Engineering Teaching Excellence

Teaching future engineering leaders
and problem solvers

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Agenda

Program Overview

Pedagogy – active learning

ETEI – initiatives with faculty

ELI - training of graduate and UG students

Discussion

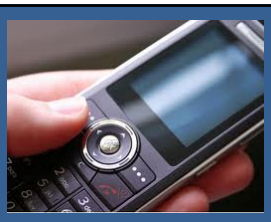
Empower Teaching Excellence at All Levels

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 ≤ 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	Real Disadvantages
Feel: less bored more efficient socially engaged	Reduced deep learning: ability to apply learning ability to connect learning analyze of new ideas critical thinking

Student Attention vs Time

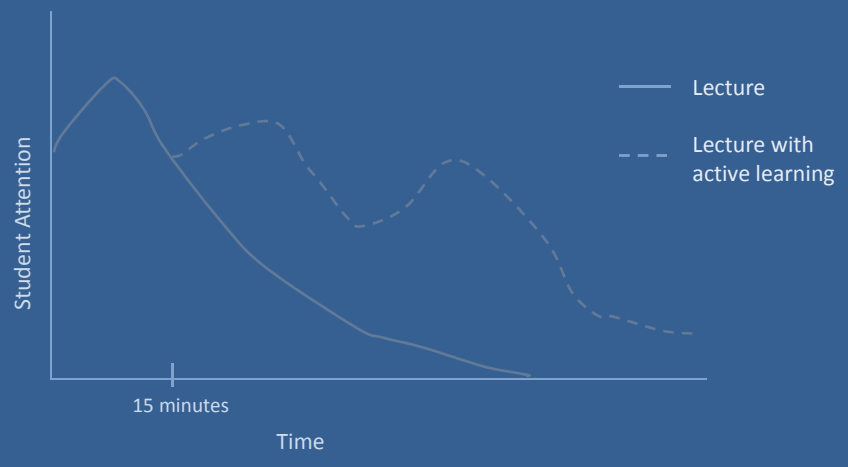


Figure adapted from Biggs and others

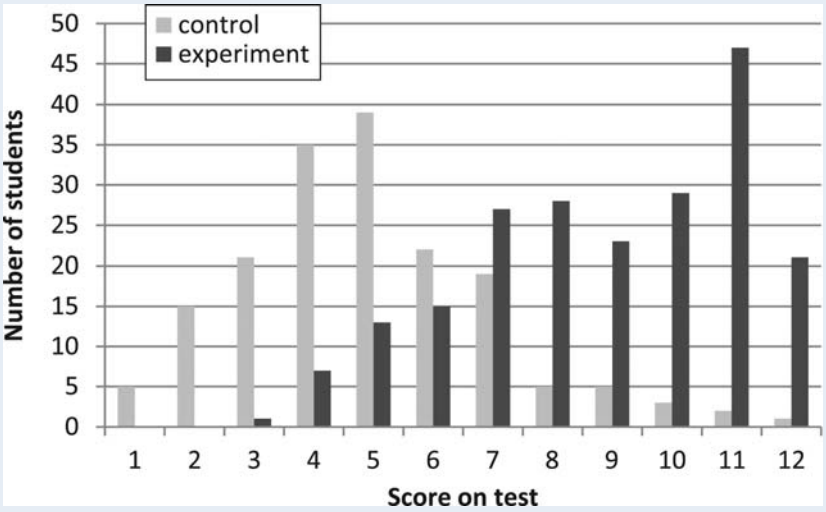
Active Learning Teaching Experiment

(by DeSlauriers, Schelew, and Wieman)

2 Matched physics classes, ~ 270 students each

Control Class	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

Student Engagement

Advantages	Disadvantages
Increased: learning (deeper, long lasting) ability to apply knowledge content connections retention	Requires: new methods more thought initially more time
Tap the need to engage: fellow students technology variety of learning styles	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

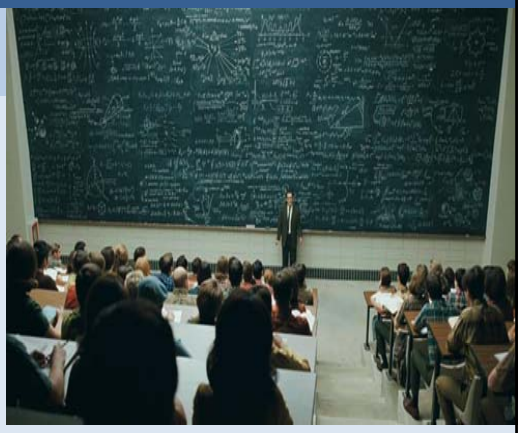
Dominant issue

- poor lecture and/or course organization

Lecture Organization

Easy Changes to Add to Lectures

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

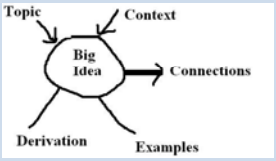


Faculty learn quickly

Novice vs Expert Thinking

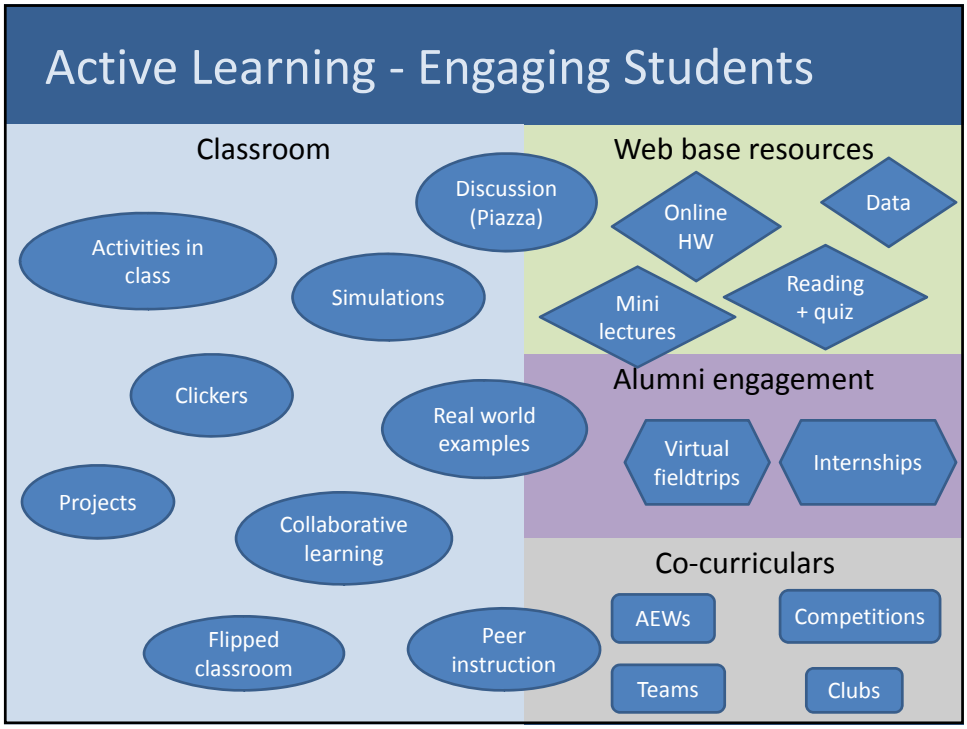
Faculty experts see:

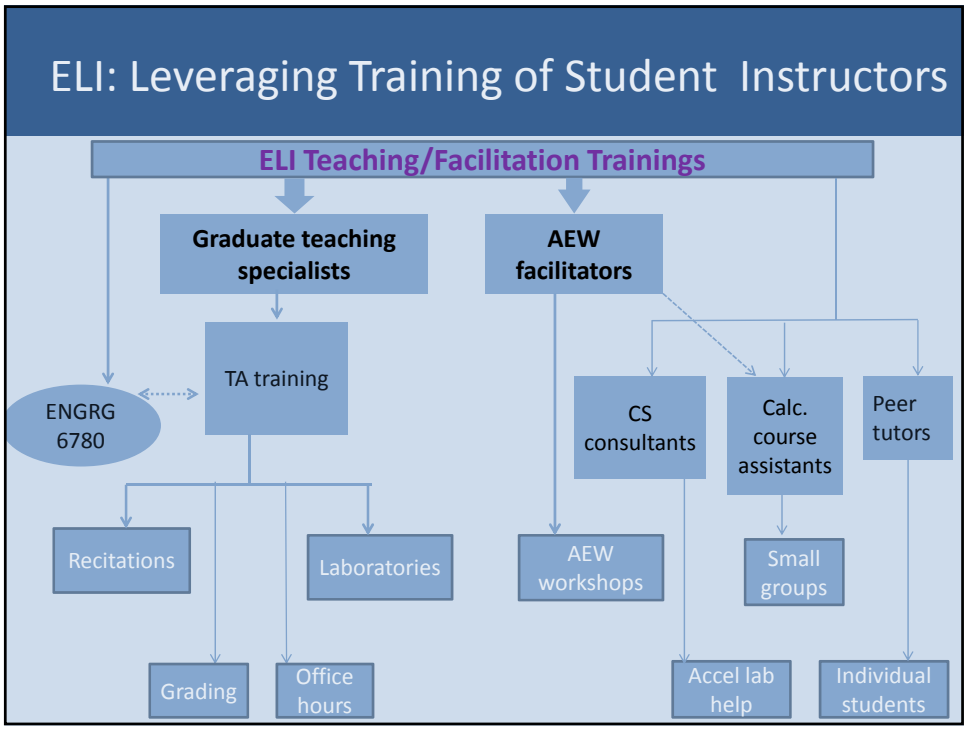
big picture ideas
content links
supporting details



Student novices see:

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


Active Learning - Engaging Students
Classroom
Activities in class
Discussion (Piazza)
Simulations
Clickers
Real world examples
Projects
Collaborative learning
Flipped classroom
Peer instruction
Web base resources
Online HW
Data
Mini lectures
Reading + quiz
Alumni engagement
Virtual fieldtrips
Internships
Co-curriculars
AEWs
Competitions
Teams
Clubs


ELI: Leveraging Training of Student Instructors
ELI Teaching/Facilitation Trainings
Graduate teaching specialists
AEW facilitators
TA training
ENGRG 6780
Recitations
Laboratories
Grading
Office hours
CS consultants
Calc. course assistants
Peer tutors
AEW workshops
Small groups
Accel lab help
Individual students

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

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)

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

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

Academic Excellence Workshops (AEWs)

Overview	Evaluation & feedback
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	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
  - Piazzza
  - 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