Fight the MOOC-opalypse! and Reflections on the Aporia of Learning

Fred Martin
University of Massachusetts Lowell
USA

bit.ly/cserc2013-fredm
plan

- the aporia of learning (physics)
- amnesia of learning
- the rainfall problem
- a personal learning story

- what is a MOOC?
- a MOOC in my "flipped classroom"
- the problem with MOOCs

- re-valuing learning
Fred’s doctoral advisers

- Edith Ackermann
- Seymour Papert
- Donald Schön
the aporia of learning

- aporia: Greek word meaning “impasse”

- Wolff-Michael Roth: how can we intentionally direct ourselves to learning something new, when by definition we do not yet know it?

the aporia of learning... physics

- Roth observed a conventional high school physics classroom, with traditional experimental demonstrations.
- The teacher was devoted and deeply understood the physical concepts he was demonstrating.
$L = 0 = L_{me} + L_{wheel}$

Figure 1.1. While sitting on the rotating chair, the teacher spins the bicycle wheel. When the axis of the wheel is parallel to that of the chair, the latter rotates in the opposite direction of the chair. When the axis of the wheel is perpendicular to that of the chair, no movement should be observed.
the aporia of learning... physics

- Students literally did not perceive the effects that the teacher intended the demonstrations to show.
- They could not do so because they did not yet have the requisite physical knowledge needed to separate a nearly imperceptible “signal” from the “noise” of everyday experience.
amnesia of learning

- once we have learned something, we forget about how it was, or felt, not to know it
- cognitive psychologists refer to this as “psychogenic amnesia”
a little test...
what is this about?
Privacy and Confidentiality
Only we and our research assistants (who will help in transcribing the audiotapes) will have an access to recorded materials. All research data will be strictly confidential. Your name or any other identification will never be disclosed. We will take every precaution to protect your privacy and confidentiality in the data collected. Recorded tapes will be destroyed no later than three years after the completion of this research project.
amnesia of learning

“Can you imagine what it was like before you learned how to read—words, numbers, equations, standard music notation?

That piece of the past for most of us is simply wiped out.”

amnesia of learning

when post-conservation children would view videos of themselves giving pre-conservation answers, they “would simply not accept the idea that it was them. ‘I didn't say that’; someone had to make this up”

(Ackermann, personal communication)
The Rainfall Problem

- Originally studied by Elliot Soloway in 1980s
- Slides courtesy of Mark Guzdial, from a talk he gave at MIT in January 2013
The Rainfall Problem

- Problem: Read in integers that represent daily rainfall, and printout the average daily rainfall.
  - If the input value of rainfall is less than zero, prompt the user for a new rainfall.
- When you read in 99999, print out the average of the positive integers that were input other than 99999.
<table>
<thead>
<tr>
<th>Level Description</th>
<th>% of Students who got it right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novices (3/4 through first course)</td>
<td>14%</td>
</tr>
<tr>
<td>Intermediates (3/4 through second course)</td>
<td>36%</td>
</tr>
<tr>
<td>Advanced (Jrs and Srs in Systems Programming)</td>
<td>69%</td>
</tr>
</tbody>
</table>
Not an anomaly

- Elliot Soloway and his students replicated this study many times.
- Others have used this same problem with similar results (Most recently: Venable, Tan, and Lister, 2009)
- Anecdotally, every institution I’ve been at has attempted this problem, with similar results.
MIMN Studies

• “Is it just Yale? Is it just Yale and Pascal?”
• In 2001, Mike McCracken et al. gathered data from 216 students in 5 institutions in 4 countries: “Build a calculator.”
  • Out of a possible 110 points, average score was 22.89.
Why is the Rainfall Problem hard?

- Writing code is a design problem.
- Students may understand the pieces, but they might not know how to put them together.
- We have learning amnesia, and we have forgotten what it’s like to not know how to code.
let’s talk about MOOCs

- what is a MOOC?
- a MOOC in my “flipped classroom”
- the problem with MOOCs
MOOC = massive open online course

- initial concept and acronym by David Cormier, whose model involved many collaboratively contributing to learning
- burst into public view with courses launched by three Stanford Univ. faculty in Fall 2011
- features of these courses: series of mini-lectures; interactive quiz questions; auto-graded homeworks and tests; discussion forums
For this problem (and only this problem) assume actions are stochastic in a way that is different than described in 4. MDP Gridworld. Instead of an action north possibly going east or west, **an action north will possibly go northeast or northwest** (i.e. to the diagonal squares).

Likewise for the other directions e.g. an action west will possibly go west, northwest or southwest (i.e. to the diagonals).
great things about MOOCs

- famous, expert teachers using informal style
- complex topics in “bite size” chunks
- engaging, frequent quiz questions
- immediate auto-grading is motivating and helpful
MOOC in “flipped classroom”

- 16 students
- Half grad, half upper-div undergrad
- Met once weekly, seminar-style
- Went through MOOC together
- Discussed HW problems around when they were due

But also...

- Supervised indiv. student projects
- Students presented their work in a public poster/demo session to dept'
- Grade was 2/3 Stanford, 1/3 project
student projects

- Video Game AI: Manipulating the A* Algorithm
- Optimal Path Planning with A* Search Algorithm
- Impersonating Myself on Chat
- Characterization of User Input on iSENSE Using Bayes Nets
- DNA read assembly using A* Search
- LMS Adaptive Filter Vs RL Q-Learning Algorithm
- Electrical Power Network Fault Response System
- Bot for the Google AI Challenge
- Collaborative Q-learning
- Markov Melody Generator
- Using AI to Improve Hajj Experience
- Using AI to Win Dots & Boxes
- Smart Surveillance: Object Tracking and Classification of Moving Pedestrians
- Reinforcing Conversation
my version of the AI class...

adding the discussion
and project transformed it:

From a class about AI

To a class on doing AI.
what’s the problem?

- pedagogy
- quality
- access
- cost
MOOCs have some innovations (mini-lectures; quizzing; autograding) but essential pedagogy is still didactic

don’t try encouraging productive confusion (e.g., Baker, D’Mello, Rodrigo, & Graesser, 2010)

don’t try encouraging vicarious learning (e.g., Chi, Roy, & Hausmann, 2007)
quality

• created by elite universities; ergo, high quality; e.g.:

@aiclass: “Advanced students will complete the same homeworks and exams as Stanford students. So the courses will be equal in rigor.”—September 28, 2011

• but what do faculty really believe?
the professors who make MOOCs

79% – yes, MOOCs are worth the hype

72% – no, my students shouldn’t get my univ’s credit for my MOOC

In other words: MOOCs are good enough—

for your students, not ours

Professors who make MOOCs

184 professors surveyed, 103 responses

72% – yes, my students should get credit for completing a MOOC

79% – yes, MOOCs are worth the hype

Chronicle of Higher Education, March 18, 2013
access

- big hype about providing access—after all, now, all you need is a web browser to access an education of the highest quality!
- based on pedagogy of MOOCs, what is profile of MOOC completers?
  (hint: it might be those who already have advanced educational backgrounds)
Online Courses Could Widen Achievement Gaps Among Different Types of Students

By JAKE NEW

Low-cost online courses could allow a more diverse group of students to take college, but a new study suggests that such courses could also widen achievement gaps among students in different demographic groups.

The study, which is described in a working paper titled "Acceptability to Online Learning: Differences Across Types of Student and Academic Subject Areas," was conducted by Columbia University’s Community College Research Center. The researchers examined 500,000 courses taken by more than 40,000 community- and technical-college students in Washington state. They found that students in demographic groups whose members typically struggle in traditional classroom settings are faring their troubles exacerbated in online courses.

The study found that all students who take online courses, no matter the demographic, are less likely to attain a degree or do as well as they would in physical versions of the same courses. However, some groups—including black, male, and younger students, and those with lower grades point averages—are particularly susceptible to that pattern.

Shanna Smith Jaggars, assistant director of the Community College Research Center and one of the paper’s authors, said the widening gap is troubling, but it needs to be put in perspective: online learning is weakening—not strengthening—education’s public good.

“We know that the gap is stronger in the under-represented and under-prepared student,” Ms. Jaggars said. "They’re falling farther behind, that if they were taking face-to-face courses."

Online learning can still be a great tool, she said, particularly for older students who juggle studying and raising a family. For those students, as well as for fourth-grade and higher-performing students, the difference between online and physical classrooms was more marginal, according to the study.

"So for older students, you can sort of see the cost-benefit balance in favor of taking more courses online," Ms. Jaggars said. "They might do a little worse, but overall it's a pretty good trade-off for the easier access."

But when a student doesn’t need online courses for their success, it’s unclear if that is a good trade-off.

Kathy J. Enger, executive director of the Northern Lights Library Network in Minnesota, said an online education for a decade, said online learning isn’t only about access. It can also bring an environment that encourages minority students to speak up without worrying about a “white gaze” in the classroom, like black students or women, she said. Ms. Enger said, “There’s more freedom for students to express themselves and feel validated in an online environment,” she added.

The study suggested several ways to improve online courses, including allowing only higher-performing students to take courses online. Ms. Jaggars said, however, that such a strategy could put some students at a disadvantage, especially younger students who enroll in the courses specifically for easier access and who do fairly well in them.

"But then we have to figure out how to help other students succeed in those classes,” she said. "We need a lot more teacher training, showing them techniques to use to try and reach out. I think it’s difficult for students and faculty to know how to do that online. Not that they don’t want to. It’s just hard."

Ms. Enger said that if students are falling behind in online courses, it’s generally because the professor teaching the course is not reaching out in the right ways.

"If it’s not working, find out what’s not working,” she said. "Then make it work."
cost of education

in USA (2012 stats),

- 15.5M students in *public* higher ed (71%)
- 6.1M students in *private* higher ed (29%)

replace access courses with MOOC?

• February 7, 2013: American Council on Education’s College Credit Recommendation Service (ACE CREDIT) recommended college credit for five courses on Coursera:

“Many students face enormous financial obstacles in pursuit of their degrees. We want to help more students enter college with credit already accrued and exit college on time, on budget and with a degree in hand.”

blog.coursera.org/post/42486198362/five-courses-receive-college-credit-recommendations
San Jose State Univ & Udacity

“This marks the first time that a broad and diverse range of students, not just matriculated students, will have access to online college classes for credit from an accredited university at a very affordable price of $150 per course.”

blogs.sjsu.edu/today/2013/sjsu-and-udacity-partnership/
“Public higher education is about to cross a historic threshold, past which students pay a higher percentage of the operating costs of college than states do.”

so let’s be honest

- report numbers of completers, not registrations (completion numbers are still impressive!)
- conduct research and report demographic info about completers
- study learning outcomes
MOOC reflections

• MOOCs can be a great resource—like a text, only better

• success of MOOCs exposes existing bad teaching practices, especially at univ. level

• MOOCs are probably bad for more-needy students; policy idea to use MOOCs for college-readiness is terrible

• we need to embrace what’s good about MOOCs while pointing out their limitations
about teaching and learning
The Teacher's Job is to Design Learning Experiences, not principally to Deliver Information.