

Engineering Teaching Excellence

Teaching future engineering leaders
and problem solvers

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Engineering Learning Initiatives

Agenda

Program Overview

Pedagogy – active learning

ETEI – initiatives with faculty

ELI - training of graduate and UG students

Discussion

Empower Teaching Excellence at All Levels

Engineering Teaching Excellence Institute (faculty centered)	Engineering Learning Initiatives (student centered)
Faculty consultations -New faculty support 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

Traditional Teaching Sage on a Stage



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

Multi-tasking While Learning?



Perceived Advantages

Feel:
 less bored
 more efficient
 socially engaged

Real Disadvantages

Reduced deep learning:
 ability to apply learning
 ability to connect learning
 analyze of new ideas
 critical thinking

Student Attention vs Time

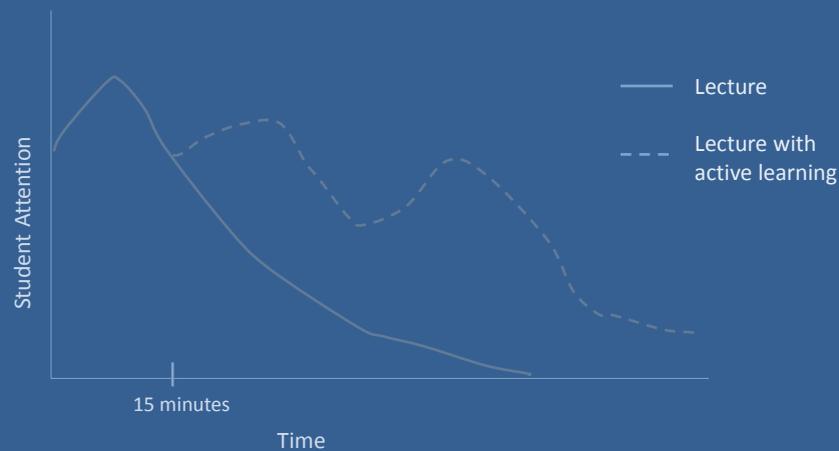


Figure adapted from Biggs and others

Active Learning Teaching Experiment

(by DeSlauriers, Schelew, and Wieman)

2 Matched physics classes, ~ 270 students each

Control Class

Teaching:

All traditional lecture

Test on week 11 content

Ave = 41%

Experimental Class

Teaching:

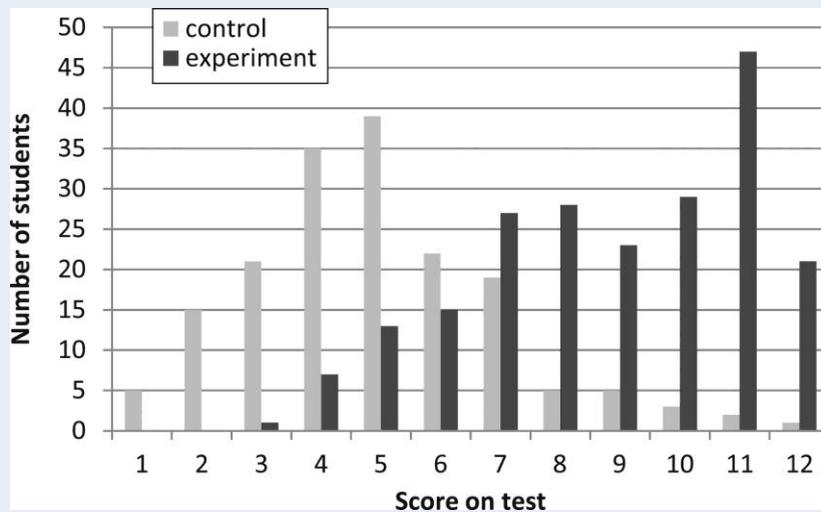
Week 1 – 10: traditional

Week 11: high engagement

Test on week 11 content

Ave = 74%

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



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



Published by AAAS

Student Engagement



Advantages

Increased:

- learning (deeper, long lasting)
- ability to apply knowledge
- content connections
- retention

Tap the need to engage:

- fellow students
- technology
- variety of learning styles

Disadvantages

Requires:

- new methods
- more thought
- initially more time

Student resistance

Change is hard

How does young employee's tendency to be connected, by cell phone or computer, impact their work productivity?

- A) It allows them to multitask and thereby be more productive.
- B) They have a work need to be connected at times, but sometimes it is a counterproductive distraction.
- C) They tend to be more distracted and have difficulty focusing on the task at hand.
- D) Don't really know

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

Move Toward More Active Learning

Empowering Faculty

Training TAs

Embracing Technology

Enlisting student input



Data Empowers Faculty

Mid-semester student surveys

On-line adaptive survey
Feedback, not evaluation

Address student concerns real time

Motivates change

ETEI Mid-Semester Surveys

Surveys 2011-12

courses	134
faculty	90
students	1973

MAE, ECE, MSE - department wide

CS, CEE, CBE - individual requests

Dominant issue

poor lecture and/or course organization

Lecture Organization

Easy Changes to Add to Lectures

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

Faculty learn quickly

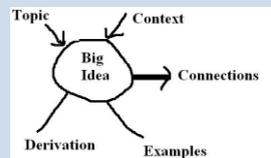


Stuhlbarg, Michael, perf. *A Serious Man*. Dirs. Joel and Ethan Coen. Focus Features, 2009

Novice vs Expert Thinking

Faculty experts see:

big picture ideas
 content links
 supporting details

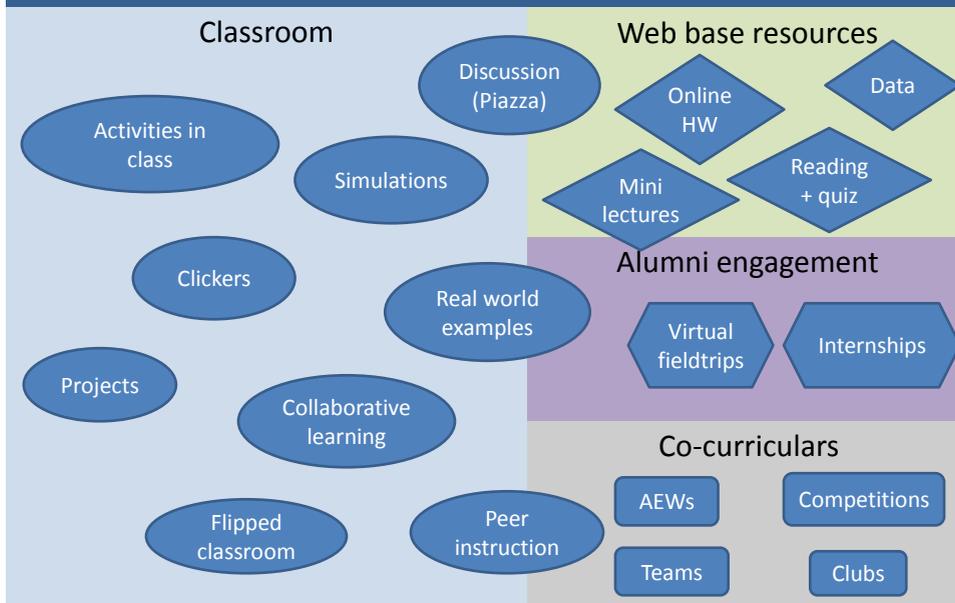


Student novices see:

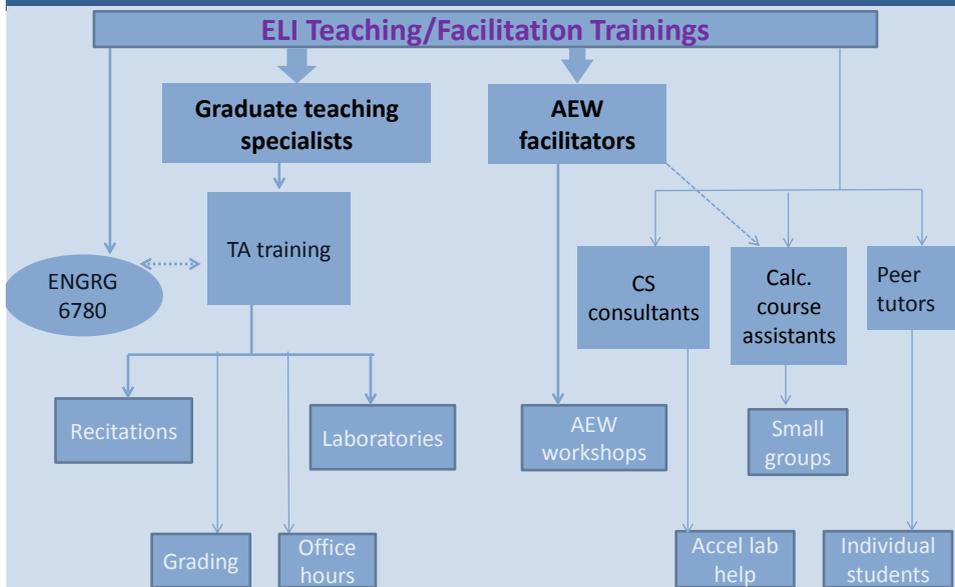
factoids to memorize
 formulas and recipes to use
 disorganized mess that fills brain



Active Learning - Engaging Students



ELI: Leveraging Training of Student Instructors



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

TA Training – 150 New TAs Trained Fall 2012

Teaching workshops (4)

Grading & Assessment
Active Learning
Learning Styles
Classroom Presence

Select-A-Session (2)

Public Speaking
Power Point Presentations
Piazza
Blackboard
LaTeX
Time management
International TAs

Large Group Presentations (2)

Diversity
Notice & Respond

Microteaching (1)

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 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

Empower Teaching Excellence at All Levels

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Faculty consultations
 -New faculty support
 Teaching innovations
 McCormick grants
 Pilot programs
 Teaching proposal support
 Classroom & technology support
 Engineering education research
Mid-semester feedback

Engineering Learning Initiatives (student centered)

Academic excellence workshops
 TA training
 Peer tutoring
Student instructor trainings
 Graduate teaching specialists
 AEW facilitators
 Tutors
 ENGRG 6780 - Teaching Seminar
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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

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

Submit short answer by cell phone or computer

ECC Support

Classrooms that work

- reliable technology
- support innovative teaching

Share ideas, knowledge, support

- Piazza
- Simulations
- Teaching Innovation grants
- AEWs

Big picture goals

Summary

Interactive teaching

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

Improved education across the curriculum

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

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