The Billion Dollar Questions in Higher Ed

By William English

MOOCs will not destroy residential education, they’ll make it more valuable, and they might save the economy too.

Higher education is ripe for change. This is the one thing that higher ed critics agree on, although proposals for reform are diverse, legion, and uncertain. Underlying both the excitement and anxieties surrounding these proposals are questions about how new technologies can improve learning and reduce costs. To most who have followed these debates it is a foregone conclusion that the first causalities in the looming transformation of higher ed will be teaching faculty and traditional classrooms. However, a closer examination of our initial experiences with these technologies suggests the precise opposite: the pedagogical value of personal human engagement is enormous and will continue to constitute the core of higher ed, although forms of interaction are likely to be rearranged in dramatic ways.

The greatest challenge facing higher ed has to do with how costs relate to value. Although a college education is still a good investment for most, there are many students who graduate with high levels of debt and few employment prospects. Moreover, tuition costs have nearly tripled in the last 30 years with little evidence of a commensurate increase in the quality of education. A variety of critics now assert that the academy has become a bureaucratically bloated, inefficient, decadent, and self-serving institution that is not living up to its full potential and social purposes. Meanwhile, aided by government loan subsidies, student debt has ballooned to some $1.2 trillion in the last decade to become the second largest form of consumer debt, leading some to wonder whether a higher ed bubble is set to be the next housing bubble.

One concern is that money has increasingly been devoted to expenses that have little to do with education: wooing students through resort-like amenities (posh dorms, gourmet food, state of the art gyms), sustaining expensive sports programs (less than 7% of D1 programs make money), and growing the administration (at rates that have far exceeded faculty hires). Another problem is that teaching is often a secondary concern for professors, whose professional advancement depends almost entirely on the quality of their research and ability to raise grant money. Finally, many institutions appear content to take students’ federally subsidized money and issue credentials without much regard for the quality, content, and value of the education received.

Worries about the costs and value of higher ed have prompted the Obama administration to propose a new system of colleges rankings that will be linked to federal loan incentives and reward schools that provide the most value (adding fuel to an already raging debate about how value should be measured). Others believe the status quo is beyond repair and have proposed more radical alternatives. For example, the Minerva Project plans to do away with a traditional residential campus and have its students move around the globe, taking seminar classes with faculty who embrace hybrid instructional technologies. In an even bolder rejection of current modes and orders, the tech entrepreneur Peter Thiel has sponsored a fellowship that allows students to bypass college all together in order to learn in the context of launching entrepreneurial ventures.
The fundamental problem that all proposals must confront is the reality that education is expensive. Done well, it requires careful personal attention from experts whose skills could be profitably employed elsewhere. Thus, higher education suffers from what economists know as the Baumol Effect – a rise in salaries driven not by increases in productivity, but by competition for labor that is highly valued in other domains. Does it make sense for Nobel laureate to spend a large part of his or her week explaining concepts to a confused 19 year old? Perhaps – but what’s certain is that we want this engagement to happen in the most efficient and productive manner possible.

Why has greater “productivity” in education been so hard to achieve? In part, this is because education has traditionally demanded physical space and interpersonal interactions that constrain the scale and quality of instruction. In order to create more value in education one either has to increase the number of students that one instructor can effectively teach, or increase the quality of instruction done in current settings. The great promise of new instructional technologies – above all MOOCs (Massive Open Online Courses) – is that they can address the problem of scale. However, it may turn out that these technologies have their greatest impact on the quality of traditional classrooms.

Enthusiasm for MOOCs is high, and dozens of America’s top colleges and universities are racing to develop these new courses in partnership with the big three platforms: Coursera, Udacity, and EdX. Although many view MOOCs as an efficient way to communicate information, this is, in one sense, doubtful. Books deliver more information per minute than videos. Nor is distance learning revolutionary, as correspondence courses have existed for over a century. The Internet does make content delivery easier than a trip to the library, although both already render much of the world’s knowledge available, in text form, to anyone’s fingertips. These truths have led some MOOC skeptics to suggest they are little more than multi-media enhanced textbooks. Finally, the ability to scale MOOCs to truly massive audiences appears limited by our ability to automate assessment. A hundred thousand students can easily watch a video and answer multiple-choice questions online, but grading a hundred thousand essays still requires an enormous amount of manpower.

A closer look at MOOCs and the technologies they incorporate (short videos, structured progression, collaborative tools, regular assessment with quick feedback, tailored review exercises, discussion forums, etc.) suggests they do represent something radically new. Their genius consists of three things:

1. They enable forms of engagement that are better optimized for human psychology;
2. They enable quick, high powered educational research to further refine content and delivery;
3. For a subset of introductory and technical courses, automated assessment allows MOOCs to scale effectively to large audiences, teaching skills that have economic value and can be linked with employment opportunities.

Regarding the first, MOOCs may prove one of the most powerful applications of the psychological insights that have emanated from behavioral economics and other academic research in recent decades. The great discoveries in these fields have shown how seemingly small changes can produce enormous effects by taking advantage of peculiar features of human psychology. To cite but one common example, “opt-in” organ donor programs lead to very low rates of participation, while “opt-out” programs secure near unanimous participation. In the educational space, psychologists have documented limits in attention span that can diminish information uptake in
longer lectures. Also, quizzes spaced at regular intervals can improve subsequent attention and dramatically increase the retention of knowledge in long-term memory. MOOC platforms integrate these insights into their design principles, substituting a string of short videos for larger lectures, and incorporating immediate comprehension questions as well as follow-up quizzes.

This may not sound revolutionary at first glance, but these features are likely to be underutilized by traditional faculty in part because of biases created by their own expertise. Professors know better than anyone what content should be incorporated into a course. However, it is precisely their familiarity with their own disciplines that can lead them to underrate how difficult it is for neophytes to acquire concepts or the importance of regular testing and practice. MOOCs focus attention on instructional design like never before, and have also inspired other educational technologies (language memorization apps, learning games, peer matching software for working groups) that help students master and apply material more effectively. Studying will never be effortless, and there is a danger that some MOOCs may entertain more than they engage. However, these technologies promise to make many forms of learning more cognitively manageable, psychologically motivating, and rationally structured than they currently are.

Related to this promise is the second great advantage of MOOCs: their ability to facilitate rapid and rigorous experimentation. MOOC platforms combine the statistical power of “big data” with the capacity to test different approaches and quickly evaluate what works and what doesn’t. This is what inspires justified confidence that these technologies will be able to hone in on novel, genuine improvements.

There is no doubt that many first-generation MOOCs have been clumsy and poorly structured. The focus has been on putting content online, with less attention devoted to optimal design and delivery. However, this will quickly change as MOOC data is leveraged to explore modifications that enhance learning. There will be massive amounts of observational data that can be mined to discover useful patterns of success, and MOOC platforms allow powerful causal inference through randomized experimentation. The same forces that have transformed websites, marketing, and the service sector over the last decade through better data availability and analysis will rationalize educational technology at an increasingly fast pace. Not only are there many ways to improve education, but they will be discovered more quickly through digital platforms and data.

The third great promise of new educational technologies is that they can solve a massive problem at the intersection of labor markets and human capital development. One of the central rationales for higher education in the modern world is that it enables students to develop specialized skills that will make them economically productive. However, it is remarkable how many businesses cannot find qualified workers, even in the face of high unemployment rates. The problem is that businesses need specific skills that take time and effort to develop, but these needs are not well matched with educational investments. Too many students leave college without developing valuable skills, and too many people who are unemployed or underemployed have no easy way of acquiring new skills.

Granted, there’s no shortage of degree programs that promise professional advancement, but unskilled workers face a serious knowledge problem. It is difficult to know exactly which skills are needed in the first place and to judge whether the eventual payoff is worth the investment of learning. Moreover, businesses have traditionally shied away from on the job training because of uncertainties about a worker’s true potential. Educational technologies can help solve these related
problems if they can dramatically lower instructional costs and encourage businesses to link success in particular courses to specific job opportunities.

Presented with inexpensive courses linked to specific jobs, workers will have more low-risk, high-reward opportunities to advance their careers. Companies will also have greater access to the skilled labor they desperately need. And unlike many current educational ventures, the interests of everyone involved will be closely aligned.

For example, Georgia Tech has teamed with Udacity and AT&T to offer an inexpensive online masters program in computer science, and AT&T plans to recruit graduates that perform well. A larger Open Education Alliance has formed with partners such as Google, Intuit, and Nvidia committed to providing education that connects students with job opportunities. The potential economic value of these sorts of academic-industry partnerships is hard to exaggerate. They could dramatically enhance the skills and productivity of a large portion of the labor force and, by extension, boost economic prosperity at large.

Ultimately, however, the promise of digital learning platforms comes with an enormous caveat and a surprising insight.

The caveat is that there will be inherent limits to what MOOCs can teach well. Some of those limits relate to scalable assessment. When a subject does not admit of objective answers that can be machine graded, it becomes difficult to implement more nuanced grading schemes on a large scale. There have been impressive efforts to leverage "peer assessment" techniques to enable students to grade each other, but these have limits and drawbacks. This is one reason that MOOC platforms are likely to be most successful for introductory courses that involve the mastery of factual content and for technical courses for which there are clear right or wrong answers. Courses involving more sophisticated questions of interpretation, judgment, and style will demand more labor intensive and less scalable grading.

However, MOOCs also face a deeper challenge related to interpretive complexity. As any teacher knows, there are many ways for students to be confused. Diagnosing this confusion and providing personal feedback tailored to a student's current understanding is one of the greatest services that a teacher can provide. Some forms of confusion will be common, and technologies can help flag what students don't understand and provide targeted, remedial instruction. This is one of the main virtues of Khan Academy, which recommends lessons to students based on their performance on practice tests, while also allowing users to look up guided lessons on specific topics. However, some sorts of confusion will be remedied more effectively through direct human engagement, which has the capacity to understand and respond to a greater range of unique questions. Indeed, until computers can pass the Turing Test (and there are reasons to think they never will), education will always stand to benefit from expert human interaction.

This is a truth recognized in Google's launch of its new "Helpouts" product, which the New York Times describes as "an acknowledgement by the company that its search engine misses a lot of information that people want." The new service allows people to video chat in real time with experts from around the globe. As another article explains, "There are just some tasks at which Google’s algorithms remain at a competitive disadvantage to actual human beings, one being personalized answers to questions that require expert assistance."
That is all to say that MOOCs are unlikely to become an effective substitute for human interaction in many corners of education, particularly with regard to disciplines that involve interpretive questions.

However, the more interesting insight that has emerged from our experience with online learning technologies thus far is that they not only confirm the importance of interpersonal engagement but can also complement it in profound ways. Indeed, there are reasons to believe that new technologies could lead to more personal instruction, while enabling it to be much more productive.

Consider the “flipped classroom,” which has emerged as a new model for innovative residential education. The idea is that students can watch a series of pre-recorded lectures on their own before class, often paired with basic comprehension quizzes, and then come to class ready to discuss material or work on more involved assignments. The overall effect is that a lecture course comes to look more and more like a seminar, allowing students and professors to engage in substantive discussions during class time.

New technologies can facilitate more productive interactions within a class as well. Learning Catalytics is one of many platforms that allow students to answer questions and receive quick feedback during class; and one of its most useful features is the ability to match students for more in depth discussions based on their responses. There is already evidence that this sort of structured peer engagement can substantially improve learning, and it speaks to the considerable power of person-to-person interactions.

Indeed, the power of direct human engagement is something that has become apparent to even the most ardent MOOC enthusiasts. As Sebastian Thrun, the MOOC pioneer and founder of Udacity, recently noted, "What we've learned is the computer program alone, a MOOC alone is not likely to be a good educational medium for large numbers of people, except for the truly highly self-motivated. To be successful, we need people on the ground to do things, to provide educational services." Moreover, even the best evidence we have thus far of the success of online learning – a hybrid statistics course that was shown to be as effective as the traditional version - still involved an hour of face-to-face instruction each week.

This explains the most significant recent shift in the MOOC paradigm, namely efforts to augment courses with opportunities for personal instruction. For example, Coursera recently announced a partnership with the US government to create “learning hubs” around the globe that will provide both Internet access and regular in-person class discussions with local teachers. The local networking site Meetup.com has facilitated hundreds of MOOC discussion groups worldwide, and other sites like Coursepods.org arrange specific in-person tutorials for online courses. Meanwhile, personal tutoring sites like Wyzant.com and Endeavor Tutoring have been flourishing. The basic truth underlying the success of in-person instruction is this: although digital platforms can make educational materials more accessible, engaging, and organized, for most learners there is no substitute for human conversation when it comes to clarifying confusion and keeping students motivated.

Although new technologies can certainly improve the scale of instruction in some domains, and save money in the process, their greater value lies in the improved quality of personal instruction they make possible. On the first point, digital technologies can save labor that was traditionally expended reworking and delivering course content each semester (by substituting recorded lectures) and save time spent grading basic assignments (by substituting some forms of automated assessment). Moreover, the quality of the lectures and exercises is likely to be much higher, as
instructors have reasons to make a concentrated, one-time investment in course design. The effect of all these improvements however, is to prepare students to be in a position to make the most of classroom time or other interactions with experts, be they virtual or in-person. Far from rendering teachers irrelevant, these technologies make interacting with educators more valuable and facilitate more productive in-person instruction.

This still leaves open a number of big questions about the net impact of educational technologies, but the following scenarios seem likely:

- Introductory and technical courses will increasingly be outsourced to digital platforms that can effectively teach large numbers of students with comparatively less professorial labor. However, even these courses will employ extensive teaching staffs to clarify confusion and provide remedial instruction.

- The success of technical courses will create enormous economic value, as students will be able to acquire employable skills at a much lower cost. Meanwhile, professors in technical fields will have more time to focus on advanced residential courses or to devote themselves to research and consulting, which, happily, will continue to be in high demand for these fields. Cost savings will be more modest in non-technical fields with fewer implications for the share of time those professors devote to teaching.

- As MOOC providers seek to generate revenue by providing courses that colleges actually count for credit, there will be a shift from the current “retail” model to a “wholesale” model. The retail model involves selling students direct access to a MOOC, which they then engage without the mediation of their home institution. However, it makes sense to have local institutions engaged in course delivery for a number of reasons. These intuitions have the manpower and space to facilitate the kinds of interpersonal engagements that greatly enhance learning and these institutions desperately need to justify their existence and claim credit for course delivery. A wholesale model – selling MOOC access to colleges, which then enhance and deliver them to students in more personalized forms – will be a win-win proposition for students and smaller educational institutions alike.

- MOOCs will have their greatest impact in developing countries where there are limited educational opportunities. The best and brightest students in these countries will have the intellectual capacity and motivation to take the greatest advantage of MOOCs. Even with minimal opportunities for interpersonal engagement, MOOCs will provide an education that is superior to many existing alternatives around the globe.

- As part of their professional development, professors from all fields will invest significant time and energy developing their own flagship digital course. Some will achieve substantial fame and come to define the standards of pedagogy and curricula in their discipline, much like the Feynman lectures did in Physics or certain textbooks do today.

- As more digital resources are produced, professors will begin to borrow components from a range of MOOCs for use in their own residential courses. Eventually, the production of shorter “modules” – discrete digital lessons that teach a particular concept or issue – will outpace MOOCs and become the most useful digital products for residential education. Modules will prove valuable study aids for a wide range of students and will also be convenient for professors to integrate into traditional course syllabi. By offering engaging, high quality explanations of foundational concepts and issues, modules will help ensure that
more students are on “the same page” and do not lack the building blocks for further learning. At the same time, the ability to draw upon existing modules will free up professors to focus more on meaningful discussions and less on remedial instruction.

- Increasing recognition of the value of personal interactions will direct new attention to the question of how students spend their time outside of the classroom. Educators will come to better appreciate how much learning goes on in dining rooms, study groups, and late night dorm discussions. These insights will lead to renewed efforts to provide spaces and opportunities for informal, extracurricular learning. Digital platforms will also help students connect with other students to explore mutual interests. Finally, analytics platforms will provide students with better advice about how to spend their free time in order to achieve their academic goals.

- Elite and upper level education will continue to be defined by the small, in-person seminar. Even if augmented with various sorts of digital resources, the seminar will still be the most productive forum for intellectual exchange, motivation, and accountability. This will be particularly true in the humanities. In an age of increasing online education, elite Schools will compete by advertising the opportunities they afford for small seminars, which will be one of their principal strengths in addition to the social networks and acculturation they have always provided. There is even an chance that the humanities will grow in prestige, as they will have a comparative advantage in offering the intimate learning experiences that are not universally accessible online.

- The greatest challenge in education will be extending the advantages of new technologies to the worst performing and least prepared students. These are the people who have the most to gain from better education. However, it is precisely their lack of education that ironically makes it difficult for poor students to engage with and benefit from new technologies. Even if they are Internet savvy, these sorts of students lack many of the basic literacy and numeracy skills needed to progress through current platforms, not to mention disciplined study habits and an appreciation of the value of learning. Consider, as one example, the remarkable fact that about of quarter of high school graduates in the US currently cannot pass the military entrance exam, which is meant to define the minimal level of aptitude needed for military training. New technologies will draw increased attention to the preconditions for learning. However, it is still too early to tell whether these technologies can make meaningful difference for our worst off students and help address the widespread failures of primary and secondary education.

In the final analysis, emerging educational technologies are likely to be both more and less revolutionary than many have claimed: more revolutionary, because their contribution to economic prosperity in both the developed and developing world could be greater than most have fathomed; less revolutionary, because these technologies are unlikely to do away with personal instruction or to lead to the demise of residential universities. Critics of higher ed are certainly right that there is an enormous amount of bad teaching on campuses today, and institutions that neglect the quality of their teaching will be put out of business. However, good teachers will have nothing to fear in the coming technological transformations of education.

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