



# An Innovative Approach for College-Level Assessment in a Large Engineering Program

The College of Engineering



ABET SYMPOSIUM XII  
Las Vegas, NV, April 15-17, 2010

Dr. Phillip Rosenkrantz, IME Department  
Dr. William Kitch, CE Department  
California State Polytechnic University, Pomona

# Cal Poly Pomona

One of the largest engineering programs in California

One of 24 California State University campuses

Over 5000 engineering students, seven departments,  
11 undergraduate degrees, 5 masters degrees

Highly ranked among non-research universities

Tournament of Roses Parade float co-built each year  
with Cal Poly San Luis Obispo





# Projects Symposium Day

- Each year approximately 75 industry friends attend Project Symposium Day and assess over 200 senior projects.
- Historically each program uses their own rubrics and processes for assessment.
- Two years ago the College of Engineering Assessment Committee conducted a post-symposium survey of industry representatives to assess seven outcomes from a college-wide perspective.
- <http://www.csupomona.edu/~engineering/locators/dataweb/symposium/index.htm>

# Excerpt from Typical Project Presentation Rubric

Outcomes	4 Exemplary (Professional Level Quality)	3 Proficient (Good Quality for Graduating Senior)	2 Marginal (Acceptable Level Quality for Graduating Senior, but room for improvement)	1 Unacceptable (Quality level is not acceptable)
<b>Ability to apply advanced material in the discipline (UD)</b>	Clearly demonstrates highly professional understanding of material included in upper division courses.	Adequately demonstrates understanding of upper division course material, but not necessarily at a fully professional level.	Display of professional level understanding of upper division material is somewhat uncertain or raises doubts in the listeners' minds about the authority of the presentation	Presentation fails to demonstrate that the speaker(s) understand or appropriately use knowledge of the discipline
<b>Ability to identify problems and determine their root causes.</b>	Clearly demonstrates a structured and appropriate problem solving approach was used for the project. Creative thinking and solid reasoning was clearly demonstrated.	Adequate approach to problem solving but may have lacked rigor or thoroughness in several aspects.	Problem solving methodology addressed and used, but approach not formulated as well as it could have been.	Problem solving approach or methodology missing or inadequate. Does not reflect a systematic approach to problem solving.



# Project Symposium Survey

- On-line survey
- Survey link sent via email to industry representatives that attended the symposium
  - 36 responses in 2008
  - 42 responses in 2009
- Approximately 2/3 response

## Cal Poly Pomona Project Symposium Feedback

### 1.

The College of Engineering would appreciate your overall impressions and feedback regarding the Project Symposium for assessment purposes to improve the college infrastructure. Thank you for your continued support.

#### 1. Calendar Year

- 2008                       2009                       2010                       2011

#### 2. Quarter

- Fall (Sept-Oct-Nov)                       Winter (Jan-Feb-Mar)                       Spring (April-May-June)

#### 3. Please indicate which of the following best describes your current or last role in industry

- Engineer     Upper management  
 Technologist     Executive level  
 First line supervision     Business owner  
 Middle management

Other (please specify)

#### 4. Please indicate which engineering department's presentations you attended (you may indicate all that apply):

- Aerospace     Engineering Technology  
 Chemical     Mechanical  
 Civil     Industrial & Manufacturing  
 Electrical & Computer

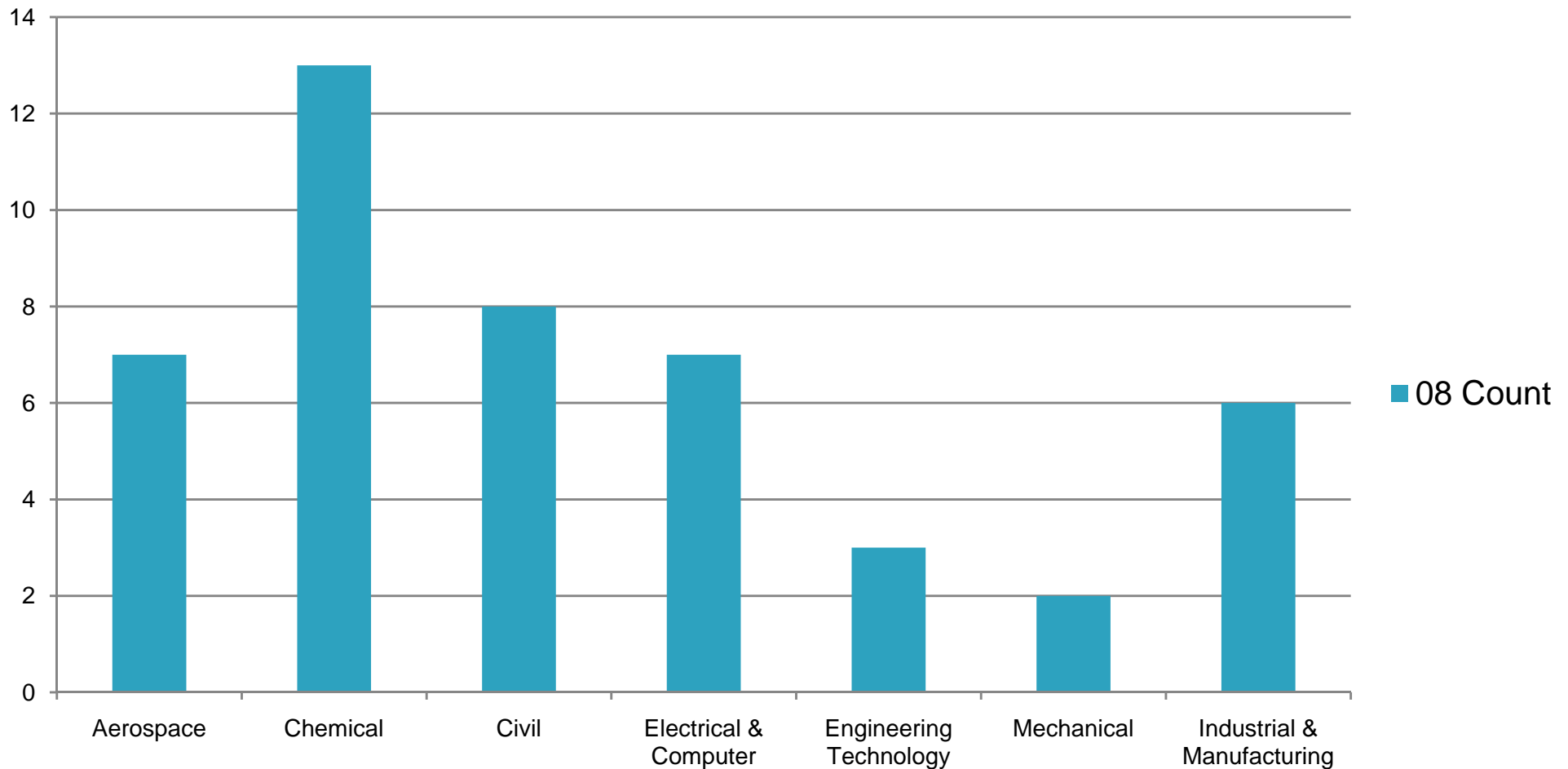


# 2008 Survey Results



# Number of Industry Representative Visits by Department

## 2008 Results







# Qualities Rated on the Survey

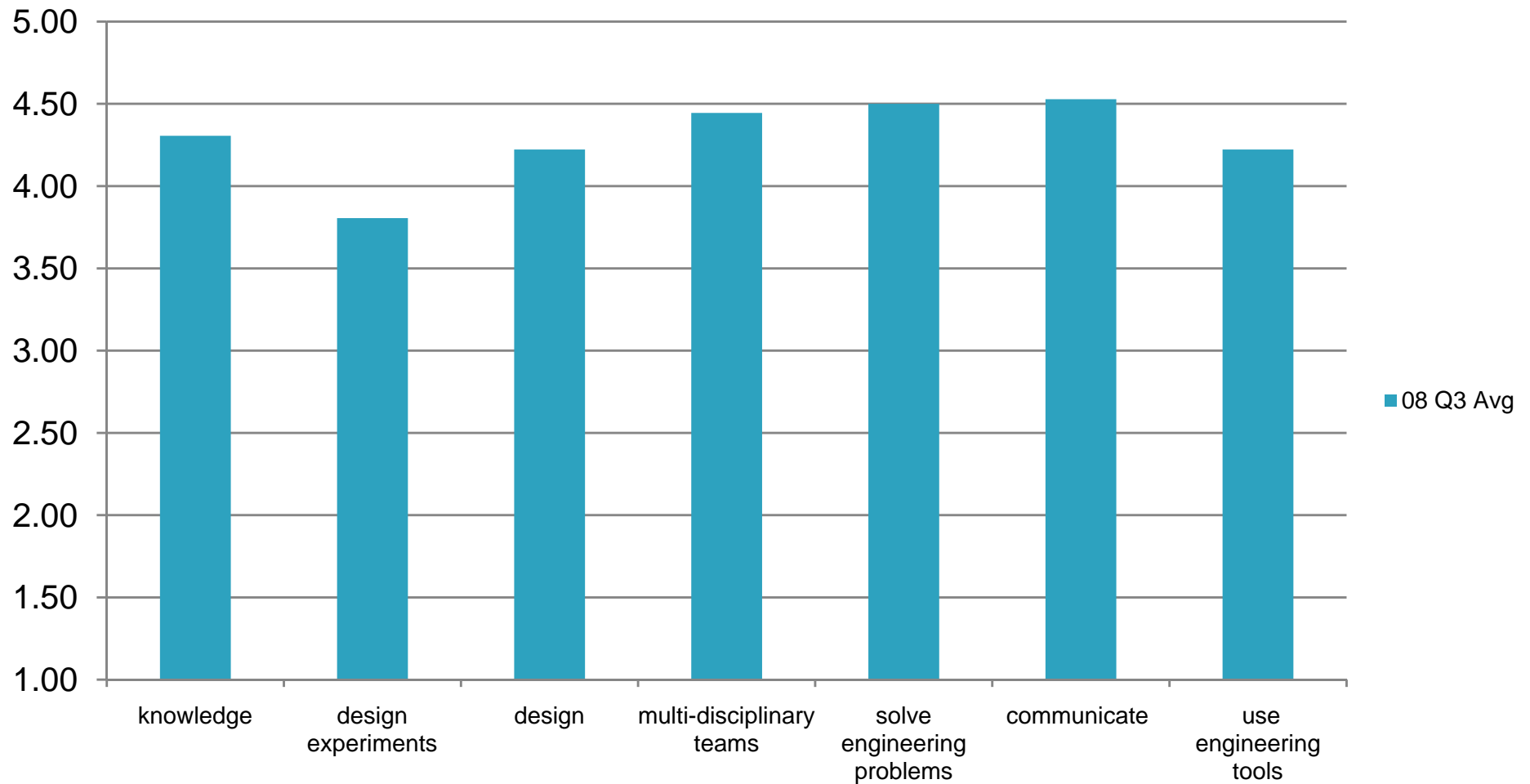
ABET a-e, g, k

- Ability to apply knowledge of mathematics, science, and engineering
- Ability to design and conduct experiments, as well as to analyze and interpret data
- Ability to design a system, component, or process to meet desired needs
- Ability to function on multi-disciplinary teams
- Ability to identify, formulate, and solve engineering problems
- Ability to communicate effectively
- Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice



# Average importance for engineering graduates? (5 = very important)

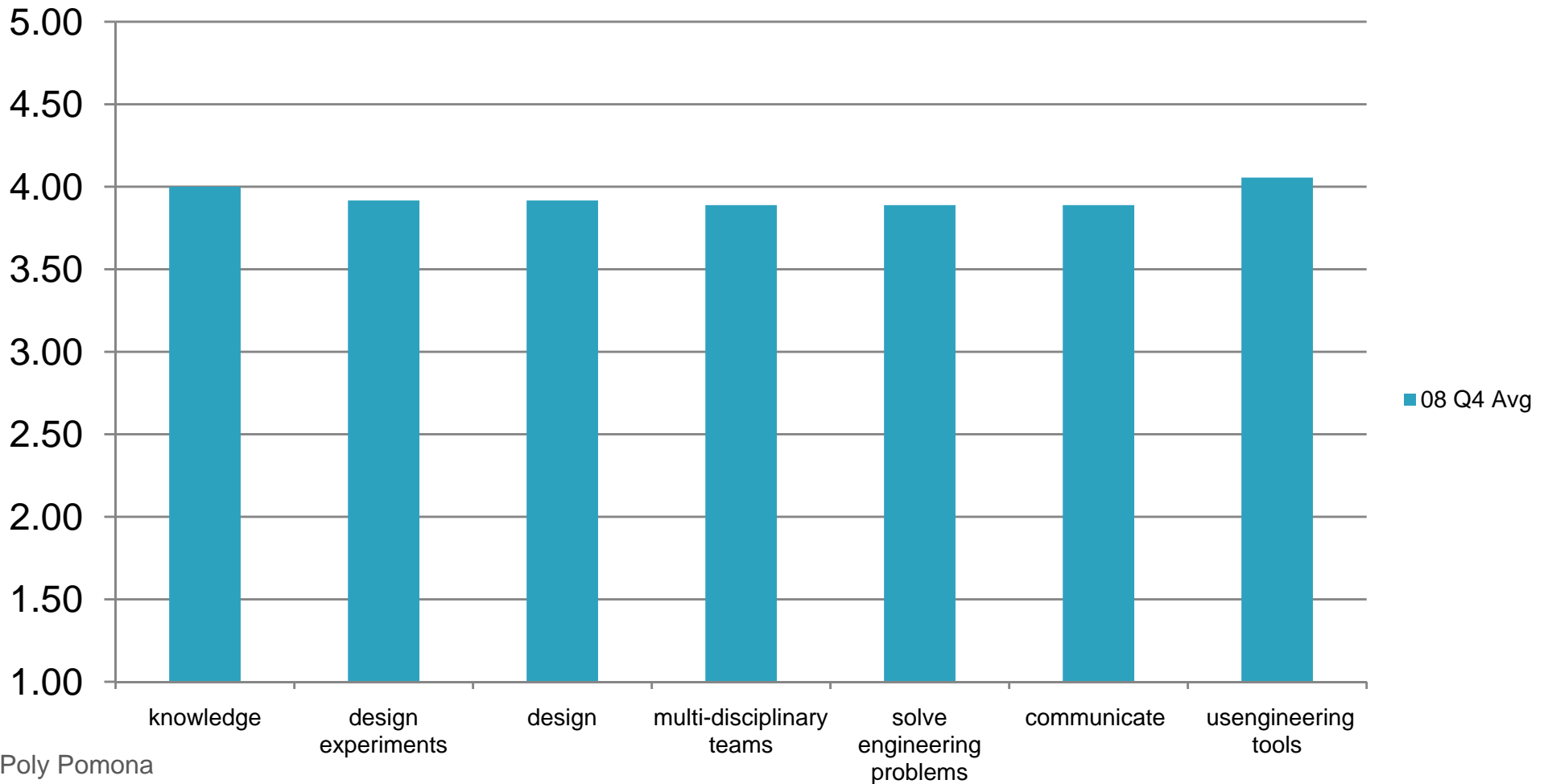
## 2008 Results





# Effectiveness of the Cal Poly Pomona educational experience?

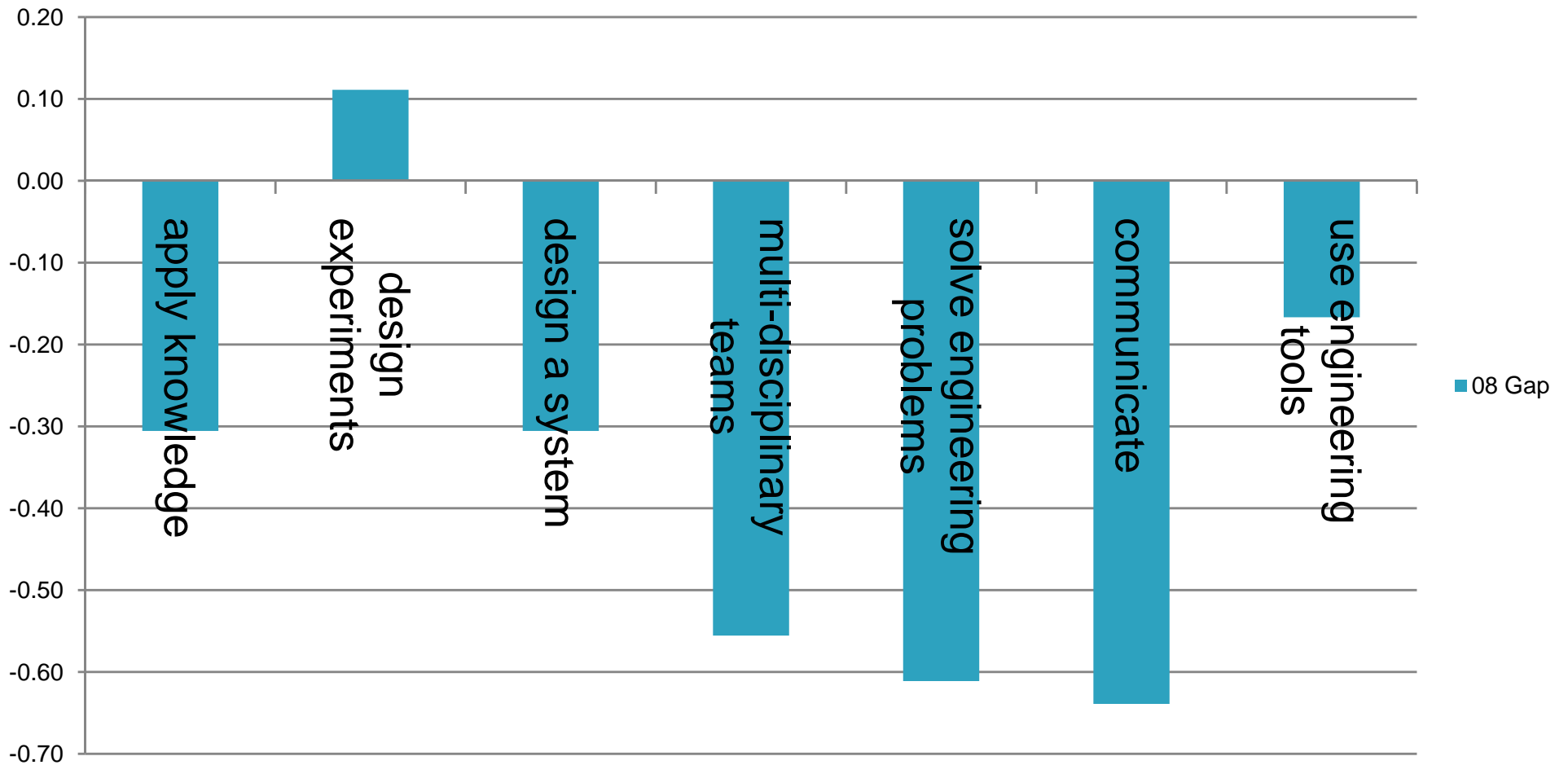
## 2008 Results





# Gap Analysis Comparison

### 2008 Gap





# Analysis

- Gap analysis shows three areas needing greatest improvement:
  - Communications
  - Ability to solve engineering problems
  - Multidisciplinary teamwork
- College adopted a three year plan to address these 3 focus areas



# Annual Themes Adopted in Fall 2008



## Three-Year College Plan

**2008-2009: Communications**

**2009-2010: Multi-disciplinary Teamwork**

**2010-2011: Problem Solving**



# 2008-2009: Communications

- The ability to communicate orally, visually, and in written form
- Includes critical thinking and comprehension skills as well as interpersonal communication skills
- Leads up to the teamwork theme in 2009-2010.



# 2009-2010: Multi-disciplinary Teamwork

- The ability to perform as an effective team leader or team member in multidisciplinary situations.
- This theme could align very well with the teamwork approaches found throughout the business world today and embodied in various strategies (e.g., Six Sigma Quality, AS 9100, ISO 9001:2004, etc.).
- There are several “High Performance Team” models that could be considered and adopted under this theme.





# 2010-2011: Problem Solving

- Almost every engineer will need problem solving skills.
- These skills include:
  - Problem identification
  - Prioritizing
  - Root cause analysis
  - Problem diagnosis
  - Creative and innovative problem solving
  - Implementation



# Communications Program 2008-2009

- “Professor for a Day” panel discussion plus class speakers.
- Engineering Futures presentation on communications by TβII National Office
- Liberal Arts and Science faculty attended Senior Project Presentations. STEM Committee formed to work on joint projects.
- Three workshops for faculty led by invited experts from inside and outside the COE.
- Pilot project requiring presenters to provide a one-page abstract usable for immediate assessment of writing skills .
- Pilot project using English M.A. students to coach students preparing presentations.

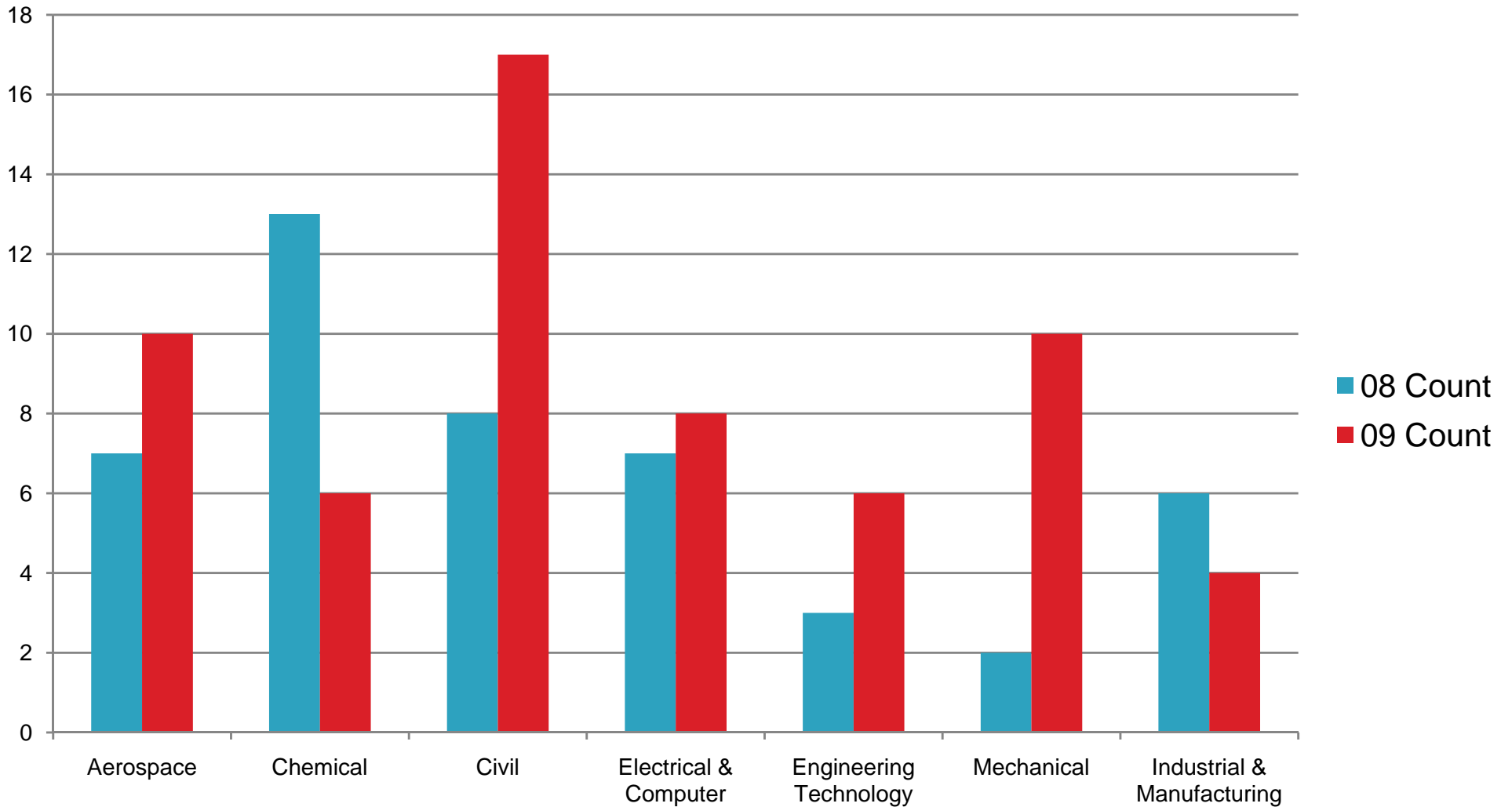


# Second Assessment Cycle 2009

- Same assessment process followed at Project Symposium Day in 2009
- Program changes:
  - Added Showcase presentations
  - Change in makeup of industry visitors
- Changes may confound results

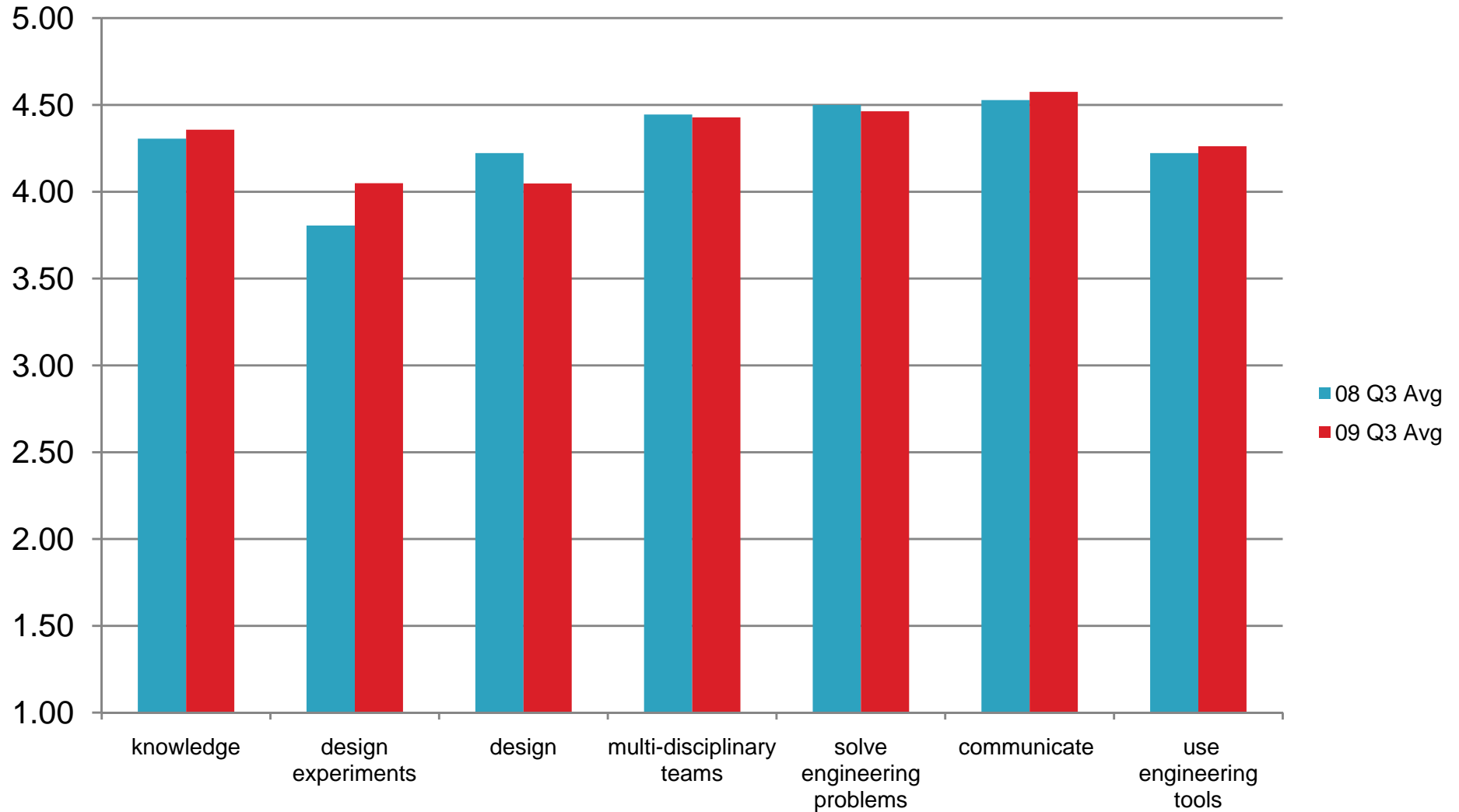


# Number of Industry Representative Visits by Department





# Average importance for engineering graduates? (5 = very important)



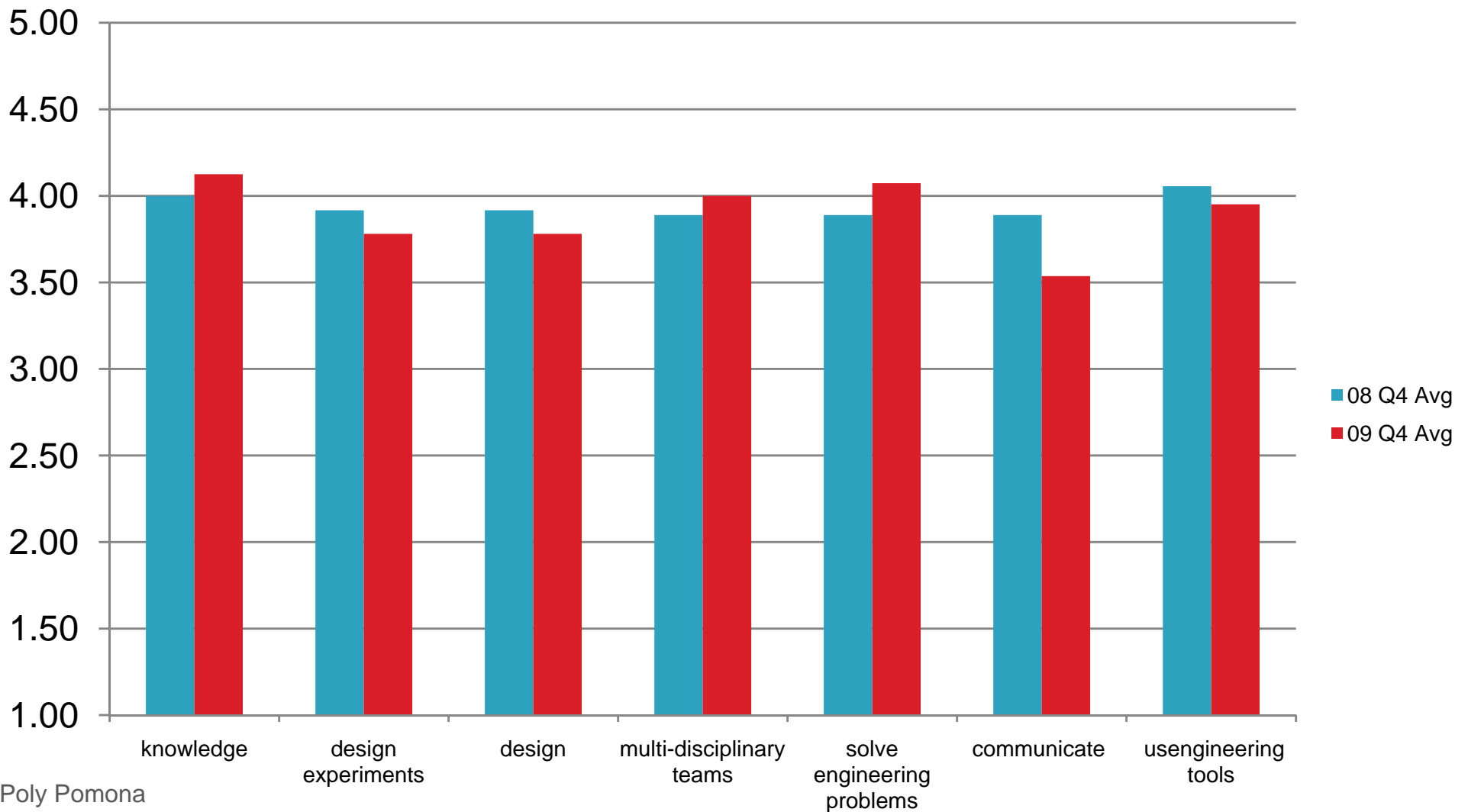


# Analysis

- Results show consistency in responses from year-to-year
- Same three areas most important:
  - Communications
  - Engineering problem solving
  - Multidisciplinary teamwork



# Effectiveness of the Cal Poly Pomona educational experience?





# Analysis

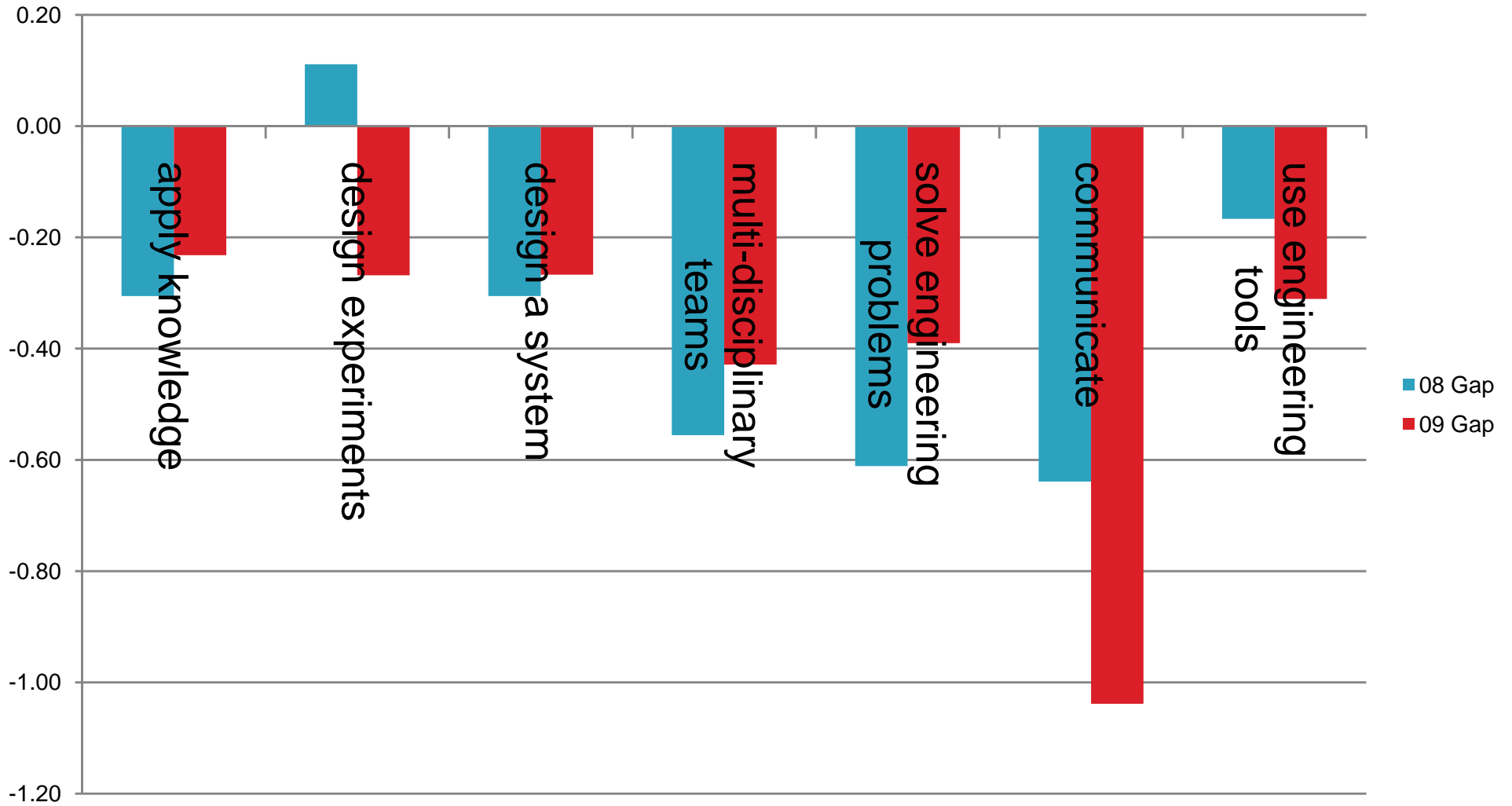
Communications dropped the most of all the outcomes assessed

- Averages dropped in three areas:
  - Ability to design experiments and analyze data
  - Ability to design a system
  - Communications
  - Ability to use engineering tools
- Averages increased in three areas:
  - Knowledge
  - Multi-disciplinary teams
  - Problem solving





# Gap Analysis Comparison





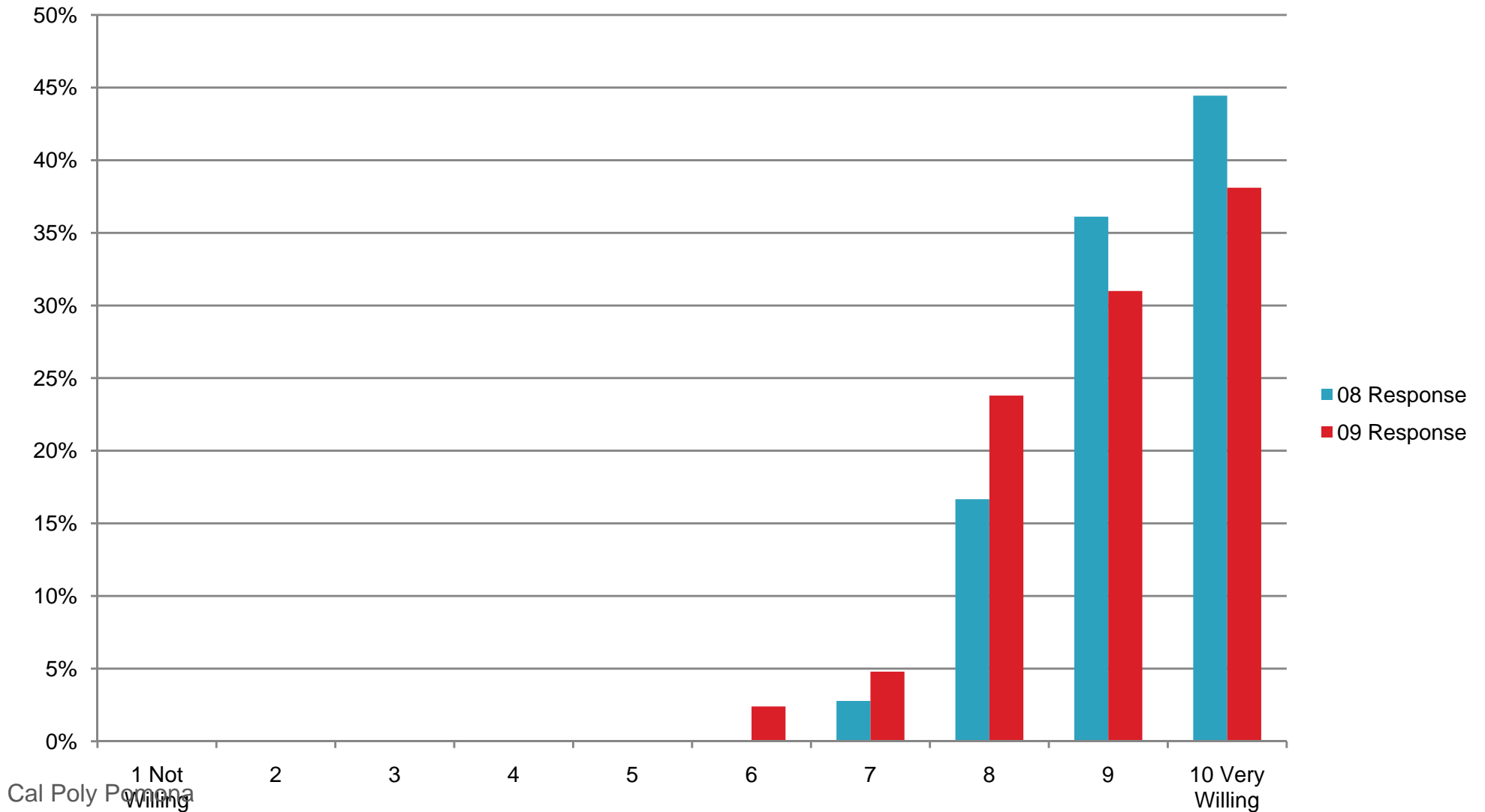
# Analysis

Communications continues to be one of our areas in need of improvement

- The gaps were smaller in all areas except:
  - Ability to Design Experiments and Analyze Data
  - Communications
  - Ability to use engineering tools
- Three focus areas still have largest gap



# How willing would you be to refer someone to the Cal Poly Pomona College of Engineering?





# Question 6 Implications

- ▶ **9-10: Promoters – (-12%)** People who are selling your programs through word-of-mouth
- ▶ **7-8: Passives – (+10%)** People who are satisfied, but have reservations about recommending the program to others. Usually not satisfied with one or more aspects.
- ▶ **1-6: Detractors – (+2%)** People who are probably saying negative things about the program.



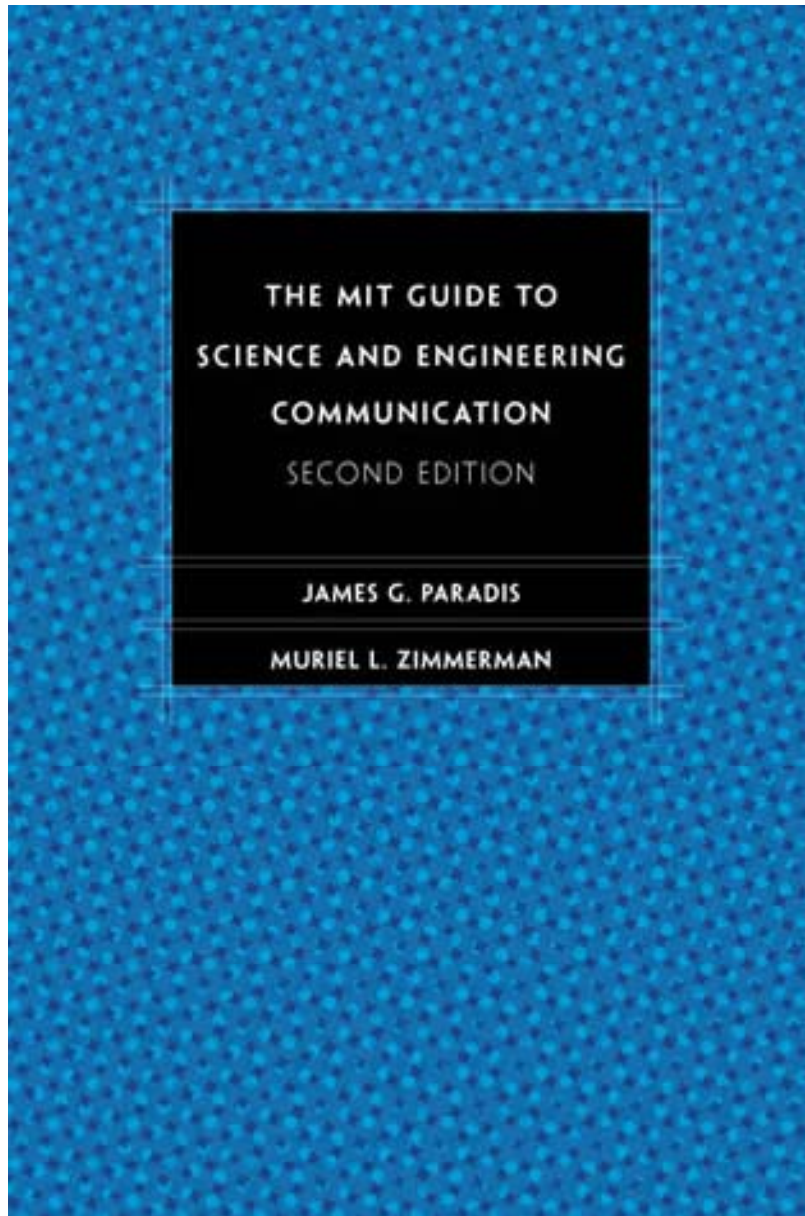
# Analysis

- Slight decrease in scores using the scale given
- Written comments show strong support and confirm concerns about communications
- Overall analysis
  - Communication skills are growing in importance
  - Valuable program but:
    - Did not reach enough students or faculty
    - Needs to continue and expand



# Ideas for Improving Communications Program

- Expand and increase seminars for faculty.
- Adopt a default “style guide” to use throughout the COE. Default guide is used unless instructor or department specifies otherwise.
- College-wide student competition judged by industry with prizes for the best presentation, written report, and research paper.
- Expanded used of the Showcase in FYE courses.



## Other Ideas


Choose a book about communications to use throughout the curriculum (at the college or department level). Use in engineering classes to help make it real to the students.

# 2009-2010 Program

## Multi-disciplinary Teamwork

- Initial Observations
  - Team projects are used in many classes but very few teamwork skills are taught.
  - Many students are learning negative teamwork skills as the result of being on dysfunctional teams witnessing traits like slacking or dominating.
  - Lack of resources available for both instructors and students.
  - Difficult to evaluate team member performance
  - FYE is not enough. More reinforcement at 200 level.





# 2009-2010 Program Multi-disciplinary Teamwork

- College developing a program with the following goals:
  - Develop resources for faculty such as:
    - On-line and face-to-face workshops
    - On-line resources that can be used in class
  - Provide resources for students
  - Collaboration with other colleges to help our students in GE and support courses



# Future Plans

- Continue assessment program
- Keep providing resources for three focus areas
- Expand reach of programs for both faculty and students
- Tie into FYE programs
- Strengthen collaboration with Liberal Arts and Science departments
- Take a long view and be persistent



# Broader Goals

- Establish communications, teamwork, problem solving, and other “soft skill” outcomes threads across undergraduate curriculum:
  - Multi-year
  - Interdepartmental—across the college of engineering
  - Cross-disciplinary—across the campus
- Requires collaboration with general education suppliers