Aftermath of the MOOC wars

Can commercial vendors support creative higher education?

Christopher Newfield

Abstract

The large-scale massive open online course (xMOOC) rose to prominence in 2012–13 on the promise that its outcomes would be better and cheaper than those of face-to-face university instruction. By late 2013, xMOOC educational claims had been largely discredited, though policy interest in ed-tech carried on. What can we learn about the future of ed-tech by analysing this eighteen-month period in higher education history? This article gathers different types of evidence to suggest several conclusions: MOOC momentum was propelled by an administrative failure to apply due diligence to xMOOC educational claims. The MOOC path was also smoothed by a confusion among key commentators between xMOOCs and small-scale 'connectivity' MOOCs that did show meaningful learning outcomes. At the same time, online courses do not overcome race-based disparities of outcome and in some cases make them worse. In addition, student use of online courses appears to be instrumental, even cynical, further limiting their educational value. MOOCs will be back in modified form to endanger educational equity and quality unless faculty members articulate explicit goals and standards for public higher education to which ed-tech can be held accountable.

Keywords

ed-tech, learning outcomes, MOOC, online, race and ethnicity, racial disparity

In the post-2008 period, the prize for the biggest higher-ed craze goes to the MOOC vendors, the private providers of Massive Open Online Courses, which swept United States media and university administrations from late summer 2011 to late summer 2013. Even insiders were not thrilled with the

term MOOC as late as December 2011.[1] But it took off a bit later, and when a reporter from the New York *Times* called 2012 the 'Year of the MOOC', the term stuck. MOOC momentum continued to build into 2013 (Pappano 2012). By that year, the U.K., Singapore and other countries were getting in on the act of defining MOOCs as the Great Disrupter – and the future – of higher education (Department for Business, Innovation and Skills 2013; Universities UK 2013).

Markets and investors were impressed by the sales pitch, which claimed to link elite university courses to a mass market. The founders of the two leading West Coast companies, Coursera and Udacity, put face-to-face courses online and attracted huge initial enrolments. Sebastian Thrun, of Google, Stanford and Udacity, put his Artificial Intelligence course online in mid-July 2011 and five weeks later had signed up 120,000 people.[2] This huge scale seemed like mass access to some and smelled like money to others. The MOOC pitch drew on Silicon Valley's perfected brand of populist capitalism, in which technology is deployed to form a mass market by giving the people exactly what they want or need. MOOCs were going to liberate the democratic potential of higher education once and for all. They would do this by driving the cost of mass access to near zero, while offering as good or better educational quality than professors working on expensive bricks-and-mortar campuses that charged unaffordable tolls.

But MOOCs took off by merging or even confusing two different modes of access. One is access to an online provider's digital materials, interactive software and assessment tools. The other is access to a learning process that leads to effective use of those materials and tools. MOOCs offered the first form of access through the Internet. But how would they offer the second form of access, which we could call *learning to learn*?

The explicit answer for most Americans would seem to be no: low-cost information access does not translate into cognitive development. Overall skill levels as well as relative university attainment rates in the U.S. have been declining for years. It is thirteenth in higher-order literacy and twelfth in readiness to use information and communication technologies for problem solving (OECD 2014: Charts A1.6 and A1.a). It is now nineteenth out of twenty-nine in tertiary degree attainment (OECD 2014: Chart A3.2).[3] Perhaps most alarmingly, the U.S. is twentieth out of twenty-three in the proportion of people who have more education than their parents (OECD 2014: Chart A4.3). It is not surprising, then, that employers regularly express dissatisfaction with the skills of successful university graduates

(Jaschik 2015). It is not surprising that two sociologists struck a nerve when they claimed that the country's universities were producing 'limited learning' (Arum and Roksa 2011). At the same time, in spite of false assurances that access for poor students was being protected, 24-year-olds in the lowest quartile of income were stuck with college graduation rates of 10.4 per cent, or about one seventh of students in the top quartile (Mortenson 2012). In spite of still other false assurances, poor students who did graduate did *not* borrow less than affluent students because of the nation's generous financial aid: poor students borrowed exactly as much, and with far less capacity to pay it off.[4] So by the time MOOCs appeared, everyone in the U.S.A. had something to hate about U.S. higher education – the cost, the debt, the limited access, the mediocre educational results.

The most comprehensive review of MOOCs to date aptly summarised the issue: 'Over the past few years, observers of higher education have speculated about dramatic changes that must occur to accommodate more learners at lower costs and to facilitate a shift away from the accumulation of knowledge to the acquisition of a variety of cognitive and non-cognitive skills' (Hollands and Tirthali 2014: 7). MOOCs rose to prominence by promising much lower costs *and* higher-order cognitive skills. Their vendors convinced people that their technology really could solve the university's chronic 'cost disease', combining mass scale with high-quality interactions among instructors and students. MOOC vendors claimed to be able to replicate 'active learning' techniques with online quizzes, chat-room-based peer review and similar techniques. Educators had traditionally assumed that what we might call Socratic attention is labour-intensive and more or less impossible to scale. Or is it?

A double promise

The MOOC vendors' answer was no, it is not impossible. Their ed-tech would allow interactive learning to scale up – professors just had to get out of technology's way. Business leaders often act like they know how everyone in society should do their job. This time they were outdone by a small group of computer science professors from a couple of the world's most elite schools – Stanford and MIT – who declared their new companies to be the only important advance in education since the invention of the Gutenberg printing press. A few months later, the *New York Times* declared 2012 the Year of the MOOC. A few months after that, dozens of university adminis-

trations had signed memoranda of understanding with MOOC companies, generally without quality checks run by their faculty.

What was the MOOC revolution? The answer is not obvious if you just look at the product itself. The term refers to a multimedia course posted on a website that is accessible to anyone with a computer and an Internet connection. These had been around for two decades before they got the MOOC name. When the name was used before its MIT-Stanford incarnation, the emphasis was on 'open' in the sense of accessible by anyone at no charge. The further emphasis was on MOOC structure as a flat social network that would enable self-organised collaborative instruction (McAuley et al. 2010). But the commercial MOOCs of 2012 were largely taped broadcast lectures on conventional course topics delivered by name-brand professors and 'chunked' into bite-sized pieces of 4–8 minutes with interactive quizzes and related features. Learning is certainly improved by interrupting lectures for questions and answers, and much of the MOOC course instruction I saw was superb. But the techniques were not new to the 2012 generation of MOOC technology. Nor were the companies furnishing *evidence* that their educational impacts were greater than what could be had through a conventional discussion course.

In the evidence vacuum, the national media stressed three things about MOOCs. First was market size. Around 160,000 people had signed up for a 2011 Stanford online course on artificial intelligence, so it looked like MOOCs could tap a global mass market in higher education.

Second, they said, this mass market could be reached at nearly no cost for additional students thanks to the digital MOOC platform. Traditional colleges had to build buildings and hire teachers, landscapers, technicians and administrators. MOOCs did away with all that thanks to the same digital miracle that allowed Facebook to add a million or a hundred million new users for little new cost. The revolution was to think of education as an information and telecommunications industry rather than as a face-to-face hands-on service that needed a physical plant.

Third, with MOOCs trying to force higher education finally to switch from a semi-artisanal, relationship-based teaching model to Silicon Valley–style digital delivery, there was huge money to be made, and investors were piling in. EdX was started with $60 (U.S.) million in capital from its partners MIT and Harvard, and Udacity and Coursera, the Stanford companies, had raised tens of millions apiece from Silicon Valley venture capitalists (Charmichael 2012; Usher 2013). MOOCs were free by definition, so the

revenue would have to come later. In classic Valley style the giant user base would come first, and once there were tens of millions of MOOC consumers around the world, monetisation was sure to follow.

None of this would last unless the MOOC leaders were right about two core claims: (1) their educational outcomes had to be 'as good or better' than traditional face-to-face teaching; (2) their costs had to be massively lower, thanks to digital automation. The real revolution MOOCsters claimed was not new teaching technology. The real revolution was solving higher education's 'cost disease', in which high quality meant lots of hands-on labour. The MOOC promise was that high quality could be had at low cost through the miracle of their digital platform.[5] This claim fits with the austerity economics that now controls the public sector in the United States as in many other wealthy nations. But were the paired claims of high educational quality at near-zero delivery costs actually true?

MOOC costs are slowly attracting formal economic analysis, but current research suggests modest savings at best. We do not yet have a general estimate that improves on overall price reductions of around 1.5 per cent for every 10 per cent of student enrolments that are shifted to 'online only' (Deming et al. 2015). The most prominent U.S. online programme remains Udacity's partnership with a branch of the Georgia Institute of Technology to create an online master's programme in computer science. And yet potential savings are wrapped in budget secrecy, propped by renewed subsidies from the corporate sponsor, AT&T, and in any case appear to lag behind predictions (Newfield 2013; Straumsheim 2016).[6] An analysis of the MOOC cost claim is beyond my scope here. I will focus instead on the scalable MOOC or xMOOC's educational claim – that, in Coursera's words, they 'provide universal access to the world's best education' – best because 'classes with online learning (whether taught completely online or blended) on average produce stronger student learning outcomes than do classes with solely face-to-face instruction' (Coursera 2015a). This claim has been the foundation of MOOC acceptability in U.S. higher education.

The xMOOC Lift-Off

In 2012 and 2013, MOOCs took state capitols, venture capital firms and the Davos World Economic Forum by storm. The star companies were Stanford University's spin-off companies Coursera and Udacity and MIT's spin-off edX.[7] They were partnering with prominent thinkers and teachers like Har-

vard's political science professor Michael Sandel to create Harvard-quality courses and open them up to millions of 'students'. Advocates like Udacity co-founder Sebastian Thrun repeatedly described a 'MOOC model in which students learn by solving problems, not by listening to a professor tell them how to solve them' (Mangan 2012: B4.). They built on the misgivings about face-to-face instruction coming from establishment figures like the president emeritus of Harvard, Derek Bok, who noted correctly that standard college lectures 'leave little room for a thorough discussion of problems', for 'collaborative efforts to solve problems' or for helping students 'acquire habits of metacognition' (Bok 2013). Online learning technology was said to give students a whole new range of opportunities to wrestle with material, learn it deeply and come up with new ideas.

The populism of the xMOOC teaching software fits nicely with the xMOOC economic mission. They were bringing Silicon Valley digital commerce to the allegedly pre-capitalist spaces of higher education, which they depicted as elitist and anti-technological. Colleges and universities had failed to address their 'cost disease', and as a result were wasting student and taxpayer money while making educational democracy impossible. By contrast, MOOCs would bring flattened, democratised higher education to the global masses who had been shortchanged, marginalised or overlooked by both their universities and their governments. Colleges have always tried to treat students as individuals, but public colleges have never been *funded* actually to do this. The ed-tech hope was that technology would now allow *mass specialisation*, which I would translate as the individualisation of learning (DeMillo 2011: 142–3; Koller 2012). This would mean access to content and practice to each according to her need.

As MOOCs were launching themselves on the global stage with false or exaggerated claims to revolutionary savings, they were also asserting that their educational outcomes were 'on average … stronger' than those of face-to-face instruction (Coursera 2015b). This claim appeared on Coursera's website with the imprimatur of the United States Department of Education. The Department of Education had sponsored a study of existing studies of online education, known as a meta-analysis. This study came with an abstract that said 'students in online learning conditions performed modestly better than those receiving face-to-face instruction' (Means et al. 2009).

In addition, Coursera's lead apostle, Daphne Koller, gave dozens of lectures in which she made MOOCs sound good by making professors sound

bad. Her primary target was lecturing, which she declared categorically obsolete. She explained the problem and the solution at the UCLA 'rebooting' conference I mentioned above:

> the insight that went into the design of this new generation of MOOCs came from a lot of the Stanford experiments on flipped classroom teaching where the idea was … let's take lecturing out of the classroom. Lecturing is not the way we want to teach our students in this day and age. It's a waste of time for me to come in to a lecture with 200 people and give the same lecture that I've been giving for 15 years telling the same jokes at the same time. It's just not a great experience for me. It's not a great experience for the students. Why not instead come and talk to the students in class? Have a dialogue and have them talk to each other and have them do active things in the classroom so that they engage with each other and with course material? … Many people have talked about the benefits of that kind of active learning in the classroom.

Elsewhere she describes the bad model as the 'sage on the stage', the professor who drones his students to sleep with notes first jotted down three decades earlier. The claim of Koller and others was that MOOCs provided a technological means of flipping the classroom by helping the students first to interact with material and then to discuss material rather than passively receive it in class.

There were two odd things about this claim, in addition to the aggressive dismissal of hundreds of thousands of work-a-day instructors. First, MOOC advocates were reinventing the wheels historically known as 'homework' for the class type known as 'the seminar'. In a seminar, students read texts and/or do assignments before the class meeting, and then come prepared to discuss the material intensively and in detail, both with the professor and their student peers. This is a standard model at private liberal arts colleges like Haverford, Oberlin, Grinnell, Millsaps or Dickinson, which have student to faculty ratios as low as 7.6 students per faculty member, and an average ratio of 11.6 (Haynie n.d.). By comparison, at my current university, UC Santa Barbara, a public research university, our English majors are allowed to take exactly one such seminar in four years, and a limited number of the rest of their courses will be 'discussions' of thirty-five students, with the rest being 100–400 student lecture courses with one discussion per week run by teaching assistants. Ironically, the simplest way to interpret MOOC advocates like Koller is as telling students to replace their state universities

with liberal arts colleges – to go back to a future of intensive learning in the seminars that have long been known to 'change lives' (Pope 2007).

The second odd thing was that advocates misstated crucial educational findings. The Department of Education meta-analysis is the most important example. We have seen the abstract, which stated that 'students in online learning conditions performed modestly better than those receiving face-to-face instruction'. The catch is in the phrase 'online learning *conditions*'. The study found that the conditions *associated with* online rather than the online technology itself enhanced educational outcomes.

What are these conditions? The central clue comes from the widely recognised fact that 'blended' or 'hybrid' courses are better than purely online courses:

> Instruction combining online and face-to-face elements had a larger advantage relative to purely face-to-face instruction than did purely online instruction … In fact, the learning outcomes for students in purely online conditions and those for students in purely face-to-face conditions were statistically equivalent (Means et al. 2009: xv).

Blending online technology with personal contact is, ironically, the only real source of online advantage. The Georgia Tech-Udacity online Masters programme acknowledges this fact when they budget for a large number of 'course assistants': this insures that the programme is actually a series of blended courses with plenty of face-to-face guidance. When Daphne Koller and others call for replacing the 'sage on the stage' with the 'guide on the side', they are in fact summoning blended courses rather than MOOCs as such, where personal interaction will take place online in the form of email, peer-to-peer chats and so on.

If blended online courses are better than both face-to-face and fully online courses, what are their defining features? Interestingly, fiddling with the human–computer interface did not seem to make that much difference. Though the data were weak here (and in some cases too old to ensure confidence), it appeared that 'Variations in the way in which different studies implemented online learning did not affect student learning outcomes significantly' (Means et al. 2009: xv). In particular, 'Elements such as video or online quizzes do not appear to influence the amount that students learn in online classes' (Means et al. 2009: xvi). This is remarkable, since video is a MOOC's instructional medium and online quizzes are its core form of interactivity, which is meant to increase the student's active engagement.

The meta-analysis got closer to features that matter when it noted the inconsistent effects of most variables. In my reading, four of these were particularly important. The first is 'giving learners control of their interactions with media and prompting learner reflection' (Means et al. 2009: xvi). One great advantage of taped online materials is that each student gets as many swings at the ball as she wants and needs. If she does not get the material the first time, she can rewind and replay two, three or ten times, and focus on this or that part of a presentation that is harder for her. Students' control over the learning process allows individualised adaptation to material, which makes learning more effective.

The second positive feature follows directly – benefits are proportional to 'the amount of time the learners spent on task' (Means et al. 2009: xiv, xviii). Online could improve outcomes if it allowed or encouraged students to correct for the general decline in student study hours that seems to be a major problem in the contemporary university (Means et al. 2009: 51). Student effort is widely accepted as a major determinant of student learning.

The third and fourth features are as follows: 'Studies using blended learning also tend to involve ... additional instructional resources, and course elements that encourage interactions among learners'. You might miss that phrase 'additional instructional resources', but it is important. Lower-achieving students go to poorer colleges with fewer resources and they have lower completion rates and general outcomes. This situation has remained unchanged for decades – until 2008, when it got worse. Online experiments, and MOOCs in particular, inspired investment in programmes that in many cases had been starved for years. The Udacity courses at San Jose State University were a case in point: MOOCs were competing against face-to-face courses that had been subject to the largest public funding cuts in the university's history.

The meta-analysis's real conclusion contradicts the one-liner lifted from the abstract, and reads as follows:

> This meta-analysis ... should not be construed as demonstrating that online learning is superior as a medium. Rather, it is the combination of elements in the treatment conditions, which are likely to include additional learning time and materials as well as additional opportunities for collaboration, which has proven effective. The meta-analysis findings do not support simply putting an existing course online, but they do support redesigning instruction to incorporate additional learning opportunities online (Means et al. 2009: 51).

The value of blended courses arose from increased student control of learning, extra study time, more money, and 'active' and 'interactive' learning opportunities. The value, in other words, came from more structured attention to the student's learning process, including attention from the student herself. Online was often an *occasion* for upgrading the learning process, but the *means* to the upgrade was upgraded studying – longer, richer, more active studying. The need to upgrade studying was in danger of getting lost in the focus on MOOC technology.

A strategic confusion

Many analysts who care about quality education conflated online instruction with active learning techniques that, in themselves, have nothing to do with online instruction. An important example was Derek Bok, mentioned above, whose chapter on teaching in *Higher Education in America* nicely summarised the value of replacing passive learning in large lectures with active learning based on structured interventions. Bok featured teaching techniques developed at the college level in the 1990s by his Harvard colleague, the physics professor Eric Mazur:

> To begin with, his use of questions forces students to think carefully enough about the underlying principle of physics that they are able not merely to repeat it but to apply it to a problem that has not been discussed. Because students know that they will be asked to solve problems during class, they pay closer attention to the lecture. The instant feedback Mazur receives by the use of clickers tells him and his students whether or not real learning and understanding have been achieved or whether he should take more time to help students overcome their lingering confusion. The discussions in small student groups allow those with wrong answers to recognize why they erred and to think of better ways to approach the problem. At the same time, students with the right answer deepen their understanding by trying to figure out why their neighbors have erred and how they can be helped to understand why another answer is correct.
>
> Of course, the time taken by interrupting the lecture to discuss a problem means that less material can be covered. This realization leads many instructors to protest that they cannot afford to use such methods. Yet instructors who cannot bear to sacrifice content take no account of how quickly information disappears if it is understood superficially, and how much longer students will retain material if they have learned it well

> enough to apply it to new problems. Thus, when Professor Mazur tested his students using his new method, they not only showed far greater understanding of the underlying principles, they also did somewhat better on questions requiring recall of material covered in the lectures (Bok 2013: 192–93).

Problem-solving, active engagement and interaction, Bok explained, lead to that holy grail of college cognition – content recall coupled with an 'understanding of the underlying principles'. Mazur achieved this excellent result by in effect replacing a lecture with a constellation of seminars, and through an enormous investment of time and mental energy by instructors and students alike. There is no question that learning is increased through increased feedback, student effort and systematic application of new concepts to the solving of problems. Bok naturally wanted to see these results generalised.

But Bok's chapter slid from Mazur's active learning techniques to the general effort to 'utilise computers' in 'online education' in order to lower costs. To represent this, he invoked Carnegie Mellon University's Open Learning Initiative, which combines face-to-face instruction with computer-assisted learning in 'blended' or 'hybrid' courses and are generally considered the gold standard in the ed-tech world (Bok 2013: 194). But hybrid courses are not 'online education' in the sense popularised by MOOCs: they are more like highly evolved versions of language courses, in which students take a class with a professor and other students and then supplement class time with 'language lab' practice at oral comprehension and speaking.

Next, Bok cited a study of another set of hybrid courses in which students learn as much as in face-to-face courses 'while spending an average of 25 per cent less time on the course'. He also touted apparent 'cost savings to the institution ranging from 19 to 57 per cent compared with carefully selected control groups enrolled in courses with different types of conventional formats' (Bok 2013: 195). In fact, students spent 25 per cent less time in class because of the hybrid format, while their study time increased somewhat. And the cost savings were not generated by the actual courses in the study but by a hypothetical cost savings model based on the traditional cost-saving technique of increasing class size and replacing tenure-track faculty with adjuncts (Bok 2013, citing Bowen et al. 2012).

The unfortunate result was to confuse intensive active learning with online technology. Bok knew better, and in a later chapter called for rigorous testing to separate the pedagogical sheep from the instructional goats.

But the fact is that as of this writing the favourable online studies have shown that active learning is the most desirable future for teaching *without* showing that it is causally generated by online or computer technology as such (Bok 2013; Bowen et al. 2012; Lovett Meyer and Thille 2008; Shavelson 2010; Thille 2008; Twigg 2003).

Online advocates like Bok conflated three separate things: active learning, hybrid courses and online education. When they did this, they were in effect confusing two different kinds of MOOCs. One was the connectivity MOOC, or cMOOC, that had long been associated with experiments in democratic and distributed higher education in Canada led by George Siemens, Stephen Downes and others. Embodied in the theory of learning known as 'connectivism', it stressed the value of peer-to-peer student interaction, student self-direction of learning processes and project-based results.[8] cMOOCs were named as such around 2008, but connectivism had been in development for at least ten years before the MOOC wave hit in 2011.

The MOOC wave eclipsed the cMOOC with a second type, the scalable or xMOOC. Its lead developers were not educational theorists or practitioners but software engineers. They had built learning management systems (LMS) and were influenced by the success of online course modules developed by Sal Khan in one direction – founder of free online course provider Kahn Academy – and by Lynda.com in another, an online workplace skills training company that was recently bought by LinkedIn. The xMOOC academic challenge was coding that would allow interactions to scale to hundreds of thousands or millions of users. They also faced the business challenge of turning their portal into a platform – a platform in the Silicon Valley sense that would control the flow of transactions and allow monetisation. Education scholars Fiona Hollands and Devayani Tirthali created a helpful summary chart (Figure 1).

In the right-hand column, the cMOOC gathers together many elements of creativity learning, particularly active, self-directed student learning in a quasi-democratic and participatory context. But these elements cannot simply be assigned to xMOOCs by virtue of the common presence of technology. Yet many people did exactly this, with additional reassurances that novel software programming would transpose cMOOC activities to the mass scale of the xMOOC.

The main strength of the mass MOOC or xMOOC was also its weakness. It claimed to solve access problems by driving the cost of delivery to near zero, and yet this threatened to massify college instruction all over again

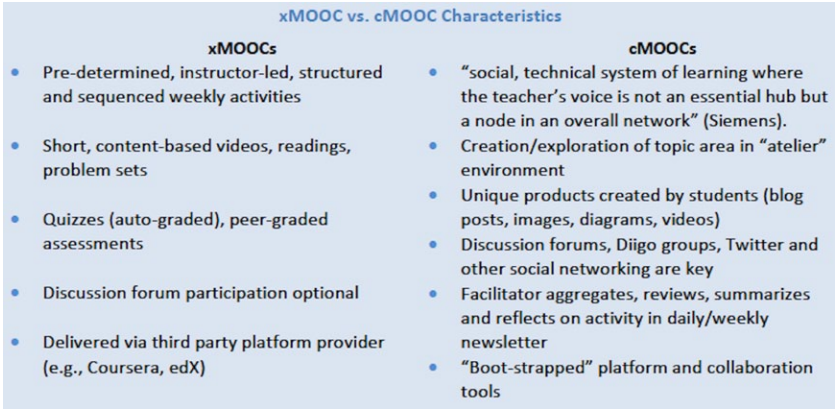

Figure 1. Comparison of two MOOC families

and guarantee poor results. The best-known xMOOC metric was that they had the worst student retention rates in the known history of higher education – in one study, 6.8 per cent of registered students completed a typical MOOC course (Parr 2013). Reducing costs to near zero by reducing learning to near zero was not the breakthrough most were hoping for. The passivity problems already created by large-scale lectures, teaching to the test and other symptoms of a crucial issue in U.S. education – permanent budget austerity – would only be made worse.

In practice, MOOC vendors tried to avoid this problem by adopting the rhetoric of cMOOC pedagogy. Any shortcomings in the current version would soon be solved by tireless coding efforts in the next version. They spoke of continuous interaction with students through techniques likes 'chunking' lectures into 7–10 minute segments punctuated by quizzes that forced students to apply their new knowledge to solve a problem. xMOOC providers often spoke of 'mastery-based learning' and 'adaptive learning', which would be made possible by simulating cMOOC-style participatory learning through programming grounded in learning analytics.

The xMOOC/cMOOC confusion was enabled by the managerial mode of university contracting that I mentioned above. The principal MOOC firms addressed themselves to politicians, financiers, investors, business managers and IT executives at major universities, rather than to the faculty as a whole. Those individual faculty who had started their own online courses were used to legitimate educational standards – except when they dissented from educational or cost estimates, in which case they were dismissed (Stark 2010). The debate was steered by a Schumpeterian bias towards tech-

nical solutions and against the effectiveness of human intervention, which justified the push towards implementation of online programmes before they had been validated. An older tradition of academic managers had held that efficient administration depended on trust among a university's various constituencies, particularly between administration and faculty (Kerr 1989: 141). But the MOOC wave was propelled by the opposite assumption, which was that efficient management depended on seeing faculty as a self-serving group that was putting their self-interest ahead of progress. Scholars like Candace Thille, a leading figure in the Open Educational Resources movement and in Carnegie Mellon's Open Learning Initiative, had raised valid concerns that faculty were better informed on their subject areas than on current pedagogical practice (Thille 2008). But these accurate claims were exaggerated into a belief in the general ineffectiveness of face-to-face college teaching. The attitude was crystallised by the president of San José State University, who had signed contracts for unproven course technologies with Udacity, but told a reporter that he was not worried about jumping the gun. 'It could not be worse than what we do face to face' (Kolowich 2013). With MOOC implementation ruled by prior conviction, it moved rapidly ahead.

Limited e-Learning

If xMOOCs were actually fulfilling their egalitarian promise to distribute the best educational resources to everyone, one proof would be that disadvantaged students in the U.S. would do *better* with online education than they do with the current face-to-face college system, with its big skews in resources.

In early 2013, I organised a research group to look into this question. We decided to compare similar types of institutions that used online strategies heavily or exclusively with those that did not. We were unable to use the Integrated Postsecondary Education Data System (IPEDS) from the U.S. Department of Education: it does not track MOOC companies or non-degree programmes in general. Nor does IPEDS 'contain school-level information on the demographic characteristics of students who are enrolled in online education' (Deming et al. 2015: 4). We included for-profits, and also took a special interest in community colleges. We created six panels of higher education institutions, using *US News & World Report* rankings to achieve similar ranges in each category of institution. We then contacted all of the online firms directly, requesting demographic and learning outcomes data.

It turned out to be very difficult to get any kind of data from existing online companies.[9] The new MOOC companies did not disclose it. But we forged ahead, and I offer our conclusions in provisional form.

Our first question was, how do online programme personnel compare to those of face-to-face programmes? Our hypothesis was that they would have reduced teaching staff compared to traditional colleges and universities. We first noted that virtually all of the higher education companies that used online as their primary teaching mode were for-profit companies. Even including the not-for-profit firms, distance-only institutions have one third as many full-time faculty as community colleges, and about one eighth as many as public research universities. Student–faculty ratios were the highest (worst) in the business – worse even than community colleges, and three times higher than the gold standard of liberal arts college. We concluded that existing distance learning colleges are at or below the bottom of the existing quality spectrum for colleges, defined as basic access to instructional personnel.

Our second question was, how do online programmes compare demographically? We found that a high proportion of their students were over the age of twenty-five – more than 80 per cent of them, or about twice the proportion we found in our community college group.[10] This finding is consistent with the online student profile that emerged from the 2011–2012 National Postsecondary Student Aid Study (NPSAS), based on 'a nationally representative cross-section of institutions and students'. The NPSAS data show that online students are older, have lower levels of parental education, are more likely to be single parents themselves, and are more likely to be working full-time while enrolled in school than are other college students' (Deming et al. 2015: 4).

The 'distance-only' institutions had five to six times the share of African Americans in their student bodies compared to our set of community colleges. They also had a larger proportion than all other types of not-for-profit colleges. (This was not the case for Latino and Asian Americans.) Compared to community colleges and four-year colleges, distance-only institutions had more than twice the proportion of Pell Grant recipients, a federal scholarship programme for which only lower-income students are eligible. The technology seemed to be reaching Black and low-income Americans who were not attending traditional colleges.

Our third research question was, do existing assessments show that online *technology* allows a comparatively low-quality learning context

(defined as few instructors for many students) to produce high-quality educational results for their relatively 'at risk' constituency (in this case, older, lower-income students with demanding work commitments, often African Americans who are more likely to have attended underperforming secondary schools).[11]

We looked first at arguably the most decisive recent study of a state-wide community college system. This study, conducted by Columbia University researchers at the Community College Research Center, used a dataset containing about 500,000 online courses taken by over 40,000 community and technical college students in Washington State.

For advocates of high-quality expansion, the results were distressing. The online format hurt rather than helped overall learning. And it hurt learning *more* for the underserved students that the MOOC boom is supposed to reach – in this case African Americans. The authors summarised their findings with unmistakable disappointment.

> Overall, the online format had a significantly negative relationship with both course persistence and course grade, indicating that the typical student had difficulty adapting to online courses. While this negative sign remained consistent across all subgroups, the size of the negative coefficient varied significantly across subgroups.
>
> Specifically, we found that males, Black students, and students with lower levels of academic preparation experienced significantly stronger negative coefficients for online learning compared with their counterparts, in terms of both course persistence and course grade. These results provide support for the notion that students are not homogeneous in their adaptability to the online delivery format and may therefore have substantially different outcomes for online learning …. These patterns also suggest that performance gaps between key demographic groups already observed in face-to-face classrooms (e.g., gaps between male and female students, and gaps between White and ethnic minority students) are exacerbated in online courses. This is troubling from an equity perspective (Xu and Jaggars 2013: 23).

This study suggested that online does not overcome learning problems that are known to correlate with sociocultural disadvantage but makes them worse.

Some MOOC advocates claimed that the new companies like edX, Udacity and Coursera would do a much better job than the incumbent online technologies: the new learning analytics are better, the programming is better

and these entrepreneurial companies are focused on using data to produce continuous improvement. Even if their students are not adaptive, as the Columbia study clearly found, the new-generation MOOC technology is.

This proposition received a preliminary test through a much-heralded partnership between Udacity and San José State University, one of the flagships of the California State University system that had been battered by continuous cuts in state funding in previous years.

Though it sits in the heart of Silicon Valley, SJSU is socially distinct from elite IT companies and their academic base, Stanford University, and serves a high proportion of first-generation college students, immigrant students and students of colour. In the midst of the economic changes of the last thirty years, Silicon Valley's celebrated tech companies have helped turn Stanford into one of the most powerful universities in the world, while local public colleges have been starved for funds. A major story on the subject noted that

> some, including De Anza College's president, Mr. Murphy, say the philanthropy and job creation do not offset Apple's and other companies' decisions to circumvent taxes. Within 20 minutes of the financially ailing school are the global headquarters of Google, Facebook, Intel, Hewlett-Packard and Cisco. 'When it comes time for all these companies – Google and Apple and Facebook and the rest – to pay their fair share, there's a knee-jerk resistance', Mr. Murphy said. 'They're philosophically antitax, and it's decimating the state'. 'But I'm not complaining', he added. 'We can't afford to upset these guys. We need every dollar we can get' (Duhigg and Kocieniewski 2012).

While the Valley's tech companies do not want to pay the taxes that support two-year De Anza College and San José State University, they do want to sell them learning tools like MOOCs. Can learning software help bridge the class divide that has been intensified through years of cuts to public college funding, cuts that flowed in part from Silicon Valley's prodigious ability to circumvent taxes?

The theory was tested in September 2013, when an NSF-funded study group published a report on the SJSU–Udacity pilot of three remedial courses (Collins 2013b). The students in these courses were by definition underprepared. The project specifically targeted at-risk populations, focusing on those who had previously failed a face-to-face version of a basic math course. The participating faculty members were generally impressed with

the materials. They believed that the content that had been developed in collaboration with Udacity had tremendous potential to advance students' critical thinking and problem-solving abilities; courses were more contextualised and more inquiry-based with added real-life contexts.

The pass rates in the Udacity-developed courses were disappointing – an overall average of 33 per cent, with fully matriculated students passing at 42 per cent. This compares unfavourably to the 74 per cent pass rate of the regular courses that Udacity's SJSU + plan was meant to replace (Collins 2013a; Rivard 2013). The switch to Udacity courses cut the SJSU pass rate in half.

The study confirmed that pass rates were linked not so much to the technology as to student effort. The clearest predictor of passing a course was the number of problem sets a student completed. Another major completion factor was the amount of time a student watched the video lectures, which offered a way of reviewing material, refining one's notes and spending more time trying to understand more difficult material. These key activities are traditionally known as *studying.* For various reasons, including the need to meet rising tuition costs by increasing paid work, students have cut back on this important activity in recent decades. No educator will be shocked to learn that students who studied early, often, steadily and persistently were more likely to pass. The quality of the studying process was the main driver of the pass rate. The low pass rate suggested that the online format did not improve the learning practices of most of the students identified as needing exactly that kind of improvement.

The NSF analysis of the Udacity pilot confirmed that technology cannot *replace* high-quality study time, but must enable or encourage it. Online technology can help increase study time, and help increase its persistence and regularity, both of which boost learning and retention of what is learned. It can set up Socratic interrogations in which students become the investigator of a problem as they test and deepen their understanding of course material in the process of trying to put it to use. But in reviewing these two studies and others, we have been unable to find evidence that a student's cognitive processes and learning activities are enhanced by the technology as such. Learning still takes time and effort, and MOOC programming does not appear to be offering technological short cuts. Concentration, focus, repetition, failure, self-correction and practice – these are among the essential learning processes that good technology can assist but not replace.

Online technology can also be an obstacle and a distraction. That was the case at SJSU where students had to navigate two separate websites for materials and puzzle through confusing instructions. The online medium produces poor communication as readily as people do – MOOCs are a combination of writing, programming, filming, editing and lecturing and are subject to the familiar law of 'garbage in, garbage out'. This is a particularly vital issue when a course includes students who do not yet really know how to learn. Learning is widely viewed as a complicated cluster of many simultaneous processes that must be strengthened, aligned and repeatedly practiced.[12] Online technology can help automate the practice of learning. It can offer a higher-order version of the Korean language lab where one has to spend hundreds of hours practicing Korean sounds, words and sentences on top of studying textbooks, doing grammar exercises, writing short paragraphs, watching Korean-language movies or TV shows, among many other activities – all of which the learner needs to integrate for progress to occur. This is the reality of human learning: learning is a process that can be regularised and intensified but not bypassed or compressed algorithmically. The best learners are those who have intensified, systematised and integrated their learning process. They do this by being reflective about their own learning process, by organising it carefully, by executing their study strategies consistently and by putting in the sheer hours that it takes to be really good at anything – 10,000 hours to mastery, by one estimate (Gladwell 2008). Good learners do not learn by thinking that a particular medium is going to do their work for them, or replace the self-conscious organisation that they use to fit the material into their own mental world.

Udacity implicitly agreed about the importance of individual learning practices by setting up a group of 'Online Support Providers' (OSPs) at SJSU. These were quasi-instructors who functioned as teaching assistants. They were available online to offer help to individual students. Their existence was another admission that online must be 'blended' with human interaction to be effective, which meant that its cost savings will be limited to non-existent – as I have already argued – *and* that the student's individual cognitive processes decide how much the student learns. One OSP described intended users as those 'who have the right background or knowledge and are ready to succeed in class, but they are just confused about something or frustrated, and they get stuck on something and can't get past a certain point for whatever reason. Getting these students … unstuck – that is where we are most effective'.. But this ad hoc intervention does not do enough for

the less-prepared students, who need day-by-day support and step-by-step continuous instruction in the learning process itself.

This is not something that online in itself can do. The mediocre results of the Udacity courses suggest, once again, that there is at present no technological escape from the step-by-step guidance that enables successful learning.

The students speak

Successful learning requires personal motivation. Deep learning requires continuous and sustained effort on the part of the student. It is time-consuming, engrossing and exhausting. It requires content mastery and reflection on one's learning processes, meaning that students need not only to learn data but also to synthesise it and integrate it, all while thinking about their procedures for doing these things. The complexities and repetitions of the successful learning process take away from free time and social life. Real learning is exhilarating but also frustrating. During the study process, its normal difficulties reduce one's sense of personal freedom and infinite possibility. Even adults are ambivalent about the effort real learning requires, and it is understandable that late teenagers and early twenty-somethings are as likely to dodge as to embrace learning of the higher kind.

Two members of my research group, Jenna Joo and Xiao Hu, conducted a series of pilot interviews with two dozen community college students that had online course experience, and found more dodging than embracing going on. Most of our subjects were international students who used English as a second language and had found themselves at the entry level of the U.S. college system. Their preparation was not comparable to that of students at highly selective colleges, and yet they appeared to value the same kind of teaching. They wanted an instructor who 'knows his students well', so that he 'knows our English levels and knows how we write'. They wanted an instructor who would 'meet one-on-one and advise them on what to do instead of directing them to go see a tutor'. Having a personal relationship with the professor created a learning atmosphere that 'feels good'. Research tends to confirm that a meaningful teacher–student relationship increases both perceived learning and actual learning outcomes.

But these students got none of this from their online courses. There they contacted instructors by email, who then, as the students had feared, referred them to tutors and on-campus learning centres. Online commu-

nication with professors is 'very challenging', one said, in part because it removes important information contained in gestures, expressions and other modes of interpersonal interaction. The students claimed that replacing instructors with peer-to-peer interaction decreased their learning. 'Peers always give positive feedback', one said, and they looked upon that process with reduced trust. They did not like being directed to the World Wide Web of online resources, which was too large and too uneven in quality. The perceived lower quality and their more negative experience prompted several to say they would not take online courses to cover their main course requirements, but only to satisfy general education requirements on topics they did not really care about.

The more alarming finding was that online courses encouraged students to *lower* their educational expectations. With online, several sought the 'easy professor', defined as one who 'doesn't take teaching or grading seriously'. They came to define the 'good' online course as one that has take-home exams so that students could complete them in groups. The good online course had also been offered many times before, so that students could use essays and other materials that previous students had written. For our interview subjects, the point of the online course was not to engage in the process of learning in all its intellectual complexity but to minimise the effort required to prepare work product for evaluation.

The 'good' online course offered conditions in which cheating shaded into collaboration and became semi-acceptable. Some students hired other students to write their essays for them, or turned in their friends' papers as their own. It is apparently not hard to find a student whose English or math is better than yours to sit at your computer and take your test. Whether or not they did these things themselves, students felt that online cheating was commonplace. The good online course, in other words, made cheating both possible and normal in that the online courses generally offered no personal bond of reciprocal trust that cheating would violate, and in most cases no intellectual ambitions that cheating would hollow out.

Cheating is the least subtle of online problems, and online providers as well as individual instructors are spending enormous amounts of time trying to devise security measures to reduce it. They are finding new ways to validate the student's identity and to ensure they are working on their own. Many of these measures, such as the monitoring of eye-movements through look-through technology, are invasive, and more appropriate to military than to educational contexts. Even if cheating were blocked in a

way that did not intrude on either privacy or learning, there would still be a problem when learning is reduced by the students' sense that they have been left to their own devices. In that case, they appear more likely to game the course in order to get by. Cheating is the most obvious form of gaming, but so is limited engagement and lower intellectual attainment that nonetheless results in course completion and a degree.

In our pilot sample, online courses faced resistance from students when instructors tried to compensate for their personal absence by increasing the number of assignments. The 'good' online course was the one that made lower demands on these students, not higher ones. Although learning technology can replicate certain kinds of focused testing and feedback, these functions form only a part of the overall learning process. One of the important intangibles that appeared in this small sample was the student experience of the instructor's personal *interest* in their learning. The centrality of interest to learning might be expected from readers of the psychologist Sylvan Tomkins, but it also appears in current cognitive psychology (Sedgwick and Frank 1995). Mary Helen Immordino-Yang finds, more generally, that 'social processing and learning generally involve internalising one's own subjective interpretations of other people's feelings and actions' (Immordino-Yang 2011: 99). Social identities and positive affective relations to others are part of learning itself. Recent findings in cognitive research on learning are beyond my scope here, but they feature the integration of a number of complex processes: addressing a problem before being given a solution, building contexts in which to fit new knowledge, building mental models to integrate key concepts, 'interleaved and varied practice' of information retrieval and effortful, active engagement.[13] Online technology can perform some of these practices as well as or better than live instructors, for some students. It performs other key functions less well, for most students. It appears actively to damage still other functions, such as reciprocal educational interest among students and their instructors. The MOOC wave put the cart before the horse, the technology before the desired learning experiences, the business model before the study of the technology's effects.

Techno-austerity: new responses?

The Year of the MOOC passed into history. By 2016, few higher education leaders were advocating ed-tech as a one-stop funding and educational fix. But I conclude by noting several major outcomes and their effects.

First, early results showed that the all-online xMOOC is not educationally viable. When xMOOC contracts involved formal, public evaluation and/or quality control from an established university, as in the Udacity projects at SJSU and Georgia Tech, the xMOOC stopped being a low-cost all-online service and became a hybrid course. It borrowed features of the cMOOC, and acquired many 'course assistants' and other educational personnel. At the time of writing, the original MOOC sales pitch of top quality at near-zero marginal cost has lost its primary audience. Few still argue that all-online programmes can replace most existing universities, as Sebastian Thrun had claimed in the 2011–2013 period (*The Economist* 2012).

Second, the ed-tech campaign retains its political power and will carry on. MOOCs succeeded in fixing the image of the American university as an uncured cost disease. In this paradigm, the only way to treat the university's disease is to cut its budgets. Since cost cutting is widely equated with replacing people with technology, thanks to the success of this strategy in manufacturing, ed-tech will remain at the head of the line of candidates for making higher education more 'efficient'.

The lesson from California is that ed-tech can deform or replace discussion of *educational* efficiency or effectiveness. The MOOC companies' tech claims sidelined the discussion of the public funding levels required by the democratic promise to fund quality education for *all* university students and not simply for those admitted to the most selective institutions. Udacity and Coursera gave the state's governor, Jerry Brown, an ironclad excuse not to reverse the twin double-digit budget cuts he had already inflicted on the University of California and the California State University in his first three years in office (Higbie 2012a, 2012b; Meranze 2013). At the same time, the entire political class assumed that the ed-tech solutions would come primarily from the private sector rather than from the universities themselves. MOOC firms thus reinforced the pincer movement that has enabled the gradual privatisation of public universities: cuts and austerity to public funds are coupled with granting private vendors access to an increasing share of the public remainder. The first attempt at this double movement failed (SJSU +), but this should be seen as a temporary setback. The neoliberal political economy of ed-tech is too powerful to be derailed by the limitations of its educational achievements. Anglophone political culture no longer requires serious evidence for its routine equation of privatisation with efficiency, and policymakers will continue to look to online technology

as an alternative to rebuilding public funding at levels that would support universal access to higher-order intellectual development.

Third, faculty generally disliked the MOOC wave but did not mount effective resistance. MOOCs occupied a grey zone between IT and teaching that administrators absorbed into their activities without presenting the boundary question to discussion and debate. The result was that MOOC contracts came to fall under administrative decision rights. Faculty review, where it did occur, remained defensive and largely out of public view.

One reason was that company executives disparaged classroom faculty as a group and cut them out of negotiations with universities, which were conducted entirely with top-level university managers, and validated by testimonies from a handful of faculty with MOOCs of their own.[14] But another reason was lack of faculty conviction about democratic educational goals. The critique of xMOOC implications for labour practices, budgets and educational outcomes remained a specialty interest. Most faculty remained onlookers, treated to a 'he said she said' debate between entrepreneurial engineers like Daphne Koller, who said MOOCs would democratise higher education, and critics, often from education or the humanities, who called them an upgraded broadcast model that would not democratise cognitive capabilities. The public cannot generally tell the difference between good and bad learning practices: even in academia, most of us continue to learn in ways that current research suggests are ineffective. But more importantly, faculty, including faculty senates, did not set about defining terms and establishing quality standards for tech-based democratisation. In particular, faculty did not pick up cMOOC standards for participatory learning and start to specify educational standards for contemporary democracy and political economy.

The direction of ed tech after MOOCs depends on whether faculty, including research faculty, get directly involved in defining quality higher education. The MOOC period showed that the one supposedly indubitable area of faculty expertise and control, instruction, could in fact be taken away from educational experts and handed over to technologists. Faculty will need to break apart the xMOOC/cMOOC confederacy that Udacity, Coursera and xEd confected in 2012, and which lingers on to support hopes for continuing austerity and increased managerial control. They will need to start defining the goals and modes of public education at the university level, or private vendors will do it for them.

Christopher Newfield is Professor of literature and American studies at the University of California, Santa Barbara. Much of his research is in Critical University Studies, which links his enduring concern with humanities teaching to the study of how higher education continues to be re-shaped by industry and other economic forces. His most recent books on this subject are *Unmaking the Public University: The Forty Year Assault on the Middle Class* (2008) and *Ivy and Industry: Business and the Making of the American University, 1880-1980* (2003). A new book on the post-2008 struggles of public universities to rebuild their social missions, called *The Great Mistake,* will be published by Johns Hopkins University Press in Fall 2016.

Email: cnewf@english.ucsb.edu

Notes

1. See, for example, the overview statement of how the Internet was transforming higher education by a leading 'new learning' advocate (Davidson 2011).

2. For the timeline, see Hill (2013a).

3. I refer to Tertiary-type A programmes (first-time graduates), excluding international student enrolments. Compare to Chart A3.2: First-time graduation rates in tertiary-type A and B education (1995 and 2012).

4. For one vivid example of the challenges faced by a low-income student, see DeParle (2012).

5. Ed tech analyst Phil Hill disputed the claim that MOOC experiments with public colleges (discussed below) aimed primarily at cost savings (Hill 2013b). He was correct that this aim was not as such written into the partnership or regulatory language he cites, but the larger motives and political aims are as I describe them in the text.

6. The article actually analyses price, not cost. Case studies can be found in Hollands and Tirthali (2014).

7. See, for example, Coursera's launch coverage in Games (2012).

8. See Siemens (2012) for a summary.

9. A total of ninety-seven national bachelor-level schools and twenty California associate-level schools were selected for comparison. The schools were classified into one of the following institution types: (1) Public Research Universities, (2) Regional Colleges, (3) Liberal Arts Colleges, (4) For-Profit Institutions, (5) For-Profit Institutions with Distance Learning Only, and (6) California Community Colleges. Schools for the first three groups were selected from the top 40 US News Report's 2013 Best Colleges Rankings (http://colleges.usnews.rankingsandreviews.com/best-colleges). Identifying and selecting schools

for the fourth category was rather challenging since their rankings were not available. Furthermore, many for-profit institutions are subsidiaries of larger parent companies and are located in multiple locations throughout the country, making selection difficult. Twenty schools that had comparable data available in the National Center for Education Statistics website were selected from the list of for-profit institutions in Wikipedia (http://en.wikipedia.org/wiki/List_of_for-profit_universities_and_colleges). The fifth group had the smallest number of institutions throughout the country, as there were only twenty-seven of them. Seventeen schools that had comparable data in the National Center for Education Statistics were selected and included in the dataset. Lastly, twenty California Community Colleges were selected from the list on a website <http://www.schools.com/articles/top-25-community-colleges-in-california> and entered into the dataset. Since almost all schools in our dataset, except those in the Public Research University category, did not have significant numbers of research and public service faculty (according to NCES), only the percentages of instructional faculty were used for comparison. Percentage of full-time instructional faculty could be a useful metric to surmise educational quality of an institution.

10. Online Research Group calculations, conducted by Jenna Joo.

11. See, for example, Orfield and Frankenberg (2014).

12. For an accessible overview of these and related conceptions of learning, see Brown, Roediger and McDaniel (2014).

13. For an accessible overview of these and other concepts from current cognitive research, see Brown, Roediger and McDaniel (2014).

14. On the categorical disparagement of faculty by MOOC advocates at an important industry event, see Samuels (2013).

References

Arum, R. and Roksa, J. (2011) *Academically Adrift: Limited Learning on College Campuses*, Chicago: University of Chicago Press.

Bok, D. (2013) *Higher Education in America*, Princeton, New Jersey: Princeton University Press.

Bowen, W.G., Chingos, M.M., Lack, K.A. and Nygren, T.I. (2012) *Interactive Learning Online at Public Universities: Evidence from Randomized Trials*, ITHAKA <http://www.sr.ithaka.org/sites/default/files/reports/sr-ithaka-interactive-learning-online-at-public-universities.pdf> (accessed 9 April 2015).

Brown, P.C., Roediger III, H.L. and McDaniel, M.A. (2014) *Make it Stick: The Science of Successful Learning*, Cambridge, MA: Harvard University Press.

Charmichael, M. (2012) 'Harvard, MIT to partner in $60 million initiative to offer free online classes to all', *The Boston Globe*, 2 May <https://www.bostonglobe.com/metro/2012/05/02/harvard-mit-partner-million-initiative-offer-free-online-classes-all/cejIeF0GFEB705YzK6urnI/story.html> (accessed 7 May 2016).

Collins, E.D. (2013a) *Preliminary Summary: SJSU+ Augmented Online Learning Environment Pilot Project*, September <http://www.sjsu.edu/chemistry/People/Faculty/Collins_Research_Page/AOLE%20Report%20-September%2010%202013%20final.pdf> (accessed 21 January 2015).

Collins, E.D. (2013b) *SJSU+ Augmented Online Learning Environment (AOLE) Pilot Project Report*, September.

Coursera (2015a) 'Our Mission' <https://www.coursera.org/about/> (accessed 31 January 2015).

Coursera (2015b) 'Effectiveness of online learning' <https://www.coursera.org/about/> (accessed 3 February 2015).

Davidson, C.N. (2011) 'Five ways the open web can transform higher education', *Now You See It* <http://www.cathydavidson.com/2011/12/five-ways-the-open-web-can-transform-higher-education/> (accessed 6 December 2011).

DeMillo, R.A. (2011) *From Abelard to Apple: The Fate of American Colleges and Universities*, Boston: MIT Press, 142–43.

Deming, D.J., Goldin, C., Katz, L.F. and Yuchtman, N. (2015) *Can Online Learning Bend the Higher Education Cost Curve?*, National Bureau of Economic Research Working Paper 20890 <http://www.nber.org/papers/w20890> (accessed 28 January 2015).

DeParle, J. (2012) 'For poor, leap to college often ends in a hard fall', *New York Times*, 22 December <http://www.nytimes.com/2012/12/23/education/poor-students-struggle-as-class-plays-a-greater-role-in-success.html> (accessed 2 April 2015).

Department for Business, Innovation and Skills (BIS) (2013) *The Maturing of the MOOC*, BIS Research Paper Number 130, September.

Duhigg, C. and Kocieniewski, D. (2012) 'Apple's tax strategy aims at low-tax states and nations', *New York Times*, 28 April <http://www.nytimes.com/2012/04/29/business/apples-tax-strategy-aims-at-low-tax-states-and-nations.html> (accessed 29 April 2012).

Games, L. (2012) 'Stanford professors launch Coursera with $16M from Kleiner Perkins and NEA', *All Things D*, 18 April <http://allthingsd.com/20120418/stanford-professors-launch-coursera-with-16m-from-kleiner-perkins-and-nea/> (accessed 21 January 2015).

Gladwell, M. (2008) *Outliers: The Story of Success*, New York: Little, Brown.

Haynie, D. (n.d.) 'Liberal Arts Colleges with low student-faculty ratios', *U.S. News & World Report* <http://www.usnews.com/education/best-colleges/the-short-list-college/articles/2014/04/22/liberal-arts-colleges-with-low-student-faculty-ratios> (accessed 1 February 2015).

Higbie, T. (2012a) 'Jerry Brown, vanguard of the digital revolution: he googled It', *Remaking the University*, 23 November <http://utotherescue.blogspot.com/2012/11/jerry-brown-vanguard-of-digital.html> (accessed 3 February 2015).

Higbie, T. (2012b) 'The Governor's thinking has become very uptight', *Remaking the University*, 25 November <http://utotherescue.blogspot.co.uk/2012/11/the-governors-thinking-has-become-very_25.html> (accessed 5 February 2015).

Hill, P. (2013a) 'MOOC Mania: Stanford AI course creates media sensation two years ago', *e-Literate*, 4 August <http://mfeldstein.com/mooc-mania-stanford-ai-course-creates-media-sensation-two-years-ago/> (accessed 9 April 2015).

Hill, P. (2013b) 'You know what would help MOOC articles? Getting the facts and goals right before analyzing', *e-Literate*, 20 August <http://mfeldstein.com/you-know-what-would-help-mooc-articles-getting-the-facts-and-goals-right-before-analyzing/> (accessed 21 January 2015).

Hollands, F.M. and Tirthali, D. (2014) *MOOCs: Expectations and Reality*, New York: Teachers College, Columbia University <http://cbcse.org/wordpress/wp-content/uploads/2014/05/MOOCs_Expectations_and_Reality.pdf> (accessed 9 April 2015).

Immordino-Yang, M.H. (2011) 'Implications of Affective and Social Neuroscience for Educational Theory', *Educational Philosophy and Theory* 43, no. 1: 98–103.

Jaschik, S. (2015) 'Well-prepared in their own eyes', *Inside Higher Ed*, 20 January <https://www.insidehighered.com/news/2015/01/20/study-finds-big-gaps-between-student-and-employer-perceptions> (accessed 9 April 2015).

Kerr, C. (1989) 'The academic ethic and university teachers: a "disintegrating profession"', *Minerva* 27, nos. 2/3: 139–56.

Koller, D. (2012) 'What we're learning from online education', *TED* <http://www.ted.com/talks/daphne_koller_what_we_re_learning_from_online_education> (accessed 9 April 2015).

Kolowich, S. (2013) 'California State U. system will expand MOOC experiment', *The Chronicle of Higher Education*, 10 April <http://chronicle.com/blogs/wiredcampus/california-state-u-system-will-expand-mooc-experiment/43361> (accessed 13 April 2013).

Lovett, M., Meyer, O. and Thille, C. (2008) 'The Open Learning Initiative: measuring the effectiveness of the OLI Statistics course in accelerating student learning', *Journal of Interactive Media in Education* 1: 13 <http://jime.open.ac.uk/article/view/142/jime-2008-14.pdf> (accessed 11 April 2015).

Mangan, K. (2012) 'MOOC mania: it's raising big questions about the future of higher education', *Chronicle of Higher Education*, 1 October <http://chronicle.com/article/Massive-Excitement-About/134678/> (accessed 9 April 2015).

McAuley, A., Stewart, B., Siemens, G. and Cormier, D. (2010) 'The MOOC model for digital practice' <http://www.elearnspace.org/Articles/MOOC_Final.pdf> (accessed 9 April 2015).

Means, B., Toyama, Y., Murphy, R., Bakia, M. and Jones, K. (2009) *Evaluation of Evidence-based Practices in Online Learning: A Meta-analysis and Review of Online Learning Studies*, U.S. Department of Education.

Meranze, M. (2013) 'Paved with good intentions', *Remaking the University*, 7 April <http://utotherescue.blogspot.co.uk/2013/04/paved-with-good-intentions.html> (accessed 2 February 2015).

Mortenson, T. (2012) 'Family income and unequal educational opportunity, 1970 to 2011', *Postsecondary Education Opportunity*, November: 1.

Newfield, C. (2013) 'Where are the savings?' *Inside Higher Ed*, 24 June <http://www.insidehighered.com/views/2013/06/24/essay-sees-missing-savings-georgia-techs-much-discussed-mooc-based-program> (accessed 2 February 2015).

OECD (2014) *Education at a Glance 2014*: *OECD Indicators*, OECD Publishing <http://www.oecd.org/edu/Education-at-a-Glance-2014.pdf> (accessed 11 April 2015).

Orfield, G. and Frankenberg, E. (2014) *Brown at 60: Great Progress, a Long Retreat, and an Uncertain Future*, UCLA Civil Rights Project <http://civilrightsproject.ucla.edu/research/k-12-education/integration-and-diversity/brown-at-60-great-progress-a-long-retreat-and-an-uncertain-future> (accessed 1 February 2015).

Pappano, L. (2012) 'The year of the MOOC', *New York Times* 2 November <http://www.nytimes.com/2012/11/04/education/edlife/massive-open-online-courses-are-multiplying-at-a-rapid-pace.html?pagewanted=all&_r=0> (accessed 21 January 2015).

Parr, C. (2013) 'New study of low MOOC completion rates', *Inside Higher Ed*, 10 May <http://www.insidehighered.com/news/2013/05/10/new-study-low-mooc-completion-rates> (accessed 10 May 2013).

Pope, L. (2007) *Colleges That Change Lives: 40 Schools That Will Change the Way You Think About Colleges*, Penguin.

Rivard, R. (2013) 'Udacity Project on "Pause"', *Inside Higher Ed*, 18 July <https://www.insidehighered.com/news/2013/07/18/citing-disappointing-student-outcomes-san-jose-state-pauses-work-udacity> (accessed 21 January 2015).

Samuels, R. (2013) 'A university without faculty: the demise of the university of Phoenix and the rise of the MOOCs', *Changing Universities*, 28 January <http://changinguniversities.blogspot.com/2013/01/a-university-without-faculty-demise-of.html> (accessed 3 February 2015).

Sedgwick, E.K. and Frank, A. (eds) (1995) *Shame and Its Sisters: A Silvan Tomkins Reader*, Duke University Press.

Shavelson, R.J. (2010) *Measuring College Learning Responsibly: Accountability in a New Era*, Stanford University Press.

Siemens, S. (2012) 'Connectivist learning theory', *P2P Foundation* <http://p2pfoundation.net/Connectivist_Learning_Theory_-_Siemens> (accessed 25 January 2015).

Stark, P.B. (2010) 'Creator of Berkeley's first online course tells all', *Remaking the University*, 11 August <http://utotherescue.blogspot.co.uk/2010/08/creator-of-first-berkeley-on-line.html> (accessed 1 February 2015).

Straumsheim, C. (2016) 'Georgia Tech plans next steps for online Master's degree in Computer Science', *Inside Higher Ed*, 27 April <https://www.insidehighered.com/news/2016/04/27/georgia-tech-plans-next-steps-online-masters-degree-computer-science> (accessed 27 April 2016).

The Economist (2012) 'Learning new lessons', 22 December <http://www.economist.com/news/international/21568738-online-courses-are-transforming-higher-education-creating-new-opportunities-best> (accessed 25 June 2013).

Thille, C. (2008) 'Building open learning as a community-based research activity', in T. Iiyoshi and M.S. Vijay Kumar (eds) *Opening Up Education: The Collective Advancement of Education through Open Technology, Open Content, and Open Knowledge*, Cambridge, Mass: The MIT Press, 165–80.

Twigg, C.A. (2003) 'New models for online learning: improving learning and reducing costs', *Educause*, September/October: 28–33.

Universities UK (2013) *Massive Open Online Courses: Higher Education's Digital Moment?*, London, Universities UK.

Usher, A. (2013) 'The future of MOOCs: Coursera and EdX', *Higher Education Strategy Associates*, 19 November <http://higheredstrategy.com/the-future-of-moocs-coursera-and-edx/> (accessed 4 August 2015).

Xu, D. and Jaggars, S.S. (2013) *Adaptability to Online Learning: Differences across Types of Students and Academic Subject Areas*, CCRC Working Paper No. 54, New York: Columbia University.