

“Massive Online Opportunities for Cash”

Reflections on Online Higher Education

**Paul Franz, Tanner Veal, Liam Aiello, Dan Meyer, Ritu Tandon, and participants in the Stanford
Graduate School of Education’s course: Education’s Digital Future**

12/4/2012

Introduction

This paper is a summary of presentations and conversations had over the course of two weeks in Stanford's Education's Digital Future (EDF) course. The bulk of discussion in these two weeks was inspired by a talk given by Adrian Sannier, Vice President of Product at Pearson. Pearson is a publishing giant making a transition to the broader online learning ecosystem. Sannier, a recent hire, is a part of the team reimagining Pearson's future, and as a part of that process he reimagines education's future broadly.

We quote liberally from Sannier's presentation in this paper, as well as from students in the course. While we provide some framing for these comments, the bulk of the paper is a curated set of discussion board posts.

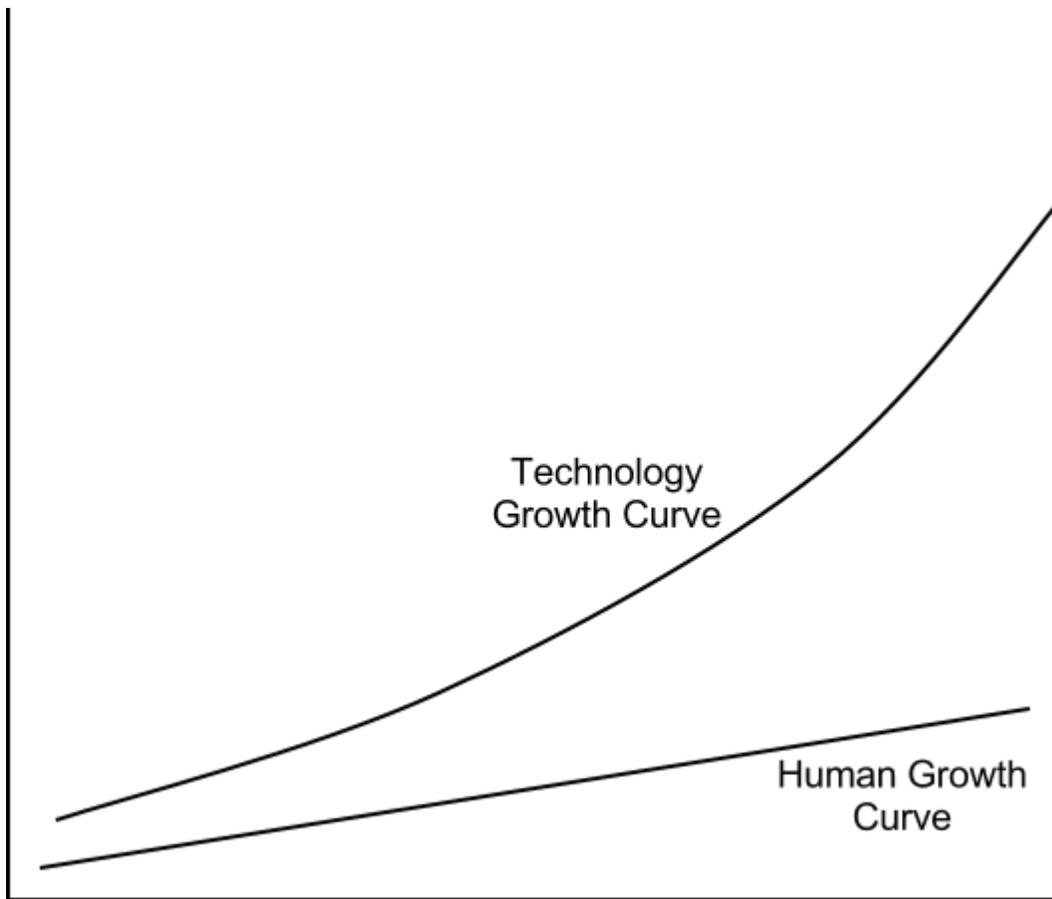
The paper is divided into six sections. The first section deals with disruptive innovations in education and in particular the way that technology changes the way that education platforms might improve themselves. The second section deals with Massive Open Online Courses (or MOOCs) in more detail. The third treats the rise of Big Data in education. The fourth ponders the limitations of MOOCs and the importance of traditional education practices. The fifth is concerned with markets, money, and credentials. Lastly, the sixth section explores potential names for the ongoing technological and educational revolution that inspired the course.

All six sections overlap, and a few themes run throughout the paper. In particular, doubts, reservations, and critical questions about the direction of education can be found throughout. While there is a guarded optimism amongst the student population in EDF, there are none who would rush blindly into an unknown future without first thinking carefully about where we've been, where we are, and where we're going.

One thing we do all agree about, however, is that education is changing. Why should education change? Sannier offers this observation, in an age of technological, data-driven innovation: "What technology do you know that in 15 years has done so little? I believe the market is going to make this change." Education is changing because it can't afford not to any longer.

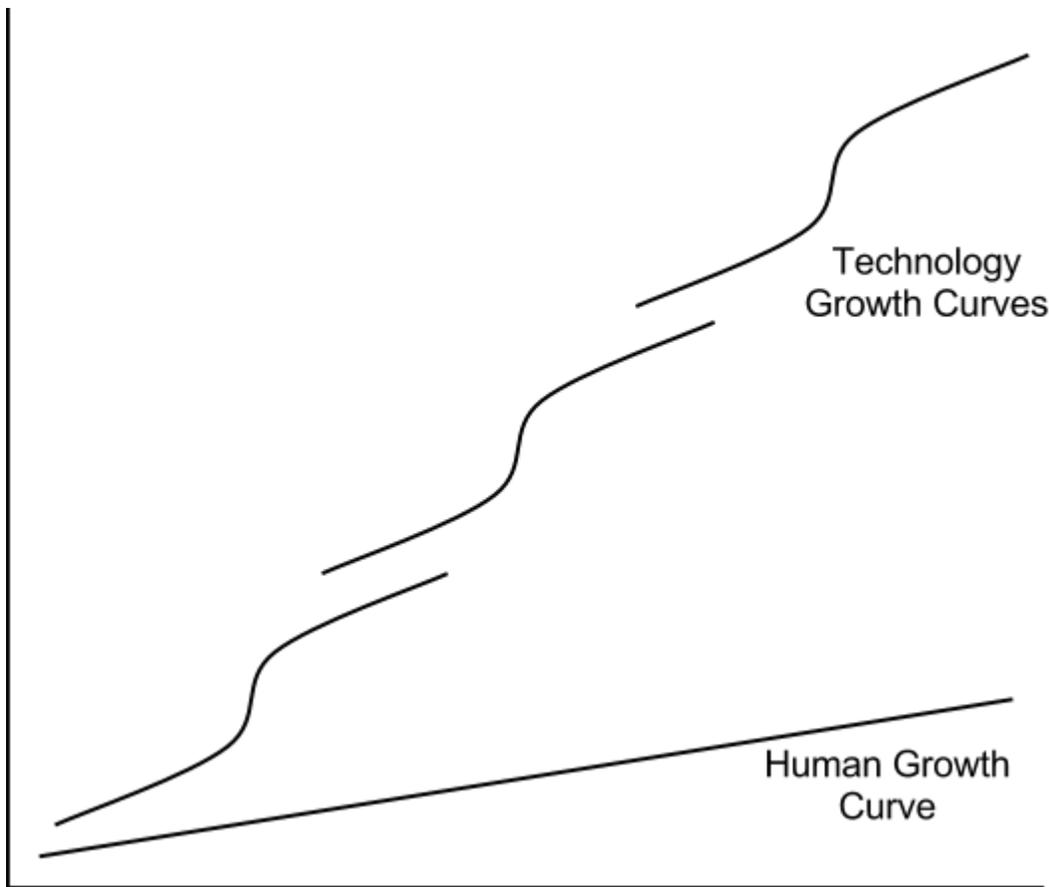
Disruptive Innovation and the Technology Growth Curve

The lynchpin of Adrian Sannier's presentation was a conceptual graph contrasting human improvement with technological improvement:



Sannier: “This curve haunts my dreams, because I think it is the curve that comes over and over again as we live in this technological age. [The lower curve] is the curve humans live on. It’s the one where you get a little better every day, just a little bit better. Maybe if you spend a lot of money, you can tilt that curve a little bit up or a little bit down. But generally speaking, this is how humans get better. [The higher curve], this is how Google gets better. You know, like one minute you can search the web and you type things in and the answers come back, and then you turn away and come back, and 6 months later it’s reading your mind... It doesn’t stop getting better, and at this incredible rate. And some of our institutions are going to be challenged to keep pace with that curve. This is why students get bored... The pressure that comes on us as these devices, as this information technology capability that seems to be at the heart of this curve accelerates, I think our institutions have to adapt.”

He explained this graph further by redrawing the technology growth curve as a series of “S-curves,” with small jumps between each one, signaling technological innovation:



Sannier: “I was with John Seely Brown a couple of weeks ago and he talked about the idea that that curve I just showed you is actually this curve right here. You have a series of S-curves that show technological progress. And when you zoom in on one, when you are on the tail end of one, like the information technology curve that founded information technology at the academy, it like accelerated, and then they flatten out, they stop giving, the golden goose stops giving eggs. But if you jump to the next curve then it goes again. And this process is what generates that exponential curve in the large. So making these jumps, this is how an institution adapts to this change.”

These growth curves call to mind the idea of disruptive innovation (Christensen, 2008), a theme that Sannier and student commenters pursued in their discussion of the future of education. There are many disruptable aspects of the education system, but a few in particular were oft-mentioned.

Greg Bybee: “Adrian Sannier opened by describing the lackluster ‘digital textbooks’ of the past decade, decrying them as nothing but pixelated versions of print with nothing fundamentally new. But in many ways, the MOOC is exactly that as well—just a large 100,000 person lecture. It opens opportunity—but how should we grab it?”

Johnny Winston: “As Adrian Sannier argued, you can put a digitized copy of a physical textbook in the hands and on the screens of students and call it progress, but you are just scratching the surface of what technology can do for education. You can use a MOOC to provide video lectures to thousands of students like never before, but if you use the simplistic teaching topology that Adrian outlined (a “rock star” teaching many) you will fall short of what is possible with a cooperative, hierarchical network between students, teachers, and content-creators. Adrian brought up this quote from Herbert Simon: “Improvement in Post-Secondary Education will require converting teaching from a ‘solo sport’ to a community based research activity.” I believe that technology can not only scale teaching, it can also improve teaching outright by decreasing communication and cooperation barriers between all stakeholders in the education ecosystem (students, teachers, content-creators etc.)”

Textbooks are an easy punching bag, but as Winston suggests, they are but an analogy for more systemic issues. The MOOC has taken the world of higher education by storm, threatening to become the kind of disruptive innovation that lets us jump from one growth curve to another, as Sannier would have it.

As Kirsten Howell notes, we’re on the cusp of an information revolution: “With the rising costs of higher education becoming catastrophic for the average family and almost comical for students from lower socioeconomic households, a counter-revolution was bound to emerge. As is, public facilities that once were symbols of affordable opportunity for students now are approaching yearly private tuitions. Classes are over-enrolled and graduating in four years is often impossible, not for lack of effort but due to the inability to enroll in the necessary classes to fulfill major and minor requirements. The extended time it takes to get a degree leads to further debt accumulation and prolongs one’s entry to the workforce. And what’s worse is once you actually do graduate; the prospects of getting a job out of college have greatly diminished in recent years. This leaves recent grads piled high with debt and striving to make ends meet working in the service industry or similar positions. In response, given the tide of innovation in

digital technology and the corresponding increases in global connectivity and access to Information Revolution has arrived.”

Notably, in Howell’s view this revolution is not called a “learning revolution.” Surely learning has more to it than information. To quote T.S. Eliot: “Where is the Life we have lost in living? / Where is the wisdom we have lost in knowledge? / Where is the knowledge we have lost in information?” These may be inspiring times, but the unbridled optimism of Sannier is not universally shared. Reservations, concerns, and counter-arguments were common themes throughout our discussions of disruptive educational technologies, and MOOCs in particular. Julia Cambre wonders about both students and instructors in this brave new world of the MOOC and the flipped classroom (wherein students watch lectures as homework, and work on problems in class).

Cambre on students: “There is this presumption that I come across quite often that all students (including those taking the on-campus versions of the courses) will get more out of the flipped class/MOOC. Trying to convert a traditional course into an online course or flipped class is complicated, and if done poorly, will be just as bad (or worse) at engaging students and teaching the material than a lecture.”

Cambre on instructors: “I think this is exciting, yet really tricky territory for the professors trying to balance their MOOC and their on-campus courses, and I hope that those who do become global ‘rock stars’ can continue to be excellent professors within their original university communities as well.”

Cambre is not alone in voicing these kinds of concerns. Molly Bullock suggests that it’s not just about students and instructors, either. Technological growth curves, she remind us, need human agents to drive them, and there’s more to making a MOOC than just pressing a button.

Bullock: “Assuming that MOOC platform providers will figure out how best to parse, utilize, and deliver the findings of the big data generated from a MOOC, Sannier is also putting a lot of faith into the notion that this will be used for ongoing iteration of course content and delivery. It is this continuous improvement, he claims that will bump us from the human curve to the technology growth curve. But MOOC making is a lot of work, so much work in fact that iteration is likely to be a slow process, mediated by those same old human limits of time, energy, and effort. After recording and editing countless hours video lectures, how likely would you be to modify your pedagogy and revamp your course between offerings after seeing that your

competition is more 'effective'? It seems likely that while rock star professors take on MOOCs as an extra to their already full load, that growth curve based on continuous improvement might resemble human style growth more than Google style growth.”

Bullock’s observations suggest two other major topics—which are deeply intertwined—that we’ll address next. The first is the relationship between the MOOC and the existing higher education system, and the second is Big Data.

MOOCing Out

Adrian Sannier is so bullish about the technology growth curve in large part because of the MOOC. We offer three quotations from his presentation that show why he’s so enthralled. The first concerns student engagement:

“Just picture what the expectation of students are as they use all these other things and every other domain of their life works like this. That let them communicate with people quickly, let them look up all these things, make all these different connections, do all this stuff. The one place they will see what they want to see is in a course like that. The one place they will see it is in a MOOC.”

In short, MOOCs are inevitable because students will demand them. His second quotation concerns scale:

“The only way that we can move the institution forward in terms of its information technology infrastructure is to find partners who are driving on that curve, who are operating at scales 100 times to 1000 times greater than what we are operating on inside the institution.”

In short, MOOCs are inevitable because they are built on information technology, and not brick-and-mortar technology. The former is much easier to bring to scale, and can thus outcompete the latter. Think bookstores and newspapers and video rental.

The third quotation is a provocative view of the results of this disruptive technology:

“How many of you have seen Epic 2020? That says, at the end, by 2020, there are only a couple of universities left, Google and Apple, and everyone else, except the kings of course, like Harvard and Yale ... will be wiped away and replaced by MOOCs.”

Whether this is true or not, or whether Sannier totally agrees with it or not, this is a bold claim. 2020 is only seven years away. Is it really the case that today’s high school freshmen will graduate from primarily digital institutions of higher education?

Sannier offered a more nuanced view of what the MOOCification of education will look like. While it may involve a thinning of the professoriate, it does not necessarily mean the total death of all local institutions. Indeed, he predicts partnerships between elite universities, community colleges, and high schools as they develop general education courses for the masses.

Sannier: “Watch a set of universities, small, partner with a set of community colleges, larger, partner with a set of high schools, larger still, to agree to work together to design the first one, and then continue to iterate that. And by these signs you will know the world is going to change.”

Sannier disparages the “sole proprietor model” that pervades education, wherein a single teacher has total control over her version of a course. Why, he wonders, should thousands of professors and high school teachers who teach the same material each do it differently? Brian Perone raises an objection here. What happens if you devalue the role of the teacher?

Perone: “While Adrian spent a lot of time arguing against the sole-proprietor model of education, he neglected to mention the positives of such a model. Ownership imbues the owner with a sense of pride, a desire to make the product that bears their name the best that it can be. If you strip that away, if you make teachers feel less responsible for their classes, is that really going to improve instruction? Do we want teachers (or at least the majority of teachers) to view themselves as craftsmen or as assembly line workers in an education factory?”

Why not put all the material into a MOOC, and let the instructor be a tutor? Surely that saves us at least in part from Perone’s assembly line? On this front Sannier sees the need for progress in how MOOCs work: “Tutors are an amazing technology to invent, passing on their expertise, helping people understand what their zone of proximal development is, helping them know which problems to try, and which problems to give up on... Study groups. The single biggest indicator of whether or not you will succeed in college is whether you form a collaborative study group. Those are missing from MOOCs. We just somehow hope they will emerge.”

So how will they emerge? Is scale alone the answer? Albert Lim thinks not:

“Scale is not the sole criterion by which we judge the effectiveness of academia, otherwise, universities such as Stanford will ensure that all its courses are run in large auditoriums which can seat thousands. ... Sannier's argument based on scale alone without considering other factors is overly transactional and one-dimensional.”

Show Me Your Big Data, Baby

While we're talking about scale, let's talk about data. Big Data. So Big that Big and Data must be capitalized. What is Big Data? There's no fixed answer, but an approximate definition is "bigger than you could reasonably deal with." So any data set that can't be loaded into a computer memory (or several computer memories), but rather must be accessed only piece-by-piece is a Big Data set. Think the kind of data that Amazon, Facebook, and Google collect.

Big Data is coming to education. For Adrian Sannier this is an exciting development, because Big Data is the key to the lock on the door to the technology growth curve.

"Big Data could help sole proprietors get better. No! Why? Because apart from did you come to class, did you read the book, did you do the assignments, what do classes have in common with one another even when they are in the same discipline? Not near enough to data mine. But teach it at scale, you don't think Andrew Ng's course is going to be unbelievable from the power of big data...people who look at this content, it's the Amazon.com-ification of education. People like you who like things like this will like things like that and will then buy them."

The implication is that if you learn from a resource, then Coursera or Udacity or some other platform can find other resources that people like you also learn from. This goes for any level of granularity, from whole courses to individual posts in forums or focused single-sentence suggestions. Sannier argues that this kind of data cannot really improve traditional education systems, because there's not enough to collect. But it can do wonders for classes at scale like Andrew Ng's "Machine Learning" course that had over 200,000 enrolled students.

Sannier: "If there are 150,000, 200,000 people taking this course, I wonder how much better that course gets term after term. How many people work on it? How much production value can be in it? How much analysis can be there to study which things worked, which things don't? Just imagine, year over year over year on that curve while Matthew Stone is slogging away on the human curve. I believe this, this is what changes the academy. The fact that there is now the ability to compare, and that one model can act on scale when the other cannot."

The potential of Big Data in education is tremendous. One need only look at other fields that have undergone data revolutions to see the seismic shifts that followed: advertising, sports

management, and health care are but three sectors where data has flipped (or is still flipping) traditional practice on its head.

Nevertheless, Big Data comes with some big questions. Privacy and data ownership is a common concern. Another is the kind of data that will be collected. Jason Randolph articulates this worry, reminding us that Big Data isn't always *good* data:

“While I’m all for analytics...I’m also very worried about the possible implications of this measurement and what meaning we might assign to it all. If high stakes tests like the SAT, definitions of aptitude, the repercussions of standardization, and the utility of intelligence quotients are all called to question in education’s changing landscape, will data and analytics replace them with anything better? Or will we continue to make far-reaching assumptions about what an individual knows and does not know?”

Clearly there’s a huge hole for a new branch of Learning Analytics research—composed of experts from both the Learning Sciences and applied Computer Science—to fill here.

Tradition, Co-Presence, and the un-MOOC-able

Big Data may be a disruptive innovation, but it faces a powerful ethos of “this is how we have always done it,” particularly in higher education. Tempting as it may be to write off doubts from academics who cling to tradition, there is reason for pause. Some courses may be un-MOOC-able. Some vital aspects of the educational experience may be impossible to replicate online. Some of the things that “we have always done” are done for good reasons; they work.

Albert Lim: “Good teaching is about the relationship and connection between the instructor and the student, and what often differentiates a great teacher from a mediocre one is the quality of relationship that teacher has with his/her students. The very fact that MOOCs are so massive simply means that students would only know of the MOOC instructor as a “talking head.” The de-personalization of the learning experience for students in MOOCs makes the learning experience a chillingly clinical one.

Rene Kizilcec: “Personally, my key concern with Education’s Digital Future is the development of social capital in the absence of physical co-presence. Adrian mentions this problem just in passing, because his vision of EDF circumvents this problem, because online learners are supposed to physically meet in tutor groups. I can see this scenario realized for K-12 education, but I’m skeptical when it comes to college level education. ... The formation of peer-

support groups needs to be encouraged and incentivized, because the social capital that is currently a by-product of education must not be undervalued.”

Physical co-presence—being in the same place as other human beings—is a bit of traditional education that works. It may not scale, and it’s difficult to collect data about, but it has proven effective (if not always cost-effective) for millennia. This is particularly true in the humanities, where the core material is not factual or procedural knowledge, where assessment is harder to do with multiple choice tests, and where the short and long term learning goals are less well-articulated than they are in most science, technology, engineering, and mathematics subjects. However difficult to measure, the outcomes of a humanities education might still be valuable.

Tanner Vea: “I’m concerned with the implications of how we conceptualize learners and teachers. If thinking about people and relationships in terms of various metrics is good for business, I wonder how this aligns with more humanistic goals. Even if it isn’t part of business plans, the datafication of students is something that it seems this technology is very good at. But are the metrics really capable of surfacing what’s most important about the learning that happens? Or put another way, if we come to see the metrics as valuable, if we come to rely on them as a primary representation of learning, what parts of the picture do we start to miss?”

As the saying goes, when all you have is a hammer, everything starts to look like a nail.

Beyond the classroom, there are other traditions that might be worth preserving. The Internet is no longer a new technology, and one of its hallmarks is openness. “Open” may be one of the Os in MOOC, but it may not stay that way. Tanner Vea again voices his concerns:

“What does it mean when we start to think of the university as a media company? Part of what is great about ... academia right now is that there is a valuable place for voices on the fringe, who may not be saying the most popular things (perhaps this is more applicable in the humanities), who are challenging the sources of power. Intellectual diversity could be a victim here. So when Sannier says, “No one’s making open source movies after all,” or, “We need a revenue stream in order to leverage the best technology,” I cringe. This sounds like a person with an interest in making sure the barriers to entry are high, and that’s not what the promise of digital media is about.

Also, most of the blockbuster movies that I see these days suck anyway.”

Vea's concerns are not just about openness of content, but about access to educational opportunity. In contrast to the mainstream narrative about MOOCs upending a deeply stratified education system, Vea suggests that stratification may actually increase, or at least it will transform:

“Excitement around data-driven accountability and digital innovations will be matched by a growing contingent of people who see these changes as antithetical to their humanistic ideals of education. ‘Small,’ ‘face-to-face,’ and other cultural markers of authenticity will become tropes of educational resistance movements, but they will also be commodified and sold at a premium.”

Computer Science for everyone, Literature for those who can afford it.

Meanwhile as we scramble to save and justify beloved traditions, Johnny Winston reminds us that a lot of the hype around MOOCs ignores that they are, in fact, reinforcing one key tradition: the lecture.

Winston: “The current MOOC madness is the equivalent of getting excited about a cost-effective new lecture hall that can now fit 500,000 students instead of 500. Yes, this is something to get excited about even if the experience of the 500,000-person virtual lecture hall is a little inferior to the physical co-present 500-student lecture hall. However, the question of access and distribution is just one small piece of education's digital future.”

There is more to the story than just scale, or even data. There's also the way that our lives are being reshaped by digital innovations in education, and in society more broadly. Molly Bullock offers a final word on the topic of tradition by reminding us that human interaction has a long tradition of layering innovation on top of existing structures:

“A glance back at the 'long view' of human interaction tells us that the tools and methods employed in communication are growing ever more complex. Think about the shift in culture and communication at the first embrace of written communication. This led to the development of science, mathematics, economics and other far more complex ways of thinking, doing, and being. But also adding to the complexity is the fact that this form of human interaction did not replace the existing one, it was layered on top of face-to-face communication. This layering, I am sure, had a profound impact on face-to-face interactions but the point here is that these interactions evolved to accommodate this new layer. The story is thus repeated for each new

layer, with the emergence of communication technologies, followed by network technologies and again with the emergence of cyberinfrastructure technologies. So the question is, with cyberinfrastructure layered on top of all of the other communication and information resources, how will our ways of thinking, doing, and being evolve?”

Dolla’ Dolla’ Dolla’ Bills Y’all

In his presentation, Adrian Sannier retold stories from his past working on educational software. “Occasionally we’d make a piece of educational content,” he explained, “but we’d have to take it out of our hide, always have to do it at a loss, and never got close to what our aspirations would be—never.” For Sannier, a prerequisite of making change on the technology growth curve is the presence of a market that can support longer term innovation in higher education. Sannier believes that the current nascent work on MOOCs can have a disruptive effect that opens up a space for just such a market: “I believe the pressure put on those institutions [that are not innovating quickly enough], coupled with the comparisons to those courses that are deployed on scale for free—those are going to put a tremendous selection pressure that could have the opportunity to create a market.” Once the doors are blown open, he suggests, a crowd of innovators will rush in to meet the newly revealed demand.

Indeed, there are signs that this transformation is already happening, but it may not be as disruptive yet as it has the potential to be. Greg Bybee notes how so far, reformers “are simply applying business principles to the education sphere. These principles include privatization, accountability, competition and choice, data analytics and measurement, lean operations, and technological disruption.”

Students had questions about the larger implications of this thinking. Attitudes ranged from inquisitive to highly skeptical. For instance, Emily Schneider wanted to know how market dynamics might impact the types of courses that are offered in a way that is divergent from traditional universities: “How many options will appear in a particular niche? How many Algebra I courses will be created? How many organic chemistry courses? Modernist literature? Labor economics? How much variance will they have? Will there be courses created for particular populations?”

There were also questions about the potential impacts of the market on students and teachers, and how they might experience pressure under a new system.

Kareem Edouard: “With 67,000 students in a course, will big business view this platform as a viable profit stream (potential of one teacher teaching 500,000 in one course for \$.99-10.99 a pop)? Pay for play certification and badges? Who certifies them? Cost?”

Anonymous: “Will professors with certain regional accents be more successful like newscasters from Midwestern states? Will students choose to watch ‘attractive’ professors over ‘good’ professors?”

Emily Schneider: “What are the mechanisms that will determine which professors become ‘rock stars’? Will there be a competitive marketplace of any type? The good teachers in a subject—particularly a basic subject—are not necessarily going to be at Stanford. So how will these people rise to the top?”

Implied in these questions is a hesitation over whether some invisible hand will provide the best outcomes. They hint at a suspicion that students might not get a fair shake, or that the educators that “rise to the top” might get selected on the basis of some other criteria besides pedagogical quality.

Students followed some of Sannier’s assumptions out to their extremes, and tried to paint a picture of what the future of higher education might look like. Shuchi Grover seemed to have some optimism: “This revolution will be driven by economics, plain and simple. Be it college degrees or textbooks, the age of unreasonably pricey commodities will end. Inflexible, pre-bundled offerings will essentially price themselves out of the market—unless they come up with some insanely attractive value proposition that will enable them to compete against the hacked model of higher education. Simply put, it’s the prices, stupid.”

Others wondered whether the market would morph to accommodate a new “high end” in higher education.

Tanner Vea: “Like mass-market paperbacks, giant MOOCs may be offered for very little money. At the same time, some rarefied experiences will be offered at a premium. Different employment trajectories will justify different individual choices, but going the ‘cheap’ route will foreclose certain opportunities to many at the same time that access is broadened.”

Liam Aiello: “Will handcrafted, personalized lessons be the new exclusive content, with scholars the online-learning version of the farmers market, offering ‘artisanal intro to ancient Greek’ alongside ‘artisanal macroeconomics’ at marked-up prices? Does the small liberal arts college have anything to contribute to the MOOC-dominated landscape?”

Yet other visions resembled dystopia. For example, Albert Lim predicted, “there will still be pockets who will continue to be denied access. It is also unclear how the financing of such a model would play out, perhaps through advertising in MOOCs? Imagine having commercial breaks in the middle of a Coursera video lecture!”

And what about the credentials we earn, and their value in seeking employment? Again, attitudes varied. Lucy Li wondered, “perhaps society will start to look at qualification and credentialing differently. Rather than hiring people because they graduated from an elite institution, companies can screen for the actual skills and knowledge needed to accomplish a task.”

Kareem Edouard hinted at the prospect of a double standard: “Stanford, MIT, Harvard, and Carnegie Mellon are currently pouring money, educational content and expertise into MOOCs to make them a reality. These same universities ... won’t be accepting new students or hiring professors who gain their accreditation through a MOOC ‘badge’ process, but with the right amount of spin they can use MOOCs as a philanthropic arm to share their knowledge with the world.”

One student quoted the work of David Labaree, Stanford historian of education: “You find that, when access to schooling increases, so does the stratification of schooling. More students come in at the bottom of the system in order to gain social access, and the system keeps expanding upward in order to preserve social advantage.”

Naming the Revolution

How did we get to this place? Mitchell Stevens led the class in a reflection on general themes in the development of higher education in the United States since the middle of the twentieth century. This spurred a brainstorm around the naming of a third revolution.

If Revolution one, from about 1945 to 1980, could be called “Massification” (because of the expansion and improvement of higher education, starting with the passage of the G.I. Bill), and Revolution two, from about 1980 to the present, could be called “Restructuring” (because of a slowed pace of growth and tightened funding), what might we call Revolution three? A number of key themes emerged, with some surprises as well. The themes, perhaps unsurprisingly, echo the earlier sections of this paper.

Theme 1: Data Collection at Scale

Rene Kizilcec, naming the revolution Optimizationism: “Optimizationism... captures the trend to data-driven, measurable solutions for education. [It] goes beyond experimentalism practiced in the social sciences, which compares control and treatment groups to identify effects of a manipulation. Optimizationism uses data-driven approaches with multiple iterations to arrive at an optimal solution for individual learners or groups of learners.”

Molly Bullock, naming the revolution Higher Education 2.0: “Web 2.0 connotes collaboration and virtual community and these are precisely the kinds of attributes that education providers (for profit and not) are eager to integrate into new vehicles for learning such as MOOC platforms and the smart higher ed tracking systems. With the networked world also comes the path of digital bread crumbs that users leave behind thus allowing for optimization through analysis of these data points. Higher Education 2.0 is emerging hand in hand with the field of learning analytics, the science driving the optimization.”

Hsiaolin Hsieh, naming the revolution Data-mining vs. Self-archiving: “With the focus on new digital-media delivery and data-collection methods, I would like to highlight one underrepresented dimension of the third wave revolution, by suggesting the rubric ‘data-mining vs. self-archiving.’ By the former I am thinking especially of the aggressive probing by for-profits into what has traditionally been the private sphere, while by the latter I intend the conscious insistence of groups and individuals on the importance of public knowledge.”

Theme 2: Flexibility for Learners

Betsy Williams, naming the revolution Wild-Westernization: “We will see a new age of autodidacts, or ‘swirlers’ who go from college to college (or MOOC to MOOC), who are assembling their educations bit by bit, without the guidance and socialization a traditional schooling experience provides. Driven by cost sensitivity and a sense that they are supposed to attend college, these students go through the school of hard knocks. For some of them, it will make them more resilient, creative, entrepreneurial, and self-directed (or perhaps it will select for those students). For others, however, it will not come together properly, and they will not substantially learn or otherwise benefit from their efforts.”

Tanner Vea, naming the revolution Diversification: “Just as people choose their own facts in politics and sources in news, higher education will soon be open to many more diverse choices.”

Julia Cambre, naming the revolution Customization: “As mentioned in the Bowen lectures, the increase in time to degree has become a crisis in higher education. With more flexibility provided by online learning, students might be able to balance their course loads and extracurricular responsibilities more appropriately.”

Theme 3: Changing Knowledge Structures and Networks

Emily Schneider, naming the revolution The Open Network: “We are also living in an age of networks—as others have commented, expertise is distributed and can be sought from various interconnected sources. This means that there is a wealth of possible lateral moves from any given digital resource, and access to depth of knowledge that can be delved into much more quickly.”

David Ayrton Lopez, naming the revolution Digital Connectivism: “[S]ince there is a wealth of free online content (in wikis, MOOCs, etc.) ‘knowledge’ is less about what you ‘know’ and more about what you can ‘access’ through online databases. It also places a high emphasis on “recency,” because networks need to be up-to-date at all time.”

Paul Franz, naming the revolution The Publishing Renaissance: “I think we've been seeing a Renaissance in publishing in general for the last several years, and it is now hitting education with full force. The MOOC is, in a certain light, just a different way of publishing course materials. In the meantime, the Intellectual Property Wars are being waged to determine what shape our post-renaissance world will look like. Who will have access to what, and at what cost, and how will content creators (increasingly everyone) be compensated?”

Theme 4: Access

Ritu Tandon, naming the revolution Digital Massification: “For me, the third revolution is in many ways the second stage of massification, in that education and knowledge is now more broadly accessible than ever.”

Brian Perone, naming the revolution Breaking the Pyramid: “[I]t seems like we're entering a period when education will no longer be a single pyramid of quality vs. quantity. A

small number of other ‘elite’ private schools...will remain the same, but everyone else will get something different in the coming revolution...It may be a mass-distributed version of what the elites have, delivered electronically and missing the ‘soul’ of an elite education...Instead of a single pyramid, we're pulling the top off and making two, a tiny elite one and a great big ‘everyone else’ one. And the differences between them will become differences of form, not just of degree.”

Theme 5: Markets

Patricia Young, naming the revolution Survival of the Fittest: “Universities will compete with new types of providers, PhD’s will compete for superstar professor status, and driven students from developing countries will be able to (even more successfully) compete with American counterparts for Google/Apple jobs. The outcome will depend in large part on how the new possibilities are negotiated among existing players. Will universities be able to reach stable partnerships with MOOC providers that will actually reduce their costs? Will professors be able to renegotiate their role, perhaps by arguing for unbundling compensation for research and teaching? Will underprivileged American students be able to tap into the social networks of online peer help or get government support to make the best of online learning?”

Max Alexander, naming the revolution Glorious or Notorious: “Imagine a world where all children have access to the best teachers, the best lessons and the best educational resources. The third revolution could usher in this moment, and it would no doubt be called the Age of the Student. [However,] I’m not necessarily convinced that the free market will continue to treat students as learners, and not as consumers. There is a lot of money to be made on emerging education technologies, and for this not to turn into an ‘Education Bubble’...there needs to be forces that moderate the dissemination and production of these new technologies.”

Kareem Edouard, naming the revolution MOOC: Massive Online Opportunities for Cash: “Let’s be real clear about this: students from Palo Alto or similar affluent communities are not using or looking to MOOCs for knowledge. They are going by in large to the state and private institutions so they can be a part of an alumni, fraternity and legacy pool. So, who will MOOCs target? The POOR WORKING CLASS! Those who see having a degree as an option to advance economic and social status.”

Conclusion

In the face of these rapid changes, participants in the course called for pause. David Ayrton Lopez warned against technological determinism, reminding us that “it is not really the technology that is doing the work, but rather the human elements ... I also feel that [technological determinism] unfairly requires technology to change, even though we all know that not every step forward is in the right direction.” The stakes are high, and so many people are potentially affected. Hallie Fox wrote, “This may be the largest experiment higher education has ever conducted. Yet as we are designing the research terms, we are also participating as subjects with an $n =$ millions.”

As we move ahead, it behooves us to realize how tentative decisions have a way of becoming permanent. Paul Franz writes, “In *You are Not a Gadget*, Jaron Lanier reminds us of design decisions in the early days of the computer that have had far reaching consequences. Those decisions were made based not merely on convenience or market (though those did play a role, of course), but also because of ideological convictions. The most interesting example, I think, is the nested file structure we all take for granted, so much so that we can't imagine using our computers without it. But there is no technological necessity to organize computer hard drives into hierarchical files and folders. Nor is that necessarily the ‘best’ organizational system, even if any alternative is nearly unthinkable to us now. So what decisions are we making in the MOOC space that privilege certain ways of thinking and knowing, which may not be the ways of thinking and knowing that we ultimately want to promote?”

Ownership, equity, cost, accountability. These are not new issues in the story of higher education. Rather, they are old questions, reshaped and perhaps amplified in a new techno-social landscape. In the face of some of the problems we perceive along these lines, the participants in EDF have identified how technological innovation may help address them. At the same time, however, some of these questions may lie beyond our scope. Dan Meyer describes this balanced approach: “We should champion and study our innovations while at the same time drawing clear lines around the space where they’re useful and being honest about the space where they’re not.”