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The Year of the MOOC

By LAURA PAPPANO

IN late September, as workers applied joint compound to new office walls, hoodie-clad colleagues who had just met were working together on deadline. Film editors, code-writing interns and “edX fellows” — grad students and postdocs versed in online education — were translating videotaped lectures into MOOCs, or massive open online courses. As if anyone needed reminding, a row of aqua Post-its gave the dates the courses would “go live.”

The paint is barely dry, yet [edX](#), the nonprofit start-up from Harvard and the Massachusetts Institute of Technology, has 370,000 students this fall in its first official courses. That’s nothing. [Coursera](#), founded just last January, has reached more than 1.7 million — growing “faster than Facebook,” boasts Andrew Ng, on leave from Stanford to run his for-profit MOOC provider.

“This has caught all of us by surprise,” says David Stavens, who formed a company called [Udacity](#) with Sebastian Thrun and Michael Sokolsky after more than 150,000 signed up for Dr. Thrun’s “Introduction to Artificial Intelligence” last fall, starting the revolution that has higher education gasping. A year ago, he marvels, “we were three guys in Sebastian’s living room and now we have 40 employees full time.”

“I like to call this the year of disruption,” says Anant Agarwal, president of edX, “and the year is not over yet.”

MOOCs have been around for a few years as collaborative techie learning events, but this is the year everyone wants in. Elite universities are partnering with Coursera at a furious pace. It now offers courses from 33 of the biggest names in postsecondary education, including Princeton, Brown, Columbia and Duke. In September, Google unleashed a MOOC-building online tool, and Stanford unveiled [Class2Go](#) with two courses.

Nick McKeown is teaching one of them, on computer networking, with Philip Levis (the one with a shock of magenta hair in the introductory video). Dr. McKeown sums up the energy of this grand experiment when he gushes, “We’re both very excited.” Casually draped over auditorium seats, the professors also acknowledge that they are not exactly sure how this MOOC stuff works.

“We are just going to see how this goes over the next few weeks,” says Dr. McKeown.



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WHAT IS A MOOC ANYWAY?

Traditional online courses charge tuition, carry credit and limit enrollment to a few dozen to ensure interaction with instructors. The MOOC, on the other hand, is usually free, credit-less and, well, massive.

Because anyone with an Internet connection can enroll, faculty can't possibly respond to students individually. So the course design — how material is presented and the interactivity — counts for a lot. As do fellow students. Classmates may lean on one another in study groups organized in their towns, in online forums or, the prickly part, for grading work.

The evolving form knits together education, entertainment (think gaming) and social networking. Unlike its antecedent, open courseware — usually written materials or videotapes of lectures that make you feel as if you're spying on a class from the back of the room — the MOOC is a full course made with you in mind.

The medium is still the lecture. Thanks to [Khan Academy](#)'s free archive of snappy instructional videos, MOOC makers have gotten the memo on the benefit of brevity: 8 to 12 minutes is typical. Then — this is key — videos pause perhaps twice for a quiz to make sure you understand the material or, in computer programming, to let you write code. Feedback is electronic. Teaching assistants may monitor discussion boards. There may be homework and a final exam.

The MOOC certainly presents challenges. Can learning be scaled up this much? Grading is imperfect, especially for nontechnical subjects. Cheating is a reality. "We found groups of 20 people in a course submitting identical homework," says David Patterson, a professor at the University of California, Berkeley, who teaches software engineering, in a tone of disbelief at such blatant copying; Udacity and edX now offer proctored exams.

Some students are also ill prepared for the university-level work. And few stick with it. "Signing up for a class is a lightweight process," says Dr. Ng. It might take just five minutes, assuming you spend two devising a stylish user name. Only 46,000 attempted the first assignment in Dr. Ng's course on machine learning last fall. In the end, he says, 13,000 completed the class and earned a certificate — from him, not Stanford.

That's still a lot of students. The shimmery hope is that free courses can bring the best education in the world to the most remote corners of the planet, help people in their careers, and expand intellectual and personal networks. Three-quarters of those who took Dr. Patterson's "Software as a Service" last winter on Coursera (it's now on edX) were from outside the United States, though the opposite was true of a course on circuits and electronics piloted

last spring by Dr. Agarwal. But both attracted highly educated students and both reported that over 70 percent had degrees (more than a third had graduate degrees). And in a vote of confidence in the form, students in both overwhelmingly endorsed the quality of the course: 63 percent who completed Dr. Agarwal's course as well as a similar one on campus found the MOOC better; 36 percent found it comparable; 1 percent, worse.

Ray Schroeder, director of the [Center for Online Learning, Research and Service](#) at the University of Illinois, Springfield, says three things matter most in online learning: quality of material covered, engagement of the teacher and interaction among students. The first doesn't seem to be an issue — most professors come from elite campuses, and so far most MOOCs are in technical subjects like computer science and math, with straightforward content. But providing instructor connection and feedback, including student interactions, is trickier.

“What's frustrating in a MOOC is the instructor is not as available because there are tens of thousands of others in the class,” Dr. Schroeder says. How do you make the massive feel intimate?

That's what everyone is trying to figure out.

Many places offer MOOCs, and more will. But Coursera, Udacity and edX are defining the form as they develop their brands.

THE FLAVOR OF THE MOOC

Coursera casts itself as a “hub” — Dr. Ng's word — for learning and networking. The learning comes gratis from an impressive roster of elites offering a wide range of courses, from computer science to philosophy to medicine. Not all are highbrow or technical; “Listening to World Music” from the University of Pennsylvania aims to broaden your iPod playlist.

While Coursera will make suggestions, Dr. Ng says, “ultimately all pedagogical decisions are made by the universities.” Most offerings are adapted from existing courses: a Princeton Coursera course is a Princeton course. But the vibe is decidedly Facebook — build a profile, upload your photo — with tools for students to plan “meet-ups” with Courserians in about 1,400 cities worldwide. These gatherings may be bona fide study groups or social sessions. Membership may be many or sparse.

No one showed at the meet-up that Stacey Brown, an information technology manager at a Hartford insurance company, scheduled for a 14th-floor conference room on a Thursday after work, despite R.S.V.P.'s from a few classmates in the area. He's taking three Coursera MOOCs, including “Gamification” from the University of Pennsylvania Wharton School. In addition to

the learning — and dropping to bosses that he’s taking a Wharton course — Mr. Brown says, “I hope to get a network.”

Others like the discipline a group offers. Kimberly Spillman, a software engineer, started taking seven MOOCs and completed three. “The ones I have study groups with people, those are the ones I finish,” Ms. Spillman says. She first joined a group for Dr. Thrun’s artificial intelligence course, and then ran one for a Udacity course on building a search engine, organizing Thursday-evening discussions of the week’s material followed by a social hour at a nearby pub. Fifteen people met each week at the Ansir Innovation Center, a community space with big tables and comfortable chairs, in the Kearny Mesa neighborhood of San Diego.

Udacity has stuck close to its math and computer science roots and emphasizes applied learning, like “How to Build a Blog” or “Building a Web Browser.” Job placement is part of the Udacity package. “The type of skills taught in computer science, even at elite universities, can be very theoretical,” Dr. Stavens explains.

Udacity courses are designed and produced in-house or with companies like Google and Microsoft. In a poke at its university-based competition, Dr. Stavens says they pick instructors not because of their academic research, as universities do, but because of how they teach. “We reject about 98 percent of faculty who want to teach with us,” he says. “Just because a person is the world’s most famous economist doesn’t mean they are the best person to teach the subject.” Dr. Stavens sees a day when MOOCs will disrupt how faculty are attracted, trained and paid, with the most popular “compensated like a TV actor or a movie actor.” He adds that “students will want to learn from whoever is the best teacher.”

That means you don’t need a Ph.D. While there are traditional academics like David Evans of the University of Virginia, “[Landmarks in Physics](#),” a first-year college-level course, is taught by Andy Brown, a 2009 M.I.T. graduate with a B.S. in physics. “We think the future of education is guys like Andy Brown who produce the most fun,” Dr. Stavens says. Mr. Brown’s course is an indie version of “Bill Nye the Science Guy” — filmed in Italy, the Netherlands and England, with opening credits for “director of photography” and “second camera and editor.”

Whether explaining what the ancients believed about the shape of the earth or, in Dr. Thrun’s statistics course, why you are unpopular, statistically speaking, voice-overs are as nonthreatening as a grade school teacher.

“You feel like you are sitting next to someone and they are tutoring you,” says Jacqueline Spiegel, a mother of three from New Rochelle, N.Y., with a master’s in computer science from Columbia who has enrolled in MOOCs from Udacity and Coursera. While taking “Artificial Intelligence,” she discovered she liked puzzling through assignments in online study groups.

The class was tough and took “an embarrassing amount of time,” says Ms. Spiegel, who found that consuming lectures by smartphone during her 14-year-old’s 6 a.m. ice skating sessions worked less well than being parked at a desktop. “I would listen to the lectures, then I would listen to them again.” Her effort was huge — some 22 hours a week — but rewarding. Ms. Spiegel befriended women in India and Pakistan through Facebook study groups and started an online group, CompScisters, for women taking science and technology MOOCs.

If Udacity favors stylish hands-on instruction, edX aims to be elite, smart and rigorous; don’t expect a gloss of calculus if you need it but never took it. Some 120 institutions have been in touch; only Berkeley and the University of Texas system have been admitted to the club.

EdX’s M.I.T. roots show in its staff’s geeky passion for building and testing online tools. They collect your clicks. Feedback from the MOOC taught last spring by Dr. Agarwal (who, students learn, is obsessed with chain saws) revealed that participants would rather watch a hand writing an equation or sentence on paper than stare at the same paper with writing already on it.

The focus is on making education logical. “Someone who is consuming the course should know it is not serendipity that the course is chunked in a certain way, but that there is intentionality to sequencing video,” says Howard A. Lurie, vice president for content development.

With mini-notebook in hand, he has been leading the “daily stand-up” meeting (so called because attendees lean against walls) to keep course development on schedule. After one meeting, Lyla Fischer, a 2011 M.I.T. graduate and edX fellow, sat at her computer, a tag still dangling from the chair, and edited the answers for problem sets in Dr. Agarwal’s course. Last spring, students could download PDFs with brief answers. Now, she says, “there is a full explanation of how to do it, here are the steps,” right on the site.

“We are trying to use the magic of all the tool sets we have,” Mr. Lurie says. Students control how fast they watch lectures. Some like to go at nearly double the speed; others want to slow down and replay. Coming: If you get a wrong answer, the software figures out where you went wrong and offers a correction.

WORKING OUT THE KINKS

Assignments that can’t be scored by an automated grader are pushing MOOC providers to get creative, especially in courses that involve writing and analysis. Coursera uses peer grading: submit an assignment and five people grade it; in turn, you grade five assignments.

But what if someone is a horrible grader?

Coursera is developing software that will flag those who assign very inaccurate grades and give their assessment less weight. Mitchell Duneier, a Princeton professor, is conducting a study that compares peer grading of the final exam in his sociology MOOC on Coursera last summer with the grades he and his course assistants would have given the students.

Mr. Brown, the Hartford I.T. manager, does not have confidence in peer feedback. “This could be a 14-year-old kid in South Africa answering me,” he says, thinking of his 14-year-old. The challenge is not just in grading. The diversity of MOOC takers — teenagers to retirees, and from across the globe — means classmates lack a common knowledge base and educational background. Out-of-their-league students, especially in highly technical courses, can drag down discussions.

Which course is right for you? What prerequisites are really needed to perform well? Princeton’s “Networks: Friends, Money and Bytes” on Coursera recommends basic linear algebra and multivariable calculus but the “instructor will see if part of the course material can be presented without requiring this mathematical background.” “Introduction to Computer Science” from Harvard lists prerequisites as “none” — as long as you’re Harvard-ready. Where are the Yelp reviews?

“We desperately need crowdsourcing,” says Cathy N. Davidson, a Duke professor of English and interdisciplinary studies. “We need a MOOCE — massive open online course evaluation.”

Most important, what do you get for your effort? Do you earn a certificate? A job interview? Or just the happy feeling of learning something?

“If one is going for the knowledge, it’s a boon,” says Dr. Schroeder of the University of Illinois. “If one is looking for credit, that is one of the challenges. How do we fit this into the structure of higher education today?”

Dr. Agarwal predicts that “a year from now, campuses will give credit for people with edX certificates.” He expects students will one day arrive on campus with MOOC credits the way they do now with Advanced Placement.

The line between online and on campus is already blurring. This spring Dr. Davidson will teach a class called “[Surprise Endings: Social Science and Literature](#)” at Duke and as a MOOC, with her Duke students running the online discussions. This fall, San Jose State students are taking Dr. Agarwal’s course on [circuits and electronics](#), with professors and teaching assistants on campus leading discussions. They add their own content, including exams. In the spring, Massachusetts Bay Community College in Wellesley will use an edX MOOC in introductory computer science.

Dr. Stavens promises more change, and more disruption: “We are only 5 to 10 percent of the way there.”

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This article has been revised to reflect the following correction:

Correction: November 11, 2012

An article last Sunday about massive open online courses, using information from the MOOC provider Coursera, included several errors. The source of a study of peer grading in a Princeton sociology MOOC was Mitchell Duneier, the teacher, not Coursera. The student work was regraded by Professor Duneier and his teaching assistants, not by Princeton instructors. And it is not the case that the results have been released. The article also misspelled the surname of a co-founder of another MOOC provider, Udacity. He is Michael Sokolsky, not Sokolosky.