Engineering Teaching Excellence

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Program Overview

Supporting Teaching Excellence

- Faculty: Engineering Teaching Excellence Institute (ETEI)
- Student Instructors: Engineering Learning Initiatives (ELI)

Pedagogy - ACTIVE LEARNING

Program Examples

- ETEI: Mid-semester feedback
- ELI: Leveraging training

Traditional Teaching "Sage on a Stage"

Advantages	Disadvantages
Covers material	Limited effectiveness
Scales to large classes	Short term memory ≤ 5-7 ideas
Cost effective	Solid attention ~ 15 minutes
	Single learning style
	Increasing distractions
We learned this way	*Vulnerable to replacement by*
	On-line courses + "best prof"

Student Attention vs Time

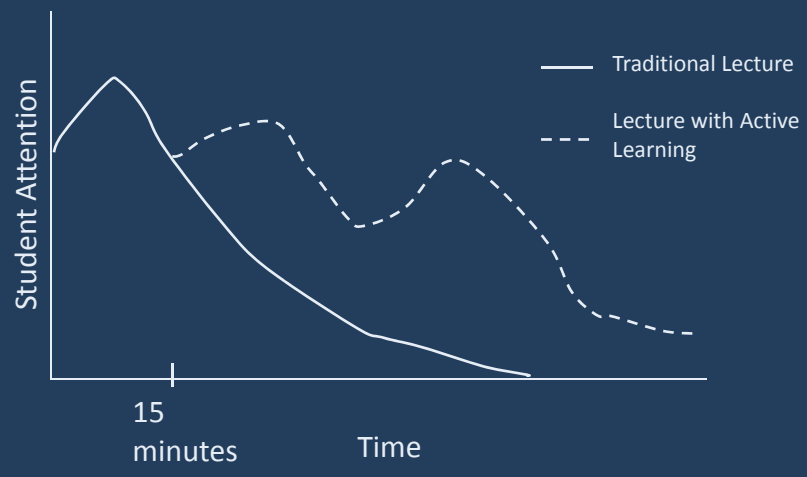


Figure adapted from Biggs and others

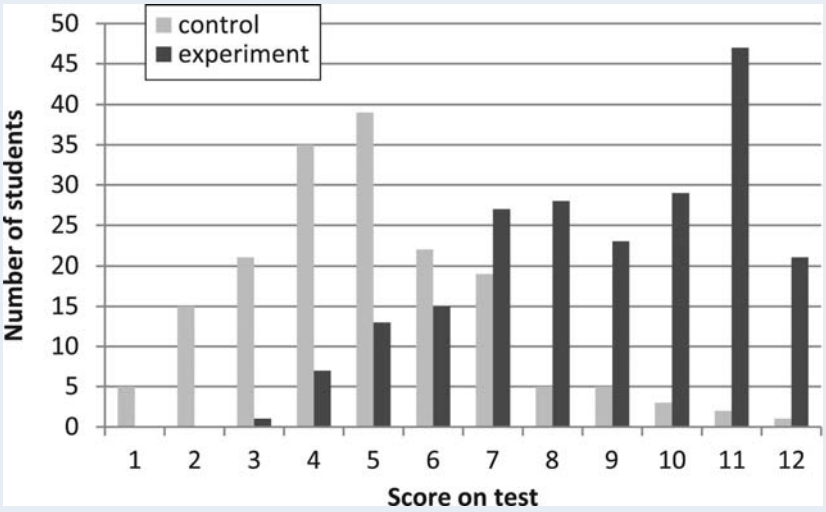
Active Learning Teaching Experiment

(by DeSlauriers, Schelew, and Wieman, 2011)

2 Matched physics classes, ~ 270 students each

Control Class	Experimental Class
Teaching: All traditional lecture	Teaching: Week 1 – 10: traditional Week 11: high engagement
Test on week 11 content	Test on week 11 content
Ave = 41%	Ave = 74%

Fig. 1 Histogram of student scores for the two sections.

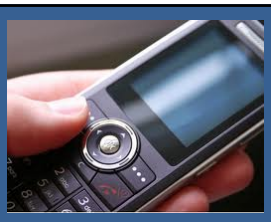


L Deslauriers et al. Science 2011;332:862-864

Science AAAS

Published by AAAS

Multi-tasking While Learning?



Perceived Advantages	Real Disadvantages
Students feel: less bored more efficient socially engaged	Deep learning is reduced: ability to apply learning ability to connect learning analyze of new ideas critical thinking

Think of your best professors. Did they use a form of Active Learning in their lectures? How did they overcome this 15 minutes attention span issue?

Participation Activity

Instructions:

- Go to http://learningcatalytics.com
- Login: email
- Password: Cornell
- Sign in
- Session ID is _____
- Discuss question in small groups
- Answer question, submit

Think of your best professors. Did they use a form of Active Learning in their lectures? How did they overcome the 15 minute attention span?

A) lecture demos
B) light something on fire
C) tell a joke
D) other method
E) they didn't (we just kept taking notes)

Increase Use of Active Learning

Empowering Faculty

Training TAs

Embracing Technology

Enlisting student input

Supporting Teaching Excellence at All Levels

Engineering Teaching Excellence Institute (faculty centered)	Engineering Learning Initiatives (student centered)
New faculty support Classroom observations Faculty – individual discussions Teaching innovations McCormick grants Pilot programs Teaching proposal support Classroom & technology support Engineering education research Mid-semester feedback	Academic excellence workshops TA training Peer tutoring Student instructor trainings Graduate teaching specialists AEW facilitators Tutors Math course assistants CS consultants ENGRG 6780 - Teaching Seminar Engineering education research

Mid-Semester Feedback

Timely, effective feedback motivates change

- Data ⇒ faculty
- Address student concerns real time

Surveys in AY 11-12

courses	134
faculty	90
students	1973

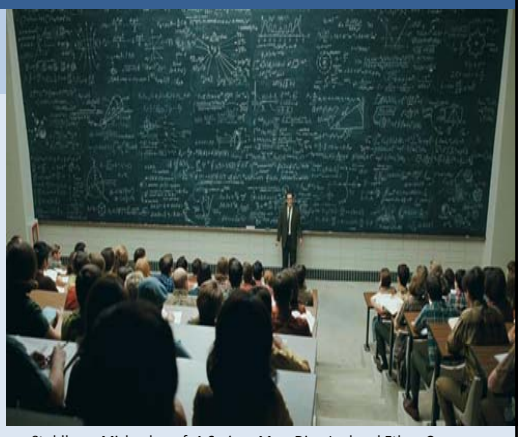
MAE, ECE, MSE - department wide
CS, CEE, CBE - individual requests

Dominant Issue is Organization

Easy Changes to Add to Lectures

- Outline
- Content headings
- Logic Flow
- Identify key points
- Application(s)

Faculty learn quickly



Stuhlbarg, Michael, perf. *A Serious Man.* Dirs. Joel and Ethan Coen. Focus Features, 2009

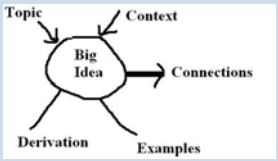
Novice vs Expert Thinking

Student novices see:

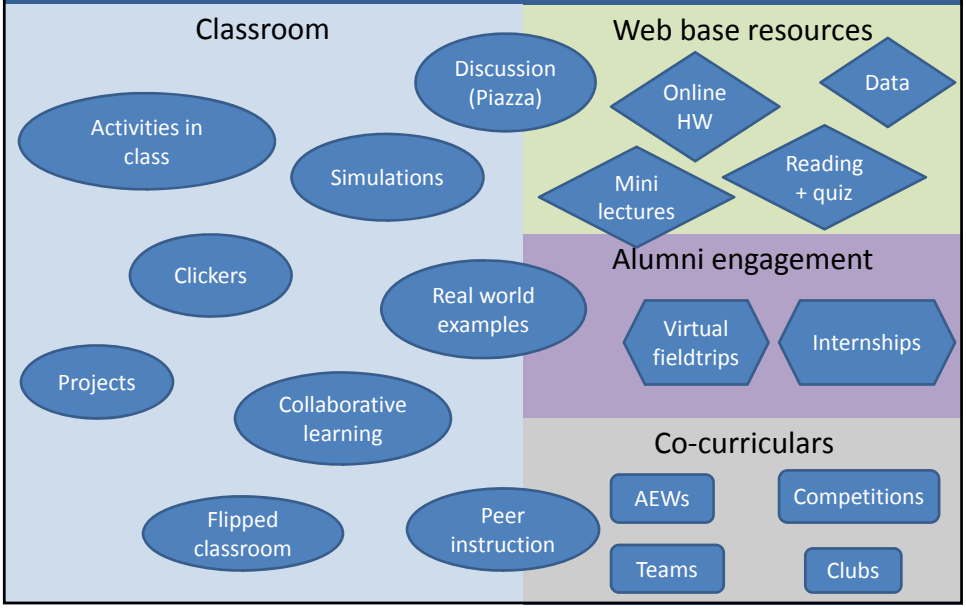
- factoids to memorize
- formulas and recipes to use
- disorganized mess that fills brain

Faculty experts see:

- big picture ideas
- content links
- supporting details



Active Learning - Engaging Students



Faculty teaching is supported by trained graduate and undergraduate student instructors

TA Training – 150 New TAs Trained
Fall 2012

Teaching workshops (4)
- Grading & Assessment
- Active Learning
- Learning Styles
- Classroom Presence

Large Group Presentations (2)
- Diversity
- Notice & Respond

Select-A-Session (2)
- Public Speaking
- Power Point Presentations
- Piazza
- Blackboard
- LaTex
- Time management
- International TAs

Microteaching (1)

TA Trainers - 8 Graduate Teaching Specialists

Preparation
- focused 8 weeks during summer

skill development
- teaching &facilitation
- public speaking
- presentation skills
- giving /receiving feedback

program content development/refinement
- evaluation feedback from TAs studied, changes made
- educational pedagogy
- recent studies in engineering education
- new ideas

Develop and lead TA training

Mid-semester TA Feedback

Evaluations for all TAs in the college (296 TAs spring 2012)

Reports ⇒ TA and the professor

TAs with "poor" evaluations invited in for consultation

Quantitative and qualitative

Responses 2473 (spring 12)

"… has a masterful command of the material and delivers it effectively, always ensuring that the students understand it" Fall 2011

TA Mid-Semester Evaluation Data

20 quantitative questions (all have a 4+ mean)
(1 = never or poor, 5 = always or excellent)

Question	Mean score Spring 2012
My TA demonstrates command of the subject matter	4.41
My TA provides clear and comprehensive explanations	4.20
My TA is actively helpful when students need assistance	4.38
My TA is effective at relating lecture material to what is covered in section or lab	4.16
Overall how would you relate the quality of your TA's teaching	4.25

Academic Excellence Workshops (AEWs)

Overview

weekly two-hour small group sessions
- chem
- computer science
- math
- stats

collaborative learning

two peer facilitators

taught at or above course level

Fall '12: 26 workshops 400 enrolled

Evaluation & feedback

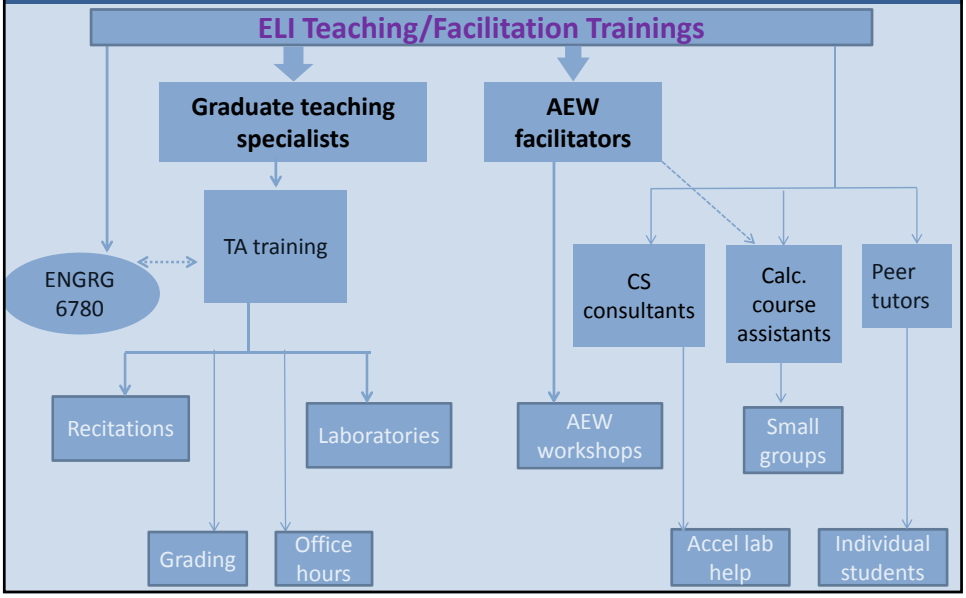
observation → feedback report

mid-semester online evaluation

Academic Excellence Workshops (AEWs)

Facilitators	Training topics
sophomores, juniors, seniors -course mastery -interest in helping peer -competitive hire two lead facilitators	learning and teaching styles teaching in a diverse classroom communication facilitation group dynamics leadership public speaking

ELI: Leveraging Training of Student Instructors



What methodologies does your company use to train your employees and which one is most effective?

Submit short answer by cell phone or computer

Summary

Teaching with Active Learning components

- Increases learning
- Plays to current student's strengths and preferences
- Engages most students

Enhancing education across the curriculum

- Faculty
- TAs
- Peer instruction (AEWs and peer tutors)

ECC Support

- Classrooms that work
  - reliable technology
  - support innovative teaching
- Share ideas, knowledge, support
  - Piazza
  - Simulations
  - Teaching Innovation grants
  - AEWs
- Big picture goals

Discussion Questions

What additional insight can ECC provide on educating new engineers for the 21st century workplace?

What suggestions does ECC have for enhancing "real-world" connections in courses and classrooms?

Engagement Approach Example

Preclass reading assignments (3-4 pages)

Preclass reading quizzes (short on-line T/F quiz)

In-class clicker questions with student-student discussion

Small-group active learning tasks

Targeted in-class instructor feedback