# Coursera at the UW: The challenges, benefits, and surprises of teaching a MOOC

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UW faculty have used and adopted a number of new technologies over the years. MOOCs (Massive Open Online Courses) are one of the latest. And like any new technology, it offers its users rich opportunities to reflect on current practice and try something new.

The popularity of MOOCs exploded in 2011 when hundreds of thousands of students enrolled in Stanford University's online computer science courses. Tuition-free and open to anyone with Internet access, MOOCs are hailed by proponents as a key to transforming higher education and expanding access to college-level courses around the world. While many participants enroll in MOOCs for the certificate of achievement they may receive for course completion, many others register simply for the challenge and joy of learning.

Over the last year, two groups at the University of Washington—UW Educational Outreach and Computer Science and Engineering (CSE)—have devoted substantial effort to experimenting with courses offered through Coursera. Though just one of several educational technology companies offering MOOCs, Coursera was chosen in part because of the relationship CSE faculty had with its founders, Andrew Ng and Daphne Koller of Stanford University, and because of its wide user base. Currently, Coursera has over four million users and over seventy campus partners offering courses.

## Scaling up: Pedagogical strategies for a class of thousands

MOOCs succeed on a massive scale by being limited to particular types of teaching and learning activities. Instruction takes place through pre-recorded online video lectures and other supplementary materials (readings, notes, and exercises) and through community discussion forums and/or local meetups of participants enrolled in a course. Critics argue that these limitations result in courses that are less rigorous than their residential counterparts and traditionally sized online courses with greater instructor interaction. Yet proponents contend that MOOCs deliver a quality educational experience and can exist alongside classroom education as an inspiring alternative.

Coursera offers options for teaching and assessment that are based on pedagogical research and are designed to help students "master new concepts quickly and effectively."[1] Interactive exercises embedded in the videos, for example, are intended to promote learning and engagement by requiring that students reconstruct content recently taught. On homework assignments, students receive immediate feedback on concepts they did not understand, and they can typically attempt the homework more than once; Coursera can provide randomized versions of the same assignment, so students can re-test their knowledge.

In addition, Coursera offers the option of peer assessment, in which students are trained to use a grading rubric to evaluate and provide feedback on other students' work. The process provides an additional learning experience and results in highly accurate feedback, since (following a crowd-source model) multiple ratings are combined to arrive at a final score.

## Learning from experience

Four UW instructors recently shared their experiences of teaching a MOOC for the first time:

- Barbara Endicott-Popovsky, Director, Center for IA and Cybersecurity, Information School, Research Associate Professor, Information School
- Daniel Grossman, Associate Professor, Computer Science and Engineering
- Arvind Krishnamurthy, Associate Professor, Computer Science and Engineering (co-taught with David Wetherall and John Zahorjan, also in CSE)
- Bill Howe, Director of Research, Scalable Data Analytics, eScience Institute

Their motivations for joining the MOOC community were multiple and varied. All were interested in technological change and getting in on the ground floor of an educational innovation. Barbara Endicott-Popovsky was also interested in the emergence of MOOCs as a social phenomenon. For the CSE department, offering courses in Coursera was a way to increase visibility for the computer science program at UW and highlight its leadership in education. Bill Howe wanted to help influence the national discussion about data science education and to introduce students to this new field of study.

These instructors' stories provide insights into the challenges and benefits of teaching a MOOC, detailed in the sections that follow. To be sure, teaching on a massive scale requires work—much more than required for a traditional class—plus a shift in thinking about how students will learn; the dynamics of teacher-student interaction in the classroom cannot be replicated in the MOOC environment. And launching a MOOC is not done alone; instructors, administrative staff, and teaching assistants must work together to ensure thorough course preparation and a smooth delivery.

But the investment of time and energy can also yield surprising insights into pedagogical practice and great personal reward. MOOCs are a unique educational model; the community of global participants, by its nature, adds fresh perspectives to course content, and instructors have access to meaningful data about what did or did not work in lectures and assignments. And success on a massive scale may inspire new ideas for how to improve a residential course. Beyond all this, in teaching a MOOC, instructors have the opportunity to reach an audience eager to learn what they have to teach, and to have the kind of impact once only imagined.

## Collaboration required

Anyone with experience will agree the task of preparing a MOOC is daunting. Estimates range from a few dozen to more than one hundred hours to record online lecture videos and prepare other course materials.[2] With thousands of students enrolled, extreme clarity, consistency, and quality control are essential for a MOOC to succeed. From planning course content and

assignments, to ensuring quality video production, and effectively running and concluding the course, MOOCs are a team endeavor.

For Barbara Endicott-Popovsky, a nine-year veteran of online instruction, preparing her first MOOC was relatively straightforward, though it still took months of preparation. With the help of instructional designers and technologists in Educational Outreach, she converted an existing course on Information Security & Risk Management, taught through EO and the iSchool, to the MOOC structure. EO staff were already familiar with the effort required to build a MOOC. They were able to repurpose Barbara's existing content, divide and organize video material into smaller chunks, record supplementary material where necessary, and ensure the consistency and integrity of the course end to end. Additional help came from a teaching assistant, who wrote questions to the videos and monitored the discussion forums during the course.

To prepare courses that would be offered in January, the Computer Science department began work in July. Dan Grossman assembled a team of motivated instructors and teaching assistants he met with weekly, dividing tasks based on interests and abilities: writing auto-grading scripts, interfacing with the Web site, plus an AV team and IT support. With guidance provided on the Coursera site, CSE staff converted a closet-sized space into a recording studio outfitted with simple equipment. Using only a camera, computer, and tablet, Dan was able to record himself lecturing and solving problems, as he would in class. "The videos weren't perfect," says Dan, "they included my typos and backspacing," but students did not seem to mind.

Unlike the other instructors, Bill Howe's MOOC was not built from an existing course. He observed that while designing material explicitly for a MOOC offers some flexibility relative to shoehorning existing classroom-based material into a new format, he missed the opportunity to "dynamically adapt the material to the needs of the students based on classroom discussion" and found it necessary to try and "anticipate every possible question" while recording videos—a significant time investment. By spring, four instructors were competing for time in the recording studio, and Bill often found himself there until 2:00 am, preferring to do the work of organizing content into lectures outside of the workday. While many schools hire a dedicated person to make sure that videos are edited properly, uploaded, and ready to go on time, this was work done by the CSE instructors themselves. This approach was effective, but Bill believes the investment in a dedicated resource for editing and material management would pay off in quality and time saved.

## Distributed team teaching, and unexpected discoveries

With a MOOC, not only are the students from other countries, sometimes the instructors are, too. Three CSE instructors—Arvind Krishnamurthy, John Zahorjan, and David Wetherall—taught a MOOC Winter quarter while David was away in Barcelona. Each had taught "Introduction to Computer Networks" previously, though as the author of the textbook used at the UW and other institutions, David drove the decision to put the course on Coursera. The MOOC provided an opportunity to update the textbook, and it gave all three instructors a chance to standardize the curriculum and improve the course. David recorded lectures in Barcelona, John developed and gave feedback on the programming assignments, and Arvind taught the course to UW students at the same time it ran in Coursera, using slides prepared by David. All three monitored the

Coursera discussion forums, along with their two half-time teaching assistants, and Arvind helped to write questions embedded in the videos.

Arvind laughs when describing the task of coordinating a local class of sixty students plus another 23,000 active MOOC participants in the first week. David would finish lectures one week ahead of the UW course, and Arvind and TAs would scramble to get the homework questions in place. Though the plan was to offer in Coursera the equivalent of the local course, Arvind found he actually taught about 85% of the content covered in the MOOC. He explained that what David might take thirty minutes to cover in recorded lectures took him fifty minutes in class; with added anecdotes and material from his own research, plus student discussion, the pace was naturally slower.

Arvind was grateful for David's lectures and thought they improved the delivery of the local course: "This is highly technical material—I would have liked these videos as a student!" Although Arvind did not watch every video, he did make them available to his local students, and made use of the same slides. One day, a student who both attended class and watched the Coursera videos told Arvind, "David's lectures are completely different." Arvind was surprised to find that indeed, although they used the same slides, David's perspective on networks differed from his own. Although they'd collaborated on research, they had never previously talked about their teaching; it was the kind of discovery he might make only if sitting in on his colleague's class.

### A global perspective on course content

When Barbara began teaching her courses in information security for Educational Outreach and the Information School, she was teaching students from the United States and preparing them to work in national corporations. With students from all over the world participating in her MOOCs, however, the content and discussions are infused with a global perspective. "Cybersecurity has strong privacy implications," Barbara explained, "and different countries have different sensitivities to these issues. We have networks that cross boundaries, assets stored in the cloud. Each country has compliance regimes, regulations—we need to take all of this into account."

For Barbara, the educational benefits of the expanded context are profound. "There's potential for harmonization when people come together and begin to take into account perspectives they hadn't previously considered. They deepen their thinking about concepts and are better prepared to engage with the global business world."

Students in Bill Howe's course experienced similar benefits. In Bill's MOOC, students had the opportunity to work on real-world data science problems posed by organizations. The optional assignments were part of a broader initiative, Coursolve, which connects courses and organizations to enable students to apply their knowledge in solving real and current challenges. Students around the globe were able to bring their unique perspectives to bear in discussions with nonprofit environmental advocacy groups, university research labs, and more. In this case, Bill's MOOC provided the kind of experiential learning opportunity that is still rare in higher

education, even in the campus classroom.

### Rethinking the residential course

Dan's experience teaching a MOOC led to new thinking about his residential course. In order to translate his UW course in Programming Languages to the Coursera platform and teach to scale, Dan had to make a few changes in his assignments. One solution was to have Coursera participants complete peer assessments for their coding assignments. Dan created a detailed rubric for students to use in evaluating each other's work, describing inferior ways to solve the problem and common mistakes people make. Students were required to complete three peer assessments before they could view their own score, ensuring they become familiar with an expert approach to the problem and practice its application. After seeing the value of these assignments for his MOOC participants, Dan is now interested in incorporating peer review into his residential course—as soon as he can figure out the infrastructure to make this happen.

Teaching a MOOC also led Dan to think differently about the structure of university courses. With a MOOC, Dan realized, the ideal timing is to release new material and assignments every week on a Friday, but allow ten days (including two weekends) for students to complete the work and turn it in. This makes sense, given the competing demands on the time of MOOC participants, many of who are working professionals. But are there also lessons here for residential courses? Dan believes releasing a week's worth of material at a time would also benefit his UW students. Ideally, he says, class would meet for ninety minutes on Monday morning and ninety minutes again in the evening. On Tuesday, students could meet with the TA, and on Wednesday, begin work on their own. Teaching a MOOC showed Dan that the only reason courses are currently scheduled the way they are is because that's the way they have always been scheduled. Other models are possible.

### A strategy for student recruitment

Both Educational Outreach and CSE see potential value in MOOCs for recruiting students to the UW. Students who register for Barbara's course in Coursera have the option to enroll in the UW Certificate Program within the first two weeks of class. Although there is a fee, enrolling in the certificate program gives students access to a more rigorous version of the course and interaction with the instructor, and results in a UW credential and graduate credit. This past year, about half a dozen students who registered for the Coursera course went on to apply to the certificate program.

In CSE, MOOCs present an opportunity to identify more qualified applicants around the globe. Arvind noted that CSE often acts conservatively in accepting applicants, selecting primarily students from schools and programs with which they are familiar. But performance in a MOOC, he explained, could function as a test of ability: "You want into our program? First take this MOOC or respond to these problem sets."

### Renewed enthusiasm for teaching

There was a certain thrill in UW instructors' voices as they shared their stories about teaching a MOOC for the first time. While all are teachers passionate about their subjects and early adopters of new technologies, they were also a bit awed by the reach and potential impact of their Coursera courses. Although only a fifth of the 50,000 students registered for Arvind's MOOC completed the work and passed the course, 25,000 watched the videos—a number far exceeding the number of students in his residential course. And MOOC participants are a different population; UW faculty reported that a good proportion of their MOOC students were professionals working in their fields who brought a great degree of expertise and practical knowledge to the class environment. "There's a huge number of people who see these courses as a way to learn, share, and grow," said Barbara. "MOOCs are convenient for adults looking to continue their education but who don't have the resources to become full-time students enrolled in a face-to-face program." And they are extremely grateful for the opportunity.

The social dimensions of the MOOC environment also fascinated instructors. MOOC participants form communities online and in their local areas. "Some students came up with their own notes and posted these each week," Arvind reported. "Another came up with a glossary of terms." A group of Spanish speakers in Dan's class formed a community to help one another keep up in the course by translating lecture notes, homework, and even video subtitles.

Beyond the discussion groups that formed online, Barbara found her own community growing. "A few hundred students contacted me through LinkedIn," she says, noting that her account resembles "a mini United Nations." She's now participating on graduate committees of several former MOOC participants, and one student, a Ghanaian living in Denmark, has requested to spend six months with her as part of his doctoral training. His goal after completing his degree is to teach Barbara's material on information security to the Ghanaian government. That kind of impact is something Barbara never imagined.

## Where to go from here?

Like any technology innovation, MOOCs are evolving. A recent EDUCAUSE Learning Initiative presentation on "Learning and the MOOC" suggested that significant change and experimentation will happen with MOOCs before they find a new status quo in education.[3] For the UW instructors who have now taught a course in Coursera, there's great interest in how this new educational model may evolve. As Barbara Endicott-Popovsky noted, "The genie's not going back in the bottle." Asked what advice they would offer to other UW faculty interested in teaching a MOOC, almost all gave the same answer: "Enroll in a MOOC first, to understand the student experience."

Institutions across the country are offering MOOCs for a range of reasons—to increase access to higher education, to showcase expert faculty, to provide options for in-demand courses. At an EDUCAUSE Learning Initiative focus session this spring, presenters raised questions for individuals and institutions in the early stages of MOOC adoption:[4]

- How can a MOOC best support engaged learning?
- What are you teaching, to whom, and for what reason?
- What supports do faculty need to create a successful MOOC?
- How will a MOOC help your department or institution fulfill its mission?

The Office of the Provost is currently working on next steps for the UW in regard to MOOCs. Watch for more in the coming months.

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[1] Coursera site. Retrieved from https://www.coursera.org/about

[2] Kolowich, S. (2013, March 18). The professors behind the MOOC hype. The Chronicle of Higher Education. Retrieved from http://chronicle.com/article/The-Professors-Behind-the-MOOC/137905/#id=overview

[3] Hill, P. & Feldstein, M. (2013). Everything you thought you knew about MOOCs could be wrong [PowerPoint slides]. Retrieved from http://www.educause.edu/sites/default/files/library/presentations/ELI134/OL01/FeldsteinHill_Everything%2BYou%2BThink%2BYou.pdf

[4] EDUCAUSE Learning Initiative (2013, April 3-4), Learning and the Massive Open Online Course (MOOC). Report available at http://www.educause.edu/library/resources/learning-and-massive-open-online-course-report-eli-focus-session