Ubiquity Symposium

MOOCs and Technology to Advance Learning and Learning Research

Opening Statement

by Candace Thille

Editor's Introduction

MOOCs have fueled both hope and anxiety about the future of higher education. Our objective in this symposium is to surface and explore some of the open questions which have arisen in the MOOC debates. In this symposium, ten authors examine different aspects of MOOCs and technology to advance learning and learning research.

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When faculty at Stanford offered an advanced computer science course online for free, they were astounded when 160,000 students registered. Others at MIT, Harvard, and Berkeley offered open online courses and got similar responses. Several commercial startups and a new non-profit sprang up to develop delivery platforms and offer broad selections from the catalogs of their partner universities. *The New York Times* declared 2012 "the year of the MOOC" [1]. Suddenly the higher education community found itself in a heated debate about how these massive open online courses (MOOCs) were going to affect them. Were MOOCs a "tsunami" [2], a "fad and bubble" [3], or something else? While much of the hype surrounding MOOCs has subsided, the phenomenon galvanized the attention of educators into a much-needed conversation about teaching and learning, the value and purpose of higher education, and the potential impact of technology on higher education's future.

The term MOOC was first used in 2008 by Dave Cormier to describe George Siemens's and Stephen Downes' "Connectivism and Connective Knowledge" course [4]. MOOCs started to gain national attention in the fall of 2011 when elite universities offered open-access free online courses. National attention intensified in 2012, when faculty who had piloted the popular MOOCs at Stanford, established two new for-profit MOOC platforms—Coursera and Udacity. Shortly thereafter, MIT and Harvard joined forces and set up their own not-for profit MOOC platform, EdX. At the end of 2012, the UK entered the field with the announcement of their own MOOC platform, FutureLearn.

Distance and online courses are neither new nor rare. The University of London began offering distance education in 1858 and currently serves more than 50,000 students in 190 countries [6]. The 2013 Survey of Online Learning revealed 32 percent of all U.S. students in degree granting post-secondary institutions took at least one online course in fall 2011 [7]. Free, recorded lectures and Open Educational Resources are also not new. The recorded lectures of full courses have been freely available for years thanks to iTunes University, Academic Earth, and Yale's open learning project. The idea of using computer technology to disseminate information or to improve learning outcomes is one of the oldest ideas in educational computing, going back to the PLATO (Programmed Logic for Automated Teaching Operations) project at the University of Illinois in the 1960s. The sudden prominence of MOOCs was the result of massive student enrollments, aggressive public relations from prestigious universities, and significant financial investment from venture capital and foundations.

All MOOCs have several features in common: They are massive relative to the numbers of students who enroll in traditional courses. (The original Siemens and Downes MOOC enrolled 2,300 students and the first MOOCs from Stanford and MIT enrolled tens of thousands to more than 100,000 students.) The courses are all offered online. The courses are all open enrollment and offered free of charge. The MOOC provider offers only a certificate of completion, but no credit toward any college degree; although in 2013 several MOOCs were evaluated and recommended for college credit by the American Council on Education College Credit Recommendation Service (ACE CREDIT) [5]. MOOCs differ in their underlying pedagogical philosophies, which are reflected in the design of the technologies that support the courses.

The original 2008 MOOC was based on a pedagogical model in which the students are responsible for co-creating the learning experience along with the instructor. It was more of a learning community than a traditional course. The underlying assumption was each person brings a unique perspective, and learning occurs when these perspectives are placed in juxtaposition; the content facilitates social connections. Most of the students were expected to define their own learning outcomes in addition to the formal learning outcomes for the students who took the course for credit. The technology would support communication and connection among participants in a distributed social network.

In contrast, MOOCs delivered through Coursera, Udacity, and EdX follow a more traditional pedagogical model: An expert faculty member's performance is the center of the course. The

technology disseminates the faculty member's performance to a massive number of students. In many MOOCs, the technology is also used to deliver assignments, which are graded either by machine or by a peer grading system. Coursera, Udacity and EdX signaled the entrance of the elite and most selective universities into the online marketplace, which was previously the domain of many less well-known and less selective schools.

Both the 2008 "connectivist" model and the 2012 "expert" model use the same term, MOOC, but with different pedagogical models, business models, and technology. For the past decade, the Open Learning Initiative (OLI), which I direct, has been creating open online courses using a third model. OLI convenes teams of multiple faculty disciplinary experts, learning scientists, human computer interaction experts, software engineers, and students. The teams apply results and processes from the learning sciences to the design, implementation, and evaluation of the OLI courses. OLI's open online courses deliver instruction while simultaneously collecting data to provide actionable feedback to four groups of critical players in the learning system: students, teachers, course design teams, and learning researchers. In the OLI model, the technology is used to support a networked educational intelligence system.

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Models of Effective Pedagogy. Most universities face a dual challenge of containing costs and increasing student success. Which existing or new pedagogical models support the design of online or hybrid environments and address the dual challenge? Which models are most effective for which disciplines and levels of learners?

Design of the Technology. To date, the MOOC technology has been primarily used to disseminate information and provide limited forms of summative assessment. What technologies are needed to support authentic and rigorous assessment? How do we use the technology to provide, at scale, detailed guidance to learners that is undergirded by expertise and tailored to the learner's current level of competence?

How can the function of assessment and providing effective guidance to learners be distributed most effectively among machines, human experts, and networks of learners? Instructors and institutions have traditionally used assessments to verify students' knowledge. What are the

challenges with verifying student knowledge in large-scale online environments and what potential solutions exist to address those challenges?

Limits of the Technology. Many educators believe the personal contact between teacher and student is essential for good coaching and individual development. They are skeptical an online environment can support the level of contact needed. What are the limits of technology? Is Dreyfus's warning true, that online environments cannot raise a learner above the level of competence [8]?

Business Models. The ideal of free, open access places limits on potential revenue sources to sustain a MOOC enterprise. What are the benefits and risks of alternative methods that are being explored for revenue generation, for example selling certificates to students, selling names of top students to potential employers, or selling licenses to use the MOOC content to other institutions? What are the costs of being a MOOC course provider and developer? What are the costs of being a MOOC user? What is the appropriate relationship of for-profit MOOC providers to non-profit institutions of higher education?

Collection, Use, and Ownership of Data. Networked online environments can collect massive amounts of student interaction data. Although the data can provide insights into student learning it is limited by the type of interaction that is observable and by the semantic tagging of the data generated by the interaction. The current MOOC platforms, and many traditional learning management systems, collect click-stream data that can measure frequency and timing of student log-ins, correctness (or incorrectness) of student responses, and the chattiness of individual students. While click-stream data may predict which students are likely to complete the course, they do not explain if or how learning is occurring. How can the learning environments and data systems be designed to yield data that transform into explanatory models of a student's learning and also support course improvement, student feedback, and the basic science of human learning? Student data is also a potential source of income for MOOC providers. What are the implications of collecting large amounts of student learning data? Who should own the data and who should have access to it?

Learning is complex. Fortunately, one of the great powers of modern information technology is supporting humans to manage complexity. The key will be in asking the right questions and leveraging the technology to support learning, research on learning, and higher education's core mission.

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The first segment of the symposium addresses particular technical and scientific innovations in MOOCs. Piotr Mitros, Anant Agarwal and Vik Paruchuri describe new forms of assessment in large-scale digital learning environments; Andrew Maas, Chris Heather, Chuong (Tom) Do, Relly Brandman, Daphne Koller and Andrew Ng outline the process and biometrics used to establish and verify student identity during a course; and Kenneth Koedinger, Elizabeth McLaughlin, and John Stamper describe how a data-driven learner model approach that uses fine grain data, conceived and developed from cognitive principles, can be used to drive instructional decision-making toward better student learning.

In the second section, the authors describe the impact of MOOCs on their residential institutions and courses. John Mitchell discusses the activities and impact of MOOCs at Stanford University and, based on his vantage point as Vice Provost for Online Learning, he predicts what the future holds. Armando Fox's contribution describes how using the materials developed for MOOCs in a small private online course changed and improved an on-campus computer science course at UC Berkeley. In contrast to Armando's description of the benefit of MOOCs on computer science education, Mark Guzdial makes a compelling argument about the limitations of MOOCs for addressing the pressing needs of computing education.

In the third, and final, section, the authors express their views on the impact of the MOOC phenomenon on big picture of higher education. The first article by Steven Ruth briefly describes some of the cost issues associated with MOOCs and suggests a perspective through which drastic tuition savings might someday be achieved, possibly through the assistance of MOOCs. Fred Siff warns online learning, and in particular MOOCs, are threatening to overrun not just old models of instruction but the very nature of higher education institutions themselves. Lewis Perelman counters that the embrace of MOOCs is a symptom, not a cause of academia's obsolescence. Finally Michael Feldman takes a step back to explore the cultural context that mediates our scientific and reflects on how that context does and should shape our collective research agenda.

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