Creating New Learning Environments in the Convergence of **C**omputing, **C**ommunications, and **C**ognition
- Institutional perspectives -

Jack M. Wilson

CEO UMassOnline.net

Experiences I am drawing upon

- RPI academic restructuring 1989-1991
- Pew Charitable Trust Grant led by Carol Twigg
- Co-founder of NLLI offshoot of EDUCAUSE
- Prior service as AAPT Executive Director
- Development of the M.U.P.P.E.T. project and text in the 80's and CUPLE Physics Software project at U. Maryland in the 80's.
- Creation of UMassOnline
- Getting shot at often – (Zemsky, PSU)

After 33 years in research universities:

- On the question of whether change is bottom up or top down:
  - The answer is "Yes" exclusively.
- Incremental change is rarely successful.
- The educational equivalent of the old Soviet employment contract:
  - We pretend to teach them and they pretend to learn. (the conspiracy Susan mentioned)
    - (nobody asks too many questions and everybody is happy.)
- No "marginal" faculty member has ever effected lasting innovation.

- People change very slowly
  - Both a comfort and irritant!

- Technology changes very rapidly

RPI Restructuring strategy: 1990-2001

- 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
- Changed the student experience of EVERY student on campus.

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 Introductory Course

750 - 1100 Students

Calculus (1100)

Physics (750)

Chemistry (650)

Intro. to Engineering Analysis (650)
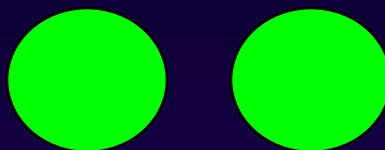
Economics (~300)

(in the beginning)

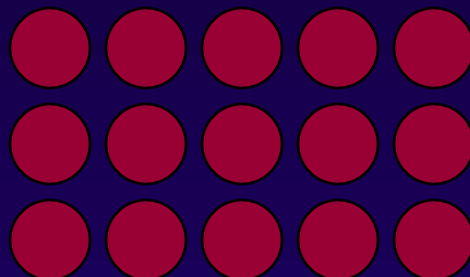Soon spread to everything from Literature to Electrical Engineering
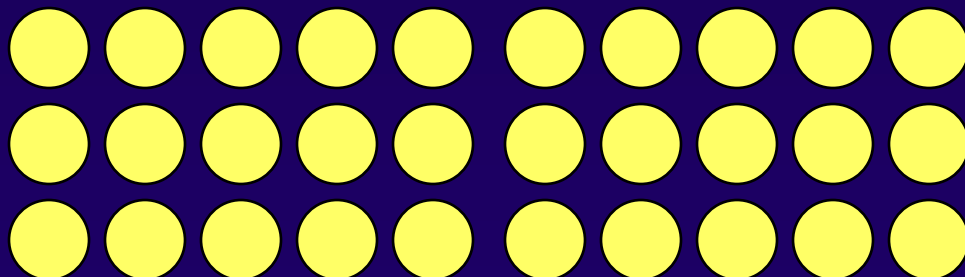
The Introductory Course

2 Lectures

750 - 1100 Students
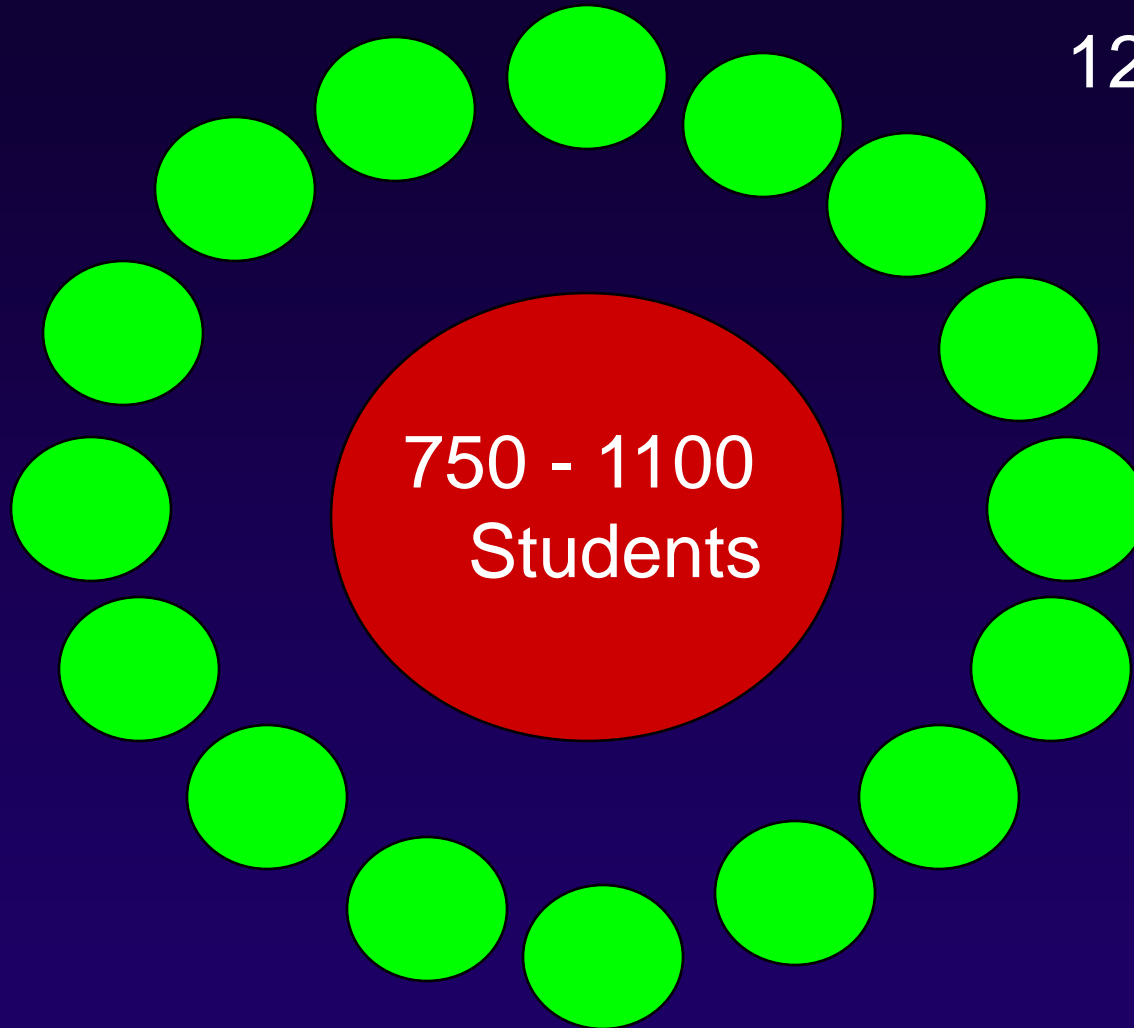
25-30 Recitations

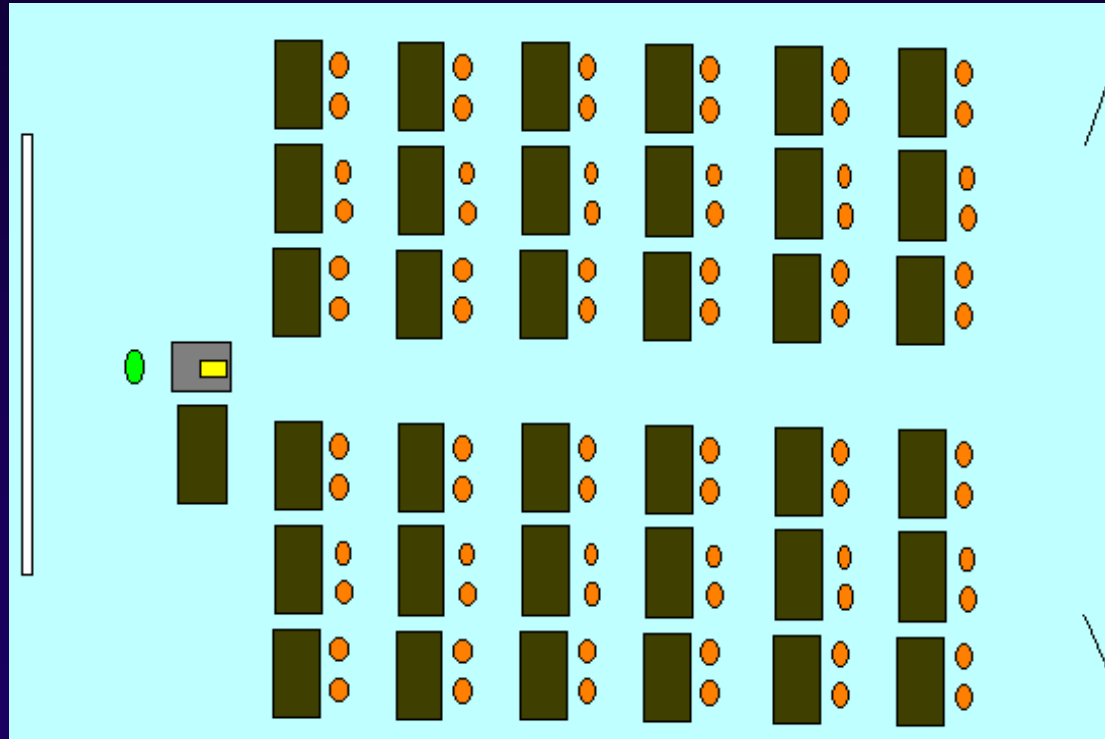30-40 Labs

The Introductory Course

750 - 1100 Students

12-15 Studios
48-64 each
1 faculty
1 TA
1 UG TA

The Traditional Classroom

We shape our buildings and afterwards, our buildings shape us.
   -Winston Churchill
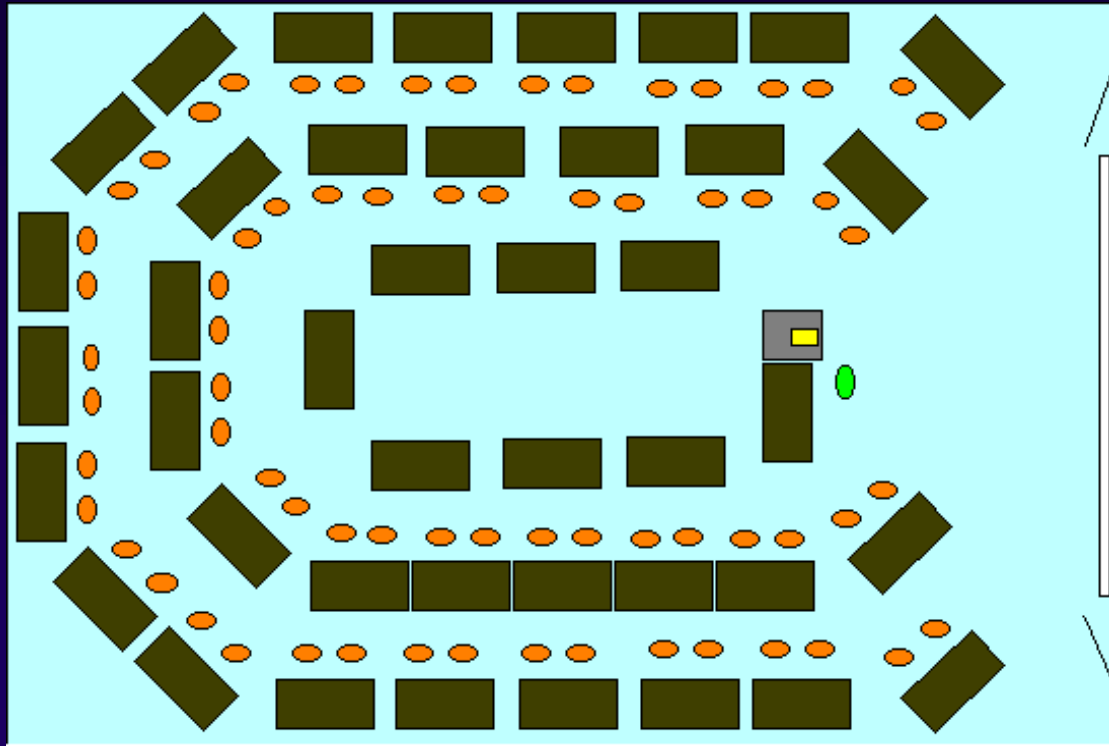
Reform the environment, stop trying to reform the people. They will reform themselves if the environment is right.
   -Buckminster Fuller

Student Mobile Computing

- Laptop requirement

- 4 years of pilot

- cost crossover

- 4 year phase in

- student reaction

- faculty readiness

- key to affordability and pervasiveness

Metrics

- 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

Ups and downs in 11 years.

- Launched in some ways in late 89.
- Major operation by early 90's.
- Diffused to nearly all faculty in physics and electrical engineering and smaller fractions in mathematics, chemistry, biology, and most of the other engineering disciplines.
- Leadership in physics:
  - Wilson->Roberge->McKenna->Cummings->D.J. Wagner
- Evaluations varied over time
  - Also section to section
- Leadership issues:
  - Presidents(4), Provosts, Deans, Chairs, Faculty, Students
- Change of admissions process to favor active learners
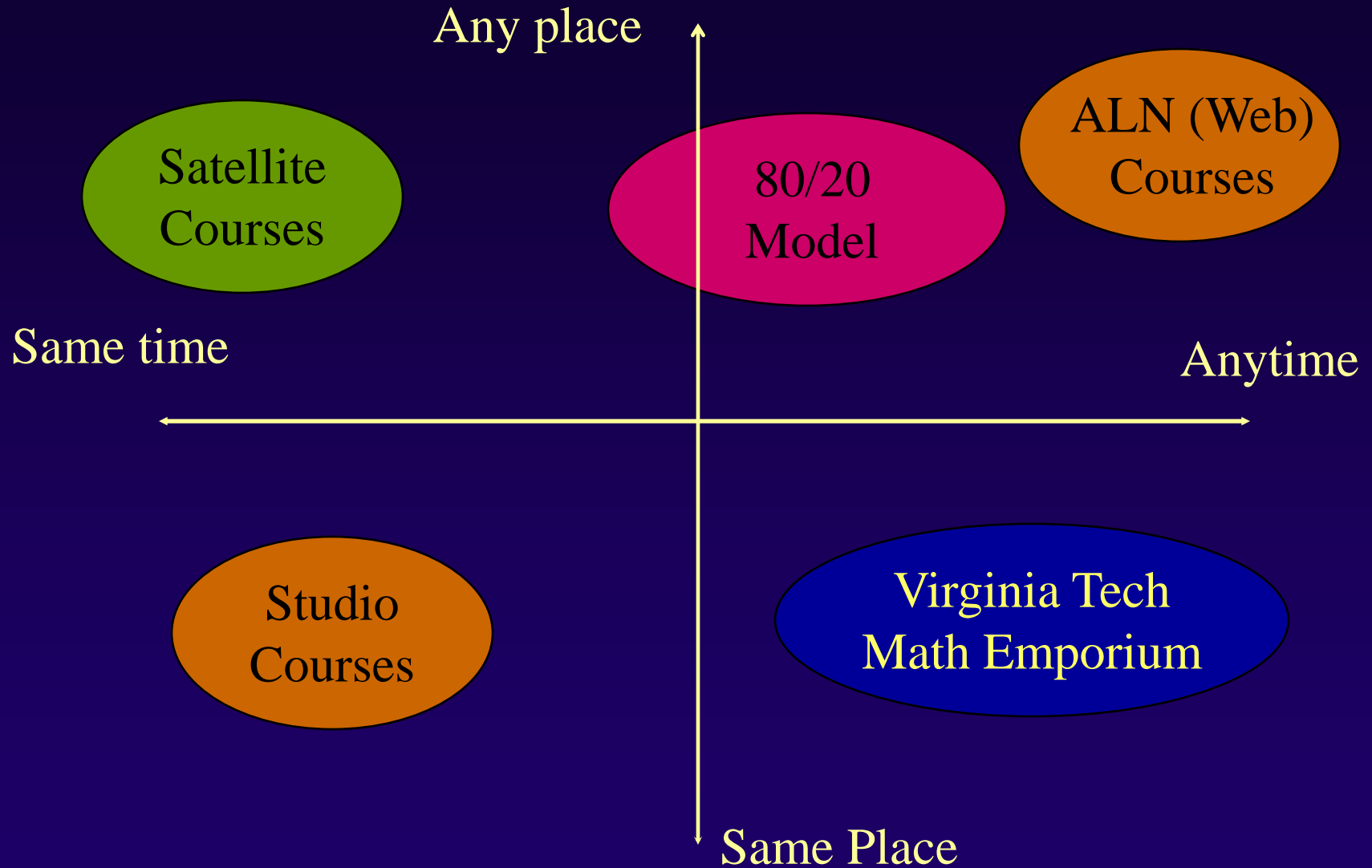
Coping with change

- 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.

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)
- **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.sbcc.net/physics/redesign/final_report/reportb.html)

The Studio at a Distance

Any place

Satellite Courses

80/20 Model

ALN (Web) Courses

Same time

Anytime

Studio Courses

Virginia Tech Math Emporium

Same Place

Jack M. Wilson

http://www.UMassOnline.net

The End

www.JackMWilson.com/eLearning

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.

Where to look?

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

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?