Educational Advances in Artificial Intelligence

■ *The Educational Advances in Artificial Intelligence column discusses and shares innovative educational approaches that teach or leverage AI and its many subfields at all levels of education (K-12, undergraduate, and graduate levels).*

Douglas H. Fisher

Leveraging AI Teaching in the Cloud for AI Teaching on Campus

In this column I describe my experience adapting the content and infrastructure from massive, open, online courses (MOOCs) to enhance my courses in the Department of Electrical Engineering and Computer Science at Vanderbilt University. I begin with my informal, early use of MOOC content and then move to two deliberatively designed strategies for adapting MOOCs to campus (that is, wrappers and small private online classes [SPOCs]). I describe student reactions and touch on selected policy and institutional considerations. In the never-ending search for increasing student bang-for-the-buck, I was motivated to increase the bang, rather than reduce the buck, the latter being well above my pay grade. I close with some vision for teaching on campus with resources from the cloud, notably on how it may strengthen community and collaboration in teaching.

In the fall of 2011, Stanford University announced three massive, open, online courses (MOOCs), including a course on databases and another on machine learning. In the spring of 2012, I integrated their online lectures into my database and machine-learning courses at Vanderbilt, which consisted of having students watch videos beforehand and employing active learning in class — although there was substantial work in designing active learning exercises for class. This led to loud, animated small-group work in class — music to my ears! I expanded the use of MOOC content for my on-campus courses, having Vanderbilt's Center for Teaching do midsemester evaluations, and tweaking my courses accordingly.[1]

The results of my end-of-the-semester evaluations were pleasing — my mean instructor and course ratings went up and standard deviations went down. I credit these positive changes to the active in-class learning and a new enthusiasm for teaching, as well as the first-rate lectures by Stanford professors Jennifer Wisdom and Andrew Ng. Rather than causing me to disengage with my students in class, properly

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leveraging the online lectures of others allowed me to more deeply engage with my students.

In AI (and later databases), I started posting my own educational videos to YouTube, which made me feel better about using the content of others. I was pleased when students, enrolled in Introduction to Artificial Intelligence Class MOOC CS188x at the University of California, Berkeley, came to my channel for remediation, taking word back to the MOOC's discussion forum. I required students in my graduate AI course, as part of their apprenticeship, to create educational videos too and optionally to post them after vetting.

Going further, I created a wrapper course (in machine learning),[2] which is an on-campus course that requires participation in a concurrent MOOC — watching videos, doing the assessments, and participating in discussion forums. Using the MOOC's autograding infrastructure eased my workload immensely. In addition to completing the MOOC, students read journal papers, which we discussed in class, and did end-of-the-semester projects (Bruff et al. 2013).

My wrapper was taught as an overload course for graduate students who very much wanted machine learning in an academic year in which it would not otherwise be offered. I took seriously the implications for student privacy, including the Family Educational Rights and Privacy Act in the United States, which is an open concern in the MOOC-on-campus landscape. Moreover, I obtained explicit written permission from Coursera[3] for using the machine-learning MOOC, important because many current MOOC-provider terms of service appear to imply that the student, though not the instructor, would be in violation for participating in a wrapper without such permission.

I revisited the University of California, Berkeley's CS188x last year by alpha testing it in a small, private, online course (Fox 2013) at Vanderbilt. A small, private, online course (SPOC) is like a wrapper, but the MOOC content and infrastructure is used only by on-campus students and therefore lacks the interesting possibilities that stem from participation in a concurrent global learning cohort. I used the SPOC format only for the first half of the semester, requiring videos before class, sometimes using my own in-class exercises and sometimes those provided with CS188x. I used the excellent CS188x video lectures primarily, but also inserted videos of my own and others (for example, from University of British Columbia), with attention to clear institutional identification. Programming projects (again provided by CS188x) were plug-ins to a Pac-Man game environment; programming projects were graded using a downloadable autograder. My exams were almost entirely in-class and of my own design, but in each case I had a small take-home component that incorporated CS188x exam questions, allowing students to use the online, autogradable capabilities for one or two practice runs on selected questions before submitting their answers.

Midsemester Center for Teaching evaluations showed that students liked this SPOC format, although there were suggestions for better in-class and MOOC-content coordination. Had I tweaked my course and continued along this path, I might have achieved phenominal success, but sadly I left the SPOC format behind. At midsemester I embarked on a preplanned machine-learning project, to coincide with an industry-sponsored programming competition (optional to students) without enough scaffolding and engagement for many students. As a result there was negative end-of-semester feedback by students and mediocre mean ratings for the course.

Disappointments notwithstanding, the vision for cloud on campus lies in the power of communities (Fisher and Fox 2014). Consider that we rightly complain about misconceptions that computing is asocial, but the characterization of traditional teaching as overtly asocial is rarely acknowledged, making it a potentially unattractive future for our students and societally harmful. Thankfully, public-facing courses make collaborations among educators (both locally and globally) exciting possibilities. For example, imagine coteaching interdisciplinary (online) courses, such as AI and the Environment, or AI and Personhood, with like-minded faculty elsewhere, no longer limited by institutional boundaries. In a richly collaborative future of public-facing education, acknowledgement of each other's teaching efforts would likely be as much an obligation and pleasure as it has long been in the noblest of research culture.

Moreover, imagine campus students and instructors informally learning from those of different cultures, on issues such as environmental sustainability and the societal implications of technology. Imagine too, our students learning from the professionals who so often take our MOOCs (Schmidt and McCormick 2013), with members of underrepresented groups in AI and computing finding empathetic and enthusiastic mentors around the globe, a process that can be enhanced by design. Imagine finding the world's greatest teaching assistants for our campus students from that global, virtual, and nontraditionally affiliated student body that participate in MOOCs (and thus, our wrappers too). Imagine expanding our campus offerings through wrappers, SPOCs, and formats yet to be implemented, on subjects with no local faculty expertise, but with local faculty participating as lead learners, side by side with their students.

I am thankful to be an educator in this time of transformation, particularly in AI, which will surely help propel the innovation (Fisher and Fox 2014), as well as benefit from it.

Notes

1. See Warming up to MOOCs by D. Fisher, 6 November

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2012, in the Chronicle of Higher Education ProfHacker blog. (chronicle.com/blogs/profhacker/warming-up-to-moocs/4402). Also see Fred Martin's early, visionary, and still timely experience (Martin 2012).

2. I adapted the term *wrapper* from the machine-learning feature selection literature, the metaphor being that the campus course selects the MOOC content best suited to the local environment.

3. See www.coursera.org.

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