

# Innovation Leashed:

## How a MOOC-Based Master's Degree Brings Invention Home to the Institution

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**Abstract.** This paper tells the story of the first MOOC-based Electrical Engineering graduate degree in the world. In so doing, it provides an object lesson about the narrative of disruption that has grown up around MOOC providers and the speed at which self-limiting systems emerge in even the newest ventures. This in turn reveals a paradox brewing at the heart of the MOOC enterprise: it is the supposedly staid institution of the university—whose entrenched systems tend to recoil from innovation back to the status quo—that actually wields the critical mass to effect change. This observation recalls us to a fundamental truth: while universities are conservators of academic tradition and systemic efficiency, they are also, most essentially, extraordinary engines of creation and innovative will. It is by tapping into that truth that we harness the potential for transformation. Ul-

timately, this paper offers a message of hope and a pathway to change at a moment when the institution of higher education is under threat. The experience of the MOOC Electrical Engineering degree suggests three primary lessons about our ability to answer that challenge: First, if we mean to achieve broad change, we must commit to the hard work of creating that change from within. Second, a bottom-up effort led by a small team with top-down support generates momentum to overcome entrenched systems that inherently resist difference. Third, and most importantly, the impetus for innovation has always resided with the university. In recognizing the systems that work to collapse innovation into convention, this paper acknowledges the difficulties that beset any groundbreaking venture; it also argues for universities' pride of place as engines of transformation that can lead the way to the future.

**Key Words:** MOOC, curricular design, University of Colorado Boulder, Coursera, disruption, innovation, MOOC-based Electrical Engineering graduate degree.

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This is the story of the first MOOC-based Electrical Engineering master's degree in the world. The mission to develop the University of Colorado Boulder's MS-EE, as I term it here, is a tale of creative endurance and institutional will. We join that tale *in medias res*, as Horace might say. The degree is still under development and not quite launched, but nonetheless offers a case study in how a bureaucratic entity overcame the inertia of long-established systems to cultivate

educational invention. The MS-EE also offers an object lesson in the narrative of disruption that has grown up around MOOC providers [Billsberry 2013]. That cautionary tale finds roots in the irony of how quickly self-limiting structures emerge in even the newest businesses, and how those structures act immediately to disrupt disruption. There's a paradox brewing at the heart of the MOOC enterprise: it is the supposedly staid institution of the university—whose entrenched systems tend to recoil from innovation back to the status quo—that actually wields the critical mass to effect change. This lesson recalls us to a fundamental truth: while universities are conservators of academic tradition and systemic efficiency, they are also, most essentially, extraordinary engines of creation and innovative will. It is by tapping into this truth that we harness the potential for transformation.

Granted, this paper's title, "Innovation Leashed," might imply that the MS-EE's inventive leap succumbed to systemic inertia, and that I'm embarking on a less-than-triumphant tale. Not so. Rather, this paper offers a message of hope and a pathway to change at a moment when the institution of higher education is under threat [Barber, Donnelly, Rizvi 2013]. Escalating costs, shrinking state funding, the pressing need to serve more diverse students, and the necessity in a rapidly changing world for professionals to engage in life-long learning for workplace survival, challenge colleges and universities everywhere in the United States. The design of the MS-EE pioneers answers to those challenges; however, even as we pushed the structure of the degree to its limit, we understood that we needed the scaffolding of the University and the larger institution of higher education to support and endorse our radical undertaking.<sup>1</sup> Thus, I use the phrase "Innovation Leashed" not because we compromised our vision, but because our success is entirely based on tethering the degree to the systems that, by their very nature, stood arrayed against radical change at the beginning of our journey. This brings me to three principles that I hope the story of the MS-EE will impart:

*First, if innovation is to be transformative, it can't be sidelined.* As CU Boulder embarked on the MS-EE, we resisted compartmentalizing inventiveness away from the central functioning of our campus. While it might be temptingly expedient to house non-normative programs in places like departments of Continuing or Professional Education, that decision marginalizes invention and insulates the university proper from disruption. We chose instead to operate from within our core as the best way to effect broad-based change. This approach is fraught, as it risks defeat from necessarily conservative systems that are built to protect and perpetuate the institution, not change it, re-

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<sup>1</sup> Tickle L. (2014) Will a Degree Made Up of MOOCs Ever Be Worth the Paper It's Written On? // The Guardian. June, 23. <https://www.theguardian.com/higher-education-network/blog/2014/jun/12/moocs-viable-alternative-traditional-degree>

ardless of the inventive drive of the human actors involved. In order to be successful, we had to understand, and pay tribute to, the validity of those systems and commit to the hard work of building change from within.

*Second, internal change can happen when a small group shepherds a bottom-up initiative that has top-down support.* The MS-EE is a faculty-driven endeavor that originated from the Electrical, Computer, and Energy Engineering (EE) department faculty with the full support of the College of Engineering and Applied Science Dean, our Graduate School Dean, and a Graduate School Executive Advisory Committee comprised of faculty representatives from every college and school at CU Boulder. This gave the project momentum and credibility as a bottom-up, academically driven mission. Our Regents, Chancellor, Provost, and CFO simultaneously endorsed the degree from the top. Their backing gave permission to our administrative teams to innovate alongside us. A small team from the Office of Strategic Initiatives partnered with EE faculty to spearhead degree development and channel that momentum across campus and within our state and federal regulatory bodies.

*Third, the impetus for innovation has rebounded from MOOC providers to the university.* In Laura Pappano's 2012 *New York Times* article, "The Year of the MOOC," massive platforms engendered notoriety and much anxiety for their disruptive potential; universities felt threatened, outdated, and staid by comparison.<sup>2</sup> Now, as MOOC providers move rapidly to offer for-credit programs, a new truth materializes: in just a few short years, MOOC platforms have already grown their own inertial systems that resist innovation. It is up to the university to disrupt them.

The lessons of the MS-EE suggest that MOOC providers have matured from their original emergence as the *enfants terribles* of higher education, poised to destroy and reinvent the field, to a more mature adolescence couched in the comfortable harbors of educational tradition.<sup>3</sup> Before I go further, let me emphasize that, as a leader of the MOOC effort on the CU Boulder campus and a MOOC instructor on Coursera, I am a fan of both.<sup>4</sup> There's little question that MOOCs usefully challenge our assumptions about teaching and instructional design and that those lessons trickle out from the platform to benefit campus-based teaching and online endeavors in general [O'Connor

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<sup>2</sup> Pappano L. (2012) The Year of the MOOC // *New York Times*. November, 2. <https://www.nytimes.com/2012/11/04/education/edlife/massive-open-online-courses-are-multiplying-at-a-rapid-pace.html>

<sup>3</sup> The discussion of disruption that's grown up around MOOCs is deeply inflected by [Christensen 2011].

<sup>4</sup> McAndrew Q. (2016) *Business Writing. Effective Communication Specialization*. Mountain View: Coursera. <https://www.coursera.org/learn/writing-for-business>

2014]. There's also no question that CU Boulder arrived at the revolutionary MS-EE because Coursera and their competitors disrupted our thinking and showed us a revolutionary means of educational delivery. We invent on MOOC platforms because they showed us the way.

This discussion's goal is not to critique MOOC providers, our University collaborators, or our Coursera partners, who eagerly joined with us to execute the vision of the MS-EE. Rather, this conversation investigates, by the MS-EE example, the implacable structural and systemic forces that threaten any risk-taking venture, no matter the human enthusiasm for it. If we are to succeed in reforming higher education, we must understand, for better or worse, what we're up against. CU Boulder first encountered these structures in the internal development of our new degree; we found them again, already emergent, in our MOOC partners. In recognizing the systems that work to collapse innovation into convention, this paper argues for universities' pride of place as engines of transformation, so that we may feed that energy back to our MOOC providers and lead the way with them to the future.

**Old school vs.  
new school**

The state-run, non-profit University of Colorado Boulder is a beautiful place to work or pursue an education.<sup>5</sup> Founded in 1876, the same year as the state, our flagship campus sits nestled at the feet of the Rocky Mountains. Those foothills provide a postcard-like backdrop for grassy quads bordered by century-old sandstone buildings capped with red tile roofs. Strolling the grounds on a beautiful, blue-sky day—of which Colorado has many—one senses deeply the Georgic rhythms that undergird campus-based higher education in the United States. Over the last 150 years, our university, like almost all others, has organically grown a set of systems—enrollment, billing, advising, and the like—and standard products—undergraduate and graduate degrees, certificates, and courses—that serve the 33,000 students and 6,500 employees on our campus.

Coursera, founded only six years ago, couldn't be more different. Based in the start-up cauldron of Silicon Valley, now with approximately 300 employees, Coursera's office-park headquarters boast a hip, open office plan with hoteling space, stand-up team meetings, work-from-home Wednesdays, catered meals, and a staff of dedicated Courserians bent on changing the world (and, one presumes, bent on taking the company public and enjoying a liberal sprinkling of financial gain from that event).<sup>6</sup>

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<sup>5</sup> Morton C., Vogel L. (2017) The 25 Most Beautiful College Campuses in America // Condé Nast Traveler. August, 28. <https://www.cntraveler.com/galleries/2016-01-29/the-20-most-beautiful-college-campuses-in-america>

<sup>6</sup> Young J.R. (2017) New CEO at Coursera Comes from Financial Tech, Not

We all know the story. This brash, for-profit upstart and its competitors Udacity and edX seemed to arise out of nowhere to challenge the august institution of higher education with astonishingly massive enrollments, completely automated environments, and an implicit threat to the campus-based university itself. edX and Coursera continue their mission, while Udacity has famously (sort of) exited the MOOC space and called its own products into question.<sup>7</sup> The hype and skeptical push-back that MOOCs still generate demonstrates the depth of their challenge to our closely held practice of higher education [Marshall, 2013]. Initially, those platforms only delivered non-credit courses, which made them easy to discount as unserious, or not truly academic, if one were looking to discredit them. Our Provost chose the opposite tack. A year after Coursera was founded, he challenged four of his most creative faculty to give this controversial, fascinating space a try.

### **The grand experiment**

One of those early CU Boulder MOOC adopters was a full professor of the Electrical, Computing, and Energy Engineering (EE) department and its former Chair, Robert Erickson. Professor Erickson holds thirteen patents, has won almost ten million dollars (U.S.) in research grants, has founded two companies, and is the author of over one hundred articles and the seminal textbook, *Fundamentals of Power Electronics* [Erickson, 1997]. He is a fellow of the Institute of Electrical and Electronics Engineers (IEEE) and he's received both CU Boulder's prestigious "Inventor of the Year" award and the Holland Teaching Excellence Award. His academic credentials are both impressive and impeccable. Professor Erickson is also a teaching rebel: he has been offering his courses with distance technologies and thinking about ways to renovate traditional university practices for decades. He was a perfect choice to test-drive Coursera.

Professor Erickson translated his graduate-level Power Electronics course onto the new platform, then redesigned it a few years later as a specialization with two departmental colleagues, Charles V. Schelke Endowed Professor Dragan Maksimovic and Assistant Professor Khurram Afridi.<sup>8</sup> In the process, they refused to dilute the rigor of the

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Higher Ed // EdSurge. June, 13. <https://www.edsurge.com/news/2017-06-13-new-ceo-at-coursera-comes-from-financial-tech-not-higher-ed>

<sup>7</sup> Cafkin M. (2013) Udacity's Sebastian Thrun, Godfather of Free Online Education, Changes Course // Fast Company. November, 14. <https://www.fast-company.com/3021473/udacity-sebastian-thrun-uphill-climb>; Young J. R. (2017) Udacity Official Declares MOOCs 'Dead' (Though the Company Still Offers Them) // EdSurge. October, 13. <https://www.edsurge.com/news/2017-10-12-udacity-official-declares-moocs-dead-though-the-company-still-offers-them>

<sup>8</sup> Afridi Kh., Erickson R., Maksimovic D. (2016) Power Electronics. Mountain View: Coursera. <https://www.coursera.org/specializations/power-electronics>

student experience. Although it's not offered for credit, Power Electronics is a true graduate class, with challenging content, homework, and assessments. The specialization's first course, "Introduction to Power Electronics," launched in January 2016. To date, over 100,000 learners have visited; the course hosts 30,000 active participants from over 185 countries, with 2,500 completions. India is the second largest home to the specialization's students behind the United States, which itself only comprises 23% of the total learner population. Professors Erickson, Afridi, and Maksimovic reach engineers almost everywhere on the planet, who absorb their rigorous curriculum in an automated environment and exit the experience with hard-core skills.

As MOOCs began to move into the for-credit space, an idea was born from the Power Electronics test case. A small group of champions, including Professor Erickson, two other EE faculty, and members of the Office of Strategic Initiatives, began to envision a full graduate degree. We were determined to use the lessons of MOOCs and the scalability and functionality of the platform to offer a student-oriented, completely redesigned, affordable degree. In our meetings, Professor Erickson consistently asked "Why?" to challenge our assumptions about teaching and university functions. From the initial, Coursera-inspired, "Why do we believe in-person lectures are inherently better than intimate video lessons?" we branched out to question everything. "Why?" became our mantra.

Why, for instance, do we have a sixteen-week semester? There's no relationship to the length of the term and the length of the time that it takes to teach a particular subject. We stretch or condense our topics into an arbitrary shell. Why is our content offered in three-credit units? Wouldn't it be better to modularize the entire curriculum into discrete learning outcomes, so that students can truly tailor their learning to their needs? Why do we think only in terms of degrees? We already know from our graduate certificates that many engineers already have master's degrees or don't need a full thirty-credit degree to refresh their training.

And, finally, most radical of all: Why do we have admissions? Historically, campuses have reviewed applications because of limited capacity and the need to create a sense of selectivity. We also owe it to our applicants to judge their ability to succeed before they make the large financial and personal commitments to come to campus. But, what if the capacity of a degree was essentially limitless? And what if tuition were greatly reduced and students didn't have to come to campus at all? Why would we have an application?

"Why?" inspired the faculty to design a truly innovative degree built on student needs and curricular outcomes, not on the systemic requirements of the university.<sup>9</sup> The MS-EE is:

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<sup>9</sup> Gershon E. (2018) Digital Frontier: CU Boulder pioneers a MOOC-based

- *Rigorous*: The curriculum derives from our accredited on-campus graduate program.
- *Scalable*: The degree will accommodate thousands of students at once.
- *Accessible*: The 30-credit degree costs US\$20,000, or about a third of our regular EE graduate degree for non-resident students.
- *Modular*: Course work is broken down into discrete subject areas and assigned fractional credit hours as suits the content.
- *Stackable*: Students may stack courses any way they like to build a degree.
- *Elective*: MS-EE faculty plan to offer 100 credits worth of curriculum under the umbrella of a 30-credit degree to give students ultimate choice in their educational journey.
- *Microcredentialled*: We assume only a small fraction of our students will actually want the full degree. Depending on their needs, learners can earn credits in a specific topic area, like Bluetooth, or a graduate certificate in a subject like Embedded Systems, or the full degree.
- *Asynchronous*: Students may take courses any time, from anywhere, at their own pace.
- *Community-based*: The degree experience includes structures of support and community and faculty interaction to foster student success.
- *Automated*: To create a truly scalable degree, the EE faculty created assessments that were rigorous but that could also be machine graded.
- *Open*: Performance-based admissions opens the program to any qualified student. To earn the degree, learners complete a designated “gateway course” with an A or B and continue until they’ve completed thirty credit hours with at least a B average. There’s no application, no entrance exam, no recommendations to collect or transcript to submit. There’s just a form to record student information for registration and billing.

In addition, the department will build two features into the degree experience: the program will be *responsive* to student needs and *research-driven*. As we break new ground in automation, we will monitor student progress and iterate our support structures to ensure student success. We will also validate or adjust the program design with educational research propelled by MS-EE data.

Of all the features of the MS-EE, performance-based admissions generated the most internal deliberations. Concern centered on two points. First, performance-based admissions seemed to imply that,

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graduate degree in Electrical Engineering // The Coloradan. June, 1. <https://www.colorado.edu/coloradan/2018/06/01/digital-frontier>

without an application, we were somehow awarding the degree to anyone, regardless of their qualifications. This of course is not true in any sense. Learners enter a graduate-level Electrical Engineering program. It's *hard*. They have to earn thirty credits and a B average throughout to obtain the degree. Second, without an application, it's possible for someone without an undergraduate degree to earn the master's degree. This prospect required us to rethink assumptions so ingrained that we didn't even know we had them. Our mantra provided the counter argument: Why is an undergraduate degree prerequisite to a graduate degree? If a student successfully completes graduate-level, rigorous, electrical engineering content, why does their undergraduate status matter at all?

**Innovation  
leashed**

The simple, three-letter question "Why?" led us to the outer reaches of program design, but we couldn't just innovate in a vacuum. Whatever the logic behind our design decisions, we had to commit to communicating broadly and building consensus in the institution of higher education around difference. We also had to forge a path through our established processes to support and approve the degree. This was an enormous undertaking. It meant re-engineering a pipeline built to replicate, not challenge, long-validated norms that legitimately protect our operational efficiency, the student experience, and the authority of the degree.

Each point of the MS-EE's variance caused necessary friction in that protective pipeline. The process of program development and review was long and complex, and involved managing difference by addressing concerns, soliciting input, and securing consensus at all levels of the University and the state and federal institutions of higher education. We were able to succeed because everyone the degree touched at CU Boulder answered its challenges with a commitment to innovation and change.

One of the imperatives of the MS-EE is its relative affordability; the degree will cost students about a third of our regular out-of-state tuition. This worthy goal cannot be sustained on good will alone; we must pay pragmatic attention to how the University will afford a two-thirds reduction in revenue if the degree is to survive. Thus, we need to scale enrollments while simultaneously reducing the burden, not just on our faculty with automated grading, but on our administrative teams with automated operational functionality.<sup>10</sup> We worked with our Registrar, Bursar, enrollment management team, and especially our information technology team to create new back-office functionality that could join our incumbent IT systems with the MOOC platform to automatical-

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<sup>10</sup> Newton D. (2018) Why College Tuition is Actually Higher for Online Programs // Forbes. June, 25. <https://www.forbes.com/sites/dereknewton/2018/06/25/why-college-tuition-is-actually-higher-for-online-programs/#1dd848fff11a>

ly enroll students, collect their payments, track their progress, and issue transcripts, certificates, and degrees. Our information technology team especially leads the charge to create one of the most operationally automated degree experiences on a MOOC platform in the world.

The chunked, modular curricular design, focused on specific learning outcomes instead of the sixteen-week, three-credit course, meant that we needed to redesign how we offer and count credit. Our Registrar answered by innovating our systems so that we can offer fractional credit for the first time in our one-hundred, forty-two-year history. Our Bursar reconsidered how we charge tuition, and the Enrollment Management team created a way for us to accommodate asynchronous, on-demand education within a tracking system that traditionally requires tethering our students to a specific term. In every case, the faculty origin of the degree gave the program credibility, while the unwavering support of our executives brought our teams to the table empowered to innovate. One of this project's most gratifying outcomes is the close partnership that emerged between the academic, technology, and administrative personnel of the University, who have come together in an audacious mission of sweeping change.

To balance the radical design of the MS-EE, we deliberately navigated a path of responsible approvals at the local, state, and federal level. On the face of it, our bureaucratic compliance might appear as the antithesis of innovation, and we faced potential failure or delay at every juncture; however, our commitment to accountability built an infrastructure of support around the MS-EE's differences that achieved the credentialing of the ground-breaking degree and the full realization of its revolutionary vision.

Our chain of approvals began critically with broad-based faculty support, not just in engineering, but from across the University. The project originated with the EE department, who voted with large majority to develop the program. This marked a vital, first step in our entire process that was key to the acceptance of the degree at every subsequent turn. Faculty remain deeply involved in the degree, which has become central to the identity of the department. About thirty EE faculty members are engaged in creating content for the MS-EE, and a faculty oversight committee develops policy and practices for the degree; they will continue their work after the program launches. Once the EE faculty voted, the Engineering College Dean approved the degree and passed it to the Executive Advisory Committee (EAC) of the Graduate School and its Dean for comment and vote.

The Graduate School Dean and her EAC, comprised of faculty members from every school and college at the University, provided important input into the degree and also voted to support it. The asynchronous, stackable nature of the MS-EE, which allows students ultimate flexibility in their experience, also required consideration of our Graduate School rules. The Dean partnered with the EAC to enable the MS-EE, and future degrees like it, to operate within the administra-

tive oversight of the Graduate School and maintain educational quality and programmatic consistency.

Finally, our University of Colorado Board of Regents, which govern the four campuses that make up our larger state-wide system, and whose members are long proponents of innovative, affordable online education, endorsed the MS-EE and its groundbreaking tuition.<sup>11</sup> The Colorado Department of Higher Education likewise approved the degree as central to the mission of our university. Thanks to collaborative problem solving at every level, we achieved endorsement of the degree by our leaders; likewise, the operational structures required for the MS-EE to succeed were falling into place.

Even as our internal approvals accumulated, we realized that we needed to account for state and federal laws that might impact the degree. We partnered closely with our legal counsel to chart a responsible path. With their input, we decided to offer the MS-EE as an auxiliary program. While this designation is transparent to our students, it's critical to the program's eventual assessment. CU Boulder must report degree completions and time to degree across our regular University programs as a measure of our institutional effectiveness. Yet, the MS-EE is an entirely different kind of offering. It's conceived for a professional audience whose members may already have a master's degree or may only need a few credits or a graduate certificate to refresh their education. Degree completers will probably be the smallest portion of our learners and may thus be an inadequate measure of the program's real value. We needed the freedom to measure success differently. The auxiliary designation establishes a responsible means for doing so and empowers the full realization of the MS-EE experiment.

Finally, we took the accreditation of the MS-EE especially seriously. We wanted to insure that the program, as path-breaking as it is, also operates fully within the guidelines of the U. S. Department of Education. Under our regional accrediting body, the Higher Learning Commission (HLC), CU Boulder is authorized to offer distance degrees broadly and in Electrical Engineering at the master's degree level specifically.<sup>12</sup> We already deliver graduate electrical engineering courses and degrees via a synchronous distance model on campus, whereby students join live classes from afar. HLC guidelines use the term "distance" to include asynchronous online degrees.<sup>13</sup> At first analysis, our

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<sup>11</sup> University of Colorado Board of Regents (2018) "Agenda Item Details." University Affairs Committee Meeting. January, 17. <https://www.boarddocs.com/co/cu/Board.nsf/Public>; University of Colorado Board of Regents (2018) Minutes of the Regular Board Meeting. February, 8. <https://www.boarddocs.com/co/cu/Board.nsf/Public>

<sup>12</sup> Higher Learning Commission (2010) Organizational Profile, University of Colorado at Boulder. August, 18. <https://www.colorado.edu/accreditation/downloads/HLCUCBNotice.pdf>

<sup>13</sup> Higher Learning Commission. Distance Education // Glossary of HLC Terminology. <https://www.hlcommission.org/General/glossary.html#InstChange>

distance accreditation seemed to cover the MS-EE and offer an expeditious solution that required no further action on our part.

In keeping with our philosophy of careful regulatory compliance, we examined the accreditation regulations closely. Per the HLC definition, a distance program hinges upon “regular and substantive interaction between the student and instructor.” We believed that the support the faculty was building into the MS-EE would meet this standard; however, a lack of specific guidelines about what “regular and substantive” actually means gave us pause. This definitional grey area, coupled with the entirety of innovations in the MS-EE, led us to a decision to proactively reach out to the HLC to accredit the degree. We also decided to re-examine the programmatic categories available to us for accreditation, and to choose the option that would provide the most conservative authorization available.

Under federal standards, seemingly old-fashioned, much maligned “correspondence” education does not require “regular and substantive interaction between the student and the instructor.” Instead of only relying on CU Boulder’s existing authorization to offer distance degrees, we sent a formal proposal detailing the MS-EE to the HLC in which we also chose to categorize it as a correspondence program. This allowed us to avoid any definitional doubt about our practices, while we also remained committed to student success. The MS-EE subsequently achieved unanimous accreditation approval from both the HLC Change Committee and the full HLC board.<sup>14</sup>

The term “correspondence” does not sit easily with any of our team members. To innovate, we had to refurbish our notions about the term, and redefine it not as a moniker of outmoded educational delivery, but as a solution that enabled our invention when every other accreditation category would have potentially curtailed it. The MS-EE will provide robust student support, but the correspondence designation provides room for us to conduct our experiment responsibly.

Throughout the approval process, we achieved success by continually balancing our groundbreaking degree with the opposite extreme of accountability. This approach allowed us to build a coalition around difference and to establish the MS-EE, not as an outlier to our academic mission, but as a revolution housed directly in its midst.<sup>15</sup> That revolution was and still is powered by the innovative will of individuals

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<sup>14</sup> Higher Learning Commission Change Panel to Dr. Philip DiStefano, Chancellor, University of Colorado Boulder, “Panel Letter and Recommendation.” (April 2, 2018); Gellman-Danley B., President, Higher Learning Commission letter to Dr. Philip DiStefano, Chancellor, University of Colorado Boulder (May 4, 2018).

<sup>15</sup> CU Boulder to offer first MOOC-delivered electrical engineering master’s degree CU Boulder Today (February 8, 2018). <https://www.colorado.edu/to-day/2018/02/08/cu-boulder-offer-first-mooc-delivered-electrical-engineering-masters-degree>

from every part of the University who are committed to the transformative mission heralded by the MS-EE.

**The innovation  
paradox**

Two years ago, the idea for the first MOOC-based Electrical Engineering degree in the world was born at the University of Colorado Boulder. Achieving that vision requires enormous effort from every part of our institution; that effort is still underway today. Our University teams have come together to take risk, to challenge the comfort of known systems, and to urge ourselves to a new frontier. We fully embraced the invitation from Coursera and its competitors to test our assumptions and push their platforms to the limit to deliver truly scaled, global, affordable, education.<sup>16</sup>

But something funny happened on the way to 2018 from the heady days of the 2012 Year of the MOOC. Coursera, a Silicon Valley-funded start-up, evolved towards profitability. edX, a Harvard- and MIT-funded non-profit, terms their goal "sustainability."<sup>17</sup> Whatever the label, the outcome is the same: MOOC providers began to restrict variability on their platforms in favor of risk management and systemic efficiency. As the University moved from standardization to innovation, it was as if our MOOC partners passed us going in exactly the opposite direction.

I don't mean to criticize either Coursera or edX in this analysis. Their survival depends on their financial viability—and we want them to survive so that we can continue to create great student experiences on their remarkable platforms. Rather, this discussion seeks to recognize, nonjudgmentally, how quickly even the newest, hippest, most disruptive venture develops systems that hinder innovation. Just as we at the University find ourselves restricted by our infrastructure, so to do our partners find themselves compelled to conformity.

As MOOC providers matured, they developed product lines with clearly defined features, protocols, and policies. This makes business sense. Discrete products create a standard experience for learners and a standard brand and quality identity around which the marketing dollar can be maximized. Whether you call them specializations or x-series, MicroMasters or MasterTracks, those product definitions and the systems that support them can quickly ossify into narrow possibilities. The result is that the opportunity for additional innovation withers; if a concept doesn't fit into a pre-determined product track, then the platform technology, business plan, and marketing strategy can't support it.

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<sup>16</sup> Friedman Th. (2012) Come the Revolution // The New York Times. May, 15. <https://www.nytimes.com/2012/05/16/opinion/friedman-come-the-revolution.html>

<sup>17</sup> McKenzie L. (2018) Free MOOCs Face the Music // Inside Higher Ed. June, 14. <https://www.insidehighered.com/news/2018/06/14/edx-introduces-support-fee-free-online-courses>

Thus, much to our surprise, it was the groundbreaking nature of the MS-EE, its assertive staking out of difference, and all the features that made it so revolutionary and exciting, that raised concerns for MOOC providers about the degree. We didn't fit the formula. The move of MOOC platforms into the high-investment, for-credit degree space only exacerbates the drive to reduce risk as the cost of failure goes up.<sup>18</sup> This is evidenced by the launch of MBAs on MOOC platforms—a logical choice, but one that is largely imitative, not inventive: MBAs are already the most popular online degree; some might even argue that they saturate the market.<sup>19</sup> Furthermore, current MOOC degrees are built on a model whereby students move into smaller-sized cohort spaces whose features replicate many of the (costly) practices of on-campus or traditional online programs.<sup>20</sup> These moves reproduce long-validated educational practices that enable student success. The problem is that, whatever our good intentions, if we simply duplicate what already works, we'll never innovate the larger structures and practices of higher education that call out for change. The MS-EE is built on a radically different vision of what a MOOC-based degree might be. Ironically, we were so proud that we'd activated the entire system of higher education behind our new vision that it never occurred to us that our innovation partners would find themselves stymied by their move to standardization.

So, where's the MS-EE stand now? The tale hasn't reached its conclusion, and it hopefully won't for many years to come. After all, finding a platform is only the very beginning of the degree's experimental quest. At the time of this writing, we're optimistic that we'll be moving forward with Coursera. The process of making that happen mirrored our own internal creation of the MS-EE. We committed to listening to and working with Coursera to find a solution. Then, just as a small team at CU Boulder spearheaded our internal effort, a small team of champions inside Coursera committed to the degree's vision and took on the work of building internal alliances and tethering the MS-EE to their systems. Coursera's executive team and CEO heard their team's creative solutions and decided—much as our Provost did five years ago when we joined Coursera—to take a risk. Today, we are undertaking the process of contract negotiation.

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<sup>18</sup> Shah Dh. (2018) The Second Wave of MOOC Hype is Here, and It's Online Degrees // EdSurge. May, 21. <https://www.edsurge.com/news/2018-05-21-the-second-wave-of-mooc-hype-is-here-and-it-s-online-degrees>

<sup>19</sup> Fullington R. MBA Popularity in the U.S. (July 2, 2018) via Economic Modeling Specialists International (EMSI).

<sup>20</sup> Lederman D. (2018) Look Who's Championing the Degree // Inside Higher Ed. March. <https://www.insidehighered.com/digital-learning/article/2018/03/06/coursera-purveyor-moocs-bets-big-university-degrees>

**Conclusion** The story of the University of Colorado Boulder's MS-EE is unfinished, yet already offers powerful lessons about the potential for institutional transformation. First, if we mean to achieve broad change, we must commit to the hard work of creating that change from within. Second, a bottom-up effort led by a small team with top-down support generates momentum to overcome entrenched systems that inherently resist difference. Third, and most importantly, the impetus for innovation has always resided with the university.

Coursera and edX are young businesses. Their condition requires conservatism as they attempt to bridge the gap between start-up financing and autonomous viability. In comparison, the University of Colorado Boulder is exceedingly viable; we've been around, doing what we do, for a century and a half. We may be underfunded, chronically under-resourced, and under threat, but we also operate with a US\$1.8 billion-dollar budget.<sup>21</sup> While that money is almost wholly encumbered, it is fed by diverse revenue streams: tuition, state funding, research grants, returns on tech transfer, and the like. If we fail with the MS-EE, it won't pose an immediate financial crisis for our institution. What *will* pose a crisis for the University and the institution of higher education is if we fail to innovate at all [Jewett 2017]. Universities must move boldly into the future; Coursera and edX have done us the great favor of both showing us a way to that future and inviting us to participate in it.

From the very moment of our foundation, universities like ours have driven transformation—of societies, of technologies, of education, of thought and knowledge. Change is our essential DNA and has been for centuries. The University of Colorado Boulder is a Research 1 institution that proudly anchors one of the most innovative business corridors in the United States.<sup>22</sup> Technology developed by our faculty has launched over 140 new start-ups, our researchers have filed for 1,276 patents in the last eight years, and 548 inventions have been submitted to CU Boulder's Tech Transfer office in the last five. We are the proud home of a community of scientists, scholars, and educators that includes five Nobel Laureates, eight MacArthur Genius Grant winners, four National Medal of Science awardees, and over eleven cutting-edge interdisciplinary research institutes that are deeply embedded in the fabric of the University. The truth of this paper is that the individual institution remains and always has been the necessary hub of invention within higher education. The MS-EE powerfully demonstrates that the drive to invent doesn't just belong to the professorate;

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<sup>21</sup> Niedringhaus C. (2018) University of Colorado Approves \$4.5 Billion Total Budget for Next Fiscal Year // Daily Camera. June, 22. [http://www.dailycamera.com/cu-news/ci\\_31963149/university-colorado-approves-budget](http://www.dailycamera.com/cu-news/ci_31963149/university-colorado-approves-budget)

<sup>22</sup> Dill K. (2015) The 10 Most Innovative Tech Hubs in the U.S. // Forbes. February, 12. <https://www.forbes.com/sites/kathryndill/2015/02/12/the-10-most-innovative-tech-hubs-in-the-u-s/#6e1717575d7d>

it infuses our entire staff—who work, after all, at a university because they are passionate about education and serving our students. Coursera and their competitors can partner with us and push us towards transformation, but it is we who have the both the real power and the real responsibility to undertake our own radical reinvention.

We're all here because we believe that education can change the world. Let's get on with it.

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