

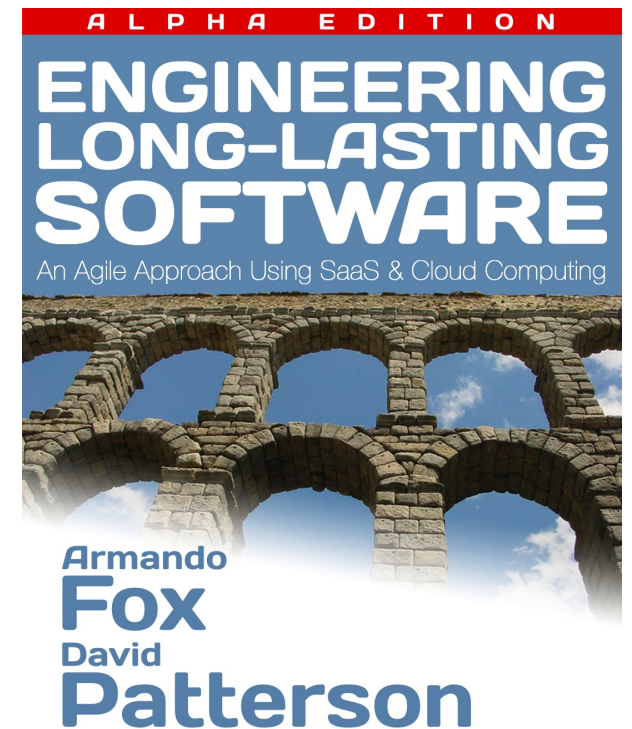


“If we can scale to 100 students, why not 100,000?”

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Background: “new” CS169

- 2009-2011: enrollment
35=>50=>75=>110=>175
(Fall12)
- Feb 2011: start textbook
- Nov 2011: agree to offer first 5 weeks on Coursera
- *Same quizzes, HWs, deadlines (lag by 5 weeks) as UCB*



<http://saasbook.info>
tinyurl.com/about-saas



What's a MOOC?

(Massive Open Online Course)

Characteristic	What we did	A plausible alternative
Content delivery	7-10 minute lecturelets	60-90 minute lectures
Assessment	Deep autograding	Peer grading; self-assessment only
Forum monitoring	TA assigned to help	You're on your own
Content capture	Screencast of live lecture	Studio + postproduction
Pacing	Synchronous deadlines	Self-paced
On-campus course	Traditional lectures	"flipped classroom"

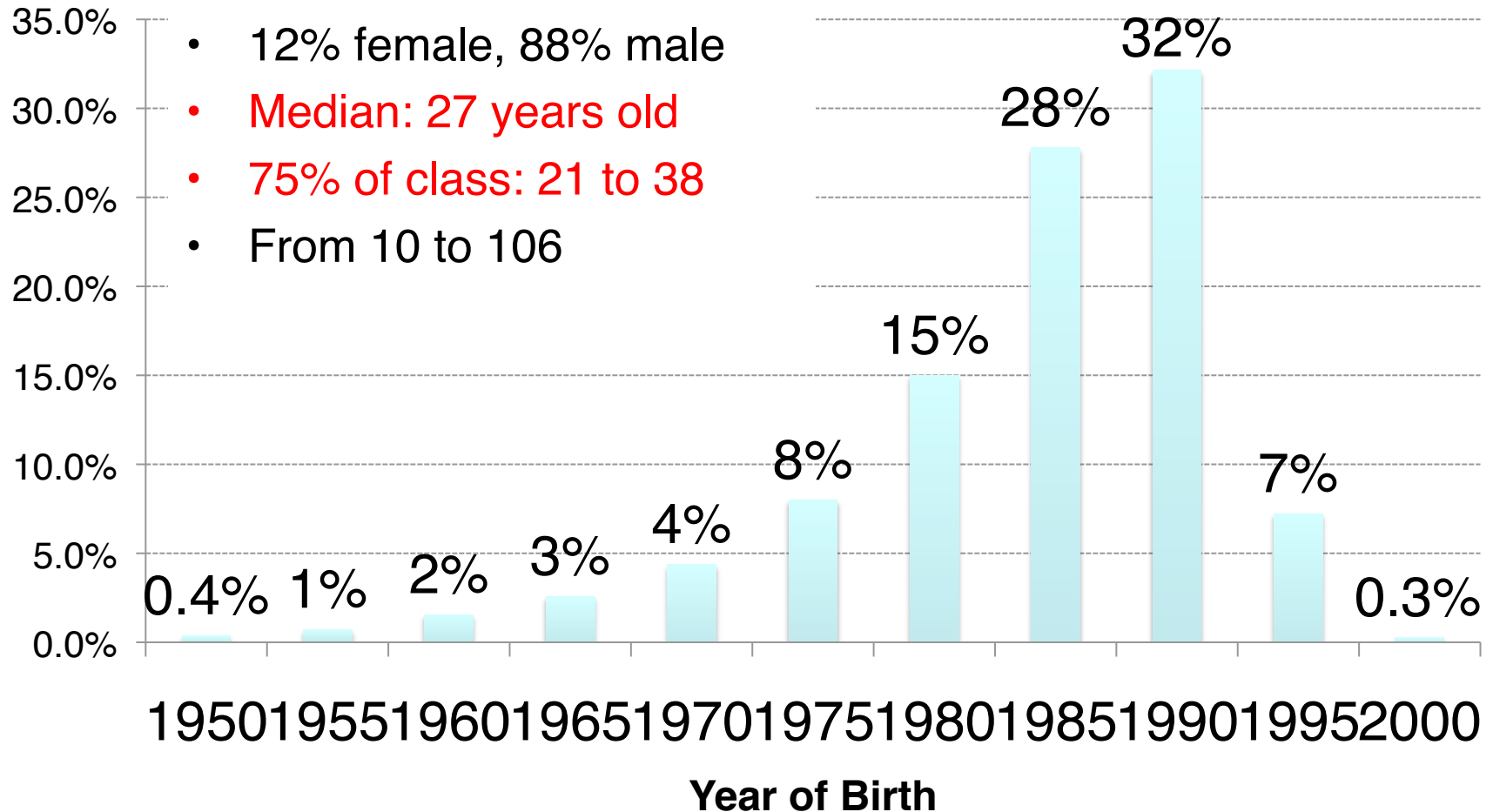


Key Changes for MOOC

- **Nontrivial autograders** for programming assignments (open source)
- **Adapting lectures** to 7-10 min segment + peer learning/self assessment question
 - 7-10 min segment + peer learning question
 - 8-10 hrs/week ugrad to convert & format videos
- **TA support** to monitor question forums
- **No final project**
- **Non-change: same HWs, quizzes, deadlines**



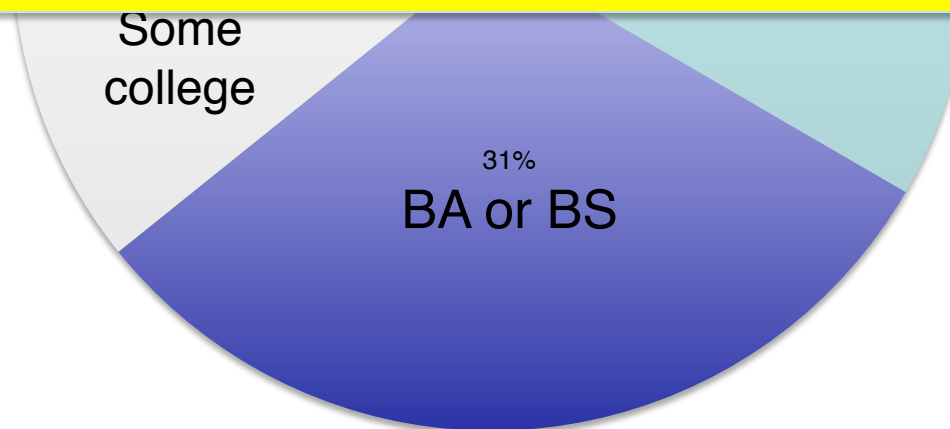
Who are these students?



Who are these 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”

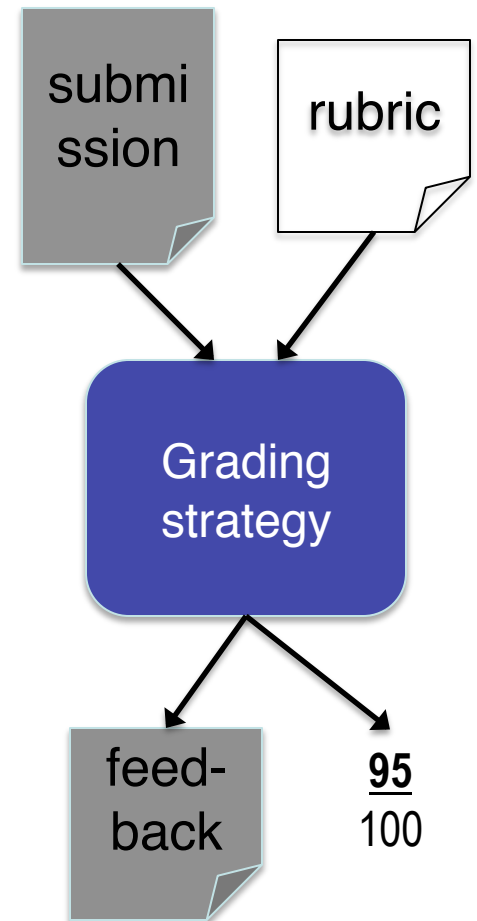
90% “attrition” confirmed by 3
other MOOCs, including MITx

3,500
“passed”

- “Better than any course available at my university”

Autograding Strategies

Submission	Grading strategy
Upload code file (s)	<ul style="list-style-type: none"> • RSpec (correctness) • [soon] reek/flay (code style)
Upload test case files	<ul style="list-style-type: none"> • Mutation testing (Amman & Offutt): app with inserted bugs should fail tests
Submit URI of cloud-deployed app (Heroku)	<ul style="list-style-type: none"> • Remote (cloud-based) integration test using Mechanize
Interactive short-answer/multiple-choice	<ul style="list-style-type: none"> • Our tools emit both printed & Coursera-compatible (online) quizzes





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)
- Free but could improve with donation: app hosting on Heroku, cloud-based integration testing

- 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

- Which students are making similar mistakes?
- Can we find exemplar of *good* solution and use for hint?
- How do ad-hoc communities impact learning outcomes?
- Can autograding technology also assist manual grading?
- Yes, we're open sourcing everything