

Online Education: The Coming Tsunami?

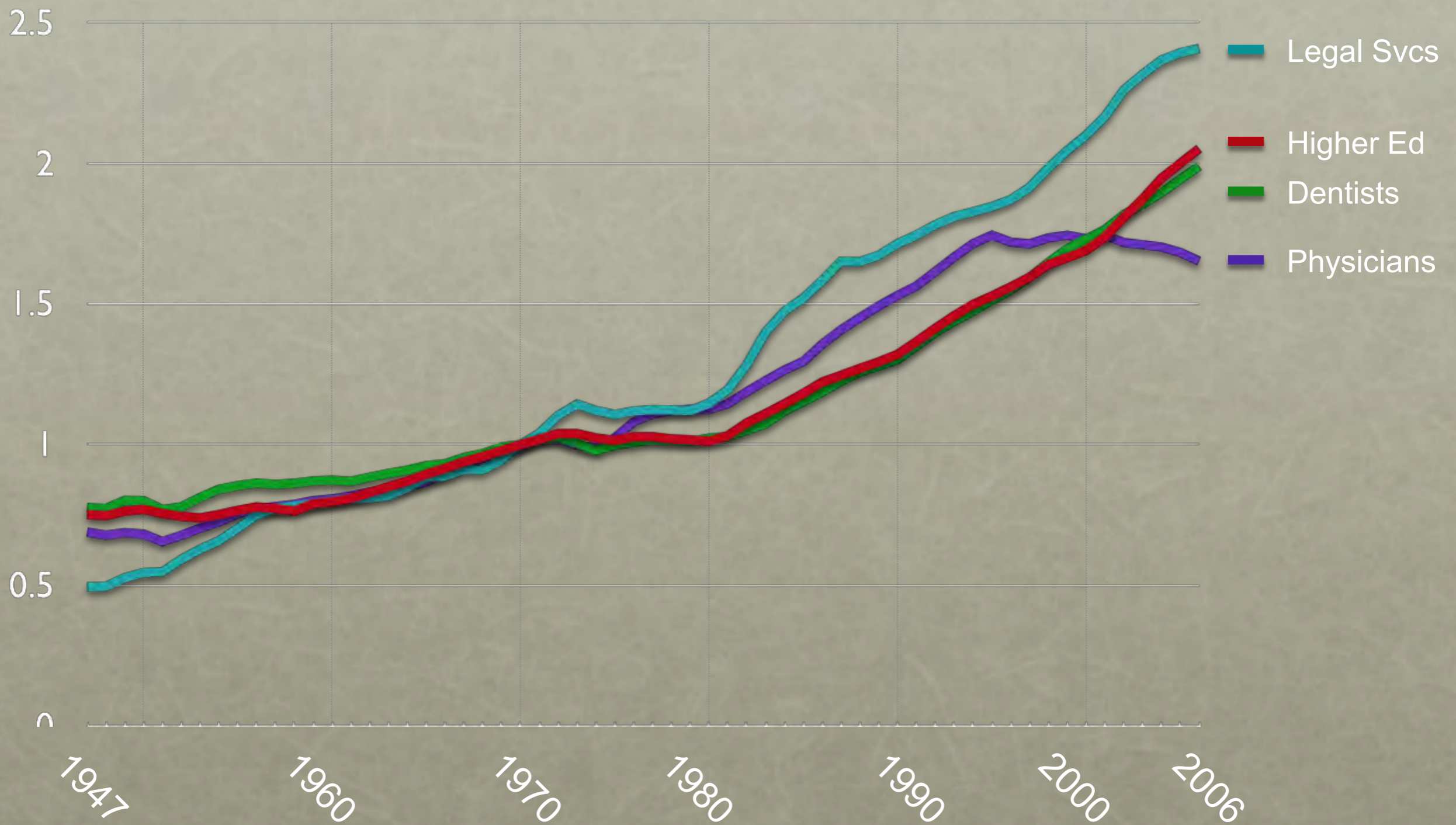
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Historical Context

- From 1150 to 1450, universities doubled every 100 years
- At that rate, would be 2,000 now. There are 20,000!
- Printing press (1450) led to in an explosion in universities
 - Rate of growth of books (or manuscripts before 1450):
 - 5x growth from 12th to 15th century;
 - 200x growth from 15th to 18th
 - Cost of 100 volume library
 - 14th century: 25 years of wages
 - 21st century: 20 days of wages
- Instructors replaced books as driving cost in education

The Cost of Higher Education



Two Big Problems in Cost/Performance of Education

1. Poor Performance

- **Massive shortage of qualified instructors worldwide**
 - 8-12 in US in science and math
 - Higher education throughout developing world
- **Goal: provide access: “good” education at “low” cost**

2. High performance is too costly for many

1. Emerging and growing problem in US higher education

- **Instructors drive costs**
 - If we simply increase student/teacher ratios: quality drops.
- **Role of technology: Drive down cost of high quality (bend cost curve)**

Can Technology Really Change Education?

- **Online technologies may change education disruptively**
 - **Untrue in the past!**
- **Why now?**
 - **Widespread, high bandwidth connectivity**
 - **New model goes beyond talking head**
 - **Lecturers are “chunked” with interactive participatory activity**
 - **Improvements in automated assessment/feedback**
 - **Social media/crowd sourcing for group learning & peer grading**
 - **Semi-synchronous and asynchronous delivery**
 - **Online is “natural” for this generation**
 - **Certification of mastery as an alternative**
 - **Desperate need to improve cost-performance of education**

STANFORD'S HISTORY IN "ONLINE" (AKA DISTANCE) EDUCATION

Project	Date	Delivery	Style	Student
SITN: online masters courses	1960s	CC TV	Sync	1000s
Tutored videotape	1970s	Videotape	Semisync	100s
EPGY: advanced HS/AP	1980s-	Online	Async	1000s
SCPD: exec ed, certificate	1990s	Internet	Semisync	10,000
AllLearn (Stanford, Yale, Princeton)	2000s	Internet	Async: no eval.	100s.
Stanford Online HS	2000s	Internet	Semisync	100s
Stanford on-campus online	2005	Internet	Semisync	1000s
Stanford on iTunes	2007	Internet	Async no eval.	1,000,000s
Stanford Massive Online	2011	Internet	Semisync/Async	100,000s 1,000s completing

Wide Range of Applications of Online Technologies

- **Improve traditional large lectures (online vs. live)**
 - **Use faculty time better (flipped classroom)**
- **Teach traditional courses remotely (done; more?)**
- **Increase students/faculty maintaining quality**
 - **Reuse lecture material**
 - **Eliminate preparation time: redeploy faculty**
- **Provide certification to large student bodies**
 - **How? Validity?**
 - **Quality given the need for automated grading?**
- **Course material to the world**
 - **The new form of textbooks**
- **Full online degree programs: scale, certification?**

LEARNING VERSUS CREDENTIALING

- **Universities perform two education functions:**
 - **Helping students learn: in class and outside**
 - **Credentialing: certifying students achieve mastery of a subject (grades & degrees)**
 - **Good certification enhances learning!**
- **Some educational efforts focus on learning:**
 - **Kahn Academy, iTunes U, OCW, etc.**
 - **Important public service, which universities should contribute to.**

WIDE VARIETY OF MOTIVATIONS

- **Improve education**
 - **On campus and off**
- **Generate revenue**
 - **Will it be significant?**
- **Enlarge or enhance mission**
 - **Overcome location or institution size constraints**
- **Increase availability at an acceptable price point**
 - **International?**
- **Profit**

CLASS SIZE & DISTRIBUTION OF ABILITY: IMPLICATIONS FOR LEARNING

- **Class size & distribution of ability affect learning:**
 - **Some experiences cannot easily replicate at scale:**
 - **Physical labs, small, interactive courses, intensive feedback courses (e.g., writing intensive courses)**
 - Edx is investing in online labs
 - Models exist for online writing instruction with tutor participation
 - **Ability of instructor (or automated online system) to adapt material for students with widely varied ability is limited**
 - **Simple repetition is not enough (what we have so far)**
 - **The greater the variation the harder the problem**
 - **Large enrollments of unscreened students exacerbates this**
 - **Likely to have large drop out or non-completion rates**
 - **We would normally view these as unacceptable and examine our admissions procedures and the teaching**
 - ***Very large* investments in content creation could provide more adaptability (unproven but seems obvious).**

CLASS SIZE & DISTRIBUTION OF ABILITY: IMPLICATIONS FOR CREDENTIALING

- **Quality of credentialing in many fields will be inversely related to class size**
 - 1. Assessment must be graded at scale**
 - **Limits both kind of assignment and level of feedback**
 - **Peer grading only OK for small-stake assignments**
 - 2. Need to have assessment “fit the class”**
 - **Variability in student capability affects credentialing**
 - **For example: course is too easy for a Stanford student**
 - **Assignments and exams do not push the best students and strain the least able**
 - **MIT 6.002 example: only 1/3 finish first assignment; < 10% complete course**

AREAS FOR INVESTMENT/RESEARCH

- Learning effectiveness: far too few controlled studies
 - Need education/learning experts
- Adaptive learning and automatic diagnosis:
 - Moving beyond repetition as the adaptation
 - Automating the help of a good tutor
- Assessment: large-scale assessment of more complex assignments/exams
 - Machine learning, Human-machine, etc.
 - How far can we go: writing, engineering problems?
- Using social media to “be in a class” virtually
 - Group learning situations
- Virtualize labs, projects
- Identification and verification of the source of submitted work

SOME IMPLICATIONS

Online learning with lots of content of varying quality

- Online courses will become the new textbooks.
- Content-alone likely to be inexpensive
- Replace of lecture function of instructors by master online lecturers
- Harder to predict what happens in credentialing:
 - Certification for post degree professional education has happened and has clear value in some fields
 - Likely to be high variability in quality of certification
 - Big question: what happens in the UG space?
- Big Unknowns:
 - Will certification of a “program” be a serious competitor for full degree credentialing (disassembly of degrees):
 - Evidence on both sides
 - No: Lower value to incomplete degrees
 - Yes: Existing certification programs for specific skills
 - Be cautious: Lesson from the music industry: songs replaced albums despite resistance!

SURFING THE TSUNAMI

- **My thought: better to face the future than hide from it**
 - **Be the disrupter; not the disrupted**
 - **Reduce cost or be eliminated**
- **Stanford's primary goals:**
 - **Improve education for Stanford students**
 - **Bend the cost curve for others**
 - **Be a high quality content provider**
 - **Experiment with online for high quality education & certification available to more students, more cost effectively**
- **Surfing a big wave is unpredictable.**

