15.358 The Business of Software and Digital Platforms

MOOCs: Contexts and Consequences
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I. Introduction and Overview

"I'm a very big believer in equal opportunity as opposed to equal outcome. Equal opportunity to me, more than anything, means a great education. Maybe even more important than a great family life. We could make sure that every young child in this country got a great education. We fall far short of that." – Steve Jobs

The high cost of college education is one of several barriers to equal opportunity in the United States. Consequently, post-secondary schooling costs have consistently been a topic of debate among educators, policymakers, and researchers for the past several decades, particularly as these costs have galloped far ahead of inflation. Daphne Koller, co-founder of the MOOC platform Coursera, mentioned in her recent TED talk that the cost of higher education in the U.S. has risen by 559 percent since 1985.[1] MOOCs (Massive Online Open Courses) have the potential to solve the problems of runaway costs and unequal access.

MOOCs are Internet-based, college-level classes, usually with a curriculum and syllabus that resemble those used in traditional courses taught at top American and international universities. Unlike traditional courses, however, MOOCs are offered via the Internet, and available to anyone with a broadband connection, free of charge.

Some education policy leaders have begun to separate MOOCs into two distinct groups, namely xMOOCs and cMOOCs. xMOOCs, in which "x" stands for extension, are instructor-guided lessons that can include forms and discussion sessions. They include platforms such as Coursera, Udacity, and edX that have created media hype in the past couple of years. Alternatively, cMOOCs, in which "c" stands for connectivist, are open and flexible platforms that encourage users to share digital content and learn from one another through blogs, wikis, tweets, etc., aiming to develop a collaborative network. These platforms are usually not funded by institutions of higher education.

The ascendancy of MOOCs is enabled by two critical factors: the era of all-the-time Internet connectivity, and the explosion in student debt. Over the past decade, widespread broadband adoption has brought constant, affordable Internet connectivity to millions of homes. Meanwhile, the smartphone era ushered in by Apple's iPhone launch in 2007 has removed most geographic constraints on this connectivity. Against this backdrop, the U.S. has seen an explosion in outstanding higher education debt -- which recently surpassed total credit card debt outstanding in the U.S., bringing greater scrutiny upon the cost-benefit analysis for students weighing higher education options. While MOOCs have steadily grown in terms of enrollment and awareness since their inception, they gained national news media attention last year when a Stanford Artificial Intelligence course offered online drew 160,000 students from more than 60 countries.[2]

MOOC students run the gamut of ages, backgrounds, and nationalities. Common reasons for MOOC enrollment include general self-enrichment, professional education, and preparation for college classes. Soon, MOOCs may even be used for introductory college credit, in a similar fashion to the way Advanced Placement tests are now used by some colleges.

In fact, a bill currently in the California State Assembly, SB 520, would enable students unable to find a seat in a required class, and unable to find a comparable online course at their school, to earn credit for MOOC completion. For any particular MOOC to be approved, however, it would have to be certified first by the American Council on Education (ACE), or

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[1] http://www.ted.com/talks/daphne_koller_what_we_re_learning_from_online_education.html

[2] Lewin, Tamar. "Instruction for Masses Knocks Down Campus Walls, *New York Times*, 04MAR2012

other reputable course reviewers, and then by a faculty group consisting of members from the University of California system, the California State University system, and the California Community College system.[3]

Sebastian Thrun, founder and CEO of the MOOC platform Udacity, recently explained in an interview that, "In California, we have 470,000 students waitlisted to get into community colleges. They're willing and eager to pay for education. But they can't get in."[4]

Given the potential for MOOCs to break course availability gridlocks, to expand the reach of excellent higher educational resources to people across the world who could not otherwise afford or even find such opportunity, and to save money for students, who can substitute MOOC completion certificates for college credit, the model has clear potential for disruption.

In fact, it is this very transformative and disruptive potential that has some people worried about the potential impact of MOOCs. Some university faculty have stated that the teaching they provide cannot -- or should not -- be mass-produced. Some believe that MOOCs will cause a significant-enough change to the higher education business model that it will be fundamentally altered. Others fear that lower-tier universities may cease to exist altogether if free MOOC credits can be applied toward degrees. Still others fear that the international reach of MOOCs will bring about a form of English-language and American cultural imperialism to the developing world.

In this paper, we will describe the background of MOOC educational models, examine current MOOC platforms, compare MOOC monetization strategies, and evaluate the positive and negative consequences of widespread MOOC adoption. It is our contention that although some people and institutions will suffer from the disruption that MOOCs may cause, the overall benefits will far exceed the negative consequences. In sum, MOOCs can, and will, improve educational quality both in the U.S. and across the world.

II. Evolution of MOOCs and Examination of Platforms: From OpenCourseWare to the Present

Carnegie Mellon's Open Learning Initiative (OLI) and MIT's OpenCourseWare (OCW) have provided free MOOC-like learning options for more than a decade. OCW grew out of a 2000 MIT faculty proposal, which advocated open, online curricula in order to best serve MIT's mission of advancing knowledge and educating students. In 2002, MIT launched a basic version of the site, which contained 50 courses. By November 2007, MIT had included over 1,800 courses in 33 academic disciplines.[5]

Carnegie Mellon's OLI is a grant-funded initiative. It was established in 2001 with a grant from the William and Flora Hewlett Foundation. Today, its biggest funders include the Hewlett Foundation, the Bill and Melinda Gates Foundation, and the Walter S. Johnson foundation. OLI's first courses were developed in 2002, and launched shortly thereafter.

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[3] Pr News Wire. "New California Legislation to Provide MOOC Courses Full Academic Credit." 13MAR2013

[4] Corcoran, Betsy. "Udacity's Sebastian Thrun On the Future of Education," *EdSurge*, 03APR2013

[5] OpenCourseWare site, ocw.mit.edu. It is worth noting here that the presentation of the OCW courses varied tremendously – and still does. Introductory courses in Computer Science and Microeconomics come with streaming videos, detailed lecture notes, thorough answers to all homework and test questions, etc. Other courses might be "included" with just a syllabus or scattered lecture notes.

MOOC, a word coined in 2008 at the University of Manitoba, did not receive hype and interest until Silicon Valley entrepreneurs embraced it. Coursera was developed at Stanford University by Computer Science Professors Daphne Koller and Andrew Ng. Coursera recently offered the first-ever MOOC developed by an Asian university. This course, titled "Science, Technology, and Society in China," was offered by Hong Kong University of Science and Technology. The course drew 17,000 registrants. China University of Hong Kong and Tokyo University are expected to launch Coursera MOOCs later this year. Coursera will launch a Chinese-language site this August.[6]

Coursera has received more than $33 million in total venture capital, with some of its funding coming from Sand Hill Road heavyweights such as Kleiner Perkins Caufield & Byers.[7] Its investors seem to be following a key principle from 15.358: Build platform power. Scott Sandel, a Coursera financier and partner at New Enterprise Associates, recently stated that:

> "Monetization is not the most important objective for this business at this point. What is important is that Coursera is rapidly accumulating a body of high-quality content that could be very attractive to universities that want to license it for their own use. We invest with a very long mind-set, and the gestation period of the very best companies is at least 10 years."[8]

Much like Coursera, Udacity has its roots at Stanford University, where it initially launched with two offerings in Computer Science. Recently, Udacity announced a partnership with Georgia Institute of Technology; together, Udacity and Georgia Tech will offer a Master's degree in Computer Science for $7000, which is 80 percent less than the existing cost of obtaining the degree on-campus.[9] Udacity also partnered this year with San Jose State University to launch a program offering remedial Math and Statistics courses, which can be transferred into the California State University system for credits. This program enables SJSU to deliver courses for just ten percent of the cost of a traditional course of instruction.

Harvard and MIT co-launched edX as a non-profit in 2012, with each committing more than $30 million to the venture. edX's website currently lists twelve partner universities: MIT, Harvard, UC-Berkeley, University of Texas, McGill, Australia National, Wellesley, Georgetown, University of Toronto, Ecole Polytechnique de Lausanne, Delft University of Technology, and Rice.

Although Coursera, Udacity, and edX dominate most of the debate currently, other platforms are either developing or already offering courses. However, rather than operate independently, several of the MOOC platforms developed at universities are partnering with edX. Class2Go, Stanford University's open-source platform for online courses, recently announced its decision to merge with edX.

Open2Study is a massively multi-user study group, in which groups of students can interact and learn collaboratively. The company also partners with universities to offer MOOCs and award certifications. Saylor Foundation offers 241 courses in the 10 most popular majors in the U.S., with a mission to make education freely available to everyone. Openly available materials and resources are assembled into courses that are peer-reviewed before they are offered. The company offers accreditation through badges, as an alternative to traditional

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[6] Najarro, Ileana. "Coursera hosts Asia's first MOOC," *The Stanford Daily*, 22APR2013.

[7] Esposito, Joseph. "Who is the Mook Among MOOCs?" *The Scholarly Kitchen*, 26MAR2013.

[8] Lewin, Tamar. "Students Rush to Web Classes, but Profits May Be Much Later," *The New York Times*, 07JAN2013.

[9] Onink, Troy. "Georgia Tech, Udacity Shock Higher Ed With $7000 Degree," *Forbes*, 15MAY2013.

university accreditations. Moreover, it plans to use the Mozilla Open Badges, a program that issues digital badges to recognize skills and achievements.

Udemy, another educational technology startup, allows instructors to host courses on its platforms. They are targeting individuals looking to teach online, but lacking the necessary technological skills and infrastructure to do so with currently-available options.

After analyzing all of the aforementioned MOOC platforms, we did not identify any single platform as being dominant. Coursera certainly has a lead in user-base, but with the number of partnerships that edX has successfully established, it might emerge as a winner. The collaboration among multiple universities might engender a critical mass of serious users, as well as the network effects required for the emergence of a "winner-take-most" platform.

III. Winners and Losers

While MOOCs have captured the attention of many in the higher education, policy, and journalism worlds, not everyone is excited about their growth. The rapid growth in MOOC enrollment has led many writers and educators to wonder whether MOOCs could undermine the higher education industry by creating an expectation of free and open courses.

To date, there is no evidence to suggest that MOOCs or other online educational options are negatively impacting enrollment at residential American higher education institutions. Over the past decade, most enrollment growth in U.S. higher education comes from non-residential options, such as commuter colleges, night school, and online courses.[10]

Until MOOC completion certifications gain widespread acceptance as being worthy of transfer credits, MOOCs will not threaten the business models of these schools. However, if and when state legislatures begin to accept MOOC completion for credit, non-residential colleges and lower-tier private colleges will see a serious threat to their business models.

Currently, lower-tier private colleges and for-profit online colleges charge students at a rate comparable to the top universities. Despite the popular perception that schools like Harvard charge comparatively astronomical bills for tuition, this is simply not the case; in the 2012-13 academic year, for instance, Harvard charged $37,576 for tuition. For that same academic year, Fordham University in the Bronx charged $42,845 for tuition. A year's tuition at the University of Phoenix (for a student taking entirely online classes and completing one-fourth of a Bachelor's Degree program) comes out to $18,500. While this figure is admittedly far cheaper than many residential options, it is hard to fathom how it can compete with an entirely online free alternative.

As MOOCs grow both in popularity and in acceptance by employers and university systems, they will cause families to more closely examine the actual costs and benefits associated with current higher education models. Colleges that do not provide clear payoffs for their graduates will have to either cut costs or risk losing students.

Administrative costs could be one of the first casualties of the MOOC revolution. From 1993 to 2007, per-student administrative costs have grown by more than 61 percent. The median pay for public-college presidents is now $441,392, and more than four such officials make more than $1 million per year.[11]

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[10] Perez-Pena, Richard. "Top Universities Test the Online Appeal of Free," *New York Times*, 17JUL2012

[11] Herman, Arthur. "A Refuge for Charlatans," *Wall Street Journal,* 20MAY2013

While some educators and administrators will be displaced by this upheaval, the net impact on society will be positive. Today, there is approximately $900 billion to $1 trillion worth of outstanding student debt in the United States, and this figure is expected to continue to rise.[12] The following statistics help to illustrate the gravity of the situation:

- Only about 37 percent of federal student loan borrowers between 2004 and 2009 managed to make timely payments without postponing payments or becoming delinquent;
- As of 2012, there are now more than $8 billion in defaulted private loans, or 850,000 distinct loans in default;
- Nearly 30 percent of college students who took out loans dropped out of school, up from fewer than a quarter of students a decade ago;
- More than half of students who take out loans to enroll in two-year for-profit colleges never finish. At traditional nonprofit and public schools, the percentage of students with loans who started college in 2003 and dropped out within six years is about 20 percent;
- 48 percent of 25-34 year-olds say they are unemployed or under-employed;
- Student loans account for the most common form of increasing debt among ages 18-24.

If California's SB 520 (mentioned earlier in this paper) is passed and then inspires similar legislation in other states, the trend of rising total U.S. student debt could be reversed. Furthermore, when a critical mass of employers begins to recognize MOOC completions as a job qualification, MOOC adoption will accelerate. This will provide relief to individuals, who will benefit from the freedom of choice offered by these affordable alternatives.

Another positive aspect of MOOCs comes from the networking opportunities they can foster. In some instances, MOOC students have formed affinity groups and study groups in the analog world. Coursera encourages such behavior by encouraging students to post pictures, form a profile, and arrange socially-themed or study-themed meetups with fellow "Courserians" in their home area.

From an epistemological point of view, MOOCs offer instructors something previously unavailable in higher education – real-time access to large data sets about student responses to test questions. Stanford's Learning Analytics Laboratory, also known as the "Lytics Lab," is at the forefront of this analysis. According to an April 2013 story in the *Stanford Report*:

> "Learning analytics refers to the interpretation of a wide range of data produced by and gathered on behalf of students to assess progress, predict performance and identify problems. Data are collected when students complete assignments, take exams, watch videos, participate on class forums or do peer assessments. As more data are collected, new questions can be asked, and classes can improve."[13]

By upending the traditional "lecture with the Professor, and assignments on your own" model, MOOCs also have the power to make education far more efficient. Currently, most traditional college courses are taught using the "sage on the stage" model – a professor stands in the front of the room and speaks, while the students are asked to passively absorb the information. Then, students are sent on their own to complete homework and other assignments

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[12] American Student Assistance, http://www.asa.org/policy/resources/stats

[13] Mackay, R.F. "Learning analytics at Stanford takes huge leap forward with MOOCs," *Stanford Report*, 13APR2013.

without the professor or Teaching Assistant (TA) present. When MOOC curricula are interwoven with in-person classes, that model can be turned on its head.

If students are tasked with watching course lectures on their own via streaming video, they can accomplish this virtually anywhere and at any time. Streaming video allows them to watch on a PC, tablet, or phone, and provides them with ample opportunities to review any content for which they feel they need clarification. The physical disconnect between the student and the professor in this model should not be viewed as problematic, because it is akin to the disconnect that currently exists between professors and students in most large college courses.

With the lectures and readings having already been completed outside of class, professors and TAs can then use class time to engage in more interactive learning with their students. This blended learning technique is popularly known as "Flip Teaching" or "Flipped Classroom." Recently, Bunker Hill Community College and Massachusetts Bay Community College decided to participate in edX, with plans to adopt elements of this model.[14]

Community colleges in general could be yet another group of winners. With strained resources, community colleges often struggle to deliver top-notch learning experiences to their students. Using the flipped classroom methodology, the Boston-area community colleges mentioned in the above paragraph will offer edX's Computer Science course. While the students will still pay the same per-credit charge, the MOOC access promises to improve the quality of education at these community colleges, as well as others who adopt the model.

Within the United States, the debate about MOOCs largely centers on the way that they will impact higher education domestically. Unfortunately, that discussion overlooks MOOCs' amazing potential to deliver top-notch educational opportunities to students throughout the developing world. Meanwhile, some fear that U.S. exportation of MOOCs into the developing world will usher in an era of "educational colonialism," as English-language, Western-dominated curriculum finds its way into global classrooms.

Available evidence suggests this fear may be exaggerated, however. Coursera and edX have already started expanding internationally, with available offerings in several languages. Udacity claims on its blog that they offer courses in 63 languages.[15] Udacians, a term used for students enrolled in Udacity's courses, have the opportunity to translate the material into another language using services from Amara, an open source captioning and subtitling service.

Parts of the developing world still lack access to digital technologies. In addition, a significant percentage of the worldwide population is not computer literate. Cultural differences will also be a barrier to worldwide adoption of any particular MOOC, as student-teacher interactions differ across countries. Examples used in American classrooms will not work internationally. Time differences can be another challenge, but recorded lectures can solve the synchronicity problem. However, recorded videos from across the world lack certain intangible aspects that could matter to particular population groups. Hence, in their current, nascent stage, MOOCs have to overcome several challenges before we will observe wider acceptance and adoption in the developing world.

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[14] Fifield, Mary L. "Coming to Terms with MOOCs: A Community College Perspective," *The New England Journal of Higher Education*, 22JAN2013.

[15] http://blog.udacity.com/2013/04/udacious-is-international-for-awesome.html

IV. Challenges and Concerns

Even the biggest MOOC proponents would concede that there are several challenges associated with the model. In most cases, these vexing issues have not been settled; ultimately, they may not be settled by a "one size fits all" sort of answer.

First, there is the challenge with respect to Intellectual Property. Who owns the content? Is it the university or the company? Is it the faculty? What about user-generated content such as homework assignments submitted by students? All MOOC-providing institutions, ranging from Coursera to Udacity to edX, have a Terms of Service Agreement that spells out the details around the ownership of the materials. Additionally, they have rules and license grants for user generated content including posts, homeworks, etc. However, it is not certain that these agreements will survive potential legal challenges.

It is certainly exciting to imagine how MOOCs will change the education industry. However, when it comes to education we must not compromise on quality. Opponents of MOOCs are not convinced that the high quality of content, instruction, design, and outcomes can be achieved in a mass-produced model. Moreover, some believe that students will not be able to achieve their desired goals from the course. Similar to any product or service, quality is critical to the success of MOOCs.

In partnership with Quality Matters (QM) Program, an organization that assesses quality of online blended learning environments, the Gates Foundation is providing grants to not only develop MOOCs, but also to test the quality and effectiveness of instruction and learning outcomes.[16] In a recent MIT/Harvard-led summit on online education, Clayton Christensen, a Harvard Business School professor, stated that just as other disruptive products and technologies eventually improved in quality, MOOCs will improve, too.

As professors already employed by universities offer MOOCs, universities are concerned about potential conflict of interest issues. University of Pennsylvania recently released a conflict of interest policy in regards to online teaching, which states that professors will require permission from the university if they decide to participate in an external online learning platform that is not part of the school's offering through Coursera. Soon, other universities will likely follow suit.

MOOCs have also received criticism that the platforms do not promote user interaction. Sal Khan, founder of Khan Academy (an online tutoring website), recently visited MIT, where he talked about how the teacher's role can become even more central with MOOCs, by fostering collaborative activity. He said that, "When we say learn at your own pace, we're not saying learn by yourself. It's, in fact, the opposite." He added that "the role of the teacher becomes far more valuable" as learners will have more one-on-one interactions with students.[17]

Furthermore, there is the challenge of grading large numbers of student responses. For strictly objective examination formats, such as multiple choice, that challenge can easily be addressed by automated scoring systems. For courses in which assignments and examinations include written work, however, some MOOCs have assigned the grading to the students. As an example, Coursera tasks each of its students to grade five other assignments each time they hand in one of their own. Coursera is currently analyzing a system that will flag inaccurate or sloppy

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[16] http://www.qualitymatters.org/raising-issue-moocs-gates-foundation-rfp-provide-course-reviews
[17] http://web.mit.edu/newsoffice/2013/sal-khan-mit-0509.html

graders. It is also comparing "crowdsourced" grading and feedback with simulated grading and feedback that students would have received in a real university course.[18]

Another major challenge is authenticating that a particular student – and not a paid proxy – has submitted a particular assignment, or sat for a particular exam. David Patterson, a UC-Berkeley Professor who teaches a software engineering MOOC, has said that, "We found groups of 20 people in a course submitting identical homework."[19]

Further complicating the authenticity issue is the fact that when identical problem set questions are used throughout iterations of a course, it is easy for people to post and store that information online. A *New York Times* reporter who chronicled his experience with several MOOCs noted that when he Googled quiz questions for a genetics course, he quickly found a Canadian website with the answer.[20]

Some MOOC platforms have moved to high-tech means in order to verify assignment and exam authenticity. Coursera has employed a keystroke program which recognizes individual students' typing patterns. The keystroke identifier takes a baseline reading during enrollment, and verifies the student's identity with each subsequent login. MOOC platforms can also partner with existing testing companies like PearsonVUE to use everything from human proctors to palm vein scans to cameras in order to ensure exam integrity.[21]

Critics often point to MOOCs' low completion rate. A factor contributing to the low MOOC completion rate is the wide variation in student motivation for taking a course. A student taking a MOOC to satisfy a curiosity in natural-language processing, for instance, might not see the need to complete all of the requisite assignments and exams. He might, however, still benefit from the MOOC experience as much as, or even more than, a student taking the course in order to get the completion certificate.

Sir John Daniel, a world renowned theorist and researcher in the field of online and distance education, deflected criticisms of the low completion rate by stating that, "These first offerings probably attracted a high proportion of the merely curious and tourists from other institutions checking what the fuss was about. As the number of xMOOCs multiplies, they will likely draw a more purposeful clientele."

To put the MOOC completion rate into perspective, some have compared it to the overall completion rate at top universities (as measured from the application process to graduation). Keith Devlin, a Stanford Mathematics Professor, recently wrote that:

> "For comparison, the equivalent figure for my own university, Stanford, is 95 percent. That's right, 95 percent; a higher attrition rate than my online course. That's not Stanford's published "graduation rate," of course. Of students *admitted*, 79 percent graduate in four years and 96 percent within six. But that's comparing apples with oranges. Anyone who decides to take a MOOC simply logs onto the website and signs up, thereby becoming one of the statistics. So a fair comparison would be to take the number of students who *apply* to Stanford. That figure is around 35,000, by chance about the number of students I expect will sign on for my course. So considerably more students who sign up for my free online course will graduate than will occur with students who "sign up" (i.e., apply) to Stanford, which graduates about 1,700 students a year."[22]

[18] Pappano, Laura. "Year of the MOOC," *New York Times,* 02NOV2012

[19] *Ibid.*

[20] Jacobs, A.J. "Two Cheers for Web U!" *New York Times,* 20APR2013

[21] Belkin, Douglas. "Web Classes Grapple With Stopping Cheats," *Wall Street Journal,* 14FEB2013.

[22] Devlin, Keith. "MOOCs and the Myths of Dropout Rates and Certification," *The Huffington Post,* 02MAR2013.

Yet another problem for MOOCs is that the very nature of the model (massive and open) prevents selectivity of students. Without any gatekeeper preventing unqualified students for registering, what would stop an immature high-schooler from commenting in an advanced Artificial Intelligence discussion board?

Concerns about openness were cited by several Amherst College faculty following their recent decision to reject edX affiliation (approximately 70 out of 110 faculty members voted to reject the affiliation). Stephen A. George, an Amherst life sciences professor who introduced the motion to reject edX, stated that the "massive, synchronous MOOC" did not fit with Amherst's "goals and values."[23] American liberal arts colleges take pride in their small classroom size and Socratic style of instruction. It will be difficult and challenging to replicate these features in MOOCs, which by their very name suggest an undertaking large in scale.

MOOC students have expressed concerns about the way the course sizes can impact discussion quality. In an April 2013 *Boston Globe* interview, writer Jonathan Haber – a man attempting to complete 32 MOOCs this year -- said that discussions work best when fewer students contribute, because when in a class of thousands, "you type in something really clever, or you see something clever and you respond to it and think you are starting a conversation, you log in five minutes later and it's a thousand comments down now."[24]

The success of MOOCs will also depend on laws and policies that will be enforced around online learning. Presently, there is not an established corpus of laws and judicial rulings governing online learning. California's SB 520 is a step in that direction; it will encourage the introduction of other such bills.

Finally, universities that are offering MOOCs are trying to figure out how MOOCs fit in with the institution's e-learning strategy. This is forcing universities to revisit their business models, often with at least one MOOC platform in the picture.

V. MOOC Business Models

Despite MOOCs' promise to revolutionize education, the long-run financial sustainability of the model is not yet clear. Initiatives like Coursera, edX, Udacity and others have received significant investments from higher education institutions and investors. Harvard and MIT have committed $60 million to edX, Coursera has raised millions from Kleiner Perkins Caufield & Byers and New Enterprise Associates[25], and Udacity has raised $20 million from Andreessen Horowitz, Charles River Ventures and Steve Blank.[26] However, the business model is not yet mature, and there aren't clear signs where this "industry" will finally head.

Currently, MOOC platforms seem to be focusing most of their efforts on building massive user bases, as opposed to monetization. At present, they are not expressly intended to provide academic credit. However, key drivers for the future financial success of MOOCs will include the extent to which credentials earned will be recognized in the workforce and academia;

[23] Hashmi, Amna H. and Cynthia W. Shih. "Rejecting edX, Amherst Doubts Benefits of MOOC Revolution," *The Crimson*, 26APR2013.

[24] Bombardieri, Marcella. "Can You MOOC Your Way Through College in One Year?" *Boston Globe*, 13APR2013.

[25] http://www.crunchbase.com/company/coursera#ixzz2T7GmFpLF

[26] http://www.crunchbase.com/company/udacity

this will ultimately have a significant impact in conversion rates from freemium to paying customers, and eventually bring about significant increases in completion rates.

The idea of offering all the content appears to conflict with an average MOOC production cost of $50,000 per course.[27] (This figure does not consider the cost of time devoted by faculty, administration, and teaching assistantship). Eventually, monetization pressure will increase. According to a recent *New York Times* article, some institutions such as Duke University are already indicating an unwillingness to provide entirely free content for an extended time period. Certainly, existing costs of are significant: if we consider that Coursera claims to offer 370 courses, this means that around $18.5 million have been already invested in production costs. This means that on average, each one of the sixty-nine Coursera partners has invested $270,000.

In recent discussions, the freemium and multi-sided business models have emerged to answer MOOCs question on revenue and profit generation. A user will have access to the product for free, along with the option to pay for certain premium services.

	Coursera	**Udacity**	**edX**
Investment	$ 22	$20	$60
Investors	Kleiner Perkins Caufield & Byers, New Enterprise Assoc.	Andreessen Horowitz, Charles River Ventures, Steve Blank	MIT Harvard
User base	3.5 Million	1.5 Million	675,000

Licensing is frequently mentioned as the alternative with highest revenue potential for MOOCs, as it would dovetail with plans to enhance traditional higher education by having students take MOOCs as prerequisites. Institutions may also pay for licenses when they use MOOCs in combination with traditional classroom work, or as substitutes for textbooks. For example, students at an Engineering School in Mexico may combine current courses with MOOCs from MIT, Stanford, or Caltech, considerably enhancing their skills and exposure to the best professors. In this case, tuition should include the cost of licensing.

The following table shows a summary of potential monetization alternatives for MOOCS, some of which have already been explored by different players in this market:

Revenue stream	Monetization	First adopters
Licensing Fee	Per-course licensing fee to universities interested in offering MOOC courses for full credit. Require anyone commercializing its content to pay a fee.	Coursera

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[27] Friedman, Thomas L. "Revolution Hits the Universities," *New York Times,* 26JAN2013.

Certificate	Charging $30 to $80 for a certificate to passing students.	Coursera, edX
Recruiting support	Headhunting services for companies interested in best students. "Finder fee" for each successful match (20% of salary, $15,000).	Udacity
Affiliate programs	Get affiliate marketing fees by matching (unsuccessful) students with other online education alternatives, publishers, advertisers or merchants (e.g. Harvard Business Review, Amazon.com)	TBD
A la carte services	Give content and assessment but charge other services such as library resources, tutoring services, coaching, etc.	TBD
Robust assessment	Proctor supervised certifications and additional robust assessment and additional human interaction to improve academic rigor.	TBD
Network development	Include networking by organizing conferences around the globe with students enrolled in certain number of courses and maintaining certain GPA	MIT, Harvard
Learning Analytics	Sell personalized learning information; charge for adaptive learning features in the platforms	TBD

High-quality material requires to be continuously updated in order to reflect the latest research, making the "shelf life" of materials potentially shorter than expected, especially in technology-focused courses in which knowledge is continuously evolving. This will represent an additional cost component that will multiply as more and more courses are included in the different MOOC platforms.

According to the *New York Times*, universities offering courses in Coursera get 6 to 15 percent of revenue and 20 percent of gross profits.[28] If we assume a breakeven course with a median university income of 11 percent of revenue and a 10 percent conversion rate to a certificate, this means that in order to recover production costs, each course will require at least 95,000 students enrolled.

Certificate Revenue	University Share	Revenue/ certificate	Production Cost	Minimum Certificate Enrolment	Conversion Rate	Minimum Enrolment
$50	11%	$5	$50,000	9,524	10%	95,238

But perhaps the biggest challenge MOOCs face in building a sustainable business model is determining the right formulas to become trusted sources of talent for corporate recruiters. For this to happen, MOOCs must first demonstrate that they have developed the appropriate

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[28] Lewin, Tamar. "Students Rush to Web Classes, but Profits May Be Much Later," *New York Times*, 06JAN2013.

processes to verify that students have adequately mastered a subject. Additionally, although single courses can allow a student to develop competence in a specific subject, recruiters frequently seek a combination of credentials that will require taking several related courses; for example, a company interested in talent for web development may require individuals with skills in Graphic Design, HTML, Python, and Ruby on Rails. In response to these sorts of requirements, MOOCs should be able to structure degree granting (multi-course) programs combining course work from different disciplines offered at the best institutions countrywide.

This possibility will open the door for recruiters to structure the required coursework for specific positions, resulting in significant savings in training and human capital development.

VI. A Look to the Future: The Status of MOOCs in 2025

At the 2013 HigherEdTech Summit, MOOCs were often referred to as a solution for low-income students and targeted individualized learning. Additionally, given that several venture-backed startups have entered this arena along with world-class universities, it is simply a matter of time until we observe large-scale adoption.

However, we do not believe that lower- and middle-tier private universities will be eager to embrace the model of MOOC completion for introductory-course transfer credit. Institutions like MIT, Stanford, and Harvard greatly benefit from the technology and content developed by MOOCs, which allows their students to complement their programs with the best from other institutions. Because the return on investment provided by these types of institutions, as well as that provided by lower-cost public alternatives, is not in doubt, they will not view widespread MOOC adoption as a threat.

MOOCs have the potential to bring personalized education to another level. The variety and quality of courses will allow students to personalize and customize their course selections in a completely unprecedented way. With an international offering of MOOCs, a student will have the potential to take classes with several Nobel laureates or industry leaders. In "Talking About Leaving: Why Undergraduates Leave the Sciences," Seymour concluded that poor teaching was the most significant causal factor behind the decision of the 40 to 60 percent of students who switched from STEM majors.[29] If students are given access to better professors and teachers, MOOCs have the potential to solve such problems.

We believe that a key success factor in this industry will be finding the right formula to foster professor-student interaction. Today, with up to 100,000 students in a single MOOC, this is virtually impossible. We anticipate that MOOCs can greatly benefit from technologies such as those available with IBM Watson, as it will allow them to better serve and interact with students.

We anticipate that in ten years, students will have the option to get 100 percent MOOC-earned degrees, along with Classroom/MOOC complemented degrees. Formulas for proficiency assessment will be identified, probably with a similar formula to that currently used for standardized exams such as the GMAT and TOEFL. New business opportunities may arise for testing companies who can work with MOOCs to provide proctored evaluations worldwide.

Presently, almost no leading institution worldwide offers content for free. We believe that some platforms will shift towards modest course fees, in part as a means of keeping students

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[29] Seymour, Elaine (1997), "Talking About Leaving: Why Undergraduates Leave the Sciences"

more engaged and committed. Eventually, course feeds become a more commonplace feature in MOOC business models, along with all the options previously discussed in this document.

Even as some current jobholders are displaced by the rise of MOOCs, the MOOC boom could create a cottage industry of discussion moderators and teaching assistants. In fact, one source for that labor pool might be the MOOC students themselves; to date, Udacity has directly hired 15 of its students (not for having the highest scores, but for being the most helpful in discussion forums).

Certainly, MOOCs have the power to upend the current university teaching hierarchy, which limits its instructor pool for most courses to Ph.D. holders. The Udacity "Landmarks in Physics" course, for instance, is taught by a 2009 MIT graduate.[30] Perhaps a hybrid educational model might enable higher education to benefit from the best aspects of MOOCs and in-person, small-scale education.

In the fall of 2012, San Jose State University (SJSU) achieved a 50 percent spike in student passage rate for its introductory Circuits and Electronics course after blending its material with MIT's OpenCourseWare (OCW).[31] The SJSU students watched the MIT lectures, and completed the OCW exercises, individually. Then, during class, the SJSU Professor used the first 15 minutes to answer questions about the OCW exercises, and the last 45 minutes to introduce and solve new problems.

In the future, the aforementioned "flipped classroom" strategy, or blended learning model, will be used more frequently at many levels of education. Flipped classrooms enhance user interactivity, which was a key finding of MOOC completion rates according to Lytics Lab at Stanford.   Three computer science MOOCs were studied, and a correlation was observed between individuals who completed the course and the participation on forum pages.[32]

Future MOOCs will include several features that make the MOOC environment more social and interactive. Gamification techniques could be included to increase learner engagement.[33] In 1996 President Clinton's vision for computing in schools included developing educational technology that will be as engaging as a video game.[34] Moreover, the 2013 New Media Consortium's Horizon's Report on Higher Education mentions Game MOOCs, a site that uses interactive, game-based learning, delivered through immersive and adaptive environments.

Different forms of MOOCs might emerge. Future platforms might include tutoring sessions, in which learners change and add content to these online classrooms, in addition to teaching the materials to other co-learners. In "Disrupting Class," Christensen talks about user-generated, collaborative learning libraries through which participants worldwide can instruct and learn from one another.[35] He mentions that we often learn better when we teach rather than when we listen to a teacher and advises entrepreneurs to invest in such technological platforms.

These libraries are synonymous with the cMOOC concept mentioned earlier. The user networks could be part of a MOOC, improving user interactivity, promoting student-centric learning, and building education social networks. What might emerge is a hybrid MOOCs model of xMOOCs and cMOOCs. These platforms could be free, but users could also be charged a fee

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[30] Pappano, Laura. "Year of the MOOC," *New York Times*, 02NOV2012

[31] Friedman, Thomas. "The Professors' Big Stage," *New York Times*, 05MAR2013

[32] https://ed.stanford.edu/news/plethora-data-helps-lytics-lab-analyze-moocs

[33] http://en.wikipedia.org/wiki/Gamification

[34] http://www.eric.ed.gov:80/PDFS/ED398899.pdf

[35] Christensen, Clayton M. (2008) "Disrupting Class," pp.138-141, 228

to use them. However, protecting intellectual property will be even more complex for such environments.

In addition, through learning analytics, the user data collected and analyzed at the backends of these platforms will enable intelligent adaptive and customized learning platforms that can provide real-time feedback such as the skills and concepts they haven't yet mastered in the course. Moreover, this data can provide insights into how humans learn, and in the process help devise new pedagogies and learning mechanisms that could transform our worlds.

However, the issue of privacy will be cause of concern yet again. Will learners be willing to share such personal data with MOOC institutions? In the recent past, despite a lot of criticism, we have observed that users have been comfortable sharing professional and personal data on sites such as LinkedIn, Twitter, and Facebook.

VII. Summary and Conclusion

Some fear the MOOC concept because it threatens to upend the status quo with respect to higher education in the United States. The important questions, then, are whether MOOCs will disrupt the trillion dollar education industry, and whether this will be a net positive or a net negative for society. By providing alternative solutions at affordable prices to a population heavily burdened by debt, MOOCs certainly present a phenomenal change opportunity. However, there are a number of challenges and concerns that these platforms must address before they gain the same credibility as institutions of higher education.

As MOOCs establish themselves, three groups of higher education institutions should not view their rise as a threat: (1) Elite, top-tier private universities; (2) High-quality state institutions, which offer excellent instruction and access to resources for a much more reasonable price; and (3) Community colleges, which provide American students with a springboard to further learning or vocational careers on a flexible schedule, relatively cheaply.

For two groups of universities, however, MOOCs pose an existential risk: (1) Lower-tier private universities that charge tuition fees comparable to the top-tier schools, but without delivering the same results; and (2) Online or majority-online universities that have arisen in recent years. If and when MOOC certificates gain widespread acceptance as employment credentials and/or transfer credits at major universities, majority-online universities (i.e. University of Phoenix, Strayer University, American Military University) would be at the greatest risk. While residential colleges offer several intangible benefits that extend beyond the confines of a classroom, the for-profit online universities will be left with little unique value to offer for the prices they seek.

An example of a market that MOOCs can clearly disrupt is the online delivery of prerequisite classes for degree programs. MBA programs, for instance, are known to offer conditional acceptances to incoming MBA students who lack significant quantitative backgrounds. These students are required to successfully complete certain online courses to demonstrate competencies, often at a cost ranging from several hundred to several thousand dollars. MOOCs will eliminate such student expenses.

For Continuing Education courses, the University of Phoenix currently charges $145 per credit hour. When MOOC options gain accreditation, it is hard to imagine why a student would prefer to pay $435 for an arguably inferior product, when she could receive a course of

instruction from a world-renowned expert in the field, tailored to her learning style with cutting-edge learning analytics, for no cost at all.

Even if online universities survive MOOC accreditation, their business model will still suffer from reduced demand. Some students might still depend on online universities to grant Bachelor's Degrees, but they could theoretically cut the cost in half by maxing out their MOOC transfer credits.

In fact, some schools are already moving in this direction. Earlier this year, the University of Wisconsin announced a program to grant Bachelor's Degrees to students who have never even set foot on the campus, but have instead demonstrated competency by taking subject matter exams.

To offset the cost of college tuition, several universities are also examining solutions in which students would be able to complete one or two years of college through MOOCs. Thereafter, the top five percent could gain admission to elite universities to complete their degrees. If students are majoring in subjects such as Biology, Chemistry, and Engineering, which can include significant laboratory work, they would have the opportunity to finish course requirements through MOOCs and wrap up laboratory experiments on-campus. Meanwhile, edX has been developing virtual laboratories for its courses, which can be graded by computers in real time.

Nonetheless, it remains to be seen whether MOOCs can include unique elements of classroom instruction valued by learners, including discussions, one-on-one student teacher interactions, peer interactions, etc. We do not yet know whether MITx can promote the MIT motto of "*Mens et Manus,*" meaning mind and hand. Opponents are not sure if MOOC users will be able to learn by doing, or whether it is even possible to successfully replicate the elegance of on-campus classrooms in online worlds.

Furthermore, MOOCs, a form of free digital learning, have fostered discussions whether we are better off with "free".[36] In recent times, we have observed industries ranging from book publishing to news media to software suffering after being forced to compete with free offerings. Similarly, MOOCs can bring the same fate to institutions of higher education. MOOCs need sustainable business models and monetization strategies that will dictate the success of these environments. Most platforms including Coursera and Udacity are already developing multiple business models around their offerings.

Daphne Koller, in a recent interview with *Wall Street Journal*, stated why she believes that MOOCs are a transformative, but not disruptive, force in education:

> "We actually are big believers in the educational system. And while we think the system is long overdue for an overhaul, we don't want to throw it away and start from scratch. Some of the instructors in our university partnerships are just amazingly gifted scholars, researchers and teachers. We think that the university played a critical role in shaping [those scholars]. If you throw out the university, who's going to produce scholars like these? What we hope and believe will happen is that the role of teachers will change. A teacher will have more time to spend teaching, as opposed to spending time in content development and preparation and in grading endless repetitions of the same assignment. Students will come to class to actually have meaningful, engaged dialogue with other students and the instructors."

In "The Tragedy of the Commons," a highly cited article in *Science*, Garrett Hardin describes the depletion of a shared resource by individuals who are each acting according to their narrow self-

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[36] Cusumano, Michael A. "Are the Costs of 'Free' too High in Online Education?", CACM, APR2013

interest.[37] An eloquent pro-MOOC blog post recently argued that by promoting shared learning and resources, MOOCs will have the reverse effect on our communities, referring to the concept as The Reverse Tragedy of the Commons.[38] Undoubtedly, we are living in interesting times; ultimately, the rise of MOOCs will be transformational for our society. With hundreds of thousands of individuals learning together in these new online environments, MOOCs are creating a social movement that will democratize education. While some segments of higher education are likely to be displaced by the MOOC revolution, the industry as a whole will be made stronger, by producing higher-quality results at a reduced cost. Internationally, billions of people who would otherwise lack access to top-notch educational resources will gain exposure to the best thinkers and concepts from around the world. In addition, the power of cMOOCs to connect learners from all corners of the globe will mean that this knowledge exchange will be multi-sided, with all voices having a chance to participate in the revolution.

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[37] Hardin, Garrett. "The Tragedy of the Commons," *Science*, 13DEC1968.
[38] http://rrteaching.blogspot.com/2012/12/moocs-and-universities-tragedy-of.html

Acknowledgements