

Teaching Innovation in the CoE

- The challenges in educating today's student
- Innovations
 - Pedagogical
 - Technological
- The Engineering Teaching Excellence Institute (TEI)
- Do you want to hire our students?
 - Is our education serving your needs?
 - Are we educating the Engineer of the 21st Century appropriately?

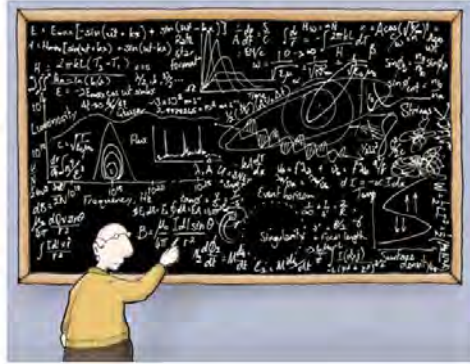
Morning

- Teaching Today
- MEng in Systems Engineering via Distance Learning
Linda Nozick, CEE, Sys Eng
- Swanson Simulation Prog
Rajesh Bhaskaran, Dir
Anne-Raphaelle Aubry,
ME, B.S. '10
John Swanson, ECC

Afternoon

- Teaching Excellence Inst
- Panel on Innovation
 - Chris Schaffer, BME
 - Susan Daniel, CBE
 - Linda Tompkins, ELI

Past



Pros

- Easy for faculty to prepare, deliver

Cons

- Student is passive learner
- All work done outside classroom



Present



The new generation

Different culture

Totally new technologies

Need new pedagogy to engage
new generation

Present

- Ppt slides, projected and handed out
- Course website, updated daily
- Video
- Email
- Wikis
- Clickers
- Wacom tablets
- Changing software applications
- Changing hardware

Pros

- Engaging for students
- Faculty more organized
- Students do more in class, learn more

Cons

- Time consuming for faculty
- Used improperly, these tools can harm rather than help

The Teaching Challenge

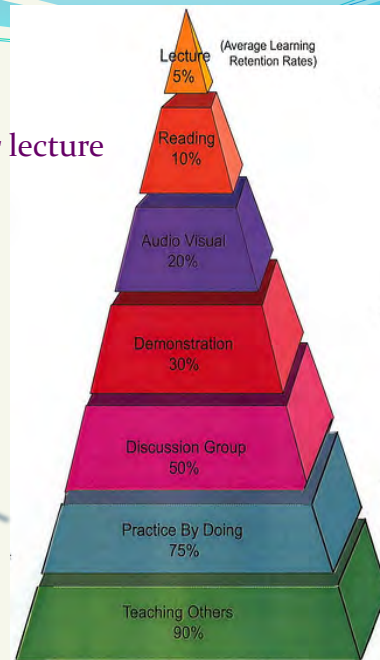
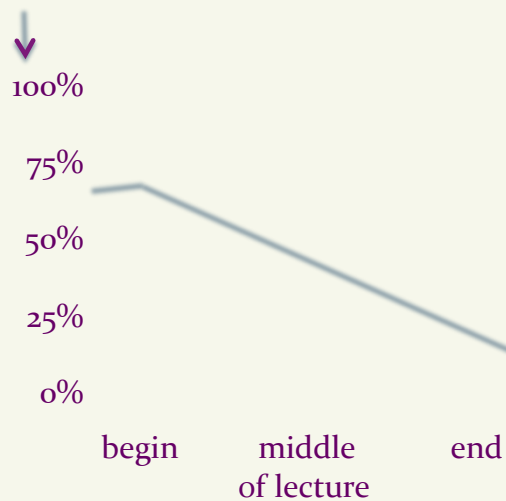
Keep up with new ideas on teaching, improve quality of teaching

In the face of

- More pressures on faculty time
- Budgetary pressures to increase class size
- Introduction of newer technologies
- Continual changes in supporting software/hardware
- Changing nature of the student body

Pure lecture: ineffective

amount recalled immediately after lecture



Alternative/complementary modes of instruction

- Problem-based learning
- Active learning
 - Think-pair-share
- Cooperative learning: teamwork but with positive interdependence, individual accountability, regular self-assessment of team functioning
- Experiential learning

ASEE at the frontier of research on education.

Felder and Brent, pioneers, hold workshops annually, visited Cornell twice to give workshops



**Prof. Antje Baeumner, BEE
Eng Teaching Award, 2002, 2006**

Learning in the class room needs to provide the environment for:

excellent learning experience,

in-depth learning,

long-term retention of knowledge,

provide basis for future classes, future career



**Prof. Antje Baeumner, BEE
Eng Teaching Award, 2002, 2006**

- Active Learning with 100+ students
- Students answer peer's questions
 - No fear of embarrassment
 - Synthesize answers, report to class

6 answerers	X X X X X X
rotate after each Q	██████████
6 questioners	X X X X X X

Subject: company developing/fabricating novel glucose biosensor. Questions deal with the design team, specs, marketing survey, etc.

**Antje Baeumner: Faculty Fellow for
Library Information Competency Initiative**

Library, annually:
1500 presentations on literature search.

Case studies for real-world problem solving in engineering modeling/quantification	Library function changing
	Place books off campus
New case study to include research-based strategies: may include data mining, discovery-oriented thinking using engineering-analysis software	Use space differently

**Asst Prof Richard Hennig, MSE
Engineering Teaching Award, 2009**



"I stop my lectures frequently to ask questions, to have short in-class discussions and problem-solving activities. This helps students to understand the material better and to identify the important points; it keeps them focused."

**Senior Lecturer, Monroe Weber-Shirk, CEE
Engineering Teaching Award, 2004, 2007**

Courses for AguaClara (co-meet)

CEE 5051-52. M.Eng design project

CEE 4550. Junior/Senior design course

CEE 2550. Frosh/Sophomore course



Problem based learning

- Weekly lectures by student teams or guests
- Students learn by working in small teams
- Students help teach and direct younger students
- Faculty and graduate students guide student work
 - Students document their work on project wiki
 - Students earn credit appropriate to their level

Monroe Weber-Shirk AguaClara

Goal: Work with Hondurans to provide drinking water to rural areas with gravity-powered water-treatment plants, no electricity

Web-based automated tool:
designs customized facilities

Students travel to Honduras

Plants built by local
implementation partners
using local material

15,000 people receive safe water from
Cornell designed AguaClara plants



Assoc Prof Michael Thompson, MSE Engineering Teaching Award, 2001

MSE 2620 Electronic Materials for the
Information Age

“innovation comes from understanding
the concepts and the connections”

Teaching with
Detailed ppt figures
Chalkboard
Clickers



Assoc Prof Michael Thompson, MSE Engineering Teaching Award, 2001

MSE 2620 Electronic Materials for the
Information Age



“I just wanted to let you know that *a lot* of my friends and I really thought today's lecture was very effective - through the iClicker questions, we were able to gauge our understanding of the material and review concepts that we may have stumbled on before. *Do* continue to make use of the iClicker in class!”

Satisfied student

Who wants to be a Millionaire?

Given that the vapor pressure of Au(l) is given by

$$\ln p(\text{atm}) = -44,400/T - 1.01 \ln T + 21.88$$

What is the enthalpy of vaporization of gold at its boiling temperature (3237 K)?

15	●	\$1 Million
14	●	\$500,000
13	●	\$250,000
12	●	\$125,000
11	●	\$64,000
10	●	\$32,000
9	●	\$16,000
8	●	\$8,000
7	●	\$4,000
6	●	\$2,000
5	●	\$1,000
4	●	\$500
3	●	\$300
2	●	\$200
1	●	\$100

50:50



A: 253,000 J/mol

B: 299,500 J/mol

C: 342,000 J/mol

D: 386,000 J/mol

Summary on Teaching Innovation

This new age requires new pedagogies

Many of our faculty are using them in innovative ways

Teaching takes more time and effort

Our Teaching Excellence Institute supports faculty in improving their teaching —this afternoon's topic.

Questions for us?

Questions for you?

- Do you want to hire our students?
 - Is our education serving your needs?
 - Are we educating the Engineer of the 21st Century appropriately?
- Advice on managing innovations and technology
 - How you use and manage technology in your business
 - Meetings, presentations

Rest of this morning

- **MEng in Systems Engineering** via Distance Learning
Linda Nozick, CEE, Systems Engineering

- **Swanson Simulation Program**
Rajesh Bhaskaran, Director
Anne-Raphaelle Aubry, Mechanical Eng B.S. '10
John Swanson, ECC