Ubiquity Symposium

MOOCs and Technology to Advance Learning and Learning Research

MOOCs: Symptom, Not Cause of Disruption

by Lewis J. Perelman

Editor's Introduction

Is the MOOCs phenomenon a disruptive innovation or a transient bubble? It may be partly both. Broadcasting lectures and opening up courses via MOOCs by itself poses little change of the academic status quo. But academia is part of a broader academic-bureaucratic complex that provided a core framework for industrial-age institutions. The academic-bureaucratic complex rests on the premise that knowledge and talent must be scarce. Presumed scarcity justifies filtering access to information, to diplomas, and to jobs. But a wave of post-industrial technical, economic, and social innovations is making knowledge and talent rapidly more abundant and access more "open." This mega-trend is driving the academic-bureaucratic complex toward bankruptcy. It is being replaced by new, radically different arrangements of learning and work. The embrace of MOOCs is a symptom, not a cause of academia's obsolescence.

Ubiquity Symposium

MOOCs and Technology to Advance Learning and Learning Research

MOOCs: Symptom, Not Cause of Disruption

by Lewis J. Perelman

Much ink—both liquid and digital—has been spilled lately about the question of whether the recent efflorescence of massive online open courses (MOOCs) constitutes a truly "disruptive" innovation in higher education.

But that issue begs a more fundamental question: If MOOCs are disruptive, what exactly are they disrupting?

Academia as an institution serves multiple purposes. Some of those are explicit and others are implicit or tacit. The explicit agendas are trumpeted in universities' catalogs, ads, and other publicity. Those overt messages generally speak of the services institutions promise to students, alumni, communities, business, and so on. The tacit agendas are largely focused on the enrichment and aggrandizement of the institution itself.

But academic institutions are only a subset of a larger, industrial ecosystem that I have called the academic-bureaucratic complex. The industrial ethos of Taylorism or "scientific management" is the guiding philosophy of the academic-bureaucratic paradigm. In that larger context, the principal function of academia is to filter, sort, and produce units of human capital to serve as cogs of the bureaucratic machine.

Denizens of the elite (or even lesser) research universities likely would demur. They would insist that their institutions' primary mission is not merely to provide vocational training—rather it is to create new knowledge. But such institutions have long emphasized their acute interest in cultivating what they call the academic profession. As a practical matter, generating research is inseparable from what is commonly discussed as "filling the pipeline" with researchers. The apprenticeship of the academic profession is no less vocational training than any other kind.

The Ethos of Knowledge Scarcity

As I noted in my book, *School's Out*,[1] sociologist Max Weber defined the essential character of bureaucratic organization as "the exercise of control on the basis of knowledge." Both academia and bureaucracy—and academic bureaucracy—rest on the premise that knowledge must be scarce. I need to explain why I say "must be."

First, historically knowledge was costly to acquire, record, and accumulate. In earlier times, academic clusters accreted around libraries. Because books were created and copied by hand, they were extremely expensive. So libraries were sequestered behind walls, with access carefully guarded.

Scholars thus needed to be hierarchically organized to determine who was most qualified to gain access to peruse the scarce knowledge encoded in a library's collection of books.

The physical scarcity of books bred a secondary scarcity of academic expertise. The scholars who had the most access to the most books became best qualified to teach what they learned to others. But in the absence of modern communication media, that could only be done in a confined physical setting, with an audience limited by the range of direct sight and hearing.

Academic clusters were both threats to and valuable assets for political leaders. And academia depended on the patronage of the wealthy and powerful both to accumulate and to protect its valuable troves of knowledge. So academia has long been connected to political power. Not coincidentally, because pre-industrial political power was more or less theocratic in most places, academic organizations also acquired an aura of sanctity.

Gutenberg's printing press disrupted much of the social structure of the West, including academia's traditional arrangements. (It also helped set the stage for the industrial revolution.) Printing drastically reduced the cost of encoding and disseminating knowledge.

Yet the ethos of scarcity on which both academia and bureaucracy are grounded persisted. The knowledge scarcity, which started as a physical necessity, became an imperative for institutional survival. Arguably too, while printing made information cheaper and more abundant, it made expertise more visible and more valued. Machiavelli published *The Prince*, like many management gurus who followed, as a tool to market his services as a political consultant to prospective clients. The limited bandwidth of print preserved most of the scarcity value of scholars and experts even as the abundance of print inflated their reputations. For the most part, tutoring and consultation still required physical proximity.

Even the later, expanded bandwidth of audio and visual recording, of photography, radio, film, and television did not dent the perceived scarcity value of the *in vivo* interaction between guru and acolyte.

So what we now call the paywall around academia not only remained edified, but was even bolstered by expanded publicity. Meanwhile, the pay required to enter the academic sanctum was not only in lucre but also in various tokens of talent, social status, connections, religious or fraternal fidelity, and such.

Today, modern technology is proliferating encoded information exponentially. The sheer mass of information in almost any interesting subject is too great for any individual or even group of would-be experts to digest. Knowledge sharing and collaboration are seen as essential both to innovation and to security.

Yet the academic-bureaucratic complex strives to protect the cult of the expert and to sequester knowledge in academic compartments and bureaucratic stovepipes. A few of the myriad ways it does so include: Make diplomas a necessary ticket to employment. Raise tuition and other costs to keep diplomas scarce. Identify institutional prestige with exclusivity. Make elite diplomas from elite institutions necessary tickets to elite employment. Create competition for admission to elite preschools, to get into elite grade schools, to get into elite high schools, to get into elite colleges, and so on.

Further, create credential and other barriers to limit who gets to teach, who gets to do research, who gets to publish, who gets access to data and publications, and who gets elected to the professional clubs and appointed to the bureaucratic posts that control these valves and turnstiles.

Beyond that, lobby and litigate to infinitely extend copyright, patent, and other intellectual property shields, and hoard them to thwart competitors and extract monopoly rents.

The access to teaching and learning that MOOCs target is an important part, but still only part of this mix of constraints aimed at keeping knowledge scarce.

Disruption of the Academic-Bureaucratic Complex

This is the context within which to consider the question of whether and how the recent boom in MOOCs may be truly disruptive to the academic-bureaucratic complex.

If MOOCs are merely a new medium for the same old processes with the same old objectives for the same old demographics, any change they introduce will not be particularly transformational. To that extent, the proliferation of MOOCs is merely a bubble—a case of “old wine in new bottles.” But in a larger context, it may be viewed as one symptom of a broader, more metamorphic transition.

The MOOC may be to an unfolding cognitive revolution what the Stanley Steamer was to the automotive revolution: one of several game attempts to replace an obsolete system, but an inadequate one.

In my view, as I first wrote 20-plus years ago,[2] the salvation of the modern economy and its further progress requires the wholesale replacement of the academic-bureaucratic complex with a radically different sociotechnical system. Both the necessity and opportunity for that mutation I continue to see driven by explosively changing information and other technologies – innovations which in turn are rattling the foundations of established, arthritic social and economic structures.

I also foresaw that the sheer mass, inertia, sprawl, and dynamic conservatism of the academic-bureaucratic complex were unlikely to yield compliantly to mere reforms. Rather, the complex would likely go the way the Soviet Union did: through bankruptcy, collapse, and replacement.

In the wake of the financial and economic upheavals of the past several years, the signs of academia's endemic insolvency are becoming more apparent: Recent graduates in many countries are finding that their diplomas are purchasing few or no employment opportunities. Their rates of unemployment and underemployment range from 15 to 50 percent. Heavy debt burdens weigh down students and their families, or in some cases the governments that subsidized their university studies. The costs of academia have soared faster than inflation or median family incomes. Income in postindustrial economies is becoming more unequally distributed, with a small technocratic elite harvesting more of the gains while much of the middle class sinks toward poverty.

Looming on the horizon is "The Singularity" foretold by computer scientists and other analysts: Robots and other automatons are fast evolving to be capable of performing even sophisticated labor more efficiently than humans can.

To think that simply blasting entertaining lectures to the Internet masses is going to transform academia is to imagine that adding a turbocharger to the horse was going to save it from being replaced by a drastically different kind of transportation system.

But in combination with several other emerging forces, the MOOC wave may be helping to weaken the bolts and joints and buttresses that are propping up the creaking academic establishment. If nothing else, when senior faculty and other denizens of Stanford, Harvard, MIT, and other elite universities first launched MOOCs and then founded MOOC ventures such as Udacity, Coursera, and edX, they reinforced the view that the standard academic model is obsolete. That in turn helps legitimize completely independent, innovative systems that are springing up outside the academic-bureaucratic complex.

Some of the other rumblings of gathering disruption of the academic-bureaucratic complex include:

- Student loan debt now exceeds total credit card debt. A growing number of baby boomers are seeing their retirement savings cannibalized by student loans they cosigned for their unemployed children or grandchildren.
- Community college graduates are out-earning bachelor's degree holders.
- Financier Peter Thiel established fellowships for students who drop out of college to launch their own ventures.
- Open science and open innovation are harnessing the power of crowdsourcing to create breakthroughs in problems that have stymied academic experts.
- New open publishing models, such as the Public Library of Science, are further exploding the scarcity paradigm of academic research, liberating research results from the paywalls of most academic journals.
- Recruiters are increasingly ignoring resumes, instead probing the social network presence of prospective employees.
- Employers are also looking more for concrete evidence of skills and experience rather than academic credentials. A new crop of startups—like entrepreneur David Blake's Degreed—are developing ways to provide employers with metrics of individual knowledge and skills independently of academic credit-hours and diplomas. Meanwhile, a growing number of employers already are ignoring diplomas and resumes in hiring. Instead they are using online simulations and other tests to directly assess applicants' capabilities to perform on the job.[3]

These kinds of trends are blowing up the central premise on which the academic-bureaucratic complex is founded: Knowledge and talent are scarce commodities, which only the academic factory can produce and certify.[4]

Christensen's Vision of Disruptive Innovation

Clayton Christensen authored the concept of "disruptive innovation." Last year he made a widely noted comment that, as a result of the MOOC wave, "In 15 years from now half of US universities may be in bankruptcy, including state schools…and in the end I'm happy to see that happen."[5]

Yet the MOOC boom mostly has come from within academia itself, and Christensen's own conception of disruptive innovation is that it almost always comes from outside the established industry that gets disrupted. In fact, more recent commentaries from Christensen and staff of his institute reinforce the idea that MOOCs probably won't transform the academic status quo.

Rather, Christensen and his colleagues now suggest that "facilitated networks or adaptive learning platforms—like Khan Academy and Knewton—may actually be better positioned than MOOCs (in their current forms) to improve learning and serve massive numbers of students with tailored offerings."[6]

In short, what will really disrupt academia is not mass production of impersonal teaching but mass access to personalized learning, plus employment selection based on demonstrated competencies, not academic credentials.

The Empire Strikes Back

While dynamic innovations may create the potential to disrupt conventional academic institutions, no one should expect a system as pervasive and deeply rooted as the academic-bureaucratic complex to simply fade away like an army of old soldiers. It would be a mistake to discount the ability of huge organizations or cartels (the Too Big To Fail perhaps) to use their political, financial, and other kinds of clout to block or even destroy the invaders who threaten their turf. Rather, as in the "Star Wars" saga, The Empire Strikes Back. Especially the academic empire.

The late sociologist Seymour Sarason often warned of the difficulty would-be reformers would face in attempting to make any substantial, lasting change in academia:

> *It is not a self-correcting system; there are no means, procedures, forums through which the system "learns." It is a system with a seemingly infinite capacity to remain the same in the face of obvious inadequacies, unmet goals, and public dissatisfaction.*[7]

Signs of Backlash

Signs of turmoil and backlash within academia in response to the looming threat of telematic disruption are already evident.

The University of Virginia was roiled in 2012 when the head of its Board of Visitors, along with some trustees and alumni, moved to fire the university's president. Released emails and subsequent public comments indicated that among the unhappy overseers' key complaints was that UVA had failed to jump on the MOOCs bandwagon which had garnered so much buzz for other elite universities. But the president, Teresa Sullivan, would not go quietly. The backlash from her along with outraged faculty, students, and alumni unleashed a brouhaha that made national news. The resulting political heat ultimately prompted Virginia's governor to force a truce, which left both Rector Helen Dragas and President Sullivan in their jobs. While UVA did

begin offering MOOCs through Coursera, its internecine battle for and against innovation continues to boil.

The California State University system, in an attempt to lower costs, is pushing experiments giving its students credit for online courses licensed through MOOC consortia. Philosophy professors at San Jose State rebelled and refused to accept a philosophy course developed for edX by Harvard professor Michael Sandel. With perhaps a twinge of irony, a group open letter from the San Jose State faculty members to Sandel protested that being forced to teach his course on "Justice" would be, in effect, an injustice to them and their students. "…[W]e believe," they wrote, "that having a scholar teach and engage with his or her own students is far superior to having those students watch a video of another scholar engaging his or her students." [8] What may have added to faculty anxiety: As part of a pilot project at San Jose State, students in one section of an electrical engineering course that relied heavily on materials from edX passed at a higher rate (91 percent) than students in the regular sections (60 percent).

The San Jose State professors expressed the fear that higher education was devolving into a two-tiered system: "Privileged" students at wealthy institutions would get taught by "a real professor" while "disadvantaged" students consigned to underfunded state or private colleges would have to settle for canned courseware and minimal interaction with faculty that the MOOC system had rendered into little more than "teaching assistants." The worry seems widely shared. Amherst faculty rejected online courses from edX and the faculty council of Duke's college of arts and sciences voted 16 to 14 to deny graduation credits for taking online courses through 2U.

When some governors and other state officials called for a $10,000 bachelor's degree a couple of years ago, a former university president reflected the widely skeptical reaction, calling such notions "improbable and impractical in any sustained or scalable way."[9] Yet Georgia Tech already has partnered with Udacity to launch a complete master's degree program in computer science online for a total cost per student of only $7,000, about one-sixth of the normal cost.[10]

Fortifying the Status Quo

Beyond these spasmodic skirmishes, the ramparts defending the academic-bureaucratic complex from disruption loom large.

One of the least appreciated factors thwarting the displacement of academia is the power of athletics, at least in the United States. While the athletic department may be a profit center in only the top tier of the National Collegiate Athletic Association, it often provides a magnetic axis around which the apparat binding alumni to colleges and schools rotates. The social power of the tribal affiliation to the "old school" is hard to break.

In the worst case, which while extreme is not unique, we have the sordid example of the Pennsylvania State University sexual abuse scandal. University administrators had labored to cover up dozens of criminal acts of sexual abuse on its campus over a period of years, possibly decades. Students rallied en masse to protest the firing of venerated football coach Joe Paterno along with other participants in the cover-up. While the NCAA imposed financial and other penalties on the football program—which had been earning over $50 million in annual profits—it spared Penn State from the so-called "death penalty," a complete ban. Yet several of the university's trustees and alumni sought to appeal the NCAA sanctions as too harsh, and criticized the university's new president for accepting them.

It is not hard—especially for those who track technological trends—to foresee automated, adaptive learning systems replacing teachers and classrooms; and an array of performance-certifying mechanisms providing a more productive dashboard for talent management than academic diplomas. But it is harder to envisage the virtual replacement for the tribal glue of football and basketball teams, with their para-feudal icons and colors.

While less egregious than the sports juggernaut, other dependencies of the academic empire pervade just about every other public and private institution in modern societies, and pose stubborn impediments even to much-needed transformation. Defenders of the academic-bureaucratic status quo already disdain any credentials earned via online or other nontraditional media as no better substitute for a "real" college degree than the General Equivalency Diploma is for a "real" high school education. More substantively, the money to pay for education—which might otherwise be applied to fund learning through other means—is generally tied to institutional accreditation. And accrediting agencies are controlled by consortia of academic institutions.

A similar barrier to change is presented by professional and other vocational associations that, over the span of several decades, have been increasingly inclined to make academic credentials a prerequisite for admission to practice. For instance, a century or so ago, it was common for bar associations to allow bar examination applicants to "read law" as preparation. Now all but a handful of jurisdictions require applicants to have a diploma from a law school approved by the American Bar Association.

Government statutes and regulations also make accredited academic credentials a requirement for employment or promotion, not only for jobs in government agencies but in other sectors as well. While the phrase "or equivalent" may be attached to job specifications, human resource departments and hiring managers generally are not inclined to risk selecting competence over credentials.

Actually, in most modern organizations, HR staff and managers usually have relied on their own academic credentials to gain admission to the positions they hold. To abandon diplomas and credit hours as criteria in selecting other employees might call the managers' own qualifications into question.

Meanwhile, the alumni network that is mutually boosted by athletic programs serves not only as a source of financial support for academic institutions but also as a potent lobbying asset to protect and project the institutions' political interests. The unions and guilds whose members' incomes and dues derive from academic payrolls supplement the political clout arrayed to defend the status quo.

Doing and publishing research are central to advancing academic careers and academic institutions. Despite their image as an engine of innovation, the high paywalls of academic journals—subscriptions can cost thousands of dollars and a single article is commonly billed at $30 to $50 or more—stand as a competition barrier which the academic-bureaucratic complex strives to protect. Since substantial research funding depends on government, political pressure is growing to assure that government-supported research results are made freely available to the public. The multi-billion-dollar academic publishing industry—and the academic elite that depend on its aura of exclusivity—are lobbying intensely to block or dilute government mandates for open access publishing.

The New Luddites

All these ploys and others are aimed at creating or maintaining the scarcity of things—opportunities for learning, teaching, research, publishing, working, creating, earning— that in the emerging sociotechnical order are abundant. Or, at least they could become abundant in the absence of academic-bureaucratic obstruction.

Well, the abundance might not extend to the "earning" part. That presents an increasingly nettlesome dilemma. Ever more open access to information and ever cheaper, smarter, more powerful tools shatter barriers to entry. Many more people can become capable providers of all sorts of products and services, and thus have an opportunity to capture revenue. But the resulting fragmentation of markets leaves the mass of players competing for minimal slices of income. Network effects may concentrate available income among a few "stars," but their individual dominance may be more transitory.

Economist Paul Krugman has sympathetically compared the plight of a growing number of today's skilled workers to that of the 19th-century Luddites, who rebelled against automated machinery that threatened their employment. He notes that a recent report from the McKinsey Global Institute includes "automation of knowledge work" among a list of major disruptive new technologies. Krugman correctly induces that "some of the victims of disruption will be workers who are currently considered highly skilled, and who invested a lot of time and money in acquiring those skills."

Recalling the distress inflicted on the Luddite rebels of Britain's wool industry some two centuries ago, Krugman concludes:

> *… [T]he modern counterparts of those woolworkers might well ask further, what will happen to us if, like so many students, we go deep into debt to acquire the skills we're told we need, only to learn that the economy no longer wants those skills?*
>
> *Education, then, is no longer the answer to rising inequality, if it ever was (which I doubt).*[11]

The End of the Empire

Where does this all lead?

The burgeoning productivity of ever more intelligent automata may greatly increase global income and wealth. But Krugman and other economic theorists are floundering to figure out how to distribute income and wealth as the academic-bureaucratic model of employment is obliterated. One thing that is clear is that more-of-the-same will not be the answer.

So as prodigious as the battlements of the academic-bureaucratic complex may seem, even more so is the tsunami of technological, economic, and social change that is rising against it. MOOCs at best are but one ripple in that gathering wave.

First, the upward spiral of academic costs is unlikely to survive the clash with the emerging reality of diminishing socioeconomic returns on diplomas. MOOCs might be part of a process for bending the academic cost curve downward. But increased production of diplomas further diminishes their value as positional goods. Making diplomas cheaper and more accessible does not salvage their diminishing utility in any other way either.

During the interim transition to whatever the post-Singularity economy may look like, far more cost-effective means for individuals to acquire economically valuable competencies seem bound to increasingly supplant the academic paper chase. The IT industry itself has been a pioneer in this shift—for decades it already has been providing ways to learn and certify specific, in-demand technical skills, independently of academic institutions.

The MOOCs movement, in search of a viable business model, now is mimicking that development as it gropes toward mechanisms to independently test and certify student achievement. But if it aims the technique simply toward generating more credit hours and diplomas, that effort will be fruitless.

Rather, there is likely to be rapidly expanding development of omni-accessible, collaborative and adaptive learning systems, far more intelligent than current models such as Khan Academy. These new systems can assess individual aptitudes and interests, match them with present and projected career opportunities—including entrepreneurial opportunities as well as "jobs"—and

provide customized learning and support to attain the needed competencies better, faster, and cheaper than anything academia can offer.

Nor is the universities' role in research and development exempt from cascading disruption. In the developed countries, the retirement, health care, and other costs of aging populations will cannibalize a growing share of government resources, leaving public research funding to stagnate or decline. The public sector share already has become minor compared to the research funding provided by the private sector. But private companies' R&D investments have tended increasingly to target practical, profitable results more than basic discoveries.

Already, the success rate of research grant proposals in medical science and other fields has declined toward single digits as the feeding frenzy for research grants pushes against a fixed or falling ceiling of available funds. One way or another, pressure will rise to increase the productivity of R&D investments.

A gathering trend toward open science and open innovation, coupled with crowdsourcing and crowdfunding seems to provide the key to blowing open R&D bottlenecks.

One example: Researchers at the University of Washington used an open, multiplayer (nearly a quarter million registered players) computer game called Foldit to solve a protein-folding problem in days that had stumped academic researchers for years. "I worked for two years to make these enzymes better and I couldn't do it," said one of the post-docs in the university research group. "Foldit players were able to make a large jump in structural space and I still don't fully understand how they did it."[12]

Another example: Innocentive, Inc., has served a host of major public and private organizations with its "…global network of millions of problem solvers, proven challenge methodology, and cloud-based technology…to help our clients transform their economics of innovation through rapid solution delivery and the development of sustainable open innovation programs."[13]

U-thanasia

Around the time Henry Ford launched the Model T, the horse transportation system— which had been dominant for millennia—was a massive industry. It directly or indirectly provided a major share of employment and overall business activity. The horse industry and culture reacted to the automotive threat intensely, sometimes even violently. [14] Despite assertive efforts by the horse establishment to stem the soaring popularity of motorized vehicles, though, the long-established industry's resistance to transformation was inevitably destined to fail.

"All the forces in the world are not so powerful as an idea whose time has come," Victor Hugo aptly observed.

Big industries and systems are disrupted, more or less fatally, when innovations come along that can serve human needs not only that the incumbents cannot serve as well, but often that the incumbents cannot even imagine. That is the fate that now faces academia, for those very reasons.

Even the greatest empires fall, often broken by their own brittleness, exhausted by their own defenses. *Sic transit gloria academia*.

About the Author

Dr. Lewis Perelman has over forty years of professional experience concerned with the processes of innovation, sustainability, and resilience. He has worked with numerous public and private organizations on strategy, policy, planning, and assessment—as a consultant, analyst, author, publisher, and teacher. In addition to consulting, Dr. Perelman has held senior positions in several leading think tanks and research institutes, including the Solar Energy Research Institute, the Jet Propulsion Laboratory, the International Institute for Applied Systems Analysis, Hudson Institute, and the Homeland Security Institute. For contact and further information, see www.perelman.net.

DOI: 10.1145/2591680

Author's Notes

[1] Lewis J. Perelman. *School's Out: Hyperlearning, the New Technology, and the End of Education*. William Morrow, New York, 1992; Avon Books, 1993.
[2] Several early publications are available (to subscribers) at http://www.scribd.com/collections/3199537/Human-Intellectual-Capital; some also may be found at https://www.researchgate.net/profile/Lewis_Perelman/publications/.
[3] "From CEB, online tests that help employers figure out whether you should be hired," *The Washington Post*, May 9, 2014.
[4] Among the many sources providing evidence of the kinds of trends listed, here is a sample:

"For those who rely on traditional methods of résumé screening, Lahti's research has led to some worrisome conclusions. 'There's almost zero correlation,' between résumé accomplishments and job performance, Lahti said."

"Some companies, especially those in the tech world, are going even further, saying they're no longer interested at all in an applicant's tried-and-true laundry list of jobs, education, awards and activities.

Hiring managers often can gain a better sense of a person's judgment, personality and communication skills by perusing their Twitter feeds or Tumblr posts, they say."

This was recently reported on the front page of *The Washington Post*: "The [US} has the world's most extensive and sophisticated system of higher education, yet top executives warn of a crisis in the science, technology, engineering and math disciplines considered to be at the core of global economic competitiveness. German companies such as Siemens in Charlotte or Wacker Chemical, which is building a working model of its polysilicon plant to train potential employees at Chattanooga State Community College, say German-style apprenticeship programs might help untie the knot."

Still in its early stages, Degreed along with some others is making progress toward documenting individual learning from many sources other than a diploma: "Kirsner's interviews also uncovered a current trend in hiring: education itself is becoming less important as portfolios and work samples are starting to take precedence."

And from *Fortune*: "Carey sees Degreed's offerings as one potential solution to this challenge. By his reckoning, the next wave of disruptive education-related technology will be focused on showing evidence of learning. Credentials are just about 'organizing information in a useful way,' he argues, and if startups like Degreed can provide such information clearly and meaningfully, then MOOCs have a shot at credibility."

This summarizes a collection of views from more than a dozen highly successful business leaders of what they think is most important in making hiring decisions: "Resumes and qualifications are less important than they seem. These leaders also look for passion, and seek people with unusual experience that can add something new."

Meanwhile, evidence that certificates from community colleges often lead to higher incomes than undergraduate or even graduate diplomas includes: "Nearly 30% of Americans with associate's degrees now make more than those with bachelor's degrees, according to Georgetown University's Center on Education and the Workforce. In fact, other recent research in several states shows that, on average, community college graduates right out of school make more than graduates of four-year universities."

"With the right major, California community college graduates can out-earn workers with bachelor's and master's degrees—often by a lot."

And again, college/university diplomas now provide better assurance of burdensome debt than of employment opportunity: "Nearly half of grads from four-year colleges are working in jobs that don't require a four-year degree."

Finally, here is an argument from an HR expert that traditional job requisitions—emphasizing academic credentials and years of experience rather than work performance—should be abolished: "Get Rid of Job Descriptions and You'll Hire Better People."

And then there is this concluding point in an essay on "6 Ways Tech Will Change Education Forever": "The university of tomorrow will not look like a university (or a MOOC)."

[5] [Watch] "In 15 Years From Now Half of US Universities May Be in Bankruptcy" Clay Christensen. WiredAcademic. March 20, 2013.
[6] Michael Horn and Clayton Christensen. Beyond the Buzz, Where Are MOOCs *Really* Going? *WIRED*, February 20, 2013.
[7] Sarason, Seymour and Robert L. Fried. *The Skeptical Visionary*. Temple University Press, 2002; p. 230.
[8] "Why Professors at San Jose State Won't Use Harvard Professor's MOOC," *The Chronicle of Higher Education*, May 2, 2013.
[9] "The $10,000 bachelor's degree: gimmick or real?" *The Washington Post*, November 30, 2012.
[10] Tony Onink. Georgia Tech, Udacity Shock Higher Ed With $7,000 Degree. *Forbes*, May 15, 2013.
[11] For example, see: Paul Krugman. Sympathy for the Luddites. *The New York Times*. June 13, 2013.
[12] Jessica Marshall. Victory for Crowdsourced Biomolecule Design. *Nature* News, January 22, 2012.
[13] http://www.innocentive.com/about-innocentive
[14] See: Brian Ladd. *Autophobia: Love and Hate in the Automotive Age*. University of Chicago Press, Chicago, 2008.