

Universities in an Era of Technological and Economic Flux

Radical Change in Higher Ed.

**Will Physics lead, follow, or get out
of the way?**

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University of Massachusetts
Amherst • Boston • Dartmouth • Lowell • Worcester • UMassOnline

Abstract

- Online education has been a juggernaut in higher education -with relentless, and surprisingly uniform and uninterrupted, growth to nearly seven million enrollees last year. While most of that growth has been at the public land-grants and a few private proprietaries, the prestigious privates have discovered online education with a vengeance – in the creation and deployment of a myriad of MOOCs. These Massive Open Online Courses adopt a very different strategy even as they use many of the same pedagogies and technologies. “Traditional” online education approaches courses through complete curricula that are most often created by faculty in departments and deployed with the usual admission, tuition, and faculty – in fairly close parallel with campus based traditions. You get admitted, pay, take courses from faculty, get evaluated, and then get credit and degrees. MOOCs turn this on its head. There is no admission process and no up-front tuition or fees. Taking the “course” is “free.” Interaction with faculty is negligible and evaluation is often done by peers, computers, or self-evaluation. Those few who actually complete the course (less than 5% at Stanford’s Coursera) receive a certificate of completion. The fine print at the bottom of the certificate points out that this certificate does not imply that the student has actually taken a course at the university, has not been admitted to the university, has not received credit from the university, and other disclaimers. In a few cases, students can take this certificate to some other community college or four year college, and present the certificate, pay the tuition and/or fees, and get the credit.
- In both “traditional” online courses and in MOOCs, physics has often been a first mover, but has rarely been a significant player! Some leaders, from Clayton Christensen at Harvard, Andrew Ng at Stanford, Anant Agarwal at MIT, to Tom Friedman at the New York Times think this is the future of higher education. What does this all mean for physics?

Bio

- Jack M. Wilson, President Emeritus and Distinguished Professor of Higher Education, Emerging Technologies, and Innovation, the University of Massachusetts, served as the 25th President of the five campus 68,000 student University of Massachusetts system from 2003-2011. He founded UMassOnline which now serves over 70,000 enrollees. He previously served Rensselaer Polytechnic Institute as The J. Erik Jonsson Distinguished Professor of Physics, Engineering Science, Information Technology, and Management as well as a research center director, Dean, and interim Provost. Prior to that he taught at the University of Maryland and was the Executive Officer of the American Association of Physics Teachers. He served on the Board of the American Institute of Physics and founded the Physics Department Chair conferences. He was also the Founder, Chairman, and CEO of the ILINC corporation, which he spun out of his Center at RPI. He has served on two Physics Decadal Survey committees of the NAS/NRC, the recent NAS/NRC task force on Research in Physics Education, and other NAS/NRC studies –including one on digital libraries.

Are MOOCs the next dot-com bubble fad?

- Or are they the real thing?
- Remember that in the deployment of any new technology (or idea) most efforts fail and only a few succeed.
- BUT..... the result of the dot-com bubble was a totally transformed US economy with many extraordinarily successful enterprises like Amazon, Google, Yahoo, Facebook, Apple (which was nearly dead!), Microsoft (which just kept getting bigger!), and so on.
- Today's economy is quite different from that of 1990. How consumers interact with retail, or even more traditional utilities, is transformed.
- Some folks figured out the economics and sociology, and others just went with the hype!
- I suspect the same in higher education.
 - Most of these projects will fail, but universities will be transformed.

The Physics Paradox

- Physics has been at the forefront of the development of innovations based upon the 3 C's of Computer, Communication, and Cognition
- But
- Physics has not been transformed by the 3 C forces and has not even seen mainstream physics education give those forces significant attention.

Places where Physics has led the way!

- **PLATO -Programmed Logic for Automatic Teaching Operations** -1960
(University of Illinois and Control Data)
 - forums, message boards, online testing, e-mail, chat rooms, picture languages, instant messaging, remote screen sharing, and multi-player games.
 - Physicists Chalmers Sherwin, Daniel Alpert, Donald Bitzer
- NeXT – first software was physics education modules
- CUPLE – **C**omprehensive **U**nified **P**hysics **L**earning **E**nvironment
 - 1989 -(Univ. of MD, IBM, other universities)
- Physics Education Research
 - Arons, McDermott, Redish, Mestre, and many others too numerous to list
- Peer Teaching –
 - Mazur and others to follow
- Open Courseware Projects and now MOOCs
- Apologies to others for the partial list

Physics NRC Report on Undergraduate Physics Education:

- “Evidence indicates that the physics community remains in a traditional mode where the primary purpose of physics education is to create clones of the physics faculty.”
- “Over the past several decades, active research by physicists into the teaching of their subject has yielded important insights about what can be done to heighten the quality of students understanding of their universe, at all levels. ”
- “But this new knowledge is slow to find significant adoption, nor is it fully understood by physics faculty.”
 - http://www.nap.edu/openbook.php?record_id=18312&page=1

Our challenge

- Physics has often been first to innovate and develop
- Physics has often been slow to deploy –VERY slow!
- This disparity has led to physics education losing market and mind share and failing to adapt to changed environments and demographics.

The Future?

- Many of us think that the future of physics education (and physics) is at stake
- Great physics (and physics teaching) will be done, but will it be done in physics departments –and does that matter?

The Paradox facing Universities

- At the same time that universities are facing extraordinary financial pressures due to a collapse of state revenue and endowments
- Everyone is looking to universities to lead us out of the economic decline
- Creating futures for students and communities
- And solving social challenges like
 - improving college readiness
 - Reducing disparities (racial, economic, gender,etc)
 - Increasing graduation rates
 - Attracting students into STEM fields
 - Better matching workforce needs

President Obama's Goal

- To be first the world by 2020 in the proportion of college graduates.
 - -Address to Congress on Feb. 24, 2009.
- The US was tied for 6th place at 30% according to 2006 data.

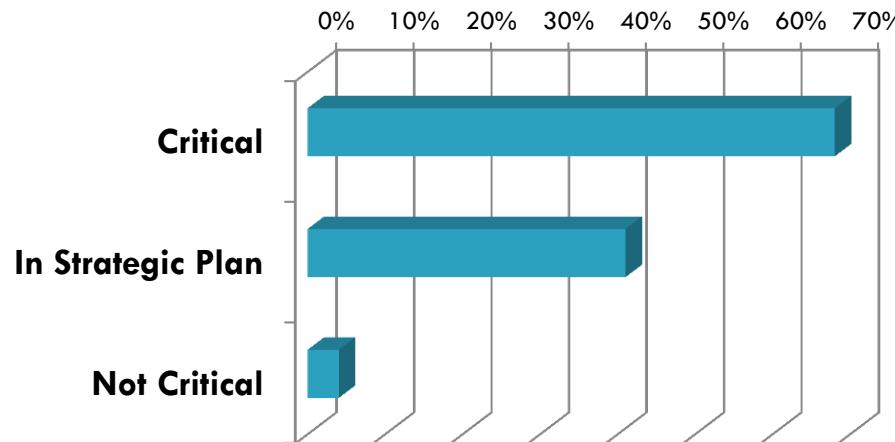


How can we do this?

- The **only way we can possibly approach these goals** is through a much more intense focus on professional education, continuing education, online learning and technology enhanced learning – from MOOCs to flipped classrooms..
- Otherwise we do not have the traditional capacity to meet the increased needs for both quality AND quantity.
 - Need to deliver educational experiences to K-12 that are not presently uniformly available.
 - Improve success, retention, persistence, and graduation rates through higher quality learning experiences.
 - Reach students unable to participate in traditional learning settings for a variety of reasons.
- Are we ready?

American Public and Land-grant Universities

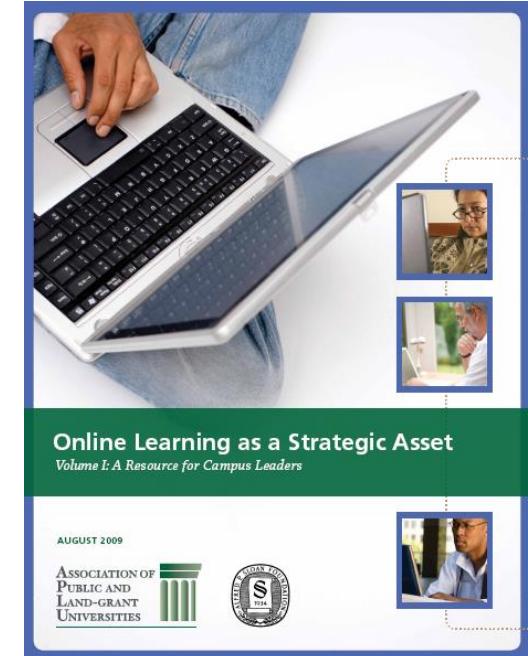
- APLU-Sloan Survey -2009
 - Strategic Importance of Online Learning
 - interviews conducted with administrators, faculty, and students at 45 public institutions across the country and more than 10,700 responses from faculty across the spectrum of teaching positions – tenure/non-tenure track; full- and part-time; and both those who have and those who have not taught online
- Critical to long-term strategy of institution - 68%
- Represented in institution's strategic plan - 41%
- Not critical to long term strategy - 4%



Online Learning as a Strategic Asset

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- Survey revealed that President's know that continuing education and distance learning needs to part of the strategic plan,
- However, many of them **were not well equipped by past experience** to understand how these programs, once considered peripheral, could become an **integral tool of their institutions strategic plans.**



Benchmarking Study Results

The Opportunities

- Everyone teaches – stereotypes are not correct
- Faculty are motivated by student needs
- Faculty recommend online
- Faculty with online experience are more positive

Benchmarking Study Results

Imperatives for Campus Leaders

- Administrators need to know who is teaching online and why
- Campus leaders need to develop creative ways to recognize and reward faculty
- Faculty and administrators need to resolve issues around perceptions of quality
- Online initiatives must be routinely reviewed and assessed to identify and address needs and opportunities as they arise

Institutional Interviews

Key Observations

- Integrate online into institutional planning, academic structure
- Review and assess routinely over time
- Develop reliable financing mechanisms
- Develop adequate and consistent resources for both faculty and students
- Engage senior leadership

The Catalyst for the Future

- What do Boston, Bombay, Beijing, Bangalore have in common with
- San Francisco, Austin, Raleigh, Cambridge, and other world economic leaders?
- They are vibrant economic regions nucleated by world class universities.
- The President is right: we must do better!

The Secret Sauce?

- Universities pouring out highly educated graduates with skills and intellectual property.
- World class research that is curing illnesses and creating new jobs, companies, and even entirely new industries.
- And doing this at very large scale.

But all is not well!

- Many think that Higher Education **costs** too much
- Higher Education has not yet taken full advantage of the research into how students learn –**cognitive** sciences.
- Higher Education reflects **disparities** in access and quality
- While **technology** has certainly pervaded higher education, it has not as significantly changed it.

Higher Education costs too much?

- This widely held political position is most notable for the lack of understanding of why this might be –if indeed it really is!
- Nonetheless- we should buckle our seatbelts for a ride to drive down the cost of higher education -and many of the “well meaning” efforts will be far more damaging than helpful. Some will be downright foolish
 - like government attempts in Florida and Texas to mandate \$10,000 bachelor’s degrees –based upon political rather than academic considerations.
 - "New University of California," an institution with no faculty and no tuition

The 3 C's - the forces on education -*

- **Computers**
- **Communication**
- **Cognition**
- Many of the innovations that catch the eye of the public do a good job on the first two and a lousy job on the third.
- We know much more about how students learn, and learning environments need to change to create the engagement that leads to student learning.
- That is indeed happening at many places
The NCAT, NRC Report, White House Conferences

* "Using the Computer in Teaching Physics," J.M. Wilson, *Physics Today* 42(1) (January 1989).).

Cognition

- My involvement with the recent National Research Council report reminded (and saddened) me to note that educational innovation often reinvents the wheel rather than advancing our understanding
 - –based upon the research on the way students learn.
- There are notable exceptions like:
 - The National Center for Academic Transformation
 - The Rensselaer Studio Courses
 - Carnegie Mellon Open Learning Initiative (OLI).
 - Many others but not enough.

TheNCAT –A brief mention

- Whenever anyone suggests that you cannot simultaneously enhance **quality**, **access**, and **cost** in traditional universities, I always ask them to look at the website of the National Center for Academic Transformation –founded right here at RPI.
- Conventional wisdom is that universities do not change, but many do –and many are documented here.
- It is particularly notable because many of these reforms were driven by research in the cognitive sciences and make student engagement paramount.

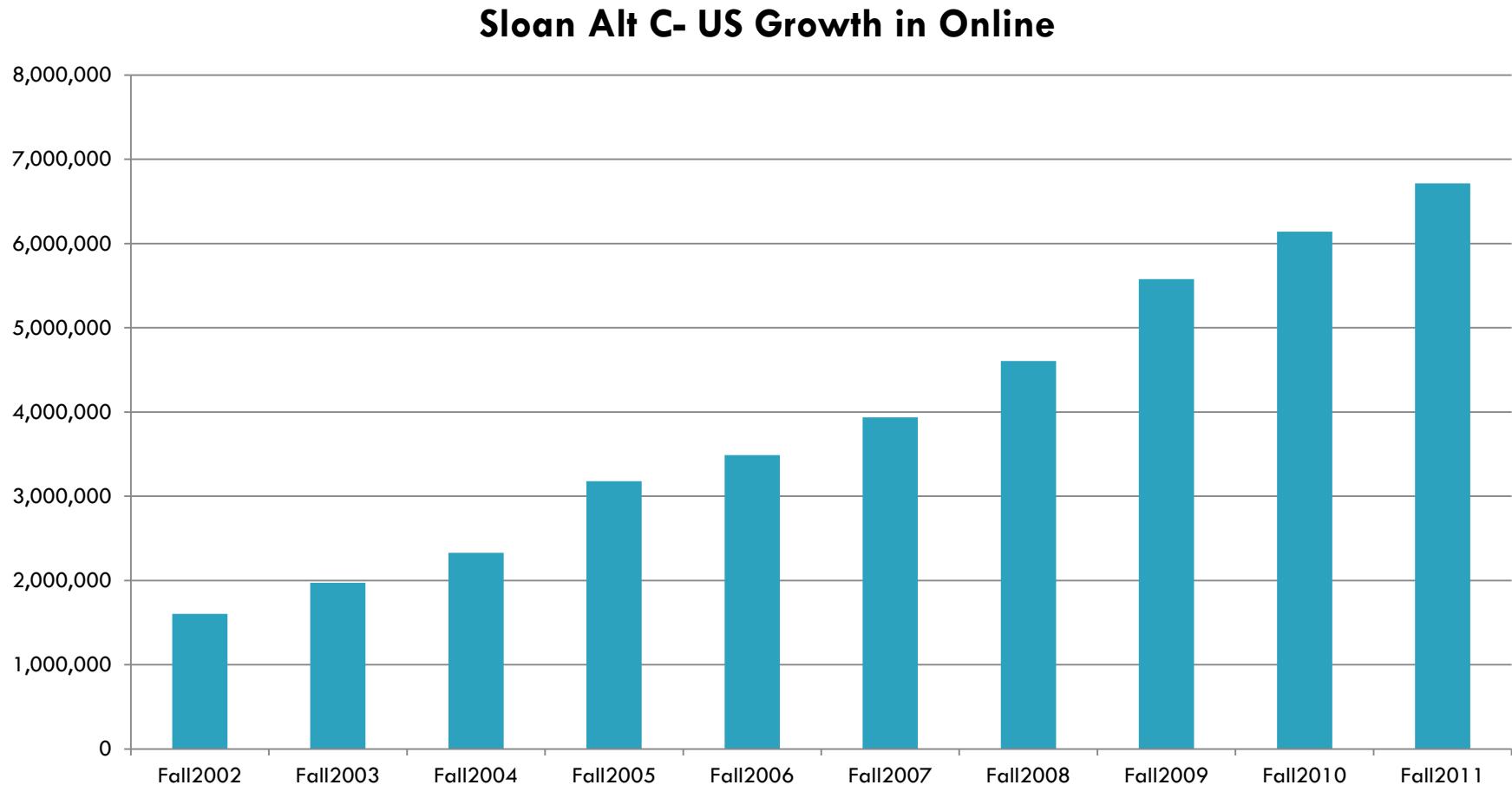
The Reality of Online Education transcends

- If one reads the traditional press coverage of online education it is dominated by either
 - Skepticism
 - Can students learn?
 - Cheating
 - etc
 - Hype
 - MOOCs will change the world and make higher education obsolete
 - The hyper prestigious universities drive the change
- **Not!**
- So what is the reality and the future?

Nov. 2003 Press: Has Online Learning failed?

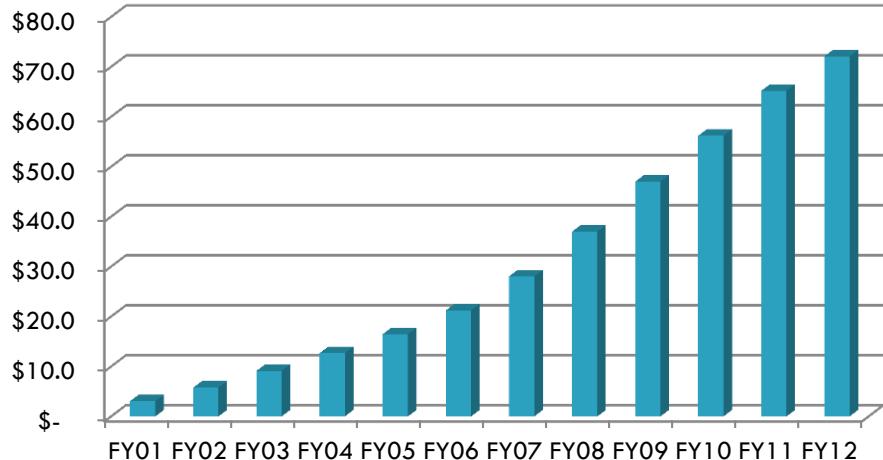
- In November of 2003, the press was ready to pronounce online learning dead!
- Hardly!
- The rapid demise of Fathom, Cardean, Pensare, Virtual Temple, Harcourt University, Caliber and others
- The Red Sox, the Cubs, and 29 other teams didn't win the world series again this year either.
 - (ed. remember this was **2003**!)
- Just like baseball, distance learning has it's winners and losers!

Relentless growth nationally

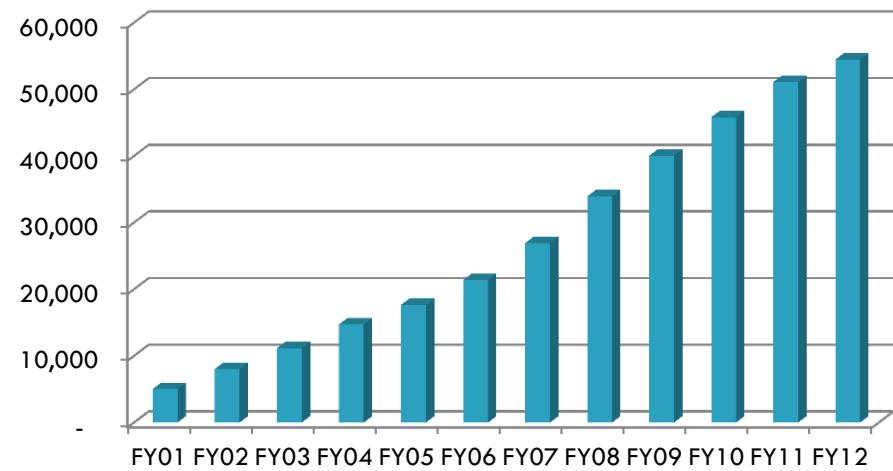


UMassOnline Growth 2001-2012

Revenue (\$ Millions)



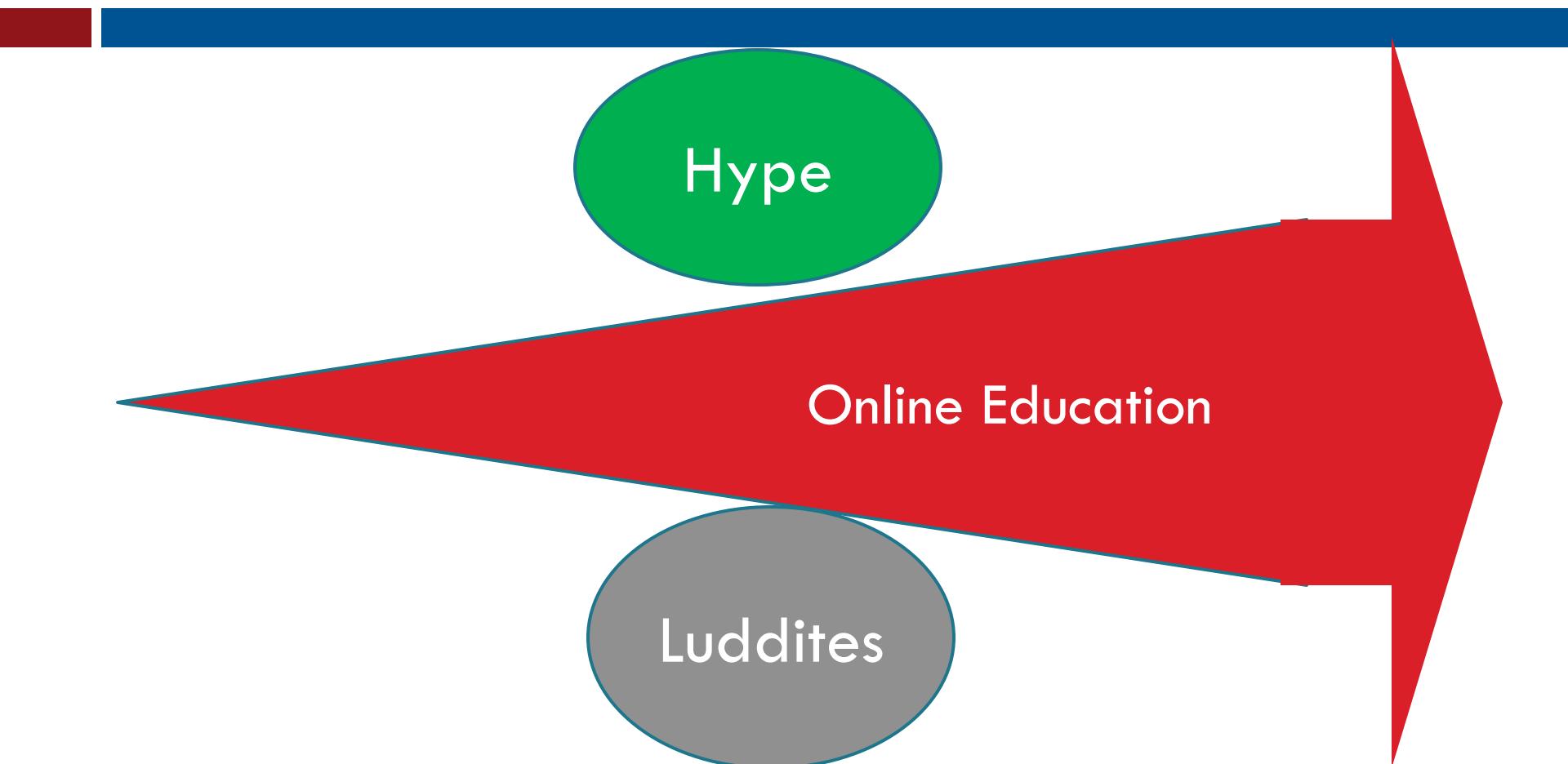
Enrollment



Keys to UMassOnline Success

- Seamless Integration with Campus-Based Programs
- Same Brand
- Same Faculty –selected by usual standards
- Same Curriculum –approved by traditional faculty
- Same Degree –on campus or off
- Same admission standards
- Ability to move between campus based and online
- Faculty buy-in because of faculty involvement and some small compensation.
- Campus based programs benefited financially.

A Relentless Force that Will Not Be Denied



Hype

Online Education

Luddites

But far too many are in denial

- While change has actually been rather large scale, the conventional wisdom is that there has been little change.
- It is also probably accurate to say that even the large scale changes have not penetrated the culture of higher education nearly as much as necessary.
- There is no shortage of contrarian voices that decry even those changes that HAVE occurred.
- The disparity is creating a vacuum into which politics is inevitably drawn.

Are MOOCs going to change the world

- Too late. The world already changed without MOOCs even if Stanford, Harvard, MIT and others had not noticed!
- “the vast majority of people who sign up for MOOC’s don’t complete their courses, yet MOOC creators are hailed as visionaries rather than being denounced for their 10-percent completion rates” –Kevin Carey –Chronicle Blog

- MOOCs are interesting and valuable experiments, but they are not on the critical path of online education –at least in their current form. BUT.....
- Online education is changing the world, and MOOCs can be a part of that.

Massive Open Online Courses MOOCs

- Kahn Academy -2006
 - Salman Kahn –non-profit -2006
- Udacity -2012
 - Sebastian Thrun, Stanford - for-profit
- Coursera -2012
 - For-Profit – Andrew Ng, Daphne Koller, Stanford
- edX (MITx -2011 and edX in 2012)
 - Harvard, MIT, Berkeley –non-profit
- Udemy -2010
 - Eren Bali and Gagan Biyani –for profit

What MOOCs Bring to the Party

- Most importantly they bring a recognition by the brand name universities that online education has changed the world and they almost missed the bus!
- They encourage faculty who have not been involved to become involved.
 - Faculty who get involved in online education become more self reflective on teaching and learning.
- They create good content presentations with (in the best of them) built-in assessment tools for student self assessment of progress.
- They generate interest in the press that the larger and more successful online programs never have!
- They attract venture capital to the education space.
- They create a data rich learning environment that can provide extensive data to help us understand how students learn through cognitive research.

What MOOCs need to work on

- Content and self assessment do not constitute a learning environment
(More on that on a future slide)
- The large numbers of users is vastly inflated by window shoppers.
 - exponential drop-off power law that characterizes participation in today's MOOCs (i.e., the final course lectures have 5% the viewing rate of the earliest lectures).
 - Mehran Sahami, Stanford University at SIGCSE
- The percentage of students who successfully finish is tiny.
- Credit is not (usually) given by the institutions creating MOOCs.
- MOOCs thus far are **courses not curricula**
- MOOCs do not (generally) provide the kind of engagement that has been shown to encourage learning. (See George Kuh....)
- Some assume that although their “good” institutions will never use MOOCs, that this will be a charitable donation to the “lesser.”
 - Data on that is coming in the next slide

What do the Professors Creating MOOCs Think?

- Some results are what most of us would expect.
 - It takes an extraordinary amount of work to create a MOOC and even more to create a good one!
 - Faculty had to do this on their own time and did not get credit of doing this through their teaching load assignments.
- Some of the results are more revealing:
 - **75%** of the respondents did not think that MOOCs would significantly reduce costs at their institution (35% none and 40% marginal).
 - That certainly goes against the conventional wisdom! “*everyone at the US Dept. of Ed thinks that MOOCs finally will help to make significant cost reductions in higher ed!*” –Dept. Of Ed. Official.
 - **72%** of those teaching MOOCs did **NOT** think that students who successfully completed their MOOC should get academic credit at their own institution, and **66%** believe that they **NEVER** would grant that credit.
 - The article makes that a positive in that 28% actually DO think they deserve credit. Some truth to that.
- The most revealing result: When those same two issues were explored for **SOME OTHER** institution, the respondents thought that they might have **far more impact**.
- At this point, those involved with MOOCs are quite **excited** about the possibilities, **daunted** by the work required, and convinced that they will not significantly change their institution, but that they might change **others**.
 - http://chronicle.com/article/The-Professors-Behind-the-MOOC/137905/?cid=at&utm_source=at&utm_medium=en#id=overview

The Biggest Myth of MOOCs

- Education will be free –or at much lower cost.
- “How can colleges charge \$50,000 a year if my kid can learn it all free from massive open online courses?”

--Thomas Friedman –NY Times March 5, 2013
- “The question is not just whether MOOCs are going to disrupt traditional education, but how. Is it just about lower costs and access?”

-Clayton Christensen, Harvard
- The threat is to the random little-known accredited college and the person you’ve never heard of who is employed there teaching garden-variety, highly-replicable three-credit courses. As Thrun credits become widely accepted, people will be less willing to pay for the other kind. -Kevin Carey, Chronicle of Higher Ed. Dec. 14, 2011.

MOOCs are not cost free.

- They look cost free because they have been done on the margin by outstanding faculty who wish to devote the time to create them, but who may not wish to continue to devote the time to operate then and revise them with the change of both content and technology.
- The unit cost can indeed be made lower by large scale use, but that does not take into account the costs of other portions of a learning environment that do not demonstrate the economies of scale.
- People do not pay for content, they pay for something much larger.

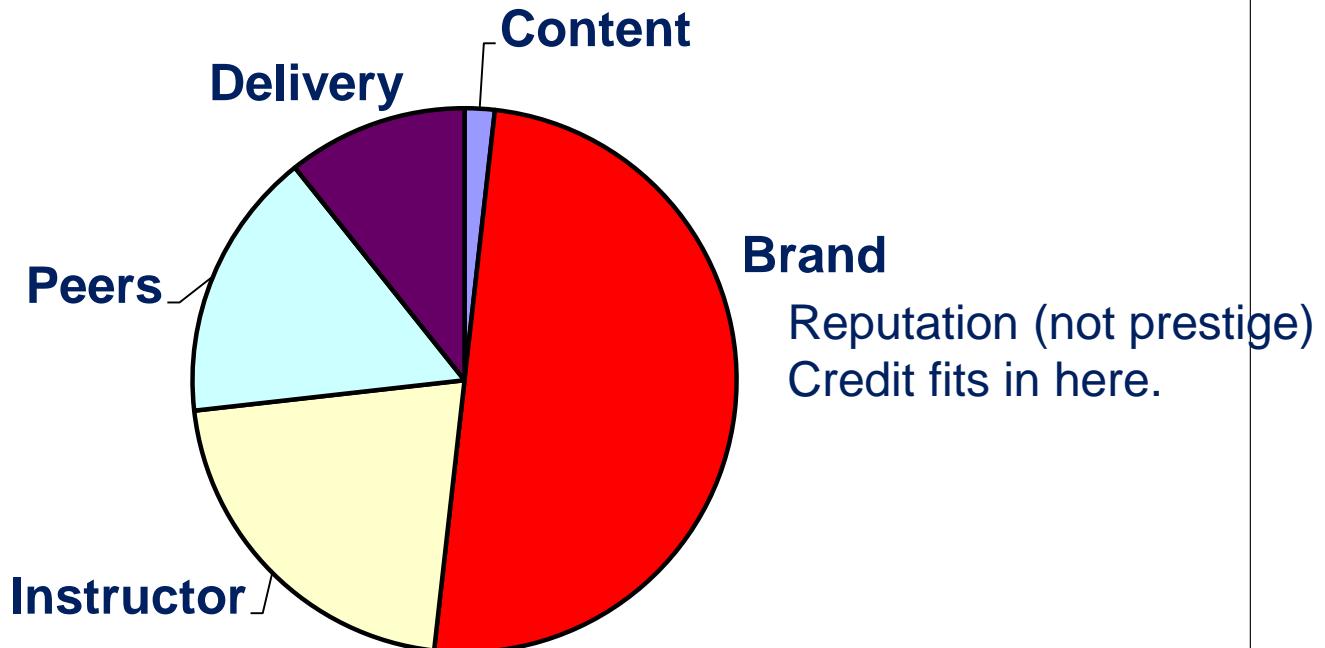
The dangers of hype

- Students get hurt by well meant, but poorly designed experiments.
- Money gets wasted at a time when every dollar is precious in higher education
- Good ideas get discredited by over-reaching and then failing.

- To anyone in the audience that I offend, I offer this prior apology but.....
- I hope that it encourages you to adopt a position of scientific skepticism and innovative optimism.

The Value Chain

What do students want and pay for?



Summary

- Online Education is a relentless force that is transforming higher education in ways that are not yet well understood or agreed to.
- Physics has often been the first mover in many of the innovations from PLATO through Online Learning to MOOCs, and yet none of these have found a significant home in undergraduate physics education and are certainly not yet transformative.

Thank you.

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