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The high costs of 'free' online education: some observations and policy suggestions

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Introduction

Over the last few years, there has been a flurry of activity and controversy around free MOOCs (massive open online courses). The Internet has revolutionized many industries and it is now education's turn. Although Internet-based learning efforts such as with YouTube and the Kahn Academy began years ago, wider Internet access and improved technology now make it possible to reach many more students at minimal costs compared with on-campus residential education. At MIT (Massachusetts Institute of Technology), we have been one of the leaders in free and open online learning. We started with Open Courseware [1] in 2002, supported by the Hewlett and Mellon Foundations as well as MIT funds, with a cost of over US$3 million a year. It offers a variety of syllabi, videos, lecture slides and other course materials. More than a dozen other universities now also contribute content. MIT followed up with more ambitious online course efforts: MITx for internal use and then edX in 2012 [2], a US$60 million joint venture with Harvard University [3]. The other major MOOC platform is Coursera [4], a for-profit company formed in 2011 by two Stanford University professors and initially supported by US$33 million in venture capital [5].

In the future, free MOOCS will continue to grow and educate millions of students, with various degrees of effectiveness. They may also force universities and colleges to control their costs better and lessen the steep rise in tuition rates and student debt (now some US$1.2 trillion) that have become an obstacle for many families. So free and open online education should be good for everyone, right? Maybe, but maybe not.

The initial argument: the high costs of 'free'

As I wrote in April 2013 [6], there are many benefits of 'free' goods as in most open-source software or a lot of digital content available through the Internet. But there can be negatives as well. This observation comes from looking back at the history of free or cheap Internet products and services and their impact on software product companies as well as on the digital music, video, book

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publishing, and newspaper and magazine businesses. Many companies struggled or failed to make the transition in business models. In education, the negative effects could occur if free online education sets a new threshold price for the industry – zero, or near zero – which becomes commonly accepted and difficult to undo. If this happens, education might go the way of other businesses affected by platform dynamics and network effects, with a few large organizations such as Microsoft, Intel, Google, Amazon and Apple emerging to dominate the market.

Free products and services appear over the Internet because the marginal cost of reproducing a digital good is essentially zero. The marginal cost of adding users to an online class of thousands of students is also close to zero, assuming that there are no human teaching assistants and grading is done by computers or voluntary crowd-sourcing. But these calculations ignore the expenses associated with creating and delivering the content: faculty research, curriculum development, marketing and sales, infrastructure overhead, quality control and administration. So, yes, digital goods and services such as software products, newspapers, magazines, books, music, videos and even college classes may have close to zero marginal costs and theoretical 'gross margins' of up to 99%, as I wrote about more than a decade ago with reference to the software business [7]. But if revenues collapse, whether they are software product sales, newspaper subscriptions or college tuition, then at least some institutions will have another calculation to make: *99% of zero=zero*. In this environment, only the large and rich survive, except for a few niche players, and the large and rich tend to become larger and richer due to the phenomenon of 'winner-take-all' dynamics, driven by network effects and positive-feedback loops [8,9].

When universities offer free courses or inexpensive extension school classes as part of their non-profit mission, it is laudable. It is even feasible economically if they can subsidize their free efforts from other revenue sources: students who pay tuition, donors who add to the endowment, or companies, governments, and foundations that fund research and education. But most colleges and universities have high costs and limited resources, and revenues tend to be cyclical. Someone ultimately has to pay for creating and delivering online educational content and services. Some institutions will also have to absorb the loss of what would otherwise have been tuition-paying students.

My biggest concern in 2013 was that universities and colleges who are not so flush financially or government-supported will struggle in the new environment. For-profit universities, whose degrees and promises of employment are already being questioned and investigated by the U.S. Congress, will probably be the first institutions to decline or disappear [10]. That may be a positive consequence for society. We also do not have to worry too much about the survival of schools of very high quality and global reputations, which usually also have large endowments and multifaceted sources of income. Their ability to charge tuition rates that reflect or exceed actual costs may well be threatened in the future, however.

For example, as seen in Figure 1, 10 years ago MIT ran a deficit and would not have been able to fund free MOOCs during the period 2001–2008, very different from the surpluses of recent years. In the nearer term, however, we should be very concerned about second-tier and other universities and colleges as well as community colleges that depend on tuition combined with very limited

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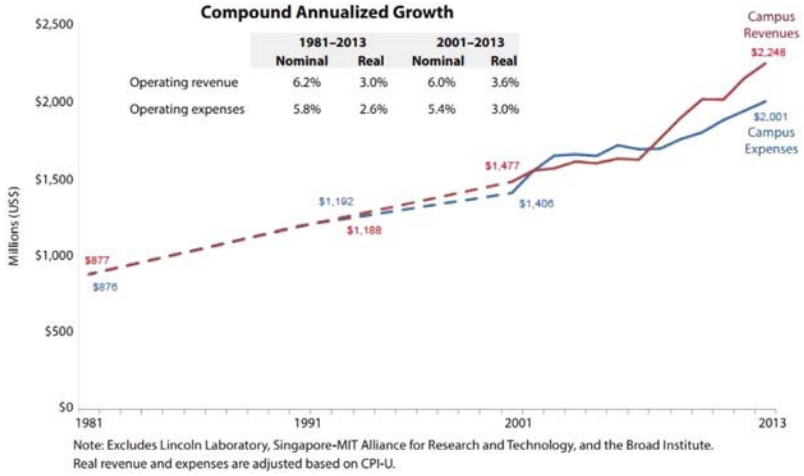


Figure 1

MIT campus operating expenses and revenues, financial years 1981–2013
Source: [11], p. 21.

government support. Many of these institutions play critical roles for education and economic development in their local regions.

It is possible that 'free' in the long run may eventually reduce variety and opportunities for learning as well as lessen our stocks of knowledge. For example: usage of Wikipedia is up, but contributions have been declining steadily over the last few years [12]. Meanwhile, encyclopedia companies, including the venerable *Encyclopedia Britannica*, have closed or found it increasingly difficult to sell their traditional products [13]. Will the world be better off if most encyclopedia companies shut their doors and most people only use Wikipedia? Maybe, but maybe not.

We have already seen a major decline in the variety and health of book publishers as well as newspapers and magazines. We lost *Newsweek* in 2012 to bankruptcy and, since 2009, almost lost the *New York Times* twice, saved only by massive cash infusions from a Mexican investor [14]. Many other newspapers and magazines have failed or had to be bailed out by local and foreign investors with a variety of agendas, and may no longer be the bastions of free speech and press that they once were. Web content has replaced a lot of for-fee content, but is the quality and objectivity the same? Again, maybe, but maybe not.

Companies that survive the onslaught of competition from free alternatives generally have business models and economies of scale and scope that enable them to take advantage of what we call 'multi-sided markets'. Their products are really 'free, but not free'. They subsidize one side of the market to gain users and make money from other parts of the market willing to pay [8]. For example, Netscape in the 1990s gave away browsers to educational or trial users for nothing, but sold hundreds of millions of dollars' worth of servers and development tools to companies that wanted to set up websites, intranets and extranets. Then later it sold advertising through its website to companies that wanted to reach users of its browser [15]. Adobe gives away the Acrobat Reader, but every year sells billions

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of dollars' worth of other products, such as servers and editing tools. Open-source software such as Linux is free, but the leading distributor, Red Hat, sells more than a billion dollars' worth of professional services each year (and also pays itself for a lot of Linux development). Google gives away the Android operating system and the Chrome browser for smart phones and tablets, and much more software functionality delivered over its website. But Google is not in the business of selling software products and services; it primarily sells advertising to companies who want to reach Google users.

In my 2013 column [6], I worried especially because my research on the software business found that about two-thirds of the public software product companies existing in 1998 disappeared by 2006 [16]. Part of the explanation is the Internet boom, which allowed some fledgling companies to go public, followed by a wave of failures as well as acquisitions led by stronger companies such as Oracle, IBM, Microsoft, Cisco, EMC, SAP and Adobe. But another part of the reason seemed to be the increasing prevalence of free or cheap alternatives that were 'good enough' and available over the Web. Most software product companies can never reach a scale big enough to sustain their businesses simply by selling advertising, like Google does. They need to sell services or monetize another side of the market related to the free products (e.g. give away a browser or reader, but charge for servers, tools and services).

Other important industries are still struggling to recover from the impact of free alternatives to their products and services. The *New York Times* made a mistake when it offered its content for nothing over the Internet, and is now trying to backtrack and adopt a hybrid model and charge for some usage. Hulu.com, the TV distribution joint venture formed in 2007 and led by NBC, Fox and Disney-ABC, once gave away all of its content free of charge, with advertising. It has evolved as well to a hybrid model, adding a monthly subscription service with premium content, much like Netflix. The music industry was nearly destroyed by free (and often illegal; remember Napster?) sharing until Steve Jobs found a way to price and distribute songs with Apple's iTunes service. Music is no longer free, for the most part, and the industry and its creators, the artists and publishers, have survived. Struggles continue, however, among individual artists and companies such as Spotify and Apple with regard to how to price streaming content and how much in payments the artists should receive. The problem is especially acute with 'streamed' content paid for indirectly by advertising since these revenues are a fraction of what artists used to receive when they sold physical albums or CDs. Meanwhile, book publishers are still figuring out how to price digital books as well as how to compete with free Web content and new entrants into publishing such as Amazon.

Do we have more variety and a better world when only a few players survive in an industry? The expansion of free MOOCs now being offered by elite universities (whose reputations are already high, without free web courses) creates the risk that lesser institutions will suffer the fate of many software product companies as well as other producers of digital goods and services. Will two-thirds of the education industry disappear? Maybe not, but maybe! It is hard to believe that we will be better off as a society with only a few remaining mega-wealthy universities dominating educational platforms with a global reach.

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Then there is the other issue of whether online education is truly a desirable substitute for in-class learning and face-to-face interaction. MOOCs are not simply off-the-shelf digital goods if they come bundled with services, such as for grading or giving feedback to the students. We often say at MIT that the personal networks and bonds our students form while at the University are probably the most valuable part of their education. Agreed, residential education may be a luxury, but we need to think more about whether MOOCs are a good substitute.

In short, many individuals and some institutions will gain significant benefits from free MOOCs to the extent that more access to education is better than little or no access. But, to be sustainable, free MOOCs really need a business model that is more like 'free, but not free', a term we first used with reference to the Netscape browser in the 1990s. Universities and colleges that offer MOOCs need to find some way to cover their costs and have enough of a surplus to invest in the future.

Reactions to the initial argument

I received several responses to the April 2013 column [6], both positive and negative [17,18]. Probably the most disturbing note came from a computer science professor who had decided to teach his course on one of the major MOOC platforms. He thought MOOCs would be the future and did not want to be left behind. Yet he confessed that he might be contributing to the 'tragedy of the commons': in other words, he feared that his individual decision would not be good in the long run for his university or for the education profession. The image that came immediately to my mind was of the natives on Easter Island who cut down the last tree. They obtained fuel for another day, but eventually their civilization collapsed. Did they know what they were doing?

With regard to my first concern, i.e. threats to the economics and survival of tuition-dependent educational institutions, two years later, it is still too early to gauge the impact of MOOCs. Nonetheless, university administrators seem to understand the economic challenges very clearly and are already making some adaptations to the free MOOCs model. For example, edX courses at present remain free, except for some professional education courses, although some charge a fee for an ID-certified certificate. More edX courses in the future are likely to charge for credentials such as certificates of completion. Some of these minimal-fee courses may be eligible for degree credit at some institutions. edX is also licensing some materials for a fee to other institutions. Coursera is heading down a similar path, that is, to charge for credentials or grading. Udacity already charges for grading and is now focusing on for-fee executive education. In other words, a business model that is more like 'free, but not free' as well as 'not free' is emerging. The per-student fees are small, but the potential aggregate sums are large.

Finding a sustainable business model for MOOCs remains critical, because education and other services always cost something to produce. In the residential world, the most elite institutions set the price for tuition. Other public and private institutions then copy these prices. However, only the elite private schools have large enough endowments and diverse sources of revenue that allow them to give

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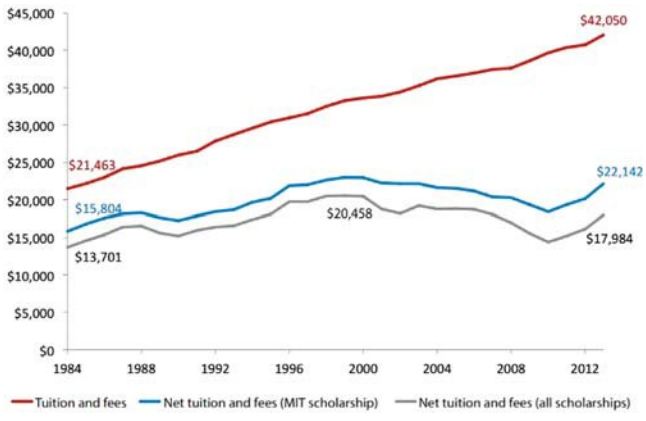
significant financial aid to needy students as well as to subsidize experiments such as free MOOCs. The average MIT student, as seen in Figure 2, pays less than half the nominal tuition rate. Moreover, as seen in Figure 3, even excluding defence-related research revenues from Lincoln Laboratories, net tuition has not exceeded more than 15% of MIT's revenues in recent decades; the University relies much more heavily on research funding as well as endowment and other sources of income.

Another economic challenge is that MOOCs are much more expensive to create and produce than traditional classes. They resemble movie productions, and may require a lot of upfront capital as well as small armies of teaching assistants to be effective.

With regard to my second concern, i.e. that a few web platforms, led by the most elite institutions, would dominate the MOOCs movement, this has occurred. Again, however, we see important adaptations. There remain the two main MOOC platforms, edX (non-profit) and Coursera (for-profit), with Udacity now playing a secondary role. However, many more universities and colleges have come to contribute content to the two main platforms. As of mid-2015, edX offered 160 courses with another 150 on the way and 250 archived. It had already served several million users and had 36 partners, including the University of Texas, University of California Berkeley and Wellesley College. As of mid-2015, Coursera claimed to have over 1000 courses, nearly 14 million users and 122 partners, led by Princeton, Brown, Columbia, Duke, Stanford, the University of Pennsylvania and Johns Hopkins. Other smaller MOOC platforms were also emerging in other parts of the world, such as China, France and the Middle East.

At the same time, enthusiasm for MOOCs in mid-2015 seemed dimmer than in the past because data so far suggest that they are unlikely to replace in-person residential education. In 2013, the *New York Times* gave front-page coverage to a University of Pennsylvania Graduate School of Education report involving a million students. Only about 4% of those who registered completed a MOOC. Half of the registered students never even viewed a lecture. In addition,

Figure 2



Net MIT undergraduate tuition and fees, 1984–2013 (inflation-adjusted to 2012)

Source: [19], p. 17.

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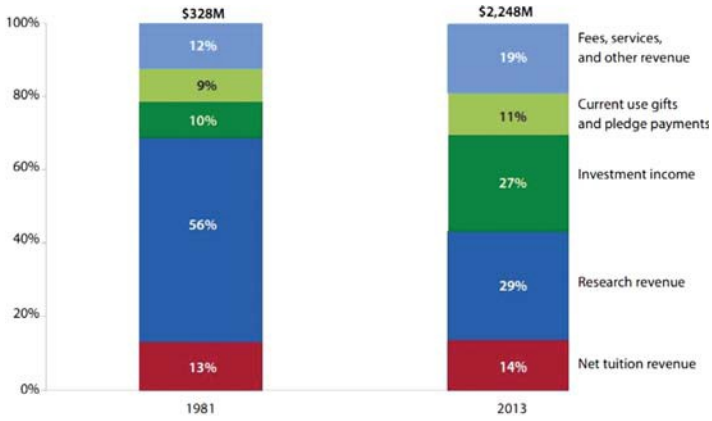


Figure 3

MIT revenue mixture, financial years 1981–2013

Source: [11], p. 25.

MOOCs do not seem to be educating the impoverished third-world masses; rather, they are providing continuing education to relatively wealthy students of working age, some 80% of whom already have college degrees [20].

Other experiments, such as between Udacity and San Jose State in small classes of 100 students, found that the online students did much more poorly than regular students, even with teaching assistants. edX also did an experiment with San Jose State and got somewhat better results, supporting the argument that MOOCs can work well when combined with live instruction in a 'blended' education model [21,22]. Udacity is now trying to work with companies to offer vocational training rather than college classes. In particular, it has partnered with AT&T and Georgia Tech to offer a three-semester Masters degree in computer science initially for US$6600, one-seventh of the tuition rate for out-of-state students [21,22].

The breadth of MOOC offerings is growing, but also leaves considerable room for traditional university education. Most MOOCs continue to be based on large undergraduate introductory lectures and some intermediate lecture courses. Putting these types of classes online has many advantages. Students can learn at their own pace; there is no need to keep giving the same lectures year after year; students can view the lectures from different locations or institutions; etc. Yet having access to live instructors also helps students learn, as the San Jose State and edX experiments suggest. It is possible to have interactive web classes (the online and for-profit University of Phoenix has done this for years), but these become increasingly difficult as the number of students rises. In addition, many advanced classes and seminars do not adapt well to the MOOC format.

Some policy suggestions

In short, MOOC platforms have made considerable progress finding ways to balance laudable educational goals with economic and pedagogical realities.

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Nonetheless, there remain several policy questions that colleges and universities still need to resolve.

(i) *Should MOOCs aimed at general education remain free?* I think this is possible and desirable. They will require subsidies to produce and deliver, and possibly salaries for the faculty and teaching assistants. However, the high-traffic MOOC platforms can generate indirect revenue to offset some costs, such as by selling ads or lists of CVs, or licensing content. Wealthy universities and colleges as well as foundations and governments also can contribute some funding. Venture capitalists are investing as well, although it is anyone's guess whether their bets will pay off.

(ii) *Should MOOCs with a credential, grade or credit towards a college degree be free?* I think not because I still believe that 'free' in the long run will damage the economic model of the many non-profit educational institutions that rely on tuition. There is another purpose as well to setting a price on these courses. If there are even very modest charges, probably the number of students who register for MOOCs will fall dramatically. However, the numbers who complete the courses should also rise, perhaps dramatically. We need to run more experiments. I would try to set the price of a credentialed or graded MOOC to balance these two goals: providing education to people who cannot come to a college campus against making enough money to cover costs plus some excess to invest in new course development and infrastructure.

(iii) *What about institutions or individual faculty that want to emphasize MOOCs' philanthropic potential?* Surely, we can still offer education for nothing or at very low cost to many students around the world through scholarships or tuition waivers, just as we already do at traditional institutions.

(iv) *How should traditional universities and colleges treat MOOCs in terms of degree credit, apart from tuition charges?* Some institutions recognize courses taken at other schools in order to waive requirements, but not to accelerate completion of a degree; other schools accept transfer credits towards a degree, but with some limits on the number of accepted credits. I would treat internal MOOCs as regular classes and external MOOCs from accredited institutions, as long as they come with grades and credit, like any other college classes where a student applies for transfer credit or waivers. I would not *carte blanche* give transfer credit for external MOOC courses, but would consider the individual student's situation case by case.

(v) *Should a student be able to get a college degree solely through taking MOOCs?* I think the answer here is yes, but I would treat the degrees more like we currently treat extension school degrees: give them a specific designation. It is already possible for students to obtain regular college and advanced degrees (even Ph.D.s!) fully online from some institutions, with or without MOOCs. The big question is whether a student who only takes, say, edX or Coursera classes, should get

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> *the identical degree* as a student who physically attended Harvard, Stanford, MIT, Berkeley, Princeton, Pennsylvania, Michigan, etc., where only a fraction of the applicants are admitted? At present, there is too much variance in the quality of the MOOCs' students and the educational experience is not the same. They should not get the same degrees. Nonetheless, edX, Coursera and other MOOC platforms may themselves evolve into degree-granting institutions.

These are simply policy suggestions for some complex questions. When it comes to education, there are also larger issues at stake, as reflected in another email I received from a former business school dean. He too worried about the threat MOOCs might be to the business models of tuition-dependent universities. More than this, though, he worried about the *need* to threaten institutions such as his. He thought the faculty union at his school had grown too powerful over the years and used its influence to resist curriculum innovations as well as to undermine the tenure process by limiting outside evaluations, which focused on research quality. Ultimately, he saw student education as suffering. So, whatever else they may do, MOOCs can be a useful 'kick in the pants'. They can persuade complacent professors and administrators to improve their educational product lest we be replaced by online videos and grading robots.

My greatest concern at this point is clarity in mission. Should universities and colleges focus on educating their local tuition-paying students or on educating the world? Many professors do both, such as by writing mass-market textbooks along with doing research. But doing everything equally well is hard. Creating and running a successful MOOC seems to be extraordinarily difficult and time-consuming, and not what most professors are trained to do. So what is Job 1? Too much attention on how to better *disseminate existing knowledge* may ultimately weaken our ability to *create new knowledge*. It would indeed be unfortunate if the fascination with online courses diminishes the time and commitment of our best faculty to teach students in person and carry out world-class research, which we need to create the knowledge and MOOCs of the future. But perhaps the real 'tragedy of the commons' will be if we fail to leverage digital technologies and the Internet to make education cheaper and more accessible around the world.

Acknowledgement

This chapter is based on two columns I published in Communications of the ACM in 2013 and 2014 [6,22].

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