



**Creating New Learning Environments  
in the Convergence of  
Computing, Communications, and Cognition**

**Jack M. Wilson**

**CEO UMassOnline.net**

# What shapes my views?

- Service as:
  - 31 years as a professor, department chair, research center director, dean ( 4 flavors), and provost
  - RPI: J. Erik Jonsson '22 Distinguished Professor of Physics, Engineering, Information Technology, and Management.
- Founder, CEO, Chairman of LearnLinc
  - a successful eLearning Co
  - Now Mentergy Corporation (NASDAQ: MNTE)
  - Sold in February 2000.

# What else shapes my views?

- Industry Consultant (IBM, AT&T, Lucent, Ford, GM...)
- Army TRADOC Advisory Committee
- Pew Center for Academic Transformation (\$8.8 M)
- One of founders of the Nat. Learning Infrastructure Init.
- Chair, NY State Task Force on Distance Learning
- Wash. DC: 8 yrs on Science Education: HS. and Univ.
- National Acad. of Science/National Research Council
  - Committees on Information Tech., Physics Decadal Overview Committee, and National Digital Library Committee
- Lots of visits, speeches, writing, reading, and visitors

# A personal journey

- Began career as a research physicist
- Research required high performance computing
- Why are students not learning about this?
- How can this help learning?
- Restructuring physics education.
- Computing Communication Cognition -> The Studio Classroom
- Restructuring Undergraduate Program
- How can the studio experience work at a distance?

# NY Times Midnight Question



- “Dr. Wilson, Governor Kean told me that all this technology emphasis was fine but the the best education was:

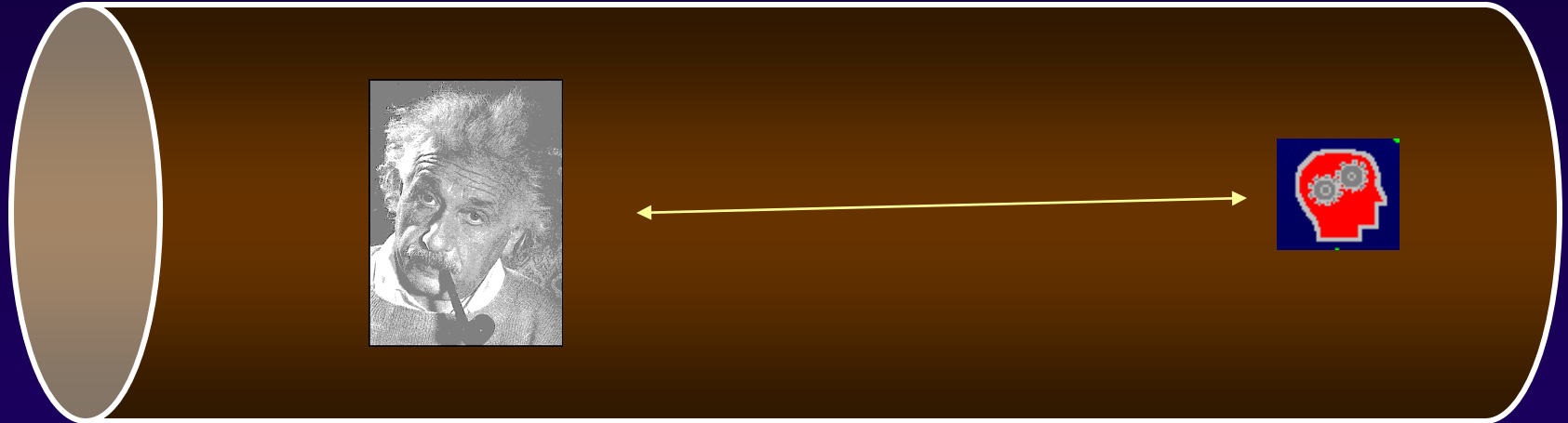
Mark Hopkins on one end of a log and the student on the other.”

- “Could you comment on that?”
  - Rosalie Stemer, New York Times in a late night call

# The Electronic Log?

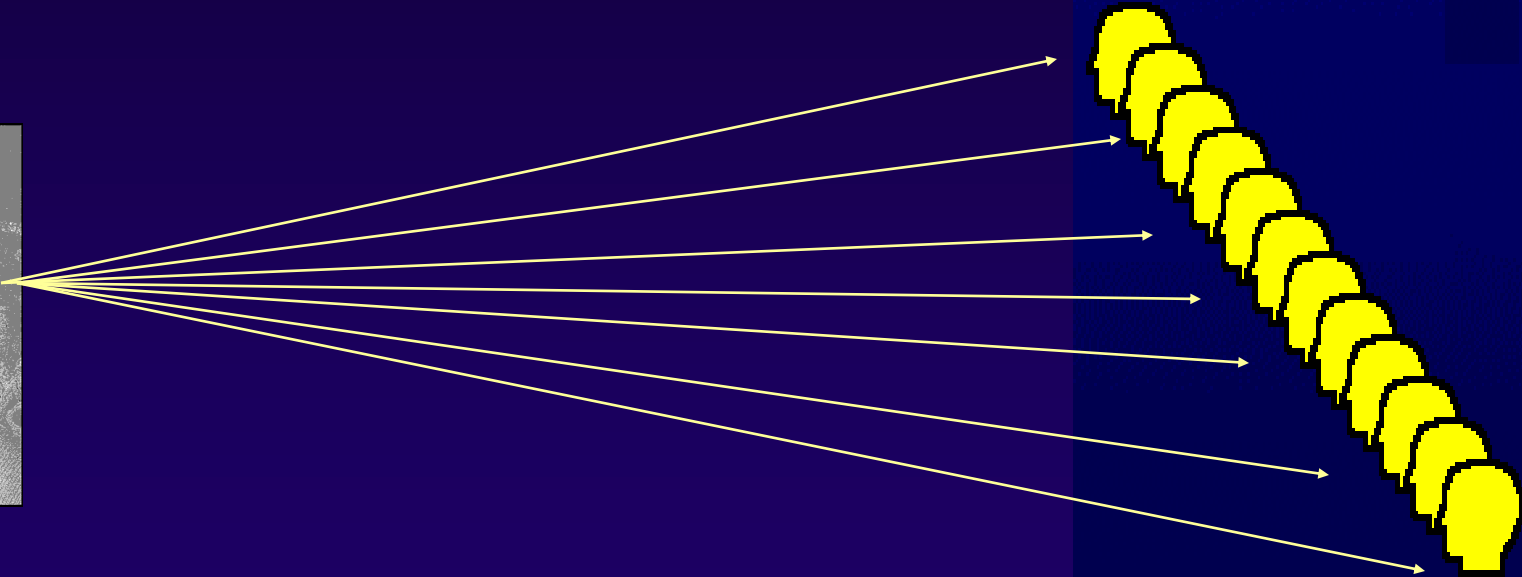
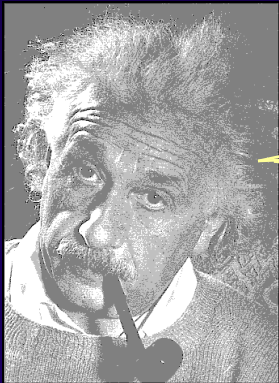
- “Rosalie, I couldn’t agree more..... as long as you will allow me to make it an **electronic log.**”
  - A sleepy Jack Wilson:
- This became the lead for the NY Times piece.
- My other hours of interviewing at other times did not appear.
  - **NY Times:** The Virtual Classroom: Colleges face tough questions about using technology to teach more students. Can video lectures and E-mail offer the give-and-take of real learning? By Rosalie Stemer; The New York Times, Sunday, January 8, 1995

## The (electronic) Log



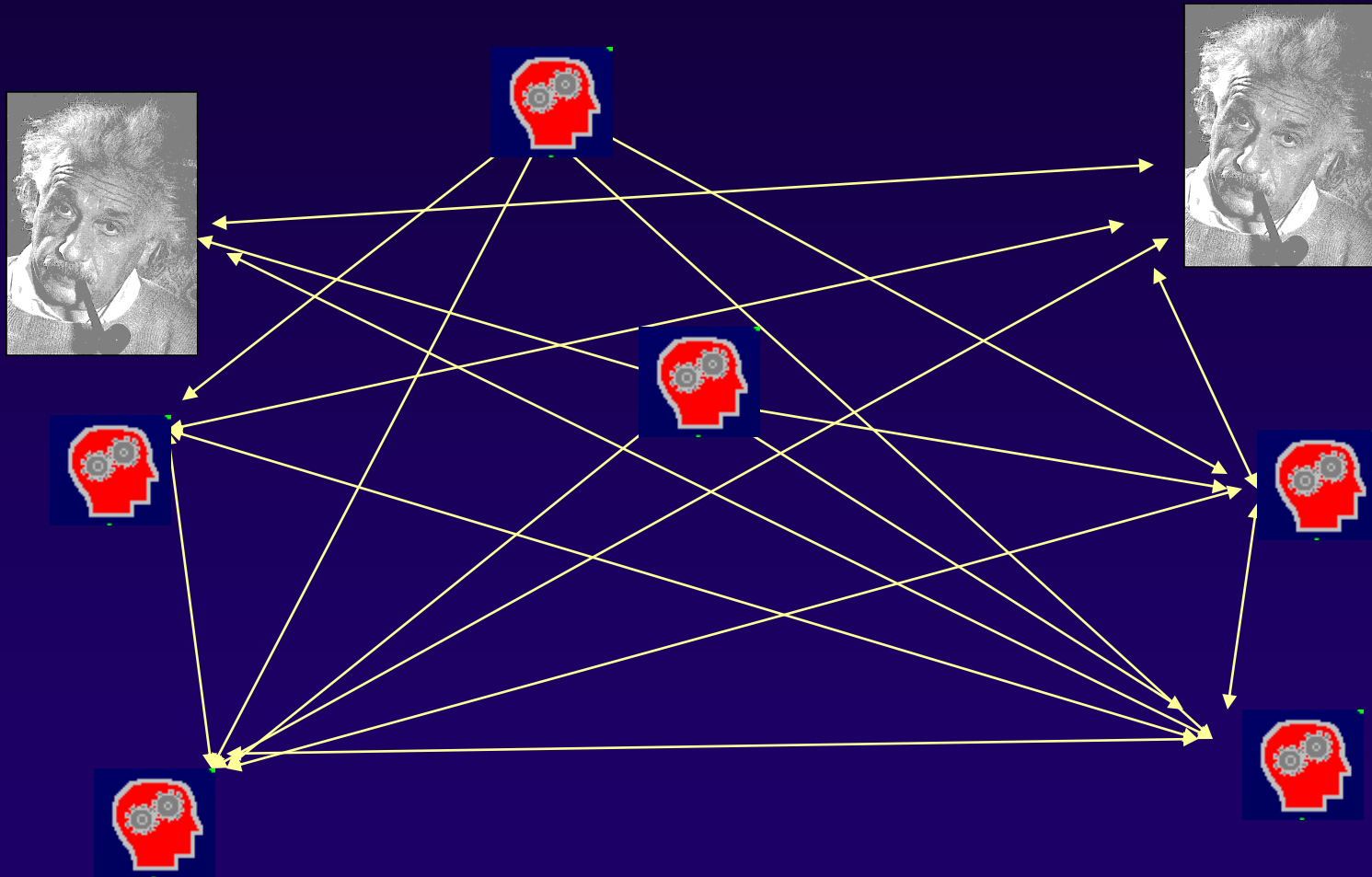
# The transmission model

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





# Distributed Collaborative Model

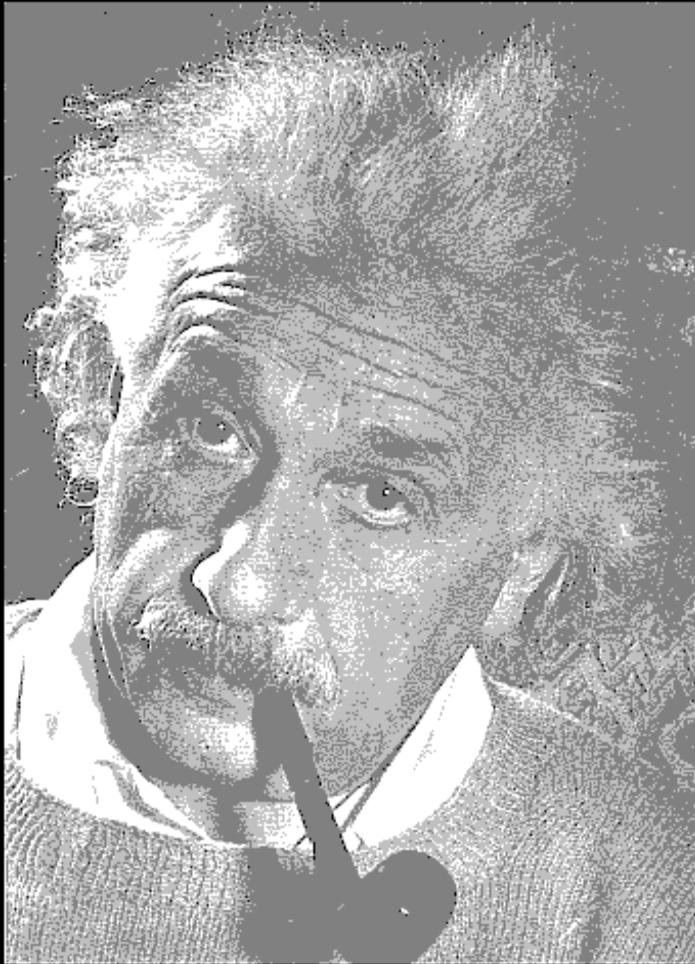


# Faculty fears and legislators hopes

- Prism: "If a student can zoom the best professors into his or her living room, then what is to happen to the rest of the countries professors?" (the mainframe model!)
  - In a word: hogwash.
- Presenting is not teaching!

# What happens to me?

- Will a



Web site  
or a CD-ROM  
(or a videotape)

replace your <Blank>  
Instructor?

# The horrible mismatch

- People change very slowly
  - Both a comfort and irritant!
- Technology changes very rapidly



# RPI Restructuring strategy: 90-99



- Replace Large Lectures with Studios
- Create 4 X 4 Curriculum
- Restructure majors
- Extend Studio into Distributed Learning
- Student Mobile Computing
  - laptops
- Wireless deployment
- Planning for a moving target
  - 11 year effort



# Philosophy of the Studio Course



- What do you do in a lecture hall?
- What about in a studio?
- How do the actions of students and faculty differ?

# Features of the Studio Courses



- De-emphasize lecture
- Combine Lecture/Recitation/Lab
  - Extensive MBL use
- Constructivist approach
- Multimedia courseware
- Theater in the Round Classroom
- Multipoint video/audio/collaborative

# The Studio Classroom



- Hesburgh Award 1995
- Boeing Outstanding Educator Award 1995
- Pew Prize 1997
- Pew CAT \$8.8 million



# The old model



**Faculty working very  
hard while the  
students listen (rest?).**

# The New Model

**Students working very hard while the faculty listen (rest?).**



**Faculty working very hard while the students listen (rest?).**

# No more lectures



- Mini-lectures
- Cooperative Learning - Teams
- Peer instruction
- Teacher as mentor
- Hands on
- Combine Lecture/Recitation/Lab
- Distributed Educational Systems

# No more books?



- Of course! Texts
- Online Texts
- Interactive Texts
- Web Access to Resources/Databases
- Full Motion Video
- Data Acquisition/Analysis/Visualization
- Live Links to Experts

# No more dirty looks



- An improved classroom climate
- Able to address diversity
  - Learning styles
  - Gender/Race/Culture
  - Interests
  - Preparation
- Developing Cooperative and Leadership Skills
- Inquiry
- Peer Teaching

# The Introductory Course



750 - 1100  
Students

Calculus (1100)

Physics (750)

Chemistry (650)

Intro. to Engineering Analysis (650)

Economics (~300)

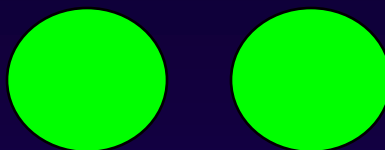
(in the beginning)

Soon spread to everything from Literature  
to Electrical Engineering

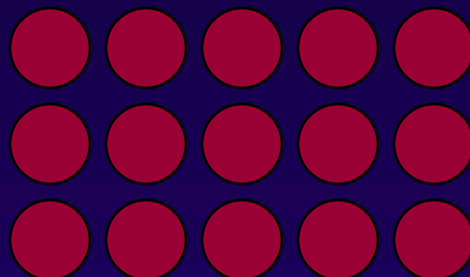
# The Introductory Course



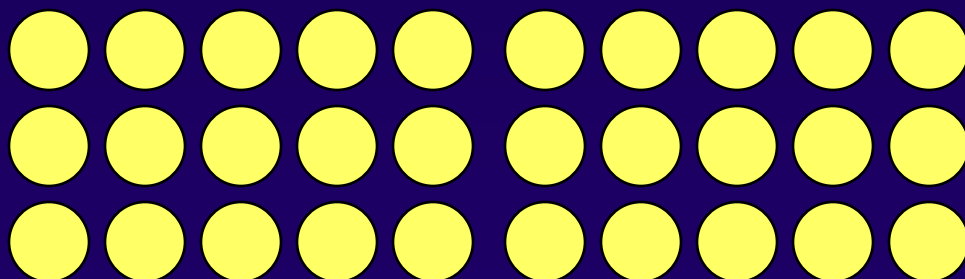
750 - 1100  
Students



2 Lectures

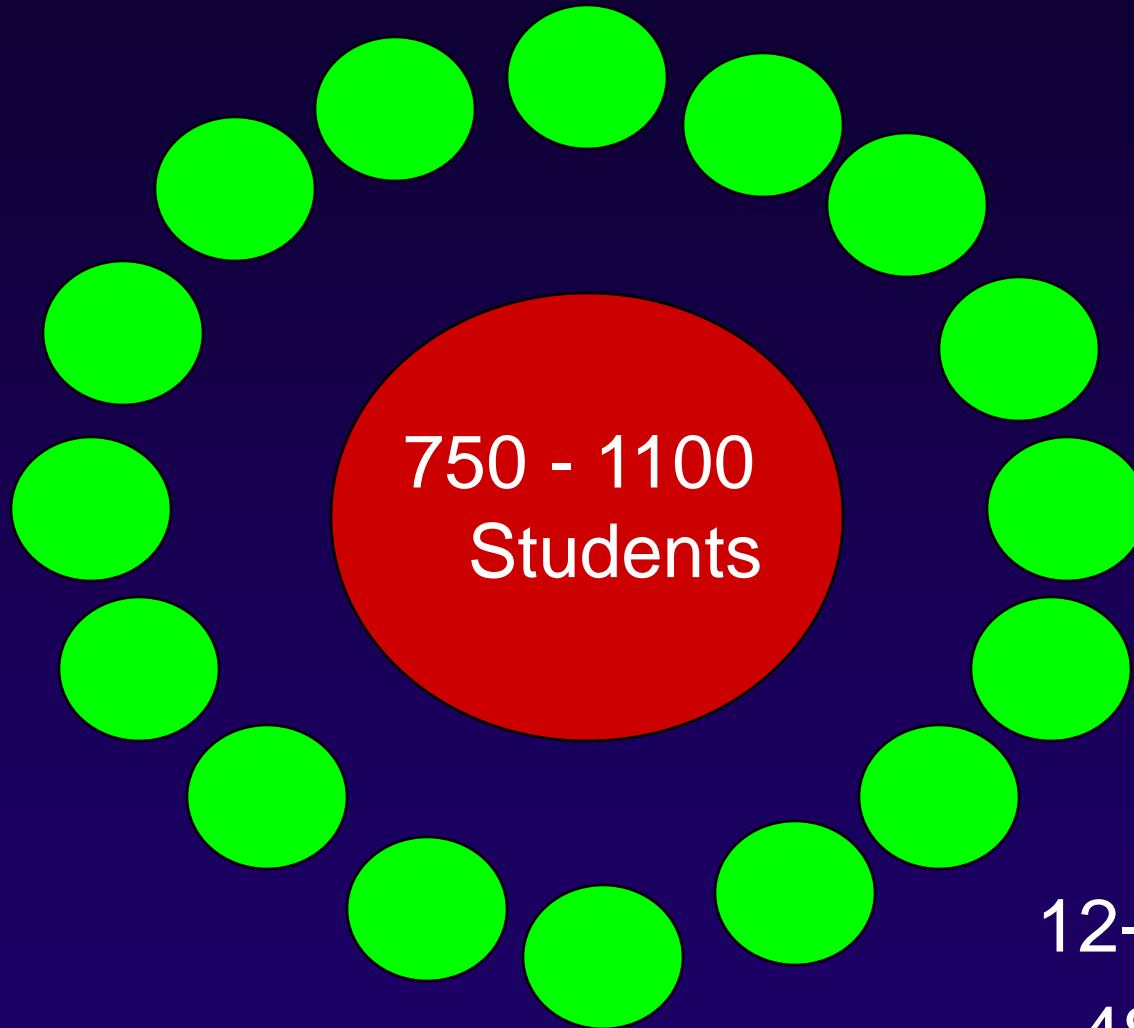


25-30 Recitations



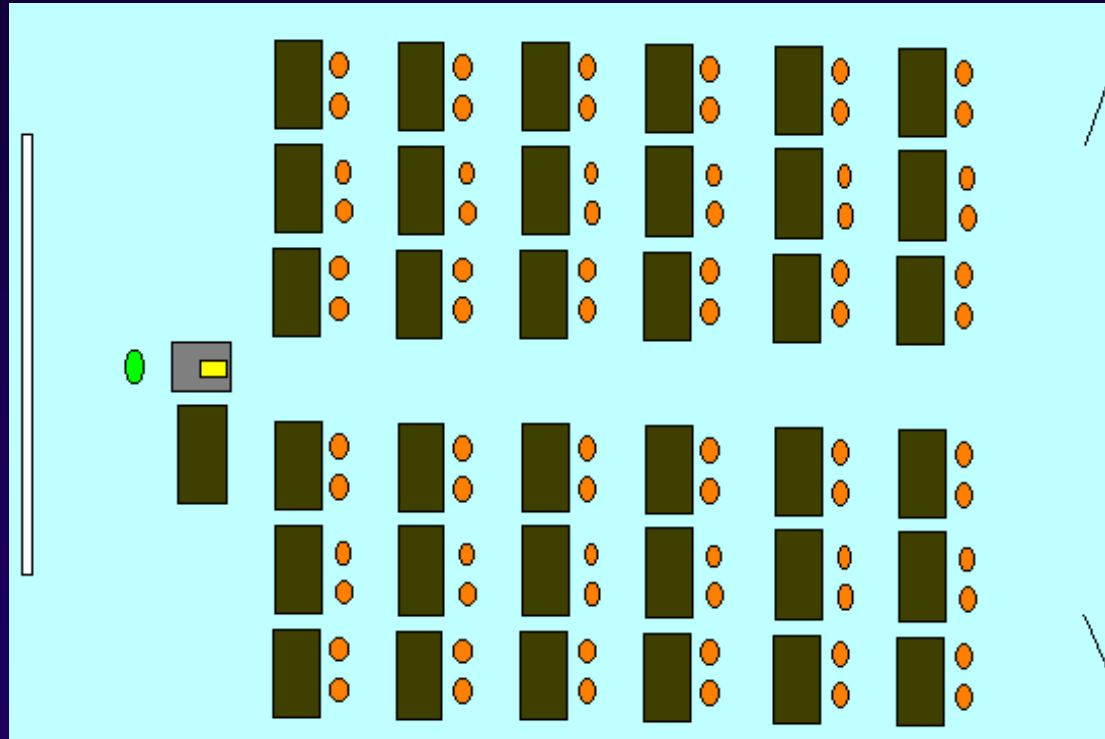
30-40 Labs

# The Introductory Course

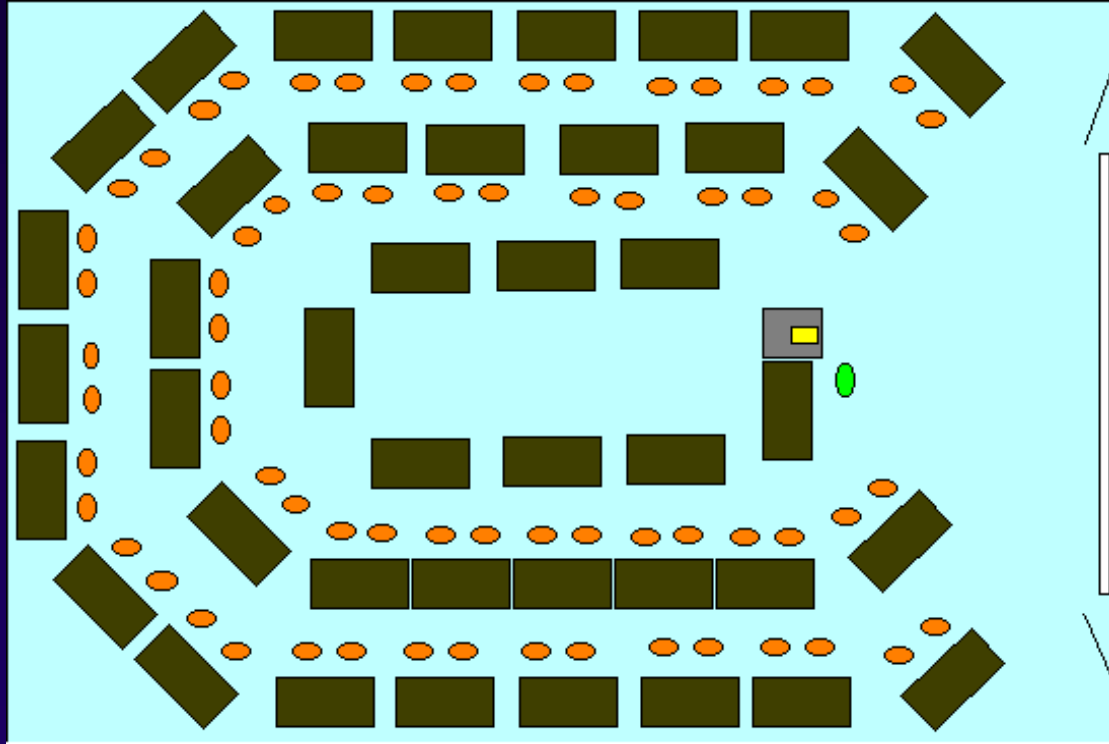




# The Traditional Classroom



# The Studio Classroom



# Student Mobile Computing



- Laptop requirement
- 4 years of pilot
- cost crossover
- 4 year phase in
- student reaction
- faculty readiness
- key to affordability and pervasiveness

- Student performance on traditional tests
- Student attendance
- Student performance on cognitive tests
- Student performance on problem solving
- Student attitudes toward the courses
- Student retention
- Faculty attitude toward the courses
- Student success in later classes

# Results



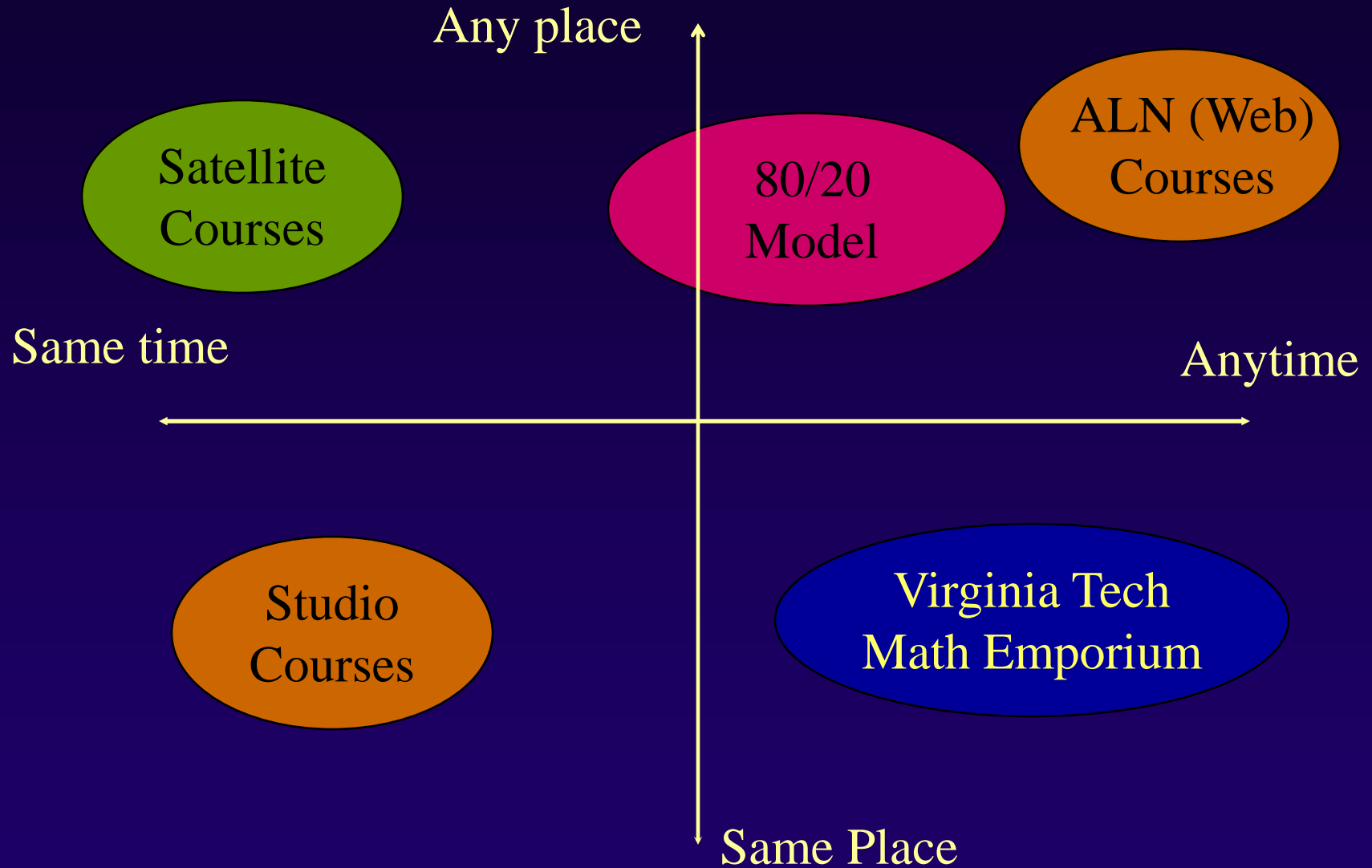
- Significant improvement: Student Satisfaction
- Significant improvement: Faculty Satisfaction
- Equal or better performance on regular exams.
- Year long Rutgers led evaluation
- Significant Attendance increase
- Cost containment
- Ongoing longitudinal study

# The Studio at other Universities



- **The University of Amsterdam** (<http://www.science.uva.nl/research/amstel/>)
- **Penn State University** (<http://www.science.psu.edu/facaffairs/strategic.htm> )  
(<http://www.psu.edu/ur/archives/news/GE.html> ) (<http://dps.phys.psu.edu/about.htm> )
- **Arizona State University** (<http://www4.eas.asu.edu/phy132/> )
- **Indiana State Univ.** (<http://physicsstudio.indstate.edu/> )
- **Cal Poly San Luis Obispo** (<http://www.cob.calpoly.edu/Evan/polyplan/polyplan.htm>)  
(<http://chemweb.calpoly.edu/phys/> )
- **Ohio State University** ([http://www.physics.ohio-state.edu/~ntg/26x/2064\\_pictures.html](http://www.physics.ohio-state.edu/~ntg/26x/2064_pictures.html) )
- **The University of New Hampshire** (<http://einstein.unh.edu/academics/courses/> )
- **Curtin Univ. of Tech. (Australia)** (<http://www.physics.curtin.edu.au/teaching/studio/> )
- **Univ. Of Mass. –Dartmouth**  
(<http://www.aps.org/meet/CENT99/BAPS/abs/S3455002.html> )
- **The Colorado School of Mines** (<http://einstein.mines.edu/physics100/frontend/main.htm>)
- **Acadia Univ. (Canada)** (<http://ace.acadiau.ca/math/boutilie/> )
- **Santa Barbara City College**  
([http://www.cs.sbccc.net/physics/redesign/final\\_report/reportb.html](http://www.cs.sbccc.net/physics/redesign/final_report/reportb.html) )

# The Studio at a Distance



# Is it over?



- Is all the excitement over eLearning over?
  - Question from a reporter at the Chronicle of Higher Education.



# High hopes for eLearning



- Pensare teamed up with Duke.
- Click2Learn teamed with NYU Online.
- Fathom teamed with XanEdu.
- U. of Penn Wharton School teamed with Caliber, a spin-off from Sylvan Learning.
- Cornell spun of eCornell
- UNext created Cardean University and partnered with Columbia, the London School of Economics, Stanford, and the University of Chicago.
  - Reportedly Cardean had pledged to pay Columbia, and perhaps the others, \$20 million dollars if they failed within five years.
- North Carolina, Harvard, and USC went to University Access for help in getting online.
- Harcourt Higher Education was launched as a college in 2000 and confidently predicted “50,000 to 100,000 enrollments within five years.”

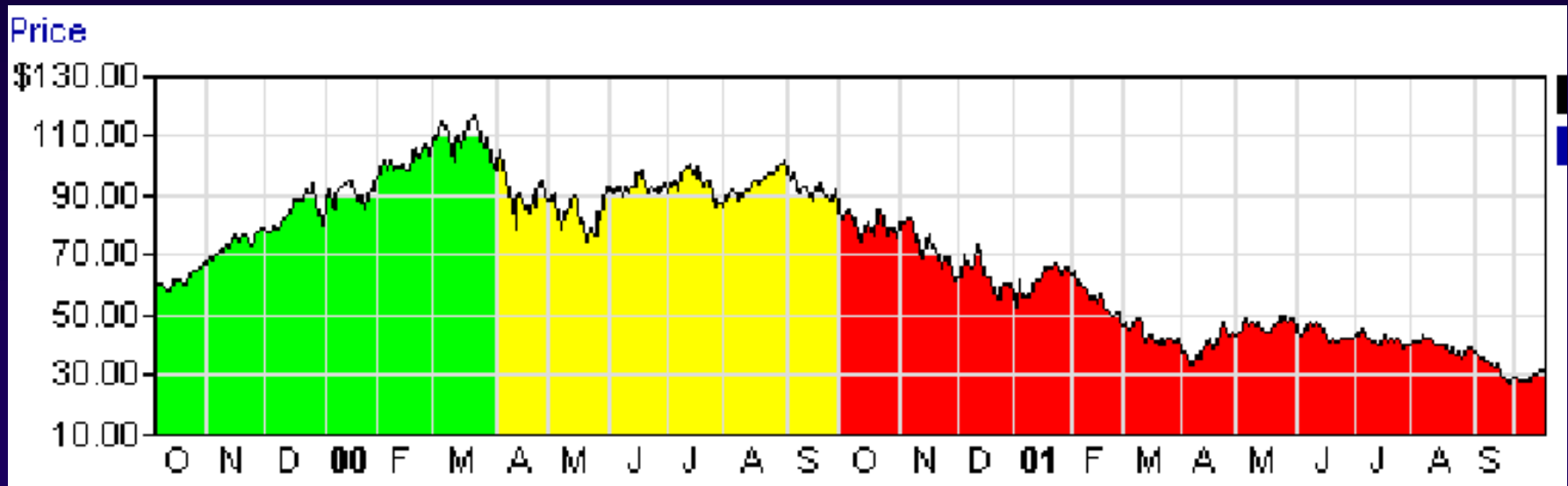
# Big investments



- Kaplan Ventures, Knowledge Universe, Pearson, and Sylvan Ventures made investments and acquisitions totaling \$3.6 billion in 2000 and were expected to invest at least \$2 billion additional in 2001 and 2002.
- eLearning, Is it Over? -Jack Wilson  
[www.JackMWilson.com/eLearning/IsItOver.htm](http://www.JackMWilson.com/eLearning/IsItOver.htm)

# From dot-boom to dot-bust

- NASDAQ



# And Now?



- Pensare is gone.
- Fathom had to obtain \$20 million in financing internally.
- Cardean laid off over half its work force and asked universities to restructure arrangements.
- Temple University quietly closed its spin-off without really ever activating it.
- Harcourt is gone after enrolling a total of 32 students in 2001.
- eCornell is open now, but with very small programs and drastically reduced expectations.
- Caliber has filed for bankruptcy.
- University Access has changed its name and withdrawn from higher education.

# Models for Virtual Universities



- For Profit Universities
  - Pure plays: Phoenix, Capella, etc.
  - Joint Ventures: Cardean, Caliber, Pensare, U21
  - Internal: UMUC, eCornell, etc.
  - Outside VC (Original Fathom plan) versus internal
- Not for Profit
  - Internal Collaborative (UMassOnline etc.)
  - Independent (WGU, etc)
  - Can choose Solo or Consortia

# Questions



- What are the advantages and disadvantages of various financial models?
- Are joint ventures between universities and for-profits viable (Pensare, Caliber, NYUOnline, U21 Global, etc)
- Can one borrow brand equity (reputation) from one institution to another: (Cardean, Pensare)
- Can one transfer brand equity (reputation) from a different business to eLearning (Harcourt)
- Given that content is a commodity, how much to invest in content?

# MIT: OCI-Content and the Value Chain



- Given what MIT has done, how can UMassOnline compete? – Boston Globe reporter

## What MIT provides

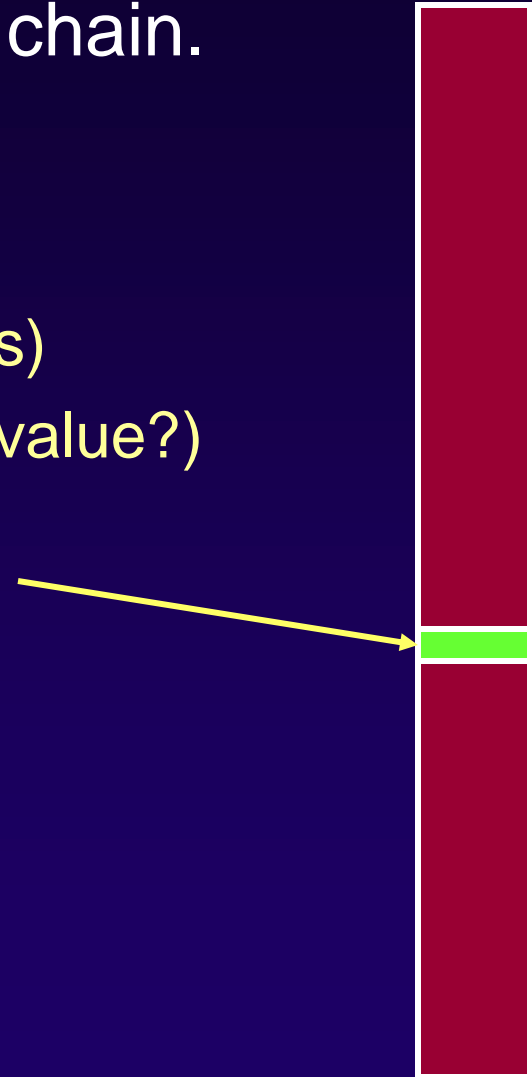
- **Course materials**

## No access

- **Reputation**
- **Courses**
- **Faculty**
- **Credentials**
- **Students**
- **Alums**
- **Library**
- **Facilities**

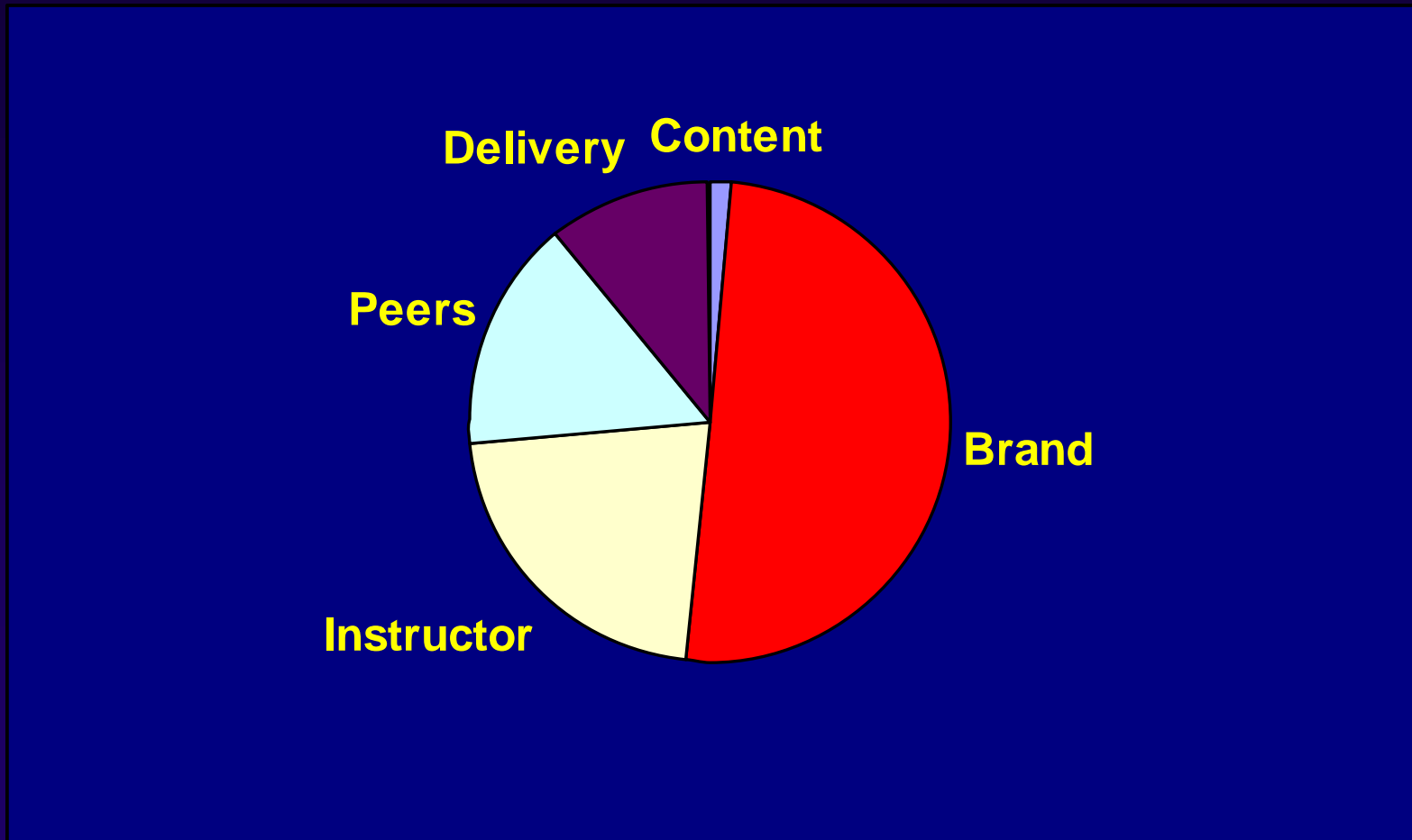
# Content?

- The smallest part of the value chain.
- Introduction to eBusiness
  - 75-125 students (business execs)
  - \$ 3000 per student (indicator of value?)
  - A book might be \$50 (content)
  - Web site is open and free
  - Revenue: \$225,000 - \$375,000
  - One faculty, one full time TA





## Brand ~ Reputation



- [www.UMassOnline.net](http://www.UMassOnline.net)
- Virtual University for the State of Massachusetts
- Intellectual capital of the UMass system.
  - Amherst
  - Lowell
  - Boston
  - Worcester (Medical School)
  - Dartmouth
- Collaborative Non-Profit model
- Financed by \$15 M loan at 7.5%
- Grant of \$ 2.25 M this summer for platform
- Will consider:
  - Independent non-profit
  - For profit

# History?



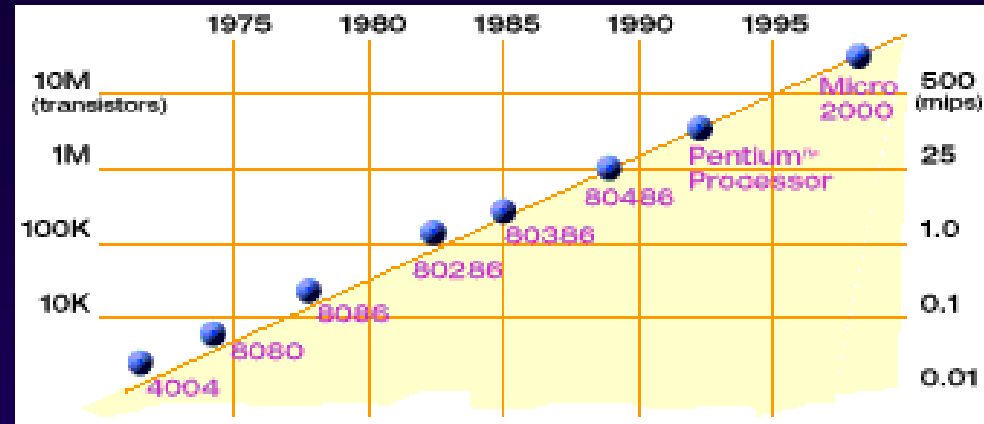
- Take the railroads. The 1880s saw more miles of track built than in any of period.
  - By the 1890s, more miles were bankrupt than at any other time.
- From 1904 to 1908, more than 240 companies entered the automotive business.
  - In 1910, a big shakeout occurred because too many companies were operating at inefficiently low scale. Today only two US companies remain.

# Is it over?

- Hardly!
- No one has repealed Moore's Law
- The Bandwidth Law (Gilder's law) is slower but still on track
- Metcalf's law remains the a key indicator for success.
  - Microsoft, AOL-TimeWarner, eBay, Amazon all demonstrate the power of the large network.

# Wilson's Favorite Laws!

- Moore's Law:
  - CPU performance doubles every 18 months



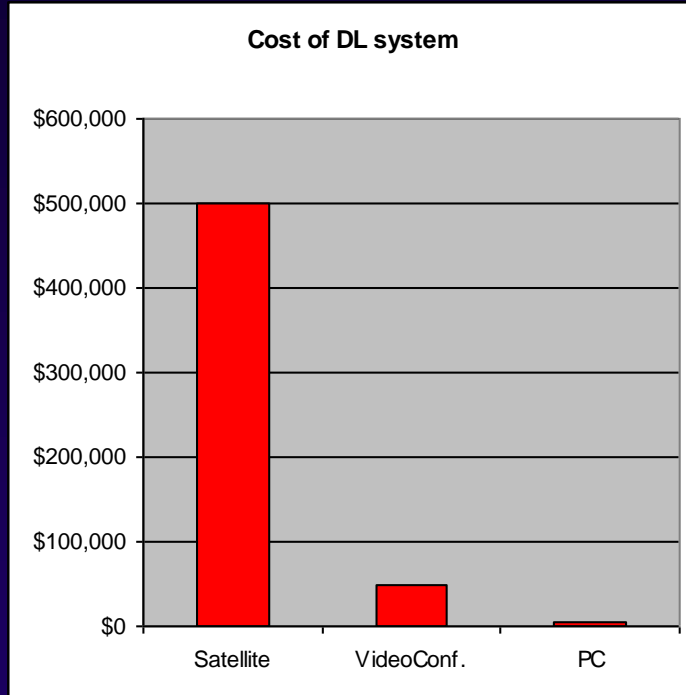
- Bandwidth law:

- Bandwidth is doubling even faster!

- Metcalf's Law:

- the value of a network scales as  $n^2$  where  $n$  is the number of persons connected.

# Distance Learning Technologies



- Satellite Video (\$500,000)
- ISDN Videoconferencing (\$50,000)
- PC Collaborative (LearnLinc, Centra, Interwise, Placeware, etc) (\$5,000)
- Web Based Asynchronous (ALN: Prometheus, WebCT, BlackBoard, eCollege, etc.) (\$5,000)

# Coping with change

- Design for the future not the present
- Design based upon human learning and not technical limitations
- When forced to compromise by technology
  - Remember it is a compromise
  - Do not enshrine compromises
  - Watch how technology changes can eliminate need to compromise.

# Components from which to select

- Live-online mini lectures & discussions (VOIP)
- Live polling
- Java applets for interactive simulations
- Microcomputer based data acquisition
- Web based multimedia
- Online texts
- Customized homework.
- Threaded ALN discussion
- Live Chat
- Virtual laboratories and team based case studies
- On-line surveys and tests.



# Models of eLearning

- The Satellite Model
- IVC: Interactive Video Conferencing
- ALN: Asynchronous Learning Network
  - Especially popularized by the Sloan Foundation
- Live eLearning on networked PC's
  - Voice and video over ip – multicast
  - Often use voice and no video
- Blended Models
  - Live or ALN plus face-to-face
  - Live or ALN plus IVC

# The ALN model



- Advantages
  - Flexible: Anytime and anyplace
  - Cheap
  - Allows anonymity
- Disadvantages
  - best for highly motivated discretionary learners
  - Completion rate is often a problem
  - Larger upfront investment in time and resource
  - Chat is a poor substitute for live interaction
  - Does not allow for visual cues and interactions

# The IVC Model



- Advantages
  - Allows visual and audio interactions
  - Widely available
  - Adapts to usual faculty approaches
  - “Made fresh daily”
- Disadvantages
  - Not anytime and limited anyplace
  - Poor quality video, awful graphics
  - Often leads to poor faculty student interactions
  - No access to polling, chat, threaded discussion....
  - Expensive

# Live On Line Learning

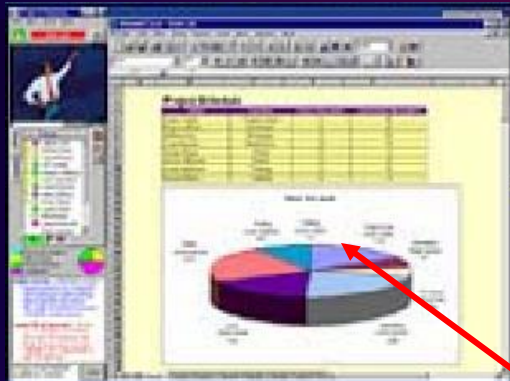


- Advantages

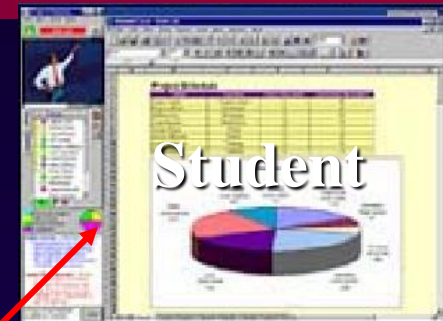
- Inexpensive PC based
- Requires only 33kB reliable connection
- Allows spontaneous live audio interactions
- Allows live polling and discussions
- Also accommodates all ALN functionality

- Disadvantages

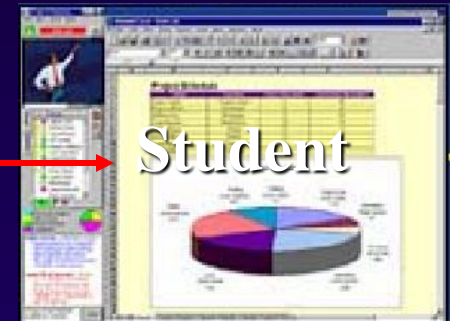
- Anyplace but only partially anytime
- Requires that student PC's have sound cards and microphones.



Instructor

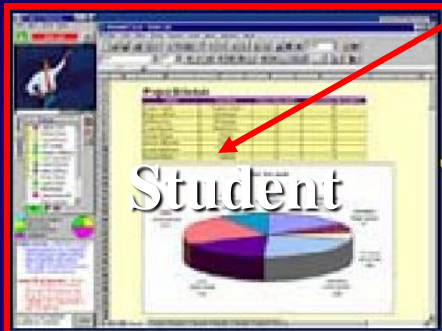


Student

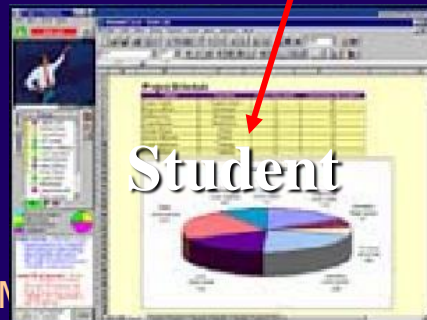


Student

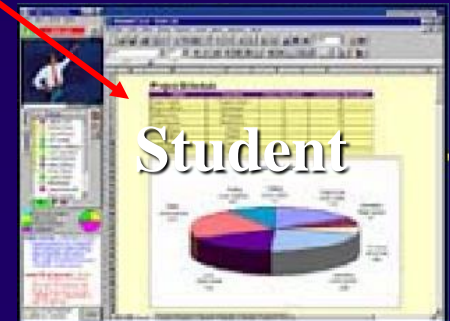
The Internet  
Voice & Data



Student



Student



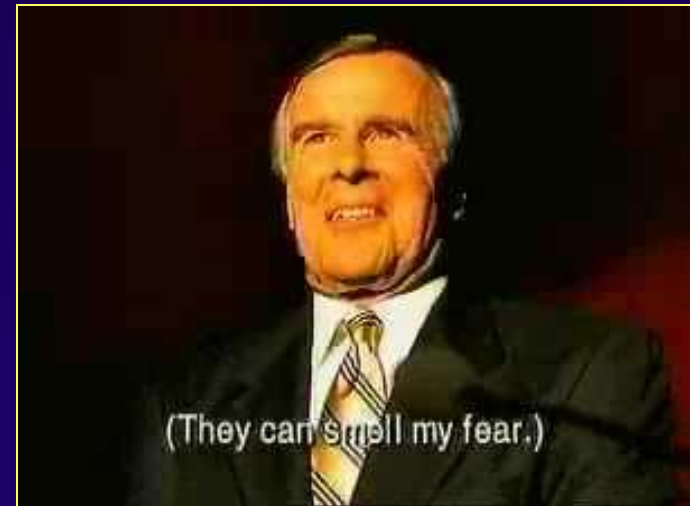
Student

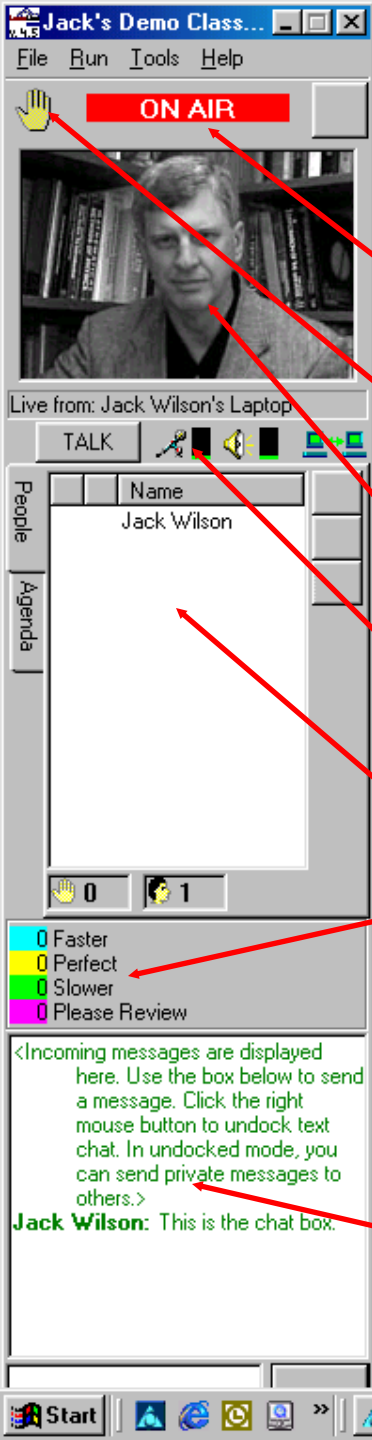
# Introduction to eBusiness



The hope, the hype the power, the pain

- Live Online Learning
- Fall 2000: 125 (50 on/75 off) campus students
  - IBM, Ford, GE, Lockheed Martin, Pratt and Whitney, Ford, Consolidated Edison, NY Power, J. P. Morgan, Carrier, Otis, etc.
- Extensive Website:
  - <http://www.jackmwilson.com/eBusiness/Syllabus-Spring2001/>
  - MBA, MSIT, MS
  - On-line studio style miniLectures, Discussion, Student presented cases, & asynchronous interaction (ALN)





- On- Air indicator
- Raise your hand
- Picture or video of speaker
- Audio and Network controls
- Agenda or class roll
- Feedback section
  - (can be pace, agreement, T/F, Yes/No, etc.)
- Chat Window

- Survival Skills for Astrophysics
  - Graduate Students in Astrophysics
  - Video/Audio/ **LearnLinc** Web Data Conf.
  - Both ISDN and Internet connection
  - 7 am Eastern ( 6 Hong Kong)
  - Student Collaborative Presentations
  - One Semester length
- Two classrooms with live video wall of the other
- Blended Live Online and IVC



# NTU-Rensselaer Course



- “Hands On World Wide Web”
- Blended Live Online and Satellite
- Feb. 10 & 17, 1998
- 8000 participants
- 500 sites
- Most successful NTU course ever
- “The future of satellite based education.”
  - Lionel Baldwin, President, NTU
- Certainly the largest!

- Built upon the successes of the 5 campuses.
- Is already the largest on-line university in New England
  - Over 6000 enrollments
- Portal: [www.UMassOnline.net](http://www.UMassOnline.net)
  - Launched in this spring
- Closely coupled to the University mission
- Operates over the M.I.T.I.
- Received \$ 2.25 million IT Bond funding to create statewide platform in partnership with M.I.T.I.
  - Eventually open to all state institutions

# Investing and Developing Programs



- Twenty five degree and certificate programs
  - Bachelor's, Master's, and Certificate programs
  - 12 new programs this fall
- Three of our programs have been recognized by US News and World Report as top on-line programs in the October 15, 2001 issue.
  - MBA – UMass Amherst
  - MEA – UMass Lowell – Ed. Administration
  - MPH – UMass Amherst- Public Health

# Serving Community Needs



- BSIT \*
- MSIT
- Nursing \*
- MBA \*
- Techno-MBA
- MPA
- MPH \*
- MS Substance Abuse Professionals
- BLA – Liberal Arts \*
- Degree Completers

# Where to look?

- Pew Center for Academic Transformation
  - [Center.rpi.edu](http://Center.rpi.edu)
- Pkal; [www.pkal.org](http://www.pkal.org)
- Hesburgh awards – faculty dev. Focus
- Pew Prizes – institutional focus
- EDUCAUSE- [www.educause.org](http://www.educause.org)
  - Technology focus
- Syllabus
- EdMedia
- TLTR and Flashlight



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<http://www.UMassOnline.net>

The End

[www.JackMWilson.com/eLearning](http://www.JackMWilson.com/eLearning)

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