Berkeley’s Online Education Initiatives

Diana Wu & Armando Fox
Challenges & Opportunities

**Challenge:** Aligning the existing enterprise

**Opportunity:** Technology hurdles are receding dramatically

**Challenge:** Potential for disruptive change

"U.S. higher education is on the verge of profound change"

"An explosion of media and content management tools is reducing development costs to trivial levels"

**Opportunity:** Future will likely remain a familiar "war for talent"

"Berkeley’s program is my top choice"

"Developing a successful online version of what we do was harder than we ever imagined"
## Summary of Berkeley’s Campus Online Strategy

### What it is

1. **Support our mission of Access and Excellence**
   - Extension of our academic model (e.g., defined programs of study, courses)
   - Similar academic values, e.g., community of scholars
   - Embracing the best that technology offers— including data
   - Responding to deep changes in how our students communicate and learn

2. **Online will be one element in our broader focus on improving teaching**
   - Using online as a way to help sustain our mission of access and excellence
   - Pursuing revenue generation aggressively, where appropriate
   - Recognition that we are in the very early days of online education
   - Many simultaneous efforts reflecting very different pedagogical challenges that different disciplines face
   - Leverage our existing and proven approaches, standards, academic governance structures, etc.

3. **Leverage the opportunity to generate new tuition revenues**
   - Radical departure in academic model
   - Effort to “redefine” higher education or Berkeley’s identity
   - Open admissions
   - Using online teaching primarily as a cheaper way to teach students
   - Yielding to inferior methods of communication and tech fads
   - Chasing revenue at the expense of scholarship, reputation, or quality of the educational experience

4. **Learn through multiple experiments across our Schools**
   - Imposing technology standards and partnerships
   - Taking large-scale financial and reputational bets
   - Different standards for student selection, instructor selection, student work, etc.

5. **Highest academic standards and integration with our existing model**
## Goals and Anti-Goals

<table>
<thead>
<tr>
<th>Category</th>
<th>Positive Goal</th>
<th>Anti-Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Academic model</strong></td>
<td>Extend &amp; improve existing academic models</td>
<td>Radically new model or “redefinition” of higher ed or UCB identity</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>Enhance on-campus instruction</td>
<td>Constrain instruction to match technology</td>
</tr>
<tr>
<td></td>
<td>Enable new education research</td>
<td>Lower costs</td>
</tr>
<tr>
<td><strong>Access &amp; Excellence</strong></td>
<td>Sustain mission of <em>access &amp; excellence</em></td>
<td>Opportunity at expense of quality or reputation</td>
</tr>
<tr>
<td></td>
<td>Preserve high standards &amp; proven governance structures</td>
<td>Lower standards for students or instructors</td>
</tr>
<tr>
<td><strong>Innovation</strong></td>
<td>Encourage experimentation</td>
<td>Impose early standards or make long-term big bets</td>
</tr>
</tbody>
</table>
Online Education Is Not One Thing

Steering Committee
EVCP, VC Admin & Finance, VP Teaching & Learning, Chair of Acad. Senate, selected Deans of Schools

Diana Wu, Armando Fox

- Public Good
  Improve on-campus & online education

- Certificate Programs
  Professional development with certification

- Degree Programs
  Fully accredited UCB degree offered fully or partially online

BerkeleyX/EdX (“MOOC”) University Extension MPH, MAS-IC, …
Example: free MOOC

Desktop computer lecture capture

During 2003-2007, performance went up from 16% to 65%

Stanford - Coursera
Example: UC Berkeley Summer Session

Professionally-produced, interactive lecture
### Example: Certificate Program

<table>
<thead>
<tr>
<th>Course</th>
<th>Syllabus</th>
<th>Modules</th>
<th>Calendar</th>
<th>Communicate</th>
<th>Report</th>
<th>Automate</th>
<th>Manage</th>
</tr>
</thead>
</table>

## X125.1 Developing the Novel I (867614)

### Writers' Forum

- **M3: Pinpoint your major conflict**
  - **Major Conflict - Hardwick (part two)**
  - **Mimi to Cregg 8/5/12**
    - Hardwick to Mimi: RE the future
    - Mimi to Cregg 8/8/12
  - **Albert, Mimi 6/11/2012 1**
  - **Hardwick, Cregg 6/13/2012 0**
  - **Mimi to Deven 6/6/12**
    - **Mimi to Deven, 6/11/12: character studies**
    - **Deven to Mimi**
    - **Mimi to Deven 6/27/12**
    - **Mimi to Deven 6/11/12**
    - **Deven to Mimi - Indian Relationships!**
    - **Mimi to Deven 6/12/12**
  - **Albert, Mimi 6/11/2012 1**
  - **Deven to Mimi 6/13/2012 1**
  - **Dhulia, Deven 6/11/2012 1**
  - **Dhulia, Deven 6/21/2012 2**
- **Module 3 re-post Susan Alexander Develop Novel 6/16/12**
  - **Alexander, Susan 6/11/2012 1**
- **Central Conflict - Deven Dhulia**
  - **Albert, Mimi 6/11/2012 1**
  - **Dhulia, Deven 6/11/2012 1**
  - **Dhulia, Deven 6/13/2012 1**
  - **Dhulia, Deven 6/12/2012 2**
- **Module 3 5/6/2012, Susan A**
  - **Mimi to Susan, 5/15/12 -- central conflict**
    - **Reply to Mimi Central Conflict 6/21/12 Susan Alexander Dev Novel**
    - **Mimi to Susan, 6/21/12**
  - **Cavallaro, Corinne 6/13/2012 1**
  - **Cavallaro, Corinne 5/6/2012 1**
  - **Corinne to Mimi 3/26/12: Climax & resolution**
  - **Corinne to Mimi 3/26/12**
  - **Mimi to Corinne 3/29/12**
  - **Corinne to Robert: 3/11/12**
  - **Albert, Mimi 6/13/2012 1**
  - **Albert, Mimi 5/15/2012 0**
  - **Jimenez, Robert 6/21/2012 2**
  - **Cavallaro, Corinne 6/21/2012 0**
Example: MPH degree course

Introduction to Environmental Health Sciences PH W200F

**Orientation to the week:** Welcome to Week 5. Check out our introduction to the week in VoiceThreads.

**Modules 8 and 9:** We have two modules of study this week. First, we will look at infectious diseases from an environmental health perspective. Then we will consider a global environmental health challenge, climate change. Click into the Module 8 and 9 pages below to find the lectures, readings, and videos.

**Discussion:** As the week goes along, get into the habit of clicking into the discussion forum at the bottom of this page to contribute to our continuing discussions.

- **Risk Estimates Survey**
  Please take this survey this week so we can work with the results in Week 6.

- **Module 8: Infectious Diseases, Ecological Contexts**
  Carlton

- **Module 9: Global Environmental Health: Climate Change**
  Seto

**Week 5 Discussion**

For 24/7 Tech Help Support:

1-866-786-8197 | onlinehelp@berkeley.edu

Click here to open VoiceThread in Full Screen and to comment.
## Delivering an Online Course

<table>
<thead>
<tr>
<th>Platform/Infrastructure</th>
<th>Design of academic offering</th>
<th>Course content</th>
<th>Course design &amp; production</th>
<th>Marketing</th>
<th>Administration</th>
<th>Teaching &amp; academic support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning technology development and integration</td>
<td>Course of study</td>
<td>Syllabus</td>
<td>Digitization of content</td>
<td>Advertising</td>
<td>Admissions</td>
<td>Instruction</td>
</tr>
<tr>
<td>Hosting</td>
<td>Recognition of completion (e.g., degree)</td>
<td>Course materials</td>
<td>Public affairs</td>
<td>Identity verification</td>
<td>ID verification</td>
<td>Office hours</td>
</tr>
<tr>
<td>Technical support</td>
<td>Outcomes measurement</td>
<td>Evaluation mechanisms</td>
<td>Prospective student inquiries</td>
<td>Registration, transcript and bursar functions</td>
<td>Registration, transcript and bursar functions</td>
<td>Sections</td>
</tr>
<tr>
<td>Admission requirements</td>
<td>Instructional design</td>
<td>Evaluation mechanisms</td>
<td>Career, alumni services</td>
<td>Career, alumni services</td>
<td>Career, alumni services</td>
<td>Academic advising</td>
</tr>
</tbody>
</table>

### Who does each step?
- Private vendor, open source software, internal, “general contractor”…

### How is each step financed?
Resources Example: Online MPH

- Vendor platform (hosted by UNEX)
- Custom video segments and tools for high-touch interaction
- Instructor works with SPH faculty coordinator and UNEX instructional design team
- Marketing by UNEX
- Shared administrative responsibilities
- Instructor & GSAs
About BerkeleyX/edX
• edX.org, a not-for-profit organization
  – More “X Universities” to be added soon
  – UCB leads X Universities consortium, sits on edX Board, contributes platform technology

• Open course materials and course platform

• Focused on high quality
  – Intellectual rigor comparable to campus course
  – Recognized great teachers who are also thought leaders in their fields

• Research to enhance campus experience
### What’s a MOOC?

(\textit{it’s NOT just putting your lectures on YouTube!})

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>What we did</th>
<th>A plausible alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content delivery</td>
<td>7-10 minute lecturelets</td>
<td>60-90 minute lectures</td>
</tr>
<tr>
<td>Assessment</td>
<td>Deep autograding</td>
<td>Peer grading; self-assessment only</td>
</tr>
<tr>
<td>Forum monitoring</td>
<td>TA assigned to help</td>
<td>You’re on your own</td>
</tr>
<tr>
<td>Content capture</td>
<td>Screencast of live lecture</td>
<td>Studio + postproduction</td>
</tr>
<tr>
<td>Pacing</td>
<td>Synchronous deadlines</td>
<td>Self-paced</td>
</tr>
<tr>
<td>On-campus course</td>
<td>Traditional lectures</td>
<td>“flipped classroom”</td>
</tr>
</tbody>
</table>
Case study: CS 169 Software Engineering

- Adapting live lectures to 7-10 min segments with 1 “Peer Learning” question/segment
  - Videos use as self-assessment question
- Nontrivial autograders for programming assignments (same HW’s as on-campus)
- Inexpensive eBook ($10) synchronized with videos (1 book section = 1 video segment)
- Virtual Machine image for Courseware
- New tools to generate quizzes & solutions in multiple formats
Autograding: Automated Non-Trivial Assessment

- Automated: machine grading (vs. human)
- Nontrivial: deeper feedback (vs. just Yes/No)
- Short answer (multiple choice, T/F, numerical, fill in blank)
- Long answer: highly assessment-specific
  - Programming assignments
  - Circuit simulation/Physical simulation
  - etc.
- Possible CS research seminar in Fall’12 to explore/prototype new autograder tools
Autograting: Automated Non-Trivial Assessment

Chapter Three - Ruby and Rails Basics

Homework 1: Ruby Calisthenics

Due Date: Mon 5 Mar 2012 11:59:00 PM PST
Hard Deadline: Mon 12 Mar 2012 11:59:00 PM PDT

<table>
<thead>
<tr>
<th>Part</th>
<th>Name</th>
<th>Last Submission</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/5</td>
<td>Part 1</td>
<td>-</td>
<td>- / 100</td>
</tr>
<tr>
<td>2/5</td>
<td>Part 2</td>
<td>-</td>
<td>- / 100</td>
</tr>
<tr>
<td>3/5</td>
<td>Part 3</td>
<td>-</td>
<td>- / 100</td>
</tr>
<tr>
<td>4/5</td>
<td>Part 4</td>
<td>-</td>
<td>- / 100</td>
</tr>
<tr>
<td>5/5</td>
<td>Part 5</td>
<td>-</td>
<td>- / 100</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>0 / 500</td>
</tr>
</tbody>
</table>

Homework 2: More Ruby, and some Rails

Due Date: Mon 12 Mar 2012 11:59:00 PM PDT
Empirical experience: 7-15 min. “segments” superior to 60-90 min. lecture

<table>
<thead>
<tr>
<th>When?</th>
<th>Live capture</th>
<th>Studio capture</th>
</tr>
</thead>
<tbody>
<tr>
<td>What?</td>
<td>Screencast</td>
<td>Live video</td>
</tr>
<tr>
<td>How?</td>
<td>Classroom infrastructure</td>
<td>Portable equipment</td>
</tr>
<tr>
<td>And Then?</td>
<td>Minimal postproduction</td>
<td>Extensive postproduction</td>
</tr>
</tbody>
</table>

ETS involvement in other capture scenarios is being discussed

http://ets.berkeley.edu/classrooms-buildings
Getting your feet wet with Labs

- edX.org: polished, field-tested courses
  - live now
  - 2 UCB courses in Fall (CS 169.1x, CS 188.1x)

- labs.edX.org: a place to experiment
  - Full courses (field test) or individual modules
  - Online course or complement campus course
  - Open/public enrollment or UCB only
  - Limited or unlimited enrollment caps
  - Live approx. October 15
BACKUP/DISCUSSION
Resources Example: BerkeleyX

- edX platform (hosted, open source)
- Adapt existing on-campus course designed by faculty
- Screencast & video capture in-classroom
- edX
- Instructor & on-campus TA’s (grad/ugrad)
BerkeleyX vs. Private Vendors (Coursera, Udacity, etc.)

• BerkeleyX (both edX.org and Labs) will be preferred vehicle for free & open courses
  – Resource decisions will reflect this
  – Faculty are at their discretion (or their Department chairs’) to use other vendors

• What “open” means:
  – Course materials By-NC-SA
  – Platform is GNU General Public License
Modules

• A subset of a course (e.g. 1-2 weeks worth)
  – Lecture video modules
  – Assessment(s)
  – Supplementary materials (online handouts, etc.)

• Why start with a module?
  – A way to “build up to” a full course
  – Experiment with pedagogy in on-campus class
  – See if technology can help on-campus class
  – Remedial/prereq material that some could skip
  – Encourage reuse by colleagues at other schools
BerkeleyX courses in Fall

• CS 169.1x Software Engrg. and CS 188.1x Artificial Intelligence
  – extensive autograding
  – 6 weeks each; *.2x (Nov-Dec 2012) covers rest of course
  – both courses very popular, with geometrically-increasing on-campus enrollments

• More courses to be announced for Spring 2013 and beyond
<table>
<thead>
<tr>
<th></th>
<th>BerkeleyX/edX</th>
<th>Certificate Programs</th>
<th>Degree progs. (MPH, MAS-IC)</th>
<th>UCOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open enroll or admissions?</td>
<td>Instructor decides</td>
<td>Most open, some adm.</td>
<td>Admissions</td>
<td>Some open, others UC only</td>
</tr>
<tr>
<td>Tuition/fees</td>
<td>$ , $</td>
<td>$</td>
<td>$$$</td>
<td>Free for UC $$$ for non-UC</td>
</tr>
<tr>
<td>UCB credit?</td>
<td></td>
<td>Varies</td>
<td>✔</td>
<td>UC Credit</td>
</tr>
<tr>
<td>UC degree?</td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Scope/length = residential course?</td>
<td>Varies; typically shorter</td>
<td>Varies</td>
<td>Varies; typically shorter</td>
<td>Yes</td>
</tr>
<tr>
<td>Rigor equal to on-campus course?</td>
<td>✔</td>
<td>Varies</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Campus residency?</td>
<td></td>
<td></td>
<td>(✔️)</td>
<td></td>
</tr>
<tr>
<td>“Virtual office hours” w/faculty?</td>
<td></td>
<td>Varies</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Assessment?</td>
<td>Automated</td>
<td>Proctored final</td>
<td>Proctored final</td>
<td>Proctored final</td>
</tr>
<tr>
<td>Faculty incentive</td>
<td>Dept. decides</td>
<td>N/A</td>
<td>Faculty/Dept. receive funds</td>
<td>Faculty/Dept. receives funds</td>
</tr>
<tr>
<td>Typical retention</td>
<td>5-10%</td>
<td>60-80%</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>
Self-paced or Cohort-based?

• “Pure” self-paced vs. “Pure” cohort-based
• Hybrid (BerkeleyX): weekly “unit” deadlines, self-paced within unit
• *Observation*: students respond to deadlines even when no “grade” at stake
• Tradeoffs:
  – Flexibility for busy students
  – Sense of being part of “learning community”
  – Useful discussion/question boards
Pros and Cons of MOOCs

+ Educate 1000s around the world
+ Ed. tech transfer: Teaching teachers
+ Motivated, thankful learners => volunteers
+ Help Alumni in fast moving fields
+ Scale polishes local course too

- Lots of extra work each time record
- 90% dropout rate
- Cheating unbound
- 1% online students are vocal jerks
- Does “flipped classroom” really work for local students?
Who are MOOC students?

- 12% female, 88% male
- Median: 27 years old
- 75% of class: 21 to 38
- From 10 to 106
Who are MOOC students?

- 75% Baccalaureate or higher; 7% instructors
- 60% do SW dev/maint at job

Busy people, many with high expectations
Funneling & Stratification

- 50,000 “registered”
- 25,000 watch ≥ 1 lecture
- 10,000 submit ≥ 1 HW
- 3,500 “passed”

90% “attrition” confirmed by 3 other MOOCs, including MITx

- “Better than any course available at my university”
Neutralizing direct costs

• $0.30 Hosted download of large VM file
  – Google & Microsoft donation: $20K credits

• <$1 cloud-based autograding
  – Amazon donation: $8K credits

• $10 Cloud computing (AWS credits)
  – Amazon donation: $500K credits

• $20 Private GitHub repo for 90 days
  – GitHub donation: $1M in account credits

• $10 E-textbook (in our case)
• Zero-config courseware works
  – downloadable or EC2-deployable VM image
  – hosted dev tools (Tracker, Heroku, GitHub…)

• Autograding works
  – Demands bug-free assignments up front
  – Frontloaded work to create autograders, many improvements planned
  – Easier to create new autograding scripts

• MOOC improved on-campus course
  – and MOOC >> recording on-campus course!
New Opportunities

• MOOC technology **improved** campus course
  – Autograding technology assists manual grading
  – TA’s have more *quality time* with students

• New research opportunities on learning
  – Which students making similar mistakes?
  – Give them hint based on *good* exemplar?
  – How do ad-hoc communities impact learning?
### Online course vs. on-campus course

<table>
<thead>
<tr>
<th></th>
<th>UCB CS 169</th>
<th>saas-class.org</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrolled/Passed</td>
<td>115/112 (up from 35,50,75 in previous offerings)</td>
<td>50,000/3,500</td>
</tr>
<tr>
<td>Bi-weekly, short-answer Quizzes</td>
<td>5</td>
<td>2 + 1 short</td>
</tr>
<tr>
<td>Auto-graded homeworks</td>
<td>plus spot-checks by TAs</td>
<td></td>
</tr>
<tr>
<td>Forum monitoring</td>
<td>TA’s</td>
<td>Volunteer TA’s from previous MOOC offering</td>
</tr>
<tr>
<td>1-on-1 help</td>
<td>Each week: 3 sections + 6 office hours</td>
<td>none</td>
</tr>
<tr>
<td>Standalone team project</td>
<td>Work with real customer, deliver prototype in 6 wks</td>
<td>none</td>
</tr>
<tr>
<td>Weeks of instruction</td>
<td>10</td>
<td>5 (Part 2 coming October)</td>
</tr>
</tbody>
</table>
Online vs. on-campus

<table>
<thead>
<tr>
<th>Hours spent/week</th>
<th>UCB</th>
<th>MOOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 2</td>
<td>3%</td>
<td>7%</td>
</tr>
<tr>
<td>3-4</td>
<td>13%</td>
<td>14%</td>
</tr>
<tr>
<td>5-6</td>
<td>21%</td>
<td>17%</td>
</tr>
<tr>
<td>7-8</td>
<td>21%</td>
<td>16%</td>
</tr>
<tr>
<td>8-9</td>
<td>11%</td>
<td>10%</td>
</tr>
<tr>
<td>10-12</td>
<td>11%</td>
<td>18%</td>
</tr>
<tr>
<td>13-15</td>
<td>11%</td>
<td>9%</td>
</tr>
<tr>
<td>16-20</td>
<td>11%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Quiz Scores (out of 25)
(Stanford AI class reports similar results)

<table>
<thead>
<tr>
<th></th>
<th>Q1 UCB</th>
<th>Q1 MOOC</th>
<th>Q2 UCB</th>
<th>Q2 MOOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>25%</td>
<td>19.3</td>
<td>17.5</td>
<td>16.3</td>
<td></td>
</tr>
<tr>
<td>median</td>
<td>21.3</td>
<td>19</td>
<td>18.3</td>
<td></td>
</tr>
<tr>
<td>75%</td>
<td>22.5</td>
<td>22</td>
<td>20.3</td>
<td></td>
</tr>
<tr>
<td>mean</td>
<td>20.0</td>
<td>19.1</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>σ</td>
<td>2.5</td>
<td>4.7</td>
<td>3.7</td>
<td></td>
</tr>
</tbody>
</table>
Pain Points and Potential Solutions

Program Planning and Administrative Approval
- Shape idea for a MOOC, online course, certificate program or degree
- For revenue-generating program, do market research and consult on program design, development timeline, financial model
- Work with Graduate Division and Academic Senate to clarify current process and recommend streamlined process if appropriate.

Academic Approval
- Maximize ROI in various forms

Investment
- Offer faculty a wide range of state-of-the-art tools and robust technology in support of their course development.
Pain Point and Potential Solution

Goal: Transform Idea into MOOC

Objective: Adapt your campus course to edX platform

How to Accomplish: Approval from your dept chair?

Goal: Transform Idea into Approved Program

Objectives:
• Shape idea
• Complete market research
• Develop program design, development timeline, financial model
• Develop and submit program proposal

How to Accomplish:
• Coordination Team develops the expertise to provide consultation on each step of the delivery chain
Goal: Offering MOOC on edX platform
Approval: no academic approval required for non-credit course

Goal: A fully approved program that meets the standards set by the Berkeley Senate, CCGI, and WASC.

Objectives:
- Identify current process and timeline for approvals
- A streamlined process for approvals that addresses all Senate and WASC concerns

How to Accomplish:
- Coordination Team works with Berkeley Academic Senate leadership and the Graduate Division
Goal: Maximum ROI in various forms

Objectives:
• Ensure external partnerships are optimally structured
• Propose expectations for economic review
• Ensure that we’re not overly relying on partners to make the investments required
• Consider in-house funding models
• Propose ROI expectations

How to Accomplish:
• Define ROI expectations for each activity
• Propose criteria to consider in external partnership agreements
• Identify sources of in-house and external funding
Shared tools

Goal: offer faculty a wide range of state-of-the-art tools and robust technology in support of their course development

Objectives:
• Identify existing tools (e.g., edX platform) and potential capabilities while exploring and considering new tools and technology both in-house and out-of-house

How to Accomplish:
• Identify existing in-house capabilities, undertake gap analysis, and recommend direction to insource or outsource for each individual program