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

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- Over two decades ago, physics educators identified the three C's as forces that were changing Physics and Physics teaching in profound ways. Computers, Communication, and Cognition would change the world, and Physics was taking the lead in all aspects. Computing was in a period in which it was advancing so rapidly that neither researchers nor educators could keep up. The internet was bursting upon the world, changing the way people communicate, and Physics did it first. Even in the cognitive sciences, much of the work was being done in understanding how physics concepts were learned and taught. In early 2011, the National Academy of Sciences formed a Committee on Undergraduate Physics Education Research and Implementation to review the progress in undergraduate physics education and see how well we had adapted to these forces. In 2013, our report, "National Academy of Sciences, Adapting to a Changing World--Challenges and Opportunities in Undergraduate Physics Education" was released. It was fair to say that the committees reaction was mixed. While Physics Education had continued to innovate and many of these innovative programs had been deployed, we were a bit disappointed that the change had not been as pervasive as the committee thought it should. We provided recommendations to the various stakeholders on what we thought could and should be done to allow Physics and Physics education to regain the momentum and prominence that we once had enjoyed. This was an optimistic report that saw how much had been accomplished, but it was also a report that advocated for an increased pace of change. We will discuss some of the issues raised in the report and some of the future opportunities (and challenges) in physics education –from studio or workshop courses, to flipped classrooms, to MOOCs.

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** -**P**rogrammed **L**ogic for **A**utomatic **T**eaching **O**perations -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

NRC Observation

- Too often, introductory physics has been cast as a subject that only a tiny elite could truly master. As a result, many students have viewed it as too difficult or unpleasant, and so have chosen not to pursue physics and other STEM majors. This has detrimentally affected not only the health of undergraduate physics and other STEM programs but also the intellectual health of the nation.
- Currently undergraduate physics education is especially challenged by financial constraints and by limited success in appealing to many of the demographic groups that represent an increasing fraction of today's incoming students and in providing enough physics teachers for our nation's high schools. Addressing these challenges requires that the physics community take a close look at the issues related to undergraduate physics education and pursue paths that can lead to improved student understanding of physics, reasoning skills and attitudes toward physics. As shown in this report, recent developments in physics education research, computer-based instruction, and social networking can guide undergraduate physics education to more positive outcomes.

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.

NRC Findings

- a. Novel curricula, materials, and approaches to instruction exist that have demonstrated improved results, not only in students' conceptual and quantitative knowledge of physics but also in their ability to engage in scientific inquiry.
- b. Some physics departments have demonstrated how to be attentive to their student communities, attract more students to physics, retain them through the major, and support them in a variety of career aspirations.
- c. There is a substantial and growing research base on which institutions can draw to improve educational practices.
- d. Implementing change will require concerted efforts at a range of levels, from individual physics faculty and departments to top administrative levels in universities, state and federal governmental agencies, research funding sources, and professional associations.

NRC Report: On Engagement

- An overarching theme has emerged from educational research: *Learning improves when students are interactively engaged with their peers, their instructors, and the material being learned, and when they are integrating the newly learned concepts with their previous ideas, whether learned in a formal classroom or in everyday life.*
- While this statement does not sound revolutionary, it does emphasize that success in physics learning is more strongly determined by how successfully and frequently students are engaged in the learning experience than by the content knowledge or the delivery skill of the instructor. This research finding does not devalue an instructor’s role, but it indicates the most accessible path to improving effectiveness.

NRC Report sees hope

- creation of new instructional tools that can be incorporated into conventional course structures and then measured learning outcomes with these new tools.
  - student response systems (or “clickers”) that can help make lectures interactive;
  - interactive small group activities based on research about specific conceptual difficulties;
  - structured collaborative group work;
  - undergraduate peer instructors or “Learning Assistants;”
  - computer-based laboratory instruments and software to facilitate real-time data collection and analysis; and
  - Web-based systems for simulations, class preparation, lectures, and homework.
  - Other physics education researchers have focused on wholesale course redesign, creating unified in-class activities where students work together to make sense of concepts, problems and experimental phenomena rather than maintaining the traditional separation of lecture, recitation, and laboratories.

Physics Market Share Declining

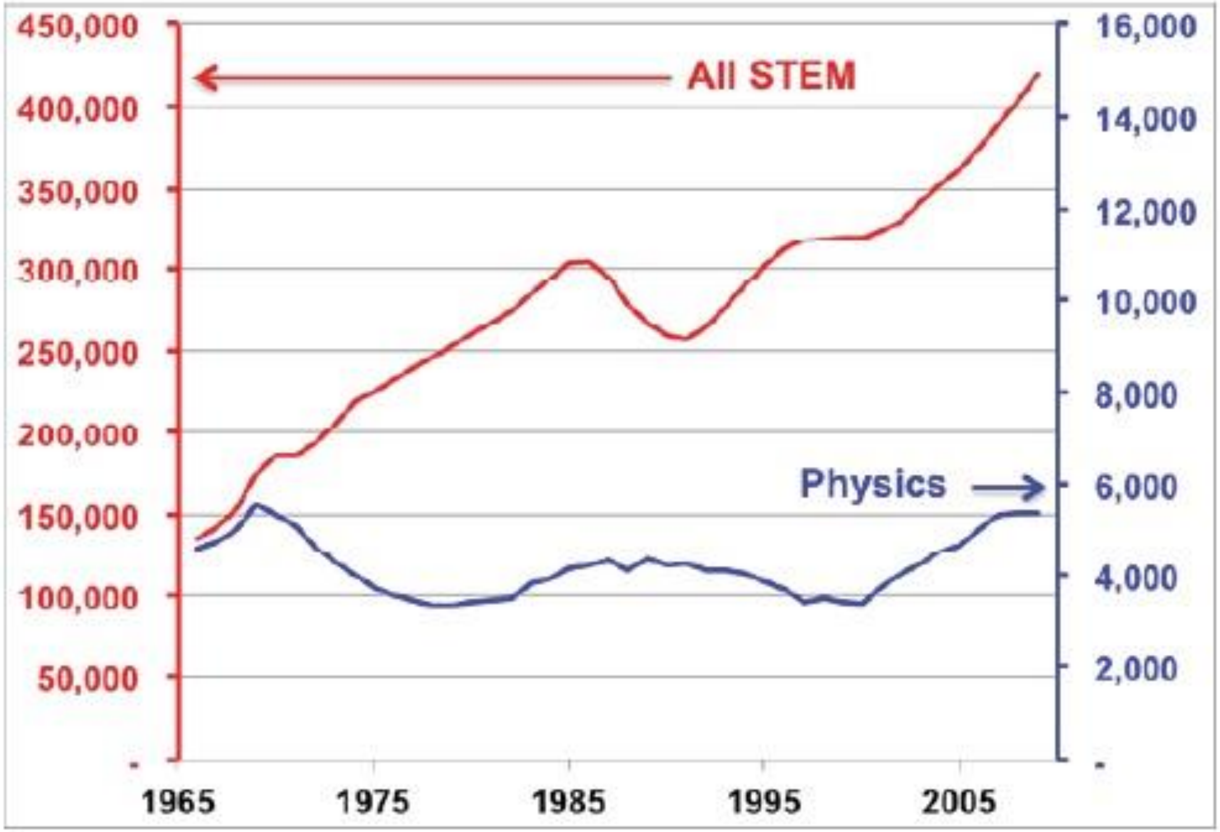
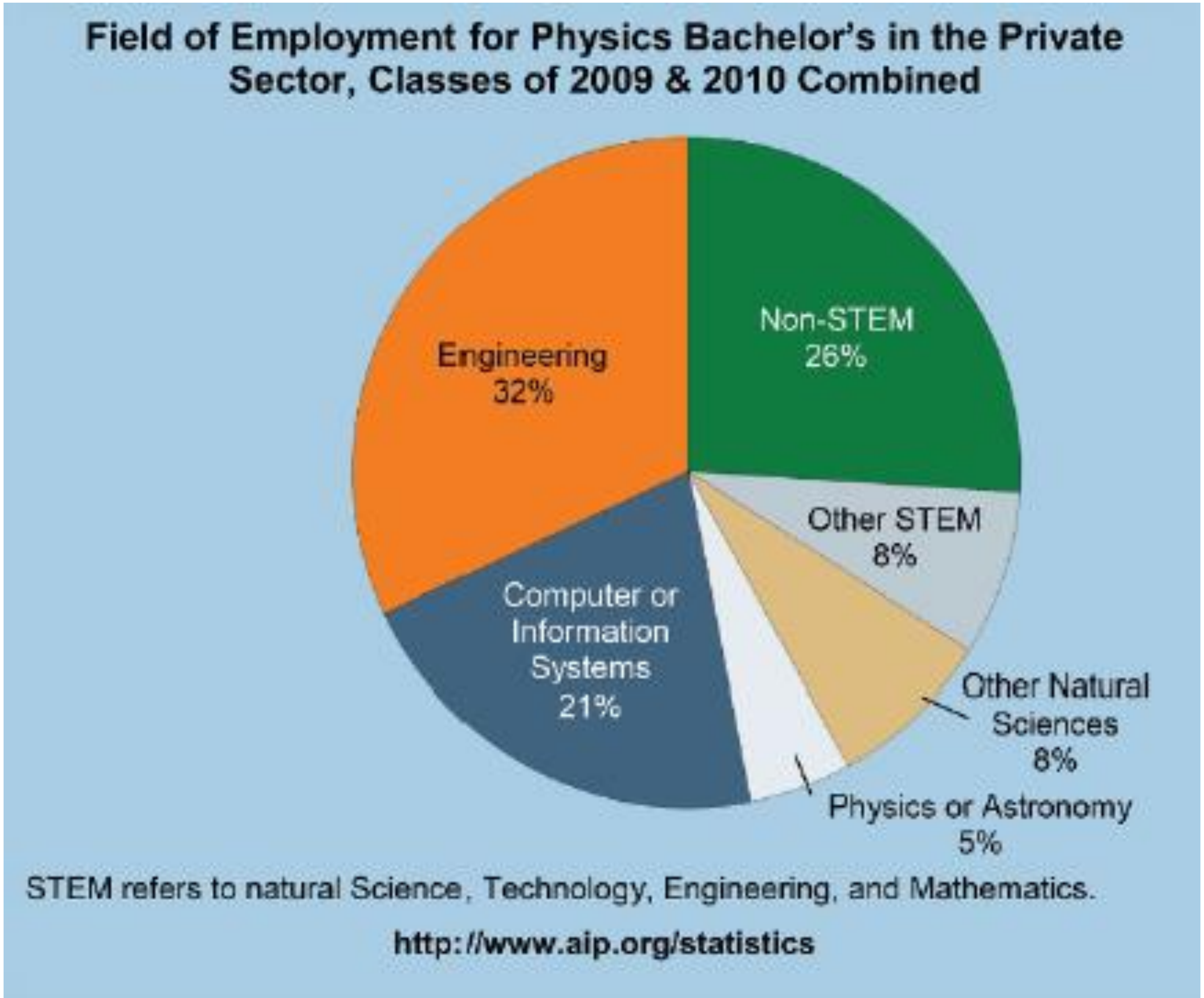


Figure 2.1 Annual graduates in all STEM fields and physics for the past 40 years. SOURCE: Data from the National Center for Education Statistics (NCES); graph from Hodapp, 2011.

In any given academic year, about 500,000 students take an introductory undergraduate physics course somewhere in the United States.

- Students take introductory physics for a variety of reasons.
  - Some are attracted to the beauty and power of physics. This interest may lead to a major or minor in the subject, often beginning with an honors-level introductory course.
  - For students pursuing degrees in education, the arts, social sciences or humanities, this interest may lead to enrollment in a non-quantitative physics course (often referred to as “physics for poets”).
  - However, the majority of students take physics as a foundation for other sciences and engineering, or as a foundation for training in the health sciences.
- only 3% of all undergraduates are enrolled in an undergraduate physics course at a given point I
  - of those, only a small percentage slightly over 1 %—end up with a physics degree.
- These numbers serve as a reminder that most students never take a physics course. Those who do have mostly practical reasons for doing so and stop as soon as they have fulfilled program requirements.

Employment


Field of Employment for Physics Bachelor's in the Private Sector, Classes of 2009 & 2010 Combined
Non-STEM 26%
Engineering 32%
Other STEM 8%
Computer or Information Systems 21%
Other Natural Sciences 8%
Physics or Astronomy 5%
STEM refers to natural Science, Technology, Engineering, and Mathematics.
http://www.aip.org/statistics

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?

1. Materials primarily for use in lecture sessions or lecture-based courses

- Polling students, using flashcards or Personal Response Systems (also known as “clickers”) has become prevalent in large lecture classes as a mechanism for motivating student engagement.
- Clickers (handheld IR or RF transmitters), allow the rapid and convenient collection and display of student responses to multiple-choice questions posed by the instructor.
- These facilitate interactive engagement techniques even in large lecture classes by encouraging discussion among peers and by giving real-time feedback to students and instructors. Because these devices are easily used in most existing classrooms and lecture halls as an adjunct to traditional learning environments, they have found wide application.

2. Materials primarily for the laboratory

- Laboratory experiments in physics courses serve many purposes, of which developing conceptual understanding is only one. For this purpose, computers equipped with data acquisition devices and analysis software offer an advantage over more traditional techniques (*e.g,* using meter sticks, timers, etc.) by allowing rapid, or even real-time, display of results, bypassing the need to tabulate data and make graphs by hand.
- For example, students can graph their own position, velocity, and acceleration in real-time, perhaps attempting to move in such a way that produces a particular graph, a strategy that can help address specific student difficulties in relating position, velocity and acceleration.
- Sensors and entire laboratory activities exist for a broad range of topics in introductory physics.
- Sophisticated but easy-to-use video analysis tools allow students to make direct measurements of the motion of objects in digital videos supplied by an instructor, found on the web, or made by students themselves using inexpensive digital cameras or even their "smart phones." The rapid production of graphs and other representations can help students focus on the physics concepts and enable discussions among peers.
- Modeling toolsets facilitate student participation in an important aspect of physics: the construction of a simplified model, particularly a mathematical model, of a physical process and the subsequent exploration of the relationship between the model and the actual phenomena while noting the limitations of the models.

3. Fully integrated courses

- While many of the methods listed here can be incorporated into existing course structures as part of lectures, labs, recitations or homework, at some institutions, the entire traditional courses structure has been replaced. New courses that integrate direct instruction (if any), with laboratory experiments, discussions, and problem solving exercises allow the introduction of different activities with different goals when appropriate, rather than according to a predetermined timetable.
- Many of these fully integrated courses feature “**studio-style**” classrooms with large tables, equipped with computers, that facilitate discussions among students. These approaches also promote coherence and consistency, which is difficult to achieve when different elements of a courses are developed and implemented independently, as is often the case.

4. Tutorials and problem-solving worksheets

- "Tutorial" has become a generic term for research-based worksheets primarily intended for use in small sections that supplement instruction in lectures and labs. Tutorials are designed to lead students, working with small groups of peers, through the reasoning processes involved in constructing, interpreting and applying fundamental concepts.
- Because many introductory physics courses have a lecture-lab-recitation structure, the introduction of tutorials in place of some or all recitations often requires little or no additional investment of faculty or teaching assistant (TA) time. However, as with all research-based instructional approaches that depend on TAs, their preparation is critical for the effective implementation of tutorials.

5. Computer simulations, intelligent tutors and pre-instruction quizzes

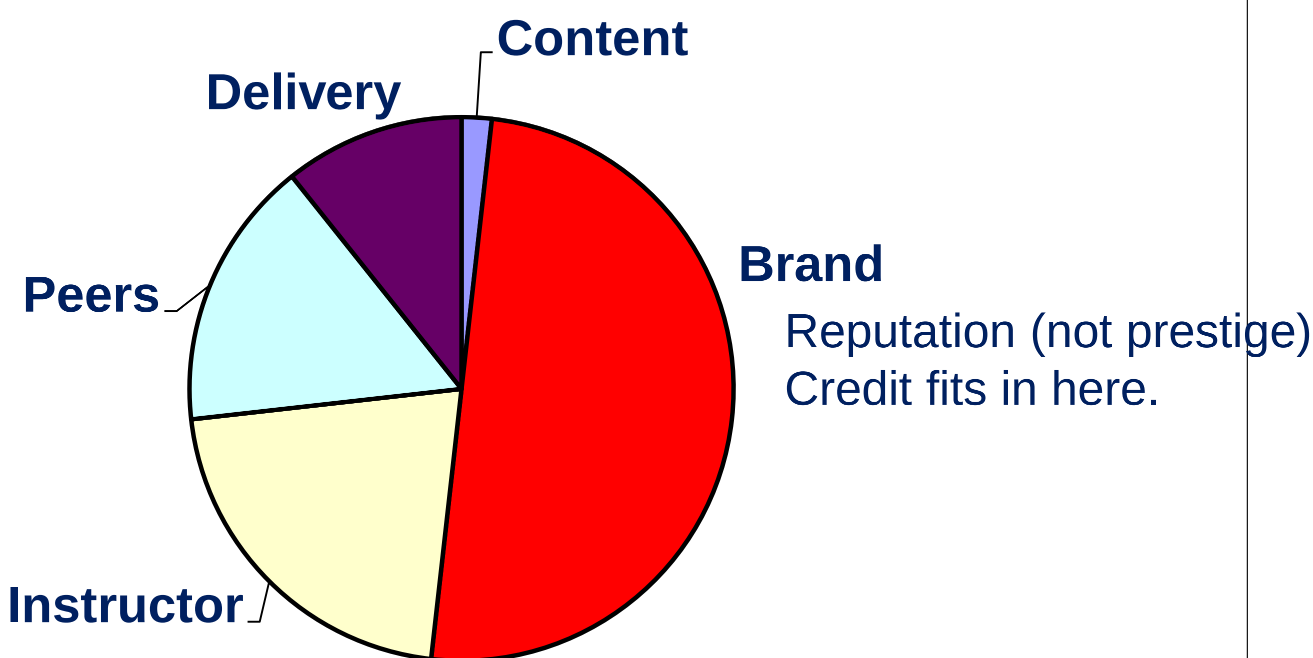
- Carefully constructed and tested simulations make visible what was previously invisible. For example students can watch microscopic models in action (electrical current, magnetic fields, gas molecules, etc.), examine how electrical, potential and thermal energy change during mechanical processes, and explore the shapes of wavefunctions associated with different potentials. All of these can facilitate instruction by helping students focus on the most important phenomena, by giving them access to richer representations (3-D models, etc), and by allowing them to explore the implications of increasing or decreasing friction, gravity, etc.

Online homework is now the norm in college physics.

- The two largest online homework systems in physics, MasteringPhysics.com and WebAssign.com, have nearly 400,000 unique users in physics per year, and together are used in more than 1/2 of over 300 US colleges surveyed recently. Homework systems by various other publishers reach an additional 20% of these colleges.
- A large fraction of students complete and submit assignments online, providing them with instant feedback and instructors with a report containing a wealth of data for analysis.
- In many cases the decision to adopt online homework systems is made for economic reasons, but many systems offer educational advantages as well.

The Value Chain

What do students want and pay for?



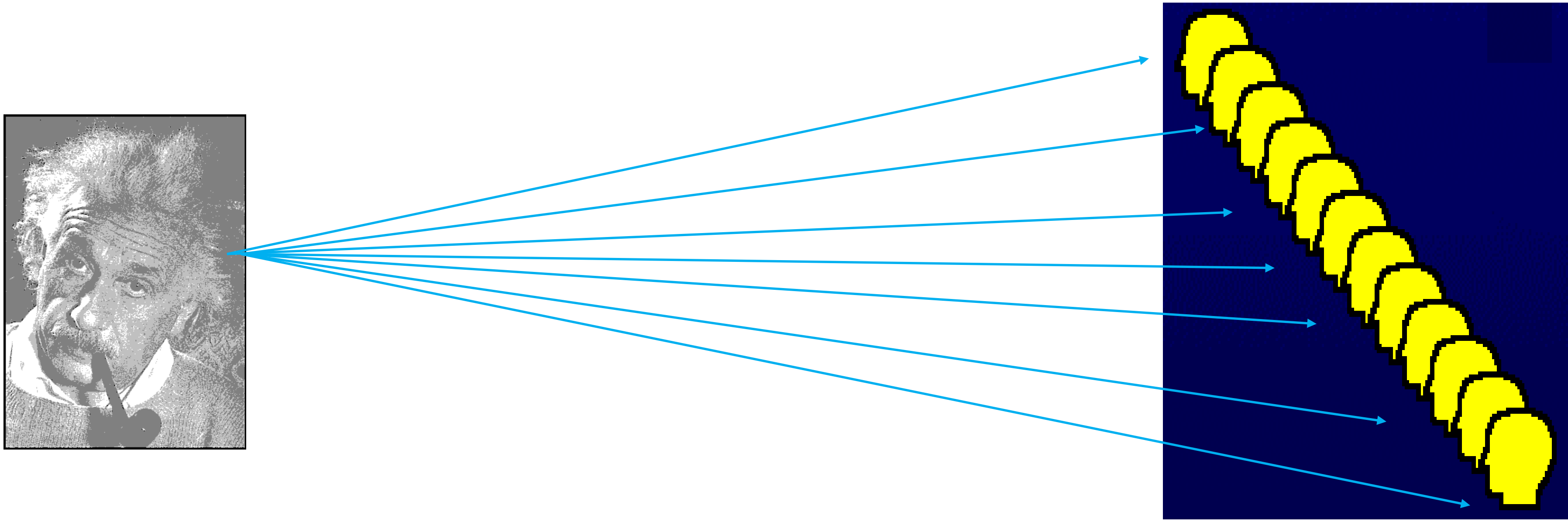
A Brief History of “Distance Learning”

- Correspondence Courses
- TV Courses – Cable, Satellite, Videotape
- Interactive Video Courses (2-way satellite, videoconferencing, and now Skype)
- ALN – “traditional” online education
- MIT OpenCourseWare
- Carnegie Mellon Open Learning Initiative
- MOOCs

- Unfortunately many of the MOOCs look eerily like the “moving hand writes and then moves on” of the video days!

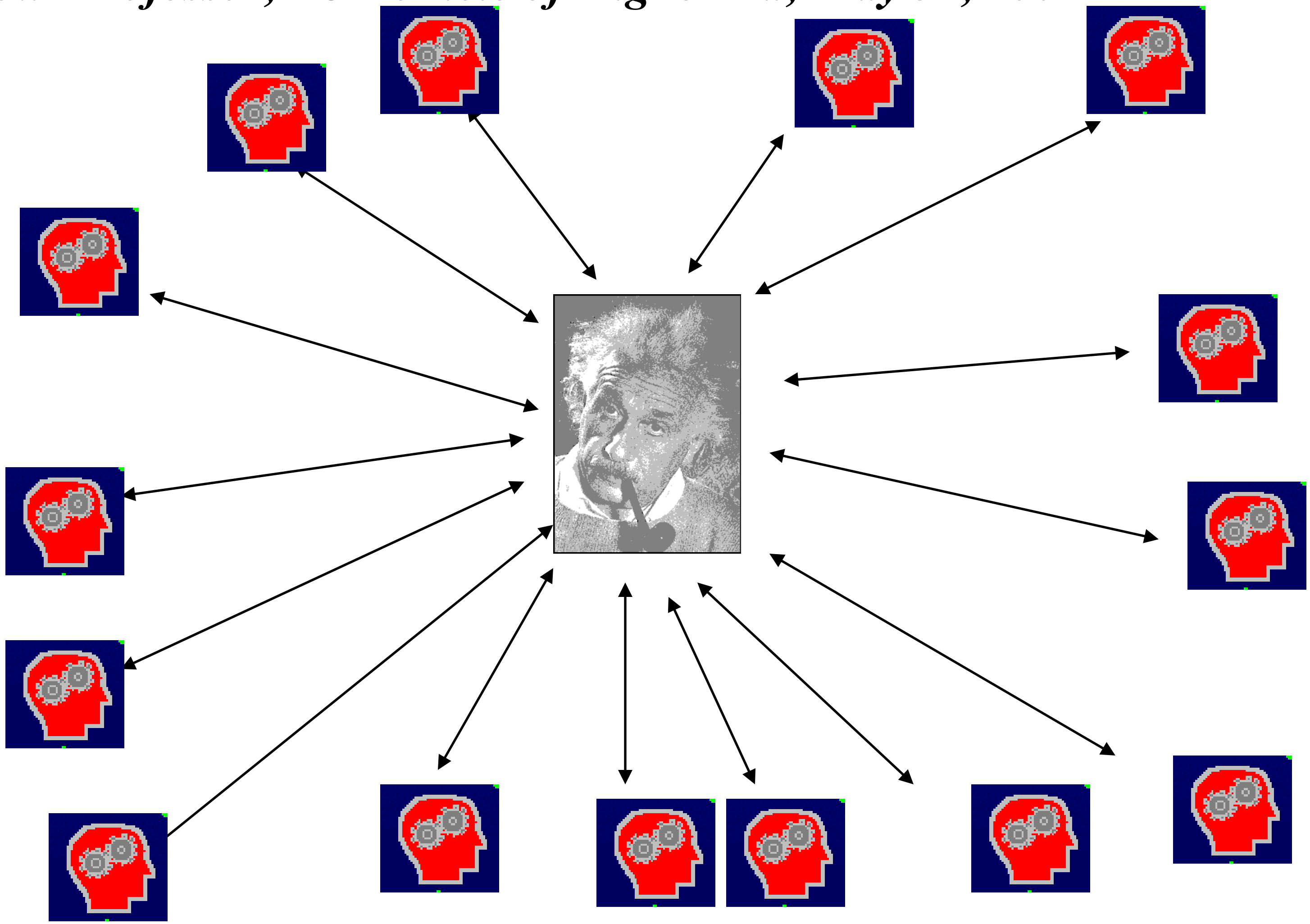
The transmission (lecture) model

- The mainframe approach
  - Face to Face: The Lecture
  - Distance: TV (Cable, Video, Satellite, or MOOC)
    - Pushes the back wall out a few thousand miles



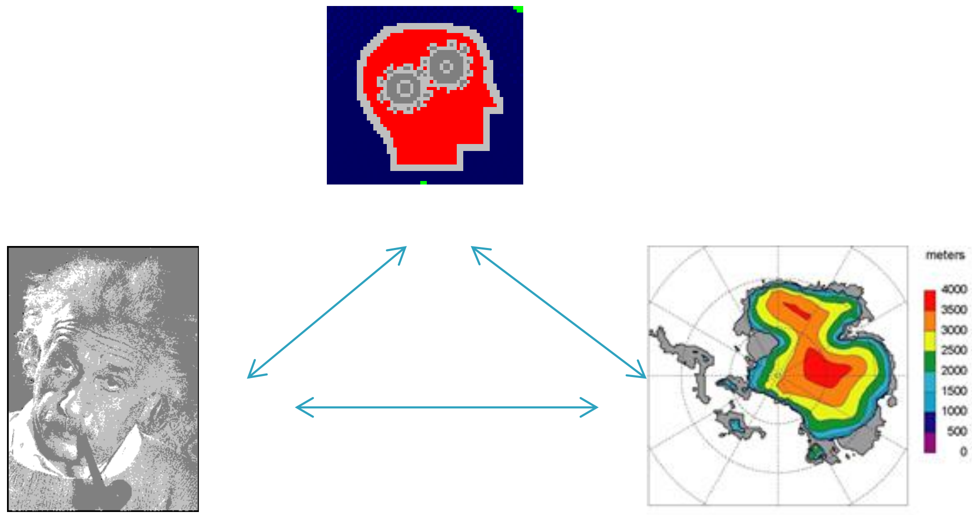
Which can become the usual on-line course organization

"The 24-Hour Professor;" Chronicle of Higher Ed; May 31, 2002



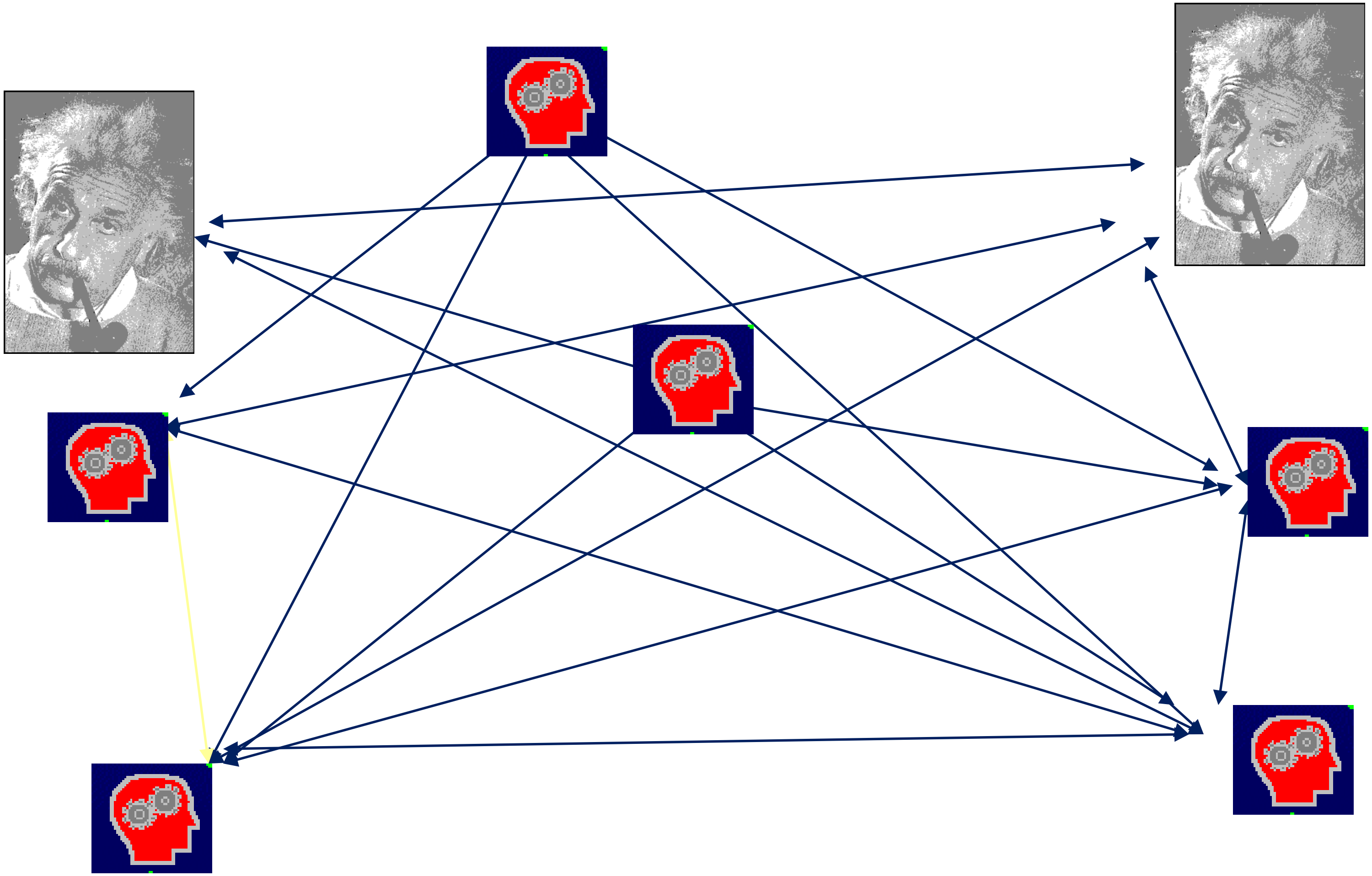
Engagement

- Faculty with student (half done in lecture)
- Student with material (reading, homework, papers, adaptive tutorials, most MOOCs, etc)
- Student with Student (peer learning, small groups, team based projects, studio classrooms, etc)

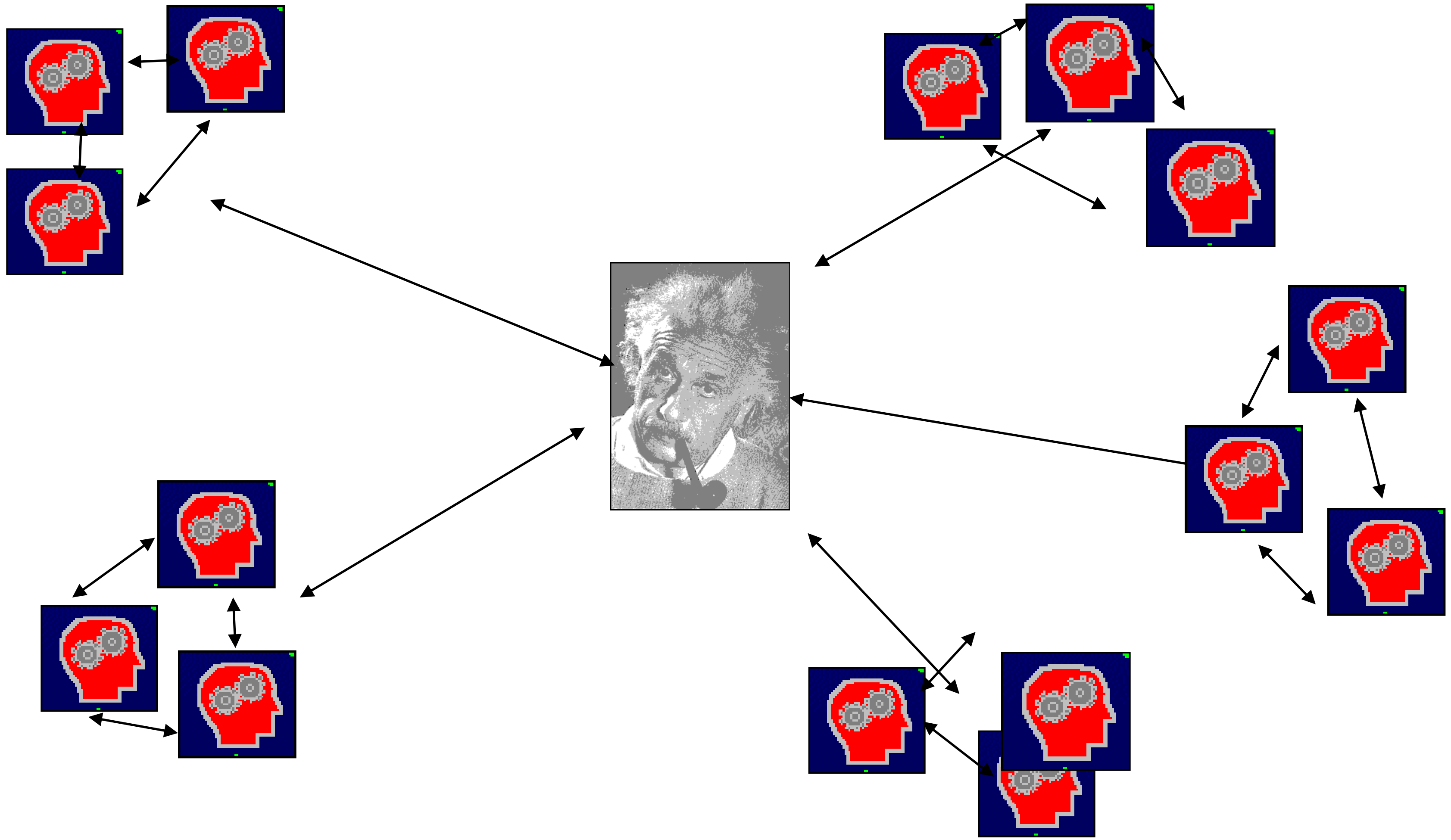


Climate change models, R. Decanto UMass/Amherst

Distributed Collaborative On-line Model



Collaborative Learning, Peer Learning…..



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.

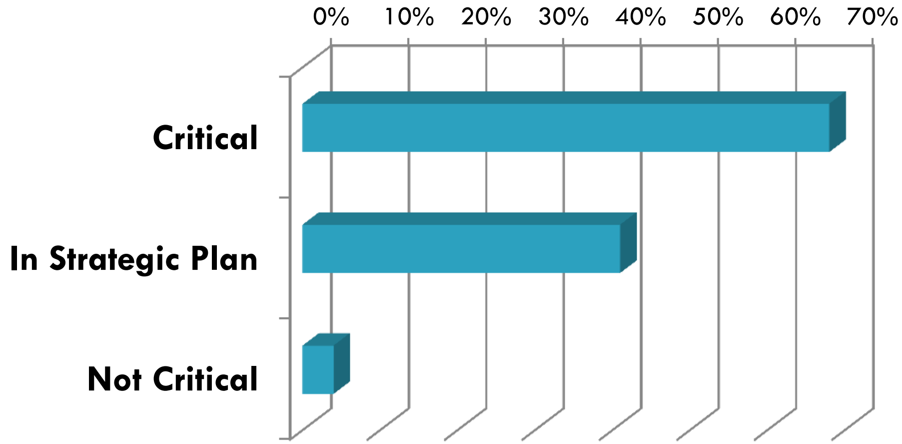
- The US was tied for 6th place at 30% according to 2006 data.

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?

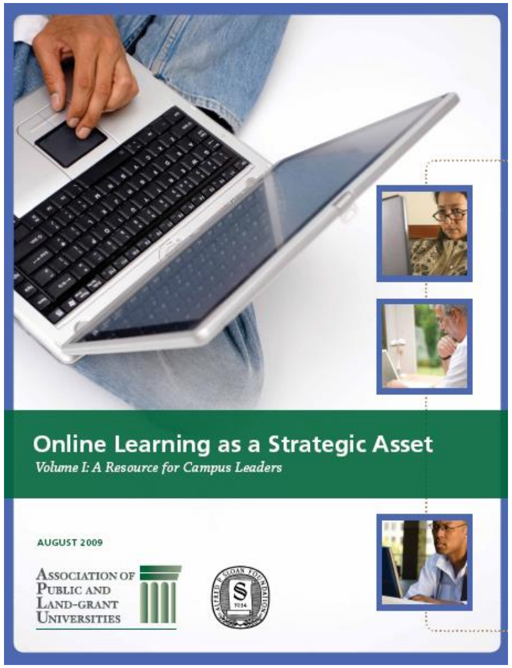
American Public and Land-grant Universities

- 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

- 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?

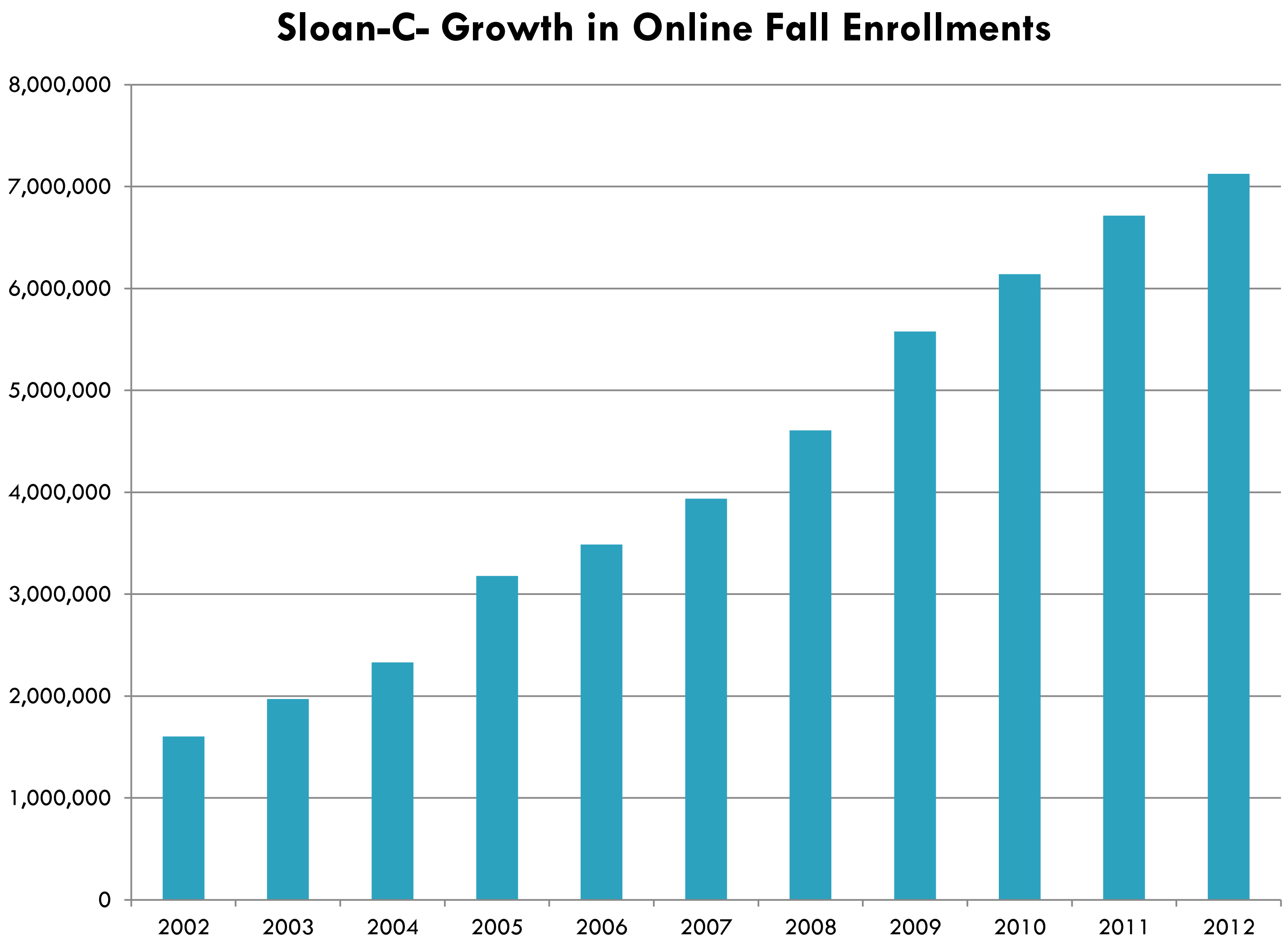
- In November of 2003, the press was ready to pronounce online learning dead!
- Hardly!
- The rapid demise of Fathom, Cardean, Pensare, Virtual Temple, Harcourt University, Caliber and others
- The Red Sox, the Cubs, and 29 other teams didn't win the world series again this year either.
  - (ed. remember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

Vintage Slide: AAC&U November 2003

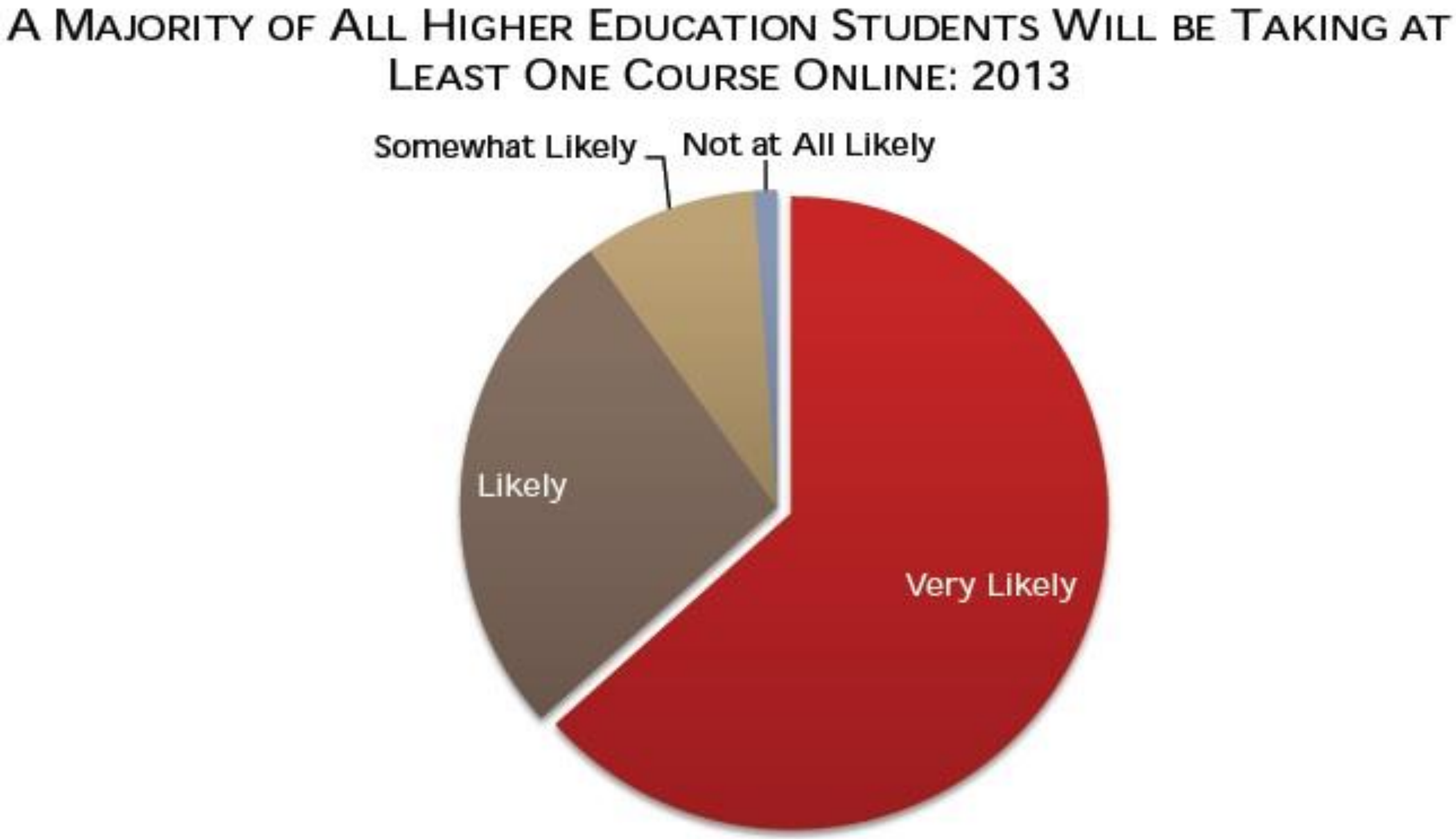
Table from Sloan-C Report 2013

Delivered Online	Type of Course	Typical Description
0%	Traditional	Course where no online technology used — content is delivered in writing or orally.
1 to 29%	Web Facilitated	Course that blends online and face-to-face delivery. Substantial proportion of the content is delivered online, typically uses online discussions, and typically has a reduced number of face-to-face meetings.
30 to 79%	Blended/Hybrid	Course that blends online and face-to-face delivery. Substantial proportion of the content is delivered online, typically uses online discussions, and typically has a reduced number of face-to-face meetings.
80+%	Online	A course where most or all of the content is delivered online. Typically have no face-to-face meetings.

Relentless growth nationally 2002-2012



Sloan-C -Is it likely?



Sloan-C: Underlying Data Set

Year	Total Enroll	TEGrowth%	At least 1online	Growth	% increase	Online%
2002	16,611,710	NA	1,602,970	NA	NA	9.6%
2003	16,911,481	1.80%	1,971,397	368,427	23.00%	11.7%
2004	17,272,043	2.10%	2,329,783	358,386	18.20%	13.5%
2005	17,487,481	1.20%	3,180,050	850,267	36.50%	18.2%
2006	17,758,872	1.60%	3,488,381	308,331	9.70%	19.6%
2007	18,248,133	2.80%	3,938,111	449,730	12.90%	21.6%
2008	19,102,811	4.70%	4,606,353	668,242	16.90%	24.1%
2009	20,427,711	6.90%	5,579,022	972,669	21.10%	27.3%
2010	21,016,126	2.90%	6,142,280	563,258	10.10%	29.2%
2011	20,994,113	-0.10%	6,714,792	572,512	9.30%	32.0%
2012	21,253,086	1.20%	7,126,549	411,757	6.13%	33.5%

Sloan-C Annual Survey -2013

- **7.1 million** of higher education students are taking at least one online course. (7,126,549)
- The 6.1 % growth rate represents over 400,000 additional students taking at least one online course.
- The percent of academic leaders rating the learning outcomes in online education as the same or superior to those as in face-to-face instruction, grew from 57% in 2003 to 74% in 2013.
- The number of students taking at least one online course continued to grow at a rate far in excess of overall enrollments, but the rate was the lowest in a decade.

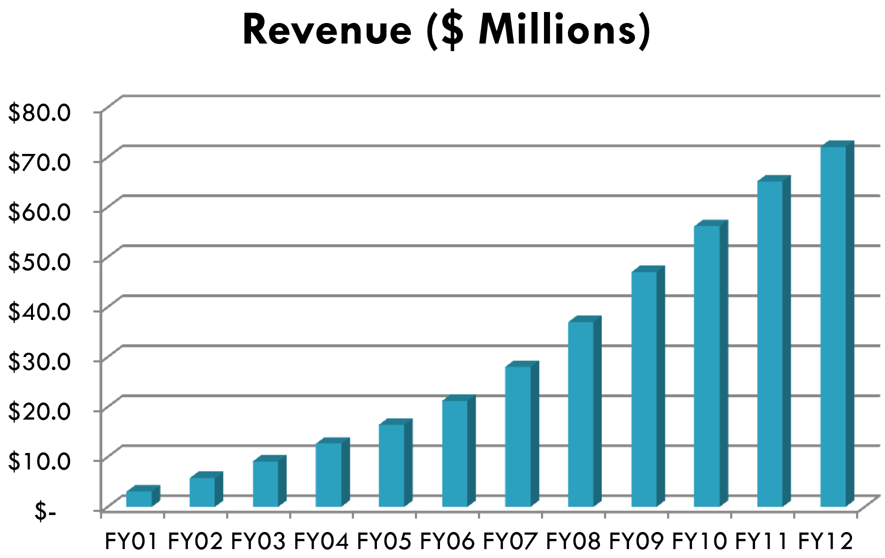
Sloan-C Report

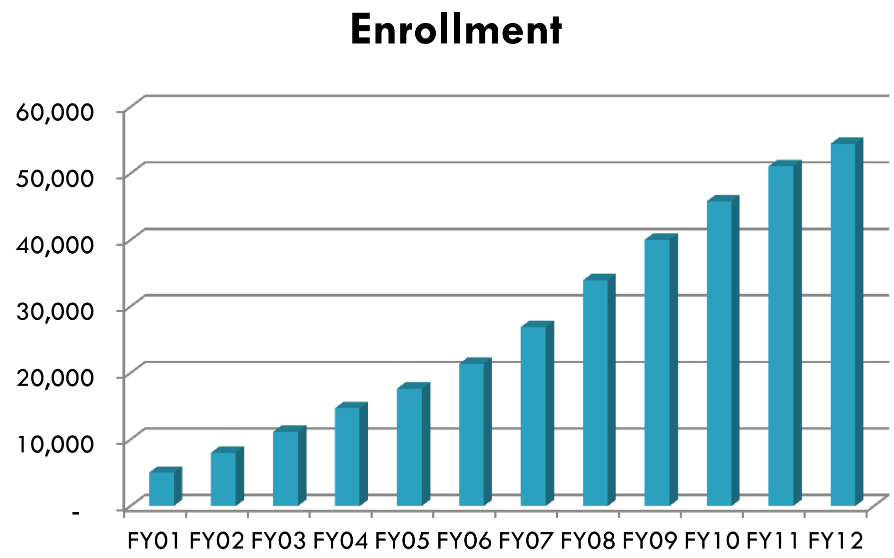
- The percent of academic leaders rating the learning outcomes in online education as the same or superior to those in face-to-face instruction had grown from 57 in 2003 to 77 percent in 2012. The upward trend was reversed this year, with a dip to 74 percent.
  - Or perception of inferiority increased from 23 percent last year to 26 percent this year, but still decreased from 43% in 2003.
- Academic leaders at institutions **with online** offerings **remain positive** about the relative learning outcomes for online courses;
- **all of the decrease** can be attributed to leaders at institutions **without online** offerings becoming more negative.

Education Department Statistics -2012

- Then, in 2012, the Education Department finally started asking colleges and universities to report data on their distance-education offerings. The National Center for Education statistics has since released its own online-enrollment figures for that year (it has not yet compiled its 2013 figures).
- In 2012, according to the department, **5.5 million** students took at least one online course. That is 1.2 million fewer than the Babson Survey Research Group estimated that year

UMassOnline Growth 2001-2012

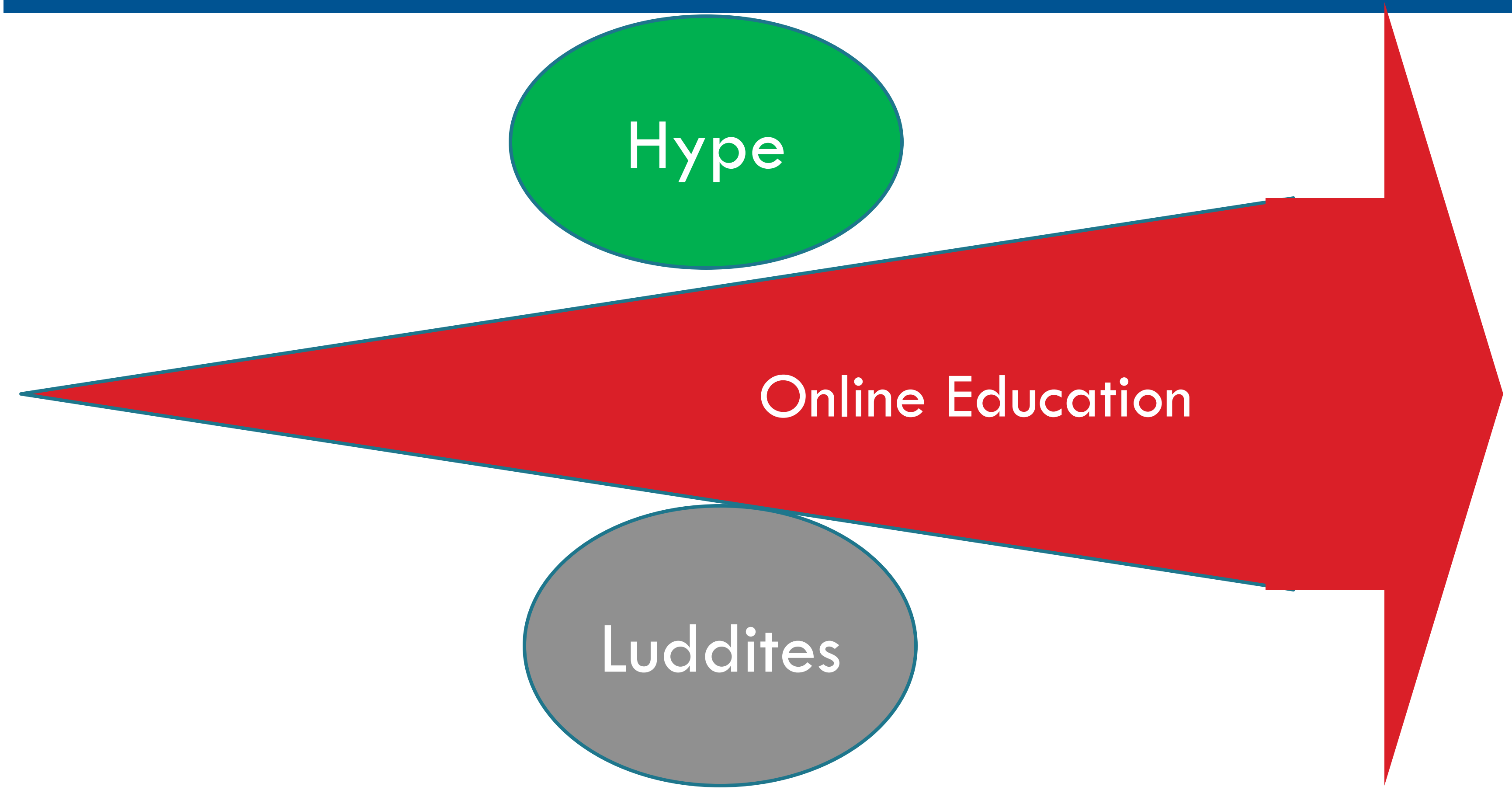




Keys to UMassOnline Success

- 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



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.

Sloan-C Annual Survey 2013

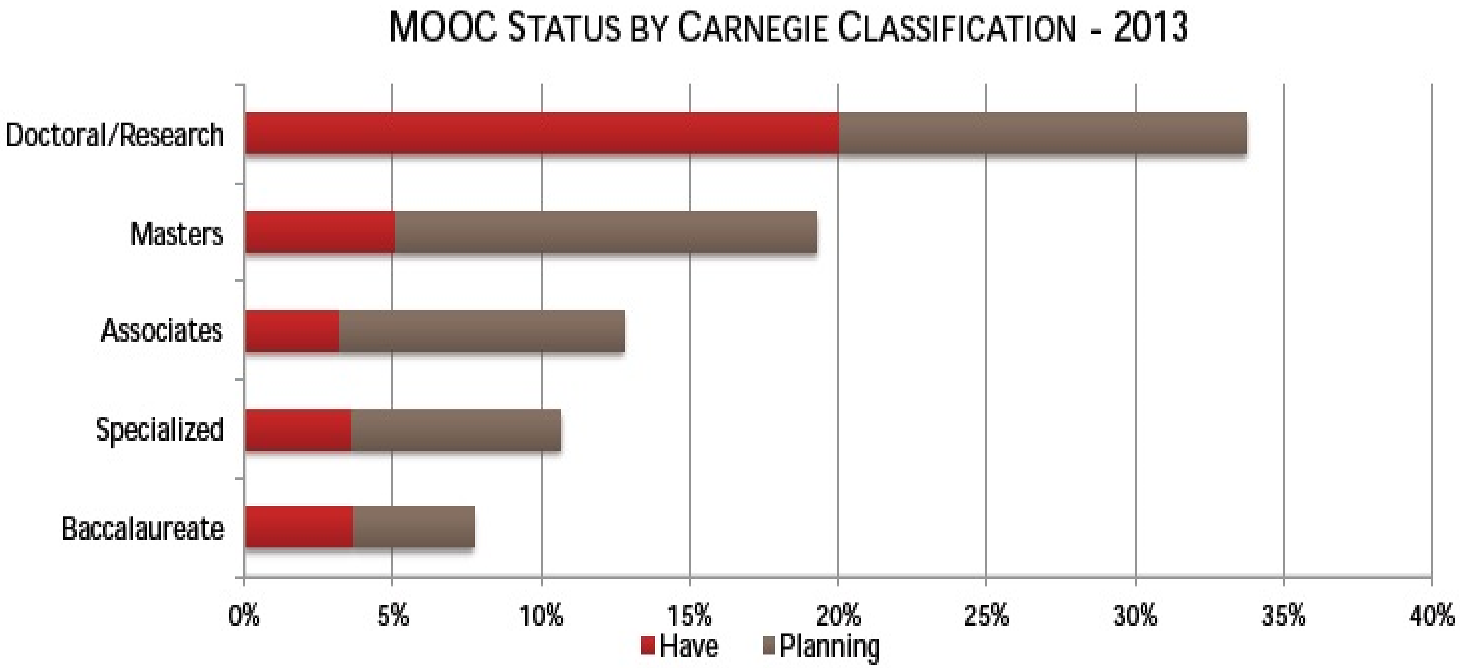
- In 2012, 26 percent of academic leaders disagreed that MOOCs were "a sustainable method for offering courses." In 2013 that number leapt to 39 percent.
- "The chief academic officers at institutions with the greatest experience and exposure to traditional online instruction are the least likely to believe in the long-term future of MOOCs," wrote I. Elaine Allen and Jeff Seaman, the report's authors.
- Half of the respondents in the 2012 survey agreed that "MOOCs are important for institutions to learn about online pedagogy"; in 2013 agreement dipped to 44 percent, while the proportion of respondents who disagreed with that statement jumped from 19 percent to 27 percent.

Sloan-C- More on MOOCs

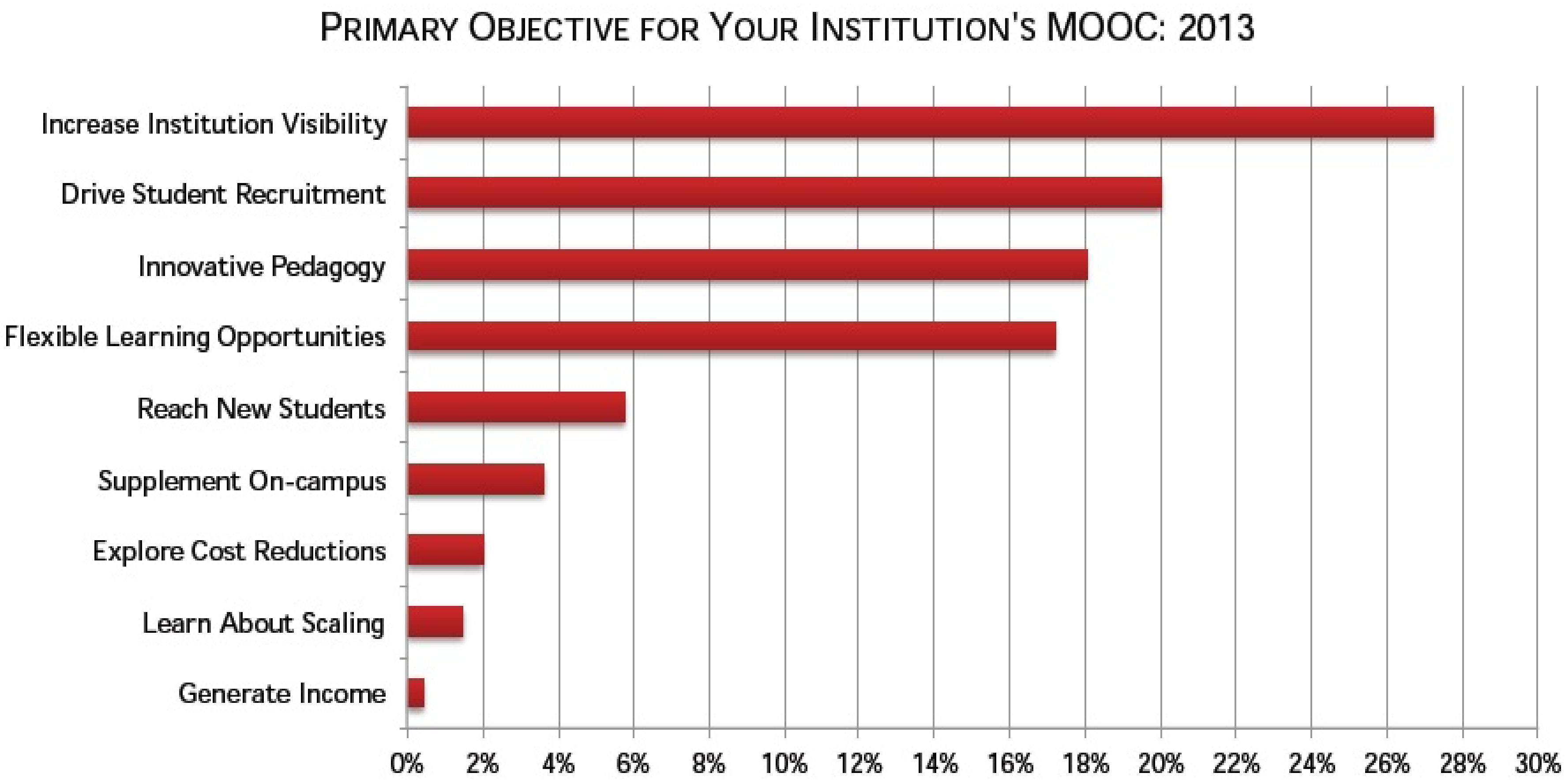
- The percent of higher education institutions that currently have a MOOC, increased from 2.6 percent to 5.0 percent over the past year.
- The majority of institutions (53 percent) report they are still undecided about MOOCs, while under one-third (33 percent) say they have no plans for a MOOC.
- Only 23 percent of academic leaders believe that MOOCs represent a sustainable method for offering online courses, down from 28 percent in 2012.
- A growing proportion of academic leaders have concerns that credentials for MOOC completion will cause confusion about higher education degrees (64 percent in 2013, up from 55 percent in 2012).

MOOCs predominate in larger institutions

- Sloan-C Survey



Why they do MOOCs?



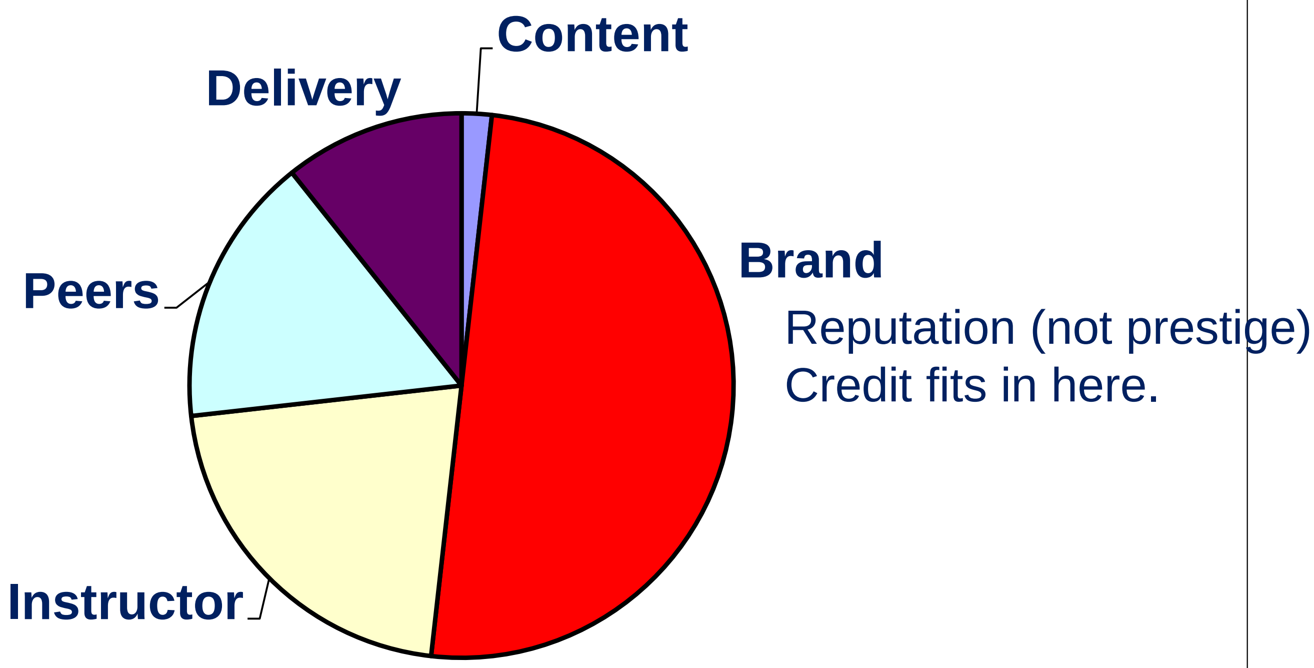
The dangers of hype

- 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?



Vintage Slide: AAC&U November 2003

Things Physics should be doing

- Introductory Course should be made more interactive
  - Studios Courses, Scale-Up, modeling, use of technology, flipped classrooms, emporiums, etc.
- Physics needs to become more involved in online learning.
  - Introductory courses to be taken by prospective students both of preparation and for AP.
  - Blended learning used in more undergraduate courses.
- MOOCs should be explored, but only in the context of more engaging environments –not as stand-alone replacements for traditional courses.
- Physics (and Physics professors) should become more aware of physics education research and cognitive science results to improve the learning environment.

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.
- Physics is at an inflection point: our prominence and market share have eroded, but we remain a subject of critical importance.
- Will we respond?

Thank you.

- Jack M. Wilson
  - President Emeritus and Distinguished Professor of Higher Education, Emerging Technologies, and Innovation.
  - www.jackmwilson.com