditional courses. As a result, there are far more levels of review. For example, at ASU Online, the online arm of Arizona State University, the technology staff reviews most courses every semester to ensure that they meet minimum requirements for presentation and format. At FTCC, all online subjects must meet quality and accessibility standards developed by a committee of faculty members. And, as noted earlier, while most institutions provide assistance to faculty offering online subjects, for faculty new to online teaching, the process can be daunting. Similarly, many institutions require faculty to take training classes before they can teach online. By contrast, no such training is normally required for traditional instruction.

Many instructors and institutions have started to embrace the need for training as online courses have become more common on their campuses. FTCC, Rio Salado College, and NVCC all have well-established (and required) online training programs for their instructors. Rather than resist these programs, some faculty members have embraced them as a way to enhance their own teaching skills. Many community colleges (as well as one large public institution, ASU) reported that they have begun to consider willingness to teach online in their hiring processes.

Faculty are extremely reluctant to teach courses that they do not "own." Except for some faculty hired specifically to teach online, most faculty expressed little interest in teaching online courses that are developed by third parties. Faculty members generally take great pride in determining the content for a particular course and the sequence and method by which the content will be taught. While they are willing to borrow from others (and to share content of their own creation), they do not wish to relinquish control over the process of course design. They do not like to teach something that is pre-packaged and in which they have little say. As one commentator said, "nobody wants to give someone else's speech." Nor is reluctance to teach content prepared by someone else solely a matter of wishing to exert control; faculty may understandably feel that they are not sufficiently familiar with someone else's material to present it adequately. This preference for "ownership" of content is weaker in community

colleges (but still prevalent). By contrast, many faculty seem more willing to embrace pre-packaged online courses aimed at delivering remedial education. Remedial education is often seen as a burden by faculty. To the extent that they can "outsource" it to an online provider, they seem more willing to do so than for other elements of the curriculum.

Faculty may be reluctant to embrace a course that does not allow for a high degree of customization in how, what, and when relevant material is presented to their students. There was a uniform assertion at all types of institutions that faculty feel much better about teaching repurposed courses or reusing course materials created elsewhere if they are able to do some customization. There are a number of reasons that customization is valued so highly. First, student populations differ across institutions, even for entry-level courses. Students come to courses with different levels of preparation, different rationales for taking the course, and different expectations about how the course will contribute to their overall education. For example, an introductory statistics course taken to satisfy a distribution requirement in a liberal arts college is likely to be taught differently from the same introductory statistics course intended for social science or engineering majors. Second, introductory courses are taught with different levels of rigor based upon who is teaching and who is taking the course. Third, both faculty and students want examples drawn from fields relevant to the interest of students taking the course. Examples in an introductory statistics course intended for psychology majors will differ from those in the same subject taught to business students. Fourth, faculty like to emphasize different subtopics within the same field. Some will focus on theory; others on applications. Fifth, faculty have different ideas about the right sequence of topics based upon their own experiences in the classroom. And sixth, faculty like to supplement materials created elsewhere with examples and readings drawn from their own research.

To better understand the desire to customize, one need only examine the market for textbooks for introductory subjects, as well as how faculty use such texts. While some "standard" texts enjoy significant market share, the textbook market is fragmented precisely because different authors and publishers are constantly trying to devise better ways to teach to specific populations. Furthermore, instructors are constantly supplementing texts with additional readings (as well as teaching some chapters out of sequence), all in an effort to continue to find the best way to present material to their students.

An uncertain intellectual property landscape for content developed for delivery online may also discourage wider development and adoption of sophisticated online courses. The familiar textbook model in which faculty authors retain copyright does not always translate well for online courses developed with institutional support that may run into the hundreds of thousands of dollars. The University of Texas is experimenting with a model where faculty course developers retain IP rights to content but the University is allowed to reuse and modify courses developed with institutional support. UT has considered using some kind of royalty model, but decided against it because it was

deemed unlikely to generate much revenue for the faculty members involved. UT put a placeholder in its agreements with faculty members that provides for future revenue sharing for courses that generate significant revenues. Other institutions, such as FTCC, have retained the rights to any work that faculty members do in creating online courses. This arrangement is not popular with the faculty, but they have little leverage in opposing it. Intellectual property rights will likely be a complicated issue for online teaching in the future, especially in the case of courses that are developed with significant support from the sponsoring institution and/or from foundations or other donors with strong views on this subject.[21]

Accrediting bodies do not seem to be inhibiting the growth of online learning. While accreditation is sometimes cited as an obstacle to online education, and can create some difficulties when different regulatory bodies define "online" courses and programs differently, we did not encounter specific examples where accrediting bodies prevented institutions from expanding their online offerings. We suspect that worries about accreditation are often proxies for other concerns.

Strategies for Overcoming Obstacles to the Introduction of Online Courses

The strategies described below include those being currently pursued by individual institutions in this study. We note that there is no magic bullet. Strategies must be adapted to address the unique circumstances encountered at each institution. Centralized institutions are likely to pursue different strategies than decentralized institutions. Similarly, those with unionized faculty work within different constraints than non-unionized institutions. Institutions that largely serve traditional students in residential settings face different challenges than institutions that serve non-traditional populations. Finally, strategies for increasing the number of individual online courses for students in a primarily residential setting may not directly translate onto efforts to create new online degree programs for students who wish to earn their entire degrees without ever being on a campus.

Provide generous technical support for faculty adopting online teaching. Those who seek to teach online incur significant initial costs. They must conceptualize their courses in ways that are different from teaching in a traditional setting. They must pre-plan the entire course at a level of specificity that often is not required for traditional courses. They must master technology that may be alien to them. Institutions that seem to be most successful in encouraging faculty to teach online make it easy for faculty to do so. Some provide explicit training for faculty in online pedagogy and offer ongoing technical support. Instructional design concepts are foreign to most faculty, and instructional design services are commonly provided centrally. Some institutions assign faculty mentors—experienced online teachers—as coaches. Some institutions provide course relief to recognize the initial up-front investment a faculty member must make in

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21 See, for example, the controversy involving Arizona State University over ownership of course materials (Kaustuv Basu, "Loss of Control," *Inside Higher Ed*, March 14, 2012, http://www.insidehighered.com/news/2012/03/14/former-asu-professors-threatens-litigation-over-online-course-ownership).

developing a new online course. Regardless of which specific strategy is pursued, university leaders must help faculty to master the technology and processes necessary to develop curriculum and teach successfully online.

Provide incentives for faculty. As we have noted previously, teaching online, especially the first time, involves a significant incremental expenditure of time for most faculty. Recognizing these costs explicitly and compensating faculty who develop online courses can make a big difference. Stipends should reflect the magnitude of the investment by the faculty member and will differ from institution to institution, and also may differ by field. However, financial incentives alone may not be sufficient. Faculty time is the scarcest resource on any college or university campus. For already overburdened faculty, a salary supplement may be far less attractive than released time to develop a new online course. Thus, it may be worth considering reducing the faculty member's competing responsibilities in other areas to make sure he or she has sufficient time to develop or learn to use the resources available to teach online.

Make faculty pioneers heroes. On each campus, there exists a handful of faculty who are willing to embrace new pedagogical technologies. Often they are the first to encounter (and the first to break down) administrative barriers to doing things differently. Administrators who seek to encourage these faculty must find a way to call attention to them and to reward them. A few institutions have created special awards to recognize especially innovative online teaching.

Tackle subjects that seem most easily adaptable to interactive online formats first. These typically include the STEM fields, business and professional education, and some introductory social science subjects. In certain settings, however, relatively simple online approaches may be adopted most readily in subjects in the humanities and social sciences—assuming that faculty leadership is in favor of online experimentation. Also, some institutions have also successfully moved introductory language instruction online; on many campuses, these courses are already being taught almost exclusively by non-tenure track faculty. For example, ASU has moved many of its introductory Spanish sections online. Faculty seem especially willing to embrace online instruction for remedial subjects.

Share any incremental revenue with the administrative unit that is offering online instruction. Although some online teaching does not generate net revenue, many institutions, as noted earlier, are pursuing online education as a means of explicitly generating new revenue sources. Some administrators are sharing this incremental revenue with those departments or schools offering the new programs. Absent revenue sharing, leaders of individual academic units (whether they be schools or departments) have little financial incentive to tackle the challenges raised by moving from traditional to online instruction.

Create separate entities within the institution for experimenting with online education. A number of institutions have set up separate administrative entities to house new online programs. These seem to allow administrators greater flexibility to create administrative rules and structures uniquely adapted to governance of online instruction. However, we note that while such separate entities may facilitate flexibility initially to experiment, the real return to invest-

ment in online education will come when it is fully integrated into the mainstream of academic life. To put it another way, to harvest fully improvements in learning outcomes and potential cost savings from online education will necessitate tackling the institutional obstacles to online instruction posed by traditional academic organizations.[22]

Issues to Consider for the Adoption of ILO

For many institutions, ILO represents the next frontier in their adoption of online learning. We see ILO as part of a natural evolution of online education. As technology improves and as faculty and administrators become more experienced and comfortable with online education generally, institutions are more likely to experiment with and embrace ILO.

We believe that ILO has the capacity to greatly expand the reach of the nation's colleges and universities to populations currently not served, while at the same time helping to bend the cost curve in higher education. Highly interactive, machine-guided online learning requires fewer facilities, fewer faculty, fewer teaching assistants, and may be easily scaled to accommodate large numbers of students. It also has the potential to benefit students by allowing them to have more targeted and personalized learning experiences and to save time and money (for example, by reducing the need to travel to classes and lowering both transportation expenses and textbook costs).

Although we believe ILO can bring these significant and potentially transformative benefits, it is likely to encounter the same challenges and obstacles universities and colleges have already faced as they have adopted various other forms of online learning. To one degree or another, all of the strategies described above—offering incentives, providing technical support, rewarding early adopters, sharing incremental revenue, experimenting with new administrative structures, and so on—will be needed, and should be used as appropriate for each institutional context. In addition, institutions should make every effort to learn from one another as they enter this new territory. Yet we also believe ILO differs in important ways, and that the broader institutional change we believe is needed may require new approaches and ways of thinking. On the one hand, because ILO actually substitutes technology for some human instruction, it is the most threatening to faculty who value close contact with students. Yet, on the other hand, ILO can free faculty from the drudgery of certain aspects of traditional instruction (grading, course administration, etc.) and allow them to use their time interacting with students in more rewarding ways, while generating productivity gains for the institution as a whole. In this section we highlight the issues we believe are most critical as institutions move in the direction of adopting ILO-style instruction.

Explicitly confront concerns about faculty size. In the absence of any attempt to manage the conversation, faculty are likely to view any initiative to move traditional courses to an online format as a strategy for reducing faculty size. Administrators need to confront these concerns directly. One potential strategy is to

> We believe that ILO has the capacity to greatly expand the reach of the nation's colleges and universities to populations currently not served, while at the same time helping to bend the cost curve in higher education.

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22 ASU is noteworthy for its efforts to fully integrate online education into the mainstream of its academic organization.

Too much discussion of online learning is of the "all or nothing" variety. We do not advocate teaching all content to all students in an online mode. Not at all.

commit to using part of any productivity gains generated by online instruction to support faculty (through improved faculty salaries, increased time for scholarship, reduced faculty teaching loads, etc.), with the balance being used to reduce the overall price of instruction to students. Depending on the future availability of dramatically improved platforms that will have to be licensed, some part of the savings may also need to be assigned to pay such fees.

Provide a way for faculty to easily customize and exert control over online content developed elsewhere. One of the major obstacles to widespread adoption of highly sophisticated forms of interactive online learning is the desire of faculty to control what they teach—and the present-day lack of centrally-available platforms that could address this problem. As noted earlier, some faculty are reluctant to offer machine-guided instruction that has not been customized to suit their students, or, alternatively, their view of how content should be presented. In our interviews, we encountered little enthusiasm for prepackaged online courses that did not permit customization regardless of the institution "sponsoring" the course, its quality, or the degree of interactivity. Even senior academic leaders expressed doubts about their desire to offer fully prepackaged courses to their students, citing a desire to "brand" courses as their own in order to preserve institutional identity. To date, no sustainable platform exists that allows interested faculty either to create a fully interactive, machine-guided learning environment or to customize a course that has been created by someone else (and thus claim it as their own). This is perhaps the largest obstacle to widespread adoption of ILO-style courses. While some groups are attempting to create such systems in both the for-profit and non-profit sector, to date no one has succeeded. Open-source efforts, like LON-CAPA, suffer from sustainability problems. It is not clear where the resources will come from in the future to sustain the investments necessary to keep such systems current. And for-profit alternatives like Knewton, 2tor, Dreambox, etc. essentially privatize the potential benefits from creating large networks of teachers and learners. Higher education as a "system" has not as yet found a solution to this problem—and it may not be able to find a solution on its own, absent up-front investments by philanthropies or governmental entities.

Generate good data on learning outcomes. Faculty who have not taught online are skeptical that online teaching is as satisfying (or that online learning is as effective) as traditional face-to-face instruction. Only by carefully documenting learning outcomes can administrators persuade them otherwise (if this does, in fact, prove to be the case). Rigorous learning assessment must be a core component of an effective strategy to promote online education.

Do careful cost accounting in order to document the potential financial consequences of shifting to an online environment. Online education requires significant up-front investment. It also requires ongoing expenditures. It has the potential in some settings to increase revenue and also to reduce instructional costs. At most institutions, however, these statements remain hypotheses. The non-profit sector can learn from the for-profit sector when it comes to under-

standing both first-time and ongoing costs of online instruction. Moreover, absent good cost accounting, most institutions will not know if they are under-investing or over-investing in online education.

Adopt a "portfolio" approach to curricular development that will address concerns about de-personalization of education. Too much discussion of online learning is of the "all or nothing" variety. We do not advocate teaching all content to all students in an online mode. Not at all. Apart from purely peda-gogic objections, which are real, students attending the great majority of our colleges and universities deserve opportunities to experience different styles of teaching and learning. There are real advantages to gaining some competence in learning in online environments, but there is also great value in discussion groups, seminars, and directed study. Ideally, students will be exposed to a care-fully designed mix of learning models, in part so that they can continue to benefit from the socialization values of higher education that have been so important historically. Some of the potential savings from the use of OLI in large basic introductory courses should be used to support these other modes of learning. This is important in and of itself, and it would also help defuse concerns that talk-ing about online learning inevitably depersonalizes education. Even the wealthi-est, most elite colleges and universities that believe they can afford to stay pretty much as they are should ask themselves if failing to participate at least to some degree in the evolution of online learning models is to their advantage in the long run. Their students, along with others of their generation, will expect to use digital resources—and to be trained in their use.

The Changing Market for Online Education

Everything about online education is changing rapidly. Today's students have largely grown up in a digital world. They know nothing else. By contrast, most faculty have learned their craft in a very different environment. Over time, fac-ulty will catch up with their students, but for now, we are in a period of enormous transition.

ILO stands the traditional model of instruction on its head. It is student-driven and student-centric. It requires a faculty member to step outside of his or her tra-ditional role as the communicator of ideas and the evaluator of content mastery. Rare is the faculty member who will do so willingly, in part because faculty are being asked to turn their backs on a familiar system and process that have served them well. We should never forget that faculty are the most successful products of our traditional educational system. Just as they have been taught and men-tored, they continue to want to teach and mentor.

It is fascinating to watch as the educational process is being reconstituted in real time. Exciting experiments are going on at many colleges and universities and in the private sector as well. People are experimenting with disaggregating the development of content, the delivery of content, the evaluation of content mastery, and the certification of achievement. Traditionally, the first three of these functions have often been performed by a single individual and the last by

> Technology and the market have a way of creating commodities out of what were previously value-added services. This is true of some aspects of teaching. Certain parts of the bundle that were previously considered as part of teaching a course will in the future be provided as commodities.

the institution that employs that individual.[23] Social networking technologies are being harnessed to facilitate peer-to-peer teaching and evaluation, giving new meaning to that old saying articulated by almost every college and university president to entering freshmen, "You will learn as much from each other as you learn from us." Computer scientists are making headway on new forms of intelligent machine grading that move well beyond scoring of multiple choice exams. We may be getting close to a day when faculty are relieved of the monotony of grading so that they can focus on more creative ways to engage their students.

Technology and the market have a way of creating commodities out of what were previously value-added services. This is true of some aspects of teaching. Certain parts of the bundle that were previously considered as part of teaching a course will in the future be provided as commodities. The challenge will be to determine how to unbundle teaching as an activity to take advantage of the opportunity that technology provides to perform some functions more effectively and at a lower cost. All the changes noted above call into question the traditional role of faculty in the learning process, as well as the traditional structure of academic institutions. They also raise questions about what the higher education landscape will look like in the future. It is too early to predict where all of this will lead us other than to say that the changes we are studying have the capacity to be revolutionary. How quickly that revolution takes place is anyone's guess, but we are convinced it will occur. Escalating costs, and the accompanying publicity given to them at a time when many families are hard-pressed, have made our current system, in the minds of a great many people, unsustainable.[24] Many also believe, as we do, that technology will drive change in the sector; and that it will do so relentlessly. We are encouraged by those institutions that are embracing these changes and seeking to shape the future rather than merely clinging to tradition.

We also recognize that our goal should not be to move instruction online simply because we are capable of doing so. Online education, and especially highly interactive, machine-guided online instruction, is attractive precisely because it offers the tantalizing potential that it can both improve learning outcomes and bend the cost curve in higher education. However, if institutions are to be successful in reducing the cost of tuition to students and their families, presidents, provosts, and trustees must exercise extraordinary leadership in making cost and price reduction a priority. As we have noted earlier, unlike the situation in

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23 Today, however, certifications of achievement are increasingly being made available from sources other than traditional, accredited universities as is demonstrated by the proliferation of digital "badges" and statements of completion provided by individual professors of massive open online learning courses. It remains to be seen whether these new forms of certifications will begin to be accepted by employers and others as substitutes for the value of traditional degrees—and whether acceptance will vary markedly by the specialized content of the course.

24 The reason for the qualification, "in the minds of a great many people," is that the very increases in productivity at the national level that, combined with lagging productivity increases in labor-intensive sectors such as education, are at the root of "the cost disease," generate resources that could be used to pay the ever-rising costs of education *if society were to choose to spend its productivity gains in this way*. This is a basic argument of William Baumol in his forthcoming book on *The Cost Disease,* cited earlier. It is also a proposition stated many decades ago by the noted Cambridge economist, Joan Robinson. Nonetheless, the political and practical objections to ever-rising costs in education will almost certainly overwhelm such arguments. The wealthy may well be willing to pay higher and higher costs of sending their children to college (as they have been for more than a century), but there is no evidence that the public at large, faced with far harder choices, shares their willingness.

We fear that if higher education does not learn how to stem the rising tide of college costs, our nation's higher education system will lose the public support on which it so heavily depends.

There is an important role for national, system-wide initiatives, designed to create sustainable platforms for ILO systems, launched with funding provided largely by either private philanthropies or governmental entities.

many other industries, competition in higher education tends to cause competitors to increase rather than control costs. Colleges and universities compete to attract the very best students by offering smaller classes, more faculty-student interaction, more hands-on learning, increasingly diverse curricular offerings, ever fancier facilities, more expensive student services, more sports, and more co-curricular activities. Furthermore, popular rankings like those provided by *US News & World Report* also create incentives for institutions to spend more, by using academic expenditures per student and per faculty as a proxy for academic quality. Finally, we note that faculty also have preferences for smaller, more intimate classes. Market pressures, institutional incentives, and faculty preferences combine to create powerful forces to drive up instructional costs and prices.

We are convinced that this upward spiral will only end if presidents, provosts and trustees make controlling costs a priority. Rather than merely looking for ways to enhance the undergraduate educational experience, we believe that academic leaders must also look explicitly for strategies to lower costs. We are not saying that many educational leaders lack courage (though, sadly, some do). Controlling costs will be a hard sell, in part because strong forces are pushing in opposite directions and, as one of our advisers said candidly, "those opposed have so many ways of throwing sand in the wheels." But we also believe that the potential for online learning to help reduce costs without adversely affecting educational outcomes is very real. Absent strong leadership, however, we fear that any productivity gains from online education will only be used to gild the educational lily. Presidents and provosts should explicitly charge their deans and faculty with teaching courses of comparable quality with fewer resources. They should commit in advance to splitting net savings with the faculty and applying the balance to lower tuition to students and their parents.

We fear that if higher education does not learn how to stem the rising tide of college costs, our nation's higher education system will lose the public support on which it so heavily depends.

This report has been written from the perspective of individual educational institutions. We do not believe, however, that individual institutions can be expected to develop the kind of generic software platform that would permit faculty at diverse institutions to develop and customize their own online content, complete with feedback loops and a high degree of interactive, machine-guided learning. It would be foolishly inefficient to rely on a "hundred flowers" approach. There are potentially huge economies of scale in investing collectively in the kind of generic software platform that is needed. Exactly how to define and design such a "foundational" platform (or an aggregated set of integrated tools), and how to develop, distribute, maintain and upgrade it, is far from obvious—especially at a time when the trend is toward more plug-and-play frameworks. Conflicting goals, ambitions, and principles of platform development will have to be reconciled.

There is an important role for national, system-wide initiatives, designed to create sustainable platforms for ILO systems, launched with funding provided largely by either private philanthropies or governmental entities.

The challenges are at least as much conceptual, organizational, and administrative as they are technical. It is not just about tools and technology—the institutional structures within which they are embedded are equally, if not more,

important. These challenges go to the heart of the traditional model of higher education and its highly decentralized mode of decision-making. Devising a strategy for accomplishing this large goal is daunting, and a subject for another day.

Appendix

Appendix: Institutions and Individuals Interviewed

INSTITUTION	TYPE		REGION	INTERVIEWEE
Arizona State University	Public	4-Year	Southwest	Michael Crow, President
				Philip Regier, Executive Vice Provost and Dean of ASU Online, Business Professor
				Art Blakemore, Vice Provost and Chair, Department of Economics
Austin Community College	Public	2-Year	South	Richard Smith, Associate Vice President, Instructional Resources and Technology
Baruch College*	Public	4-year	Northeast	James McCarthy, Provost
				Arthur Downing, Chief Information Officer
Boston University	Private	4-Year	Northeast	Robert Brown, President
Bryn Mawr	Private	4-Year	Northeast	Jane McAuliffe, President
				Kimberly Cassidy, Provost
Fayetteville Technical Community College*	Public	2-Year	South	Robert Ervin, Vice President for Learning Technologies
				Darryl McGraw, Chief Information Officer, Wake Technical Community College
				Bill Randall, former North Carolina Community College System Associate Vice President for Learning Technologies
				David Smith, Director, Technology Innovations and Applications
George Washington University	Private	4-Year	Mid-Atlantic	Steven Lerman, President
Indiana University*	Public	4-Year	Midwest	Barbara Bichelmeyer, Director of the Office for Online Education
Kentucky Community and Technical College System	Public	2-Year	South	Jay Box, Chancellor
Massachusetts Institute of Technology	Private	4-Year	Northeast	Dave Pritchard, Professor of Physics
				Hal Abelson, Professor of Computer Science and Engineering
Montgomery County Community College*	Public	2-Year	Northeast	Deep Dive Committee (group discussion during campus visit)
Morgan State University	Public	4-Year	Mid-Atlantic	David Wilson, President
				Joan Robinson, Provost
Northeastern University	Private	4-Year	Northeast	Joseph Aoun, President
Northern Virginia Community College	Public	2- Year	Mid-Atlantic	Robert Templin, President
Pennsylvania State University	Public	4-Year	Northeast	Craig Weidemann, Vice President for Outreach
Rio Salado Community College	Public	2-Year	Southwest	Chris Bustamante, President
				Vernon Smith, former Vice President for Academic Affairs
Southern New Hampshire University	Private	4-year	Northeast	Paul LeBlanc, President
State University of New York-Ulster County Community College	Public	2-Year	Northeast	John Ganio, Dean of Academic Affairs
				Sherry Chisamore, Director, Distance Learning
				Hope Windell, Multimedia Instructional Designer
University of Illinois	Public	4-Year	Midwest	Mrinalina Rao, Vice President for Academic Affairs
				Charles Evans, Assistant Vice President and Director, University Outreach and Public Service
				Iris Stovall, Director, Illinois Virtual Campus
University of Kentucky	Public	4-Year	South	Vince Kellen, Chief Information Officer
University of Maryland, Baltimore County*	Public	4-Year	Mid-Atlantic	John Fritz, Assistant Vice President for Instructional Technology and New Media

INSTITUTION	TYPE		REGION	INTERVIEWEE
University of Maryland, University College	Public	4-Year	Mid-Atlantic	Greg von Lehmen, Provost
University of Massachusetts	Public	4-Year	Northeast	Jack Wilson, President Emeritus
University of North Carolina	Public	4-Year	Southeast	Holden Thorp, Chancellor
University of Texas	Public	4-Year	South	Harrison Keller, Vice Provost, Higher Education Policy and Research
Utah State University	Public	4-Year	West	Ronda Menlove, Senior Vice Provost for Regional Campuses and Distance Education
				Robert Wagner, Vice Provost and Executive Director, Regional Campuses and Distance Education
Virginia Tech	Public	4-Year	Southeast	Peter Macedo, Director, Institute for Distance and Distributed Learning
Washington State Board of Community and Technical Colleges	Public	2-Year	Northwest	Charles Earl, Executive Director, Washington State Board for Technical and Community Colleges
				Connie Broughton, Director, eLearning and Open Education
OTHER				
United States Coast Guard	—	—	—	Lieutenant Adam Birst

Deep Dive institution. This list includes only the primary contacts at each institution.