# Assessing and Enhancing the ME Curriculum on a Continuing Basis

Curriculum Reform Meeting
California State University, Los Angeles

Darrell W. Guillaume
8/22/05

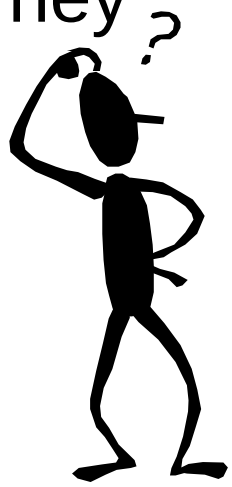
# Assessment Process

# Evaluation Versus Assessment

- Evaluation
  - Performance is Measured
  - A Score or Label is Assigned
  - Judgment is Rendered (Comparison With Others)
  - Praise or Condemnation Ensues
- Assessment
  - Performance is Measured
  - Comparison is Made with Past Results
  - Improvement is Made (Key:  Continuous Improvement)

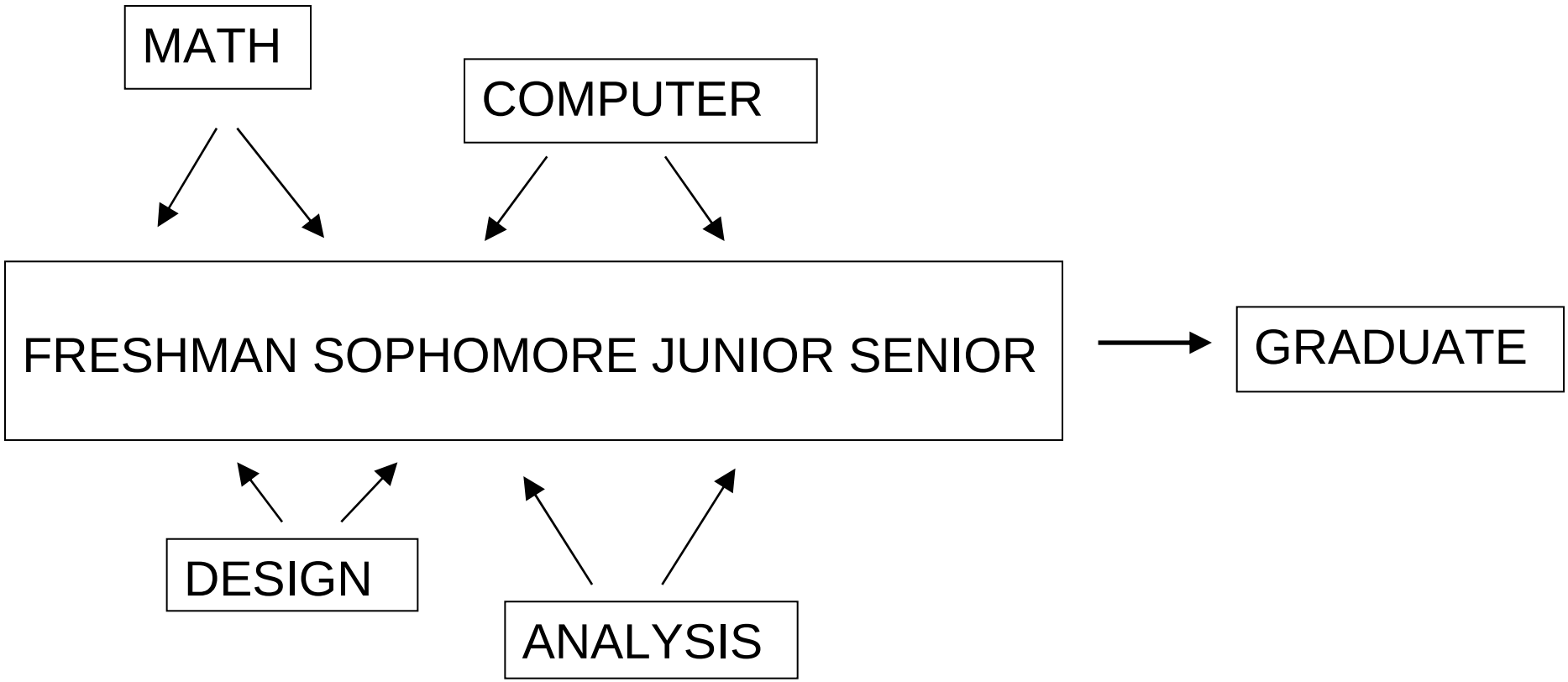
# Assessment Questions

- What Is in the Curriculum?
  - What Else Should Be Included?
  - Who Should Decide?
  - How Often Should it Be Changed?
- What Do Students Know, What Can They Do, and What Attitudes Do They Have when They Leave?
  - How Should these Be Measured?
  - When Should these Be Measured?

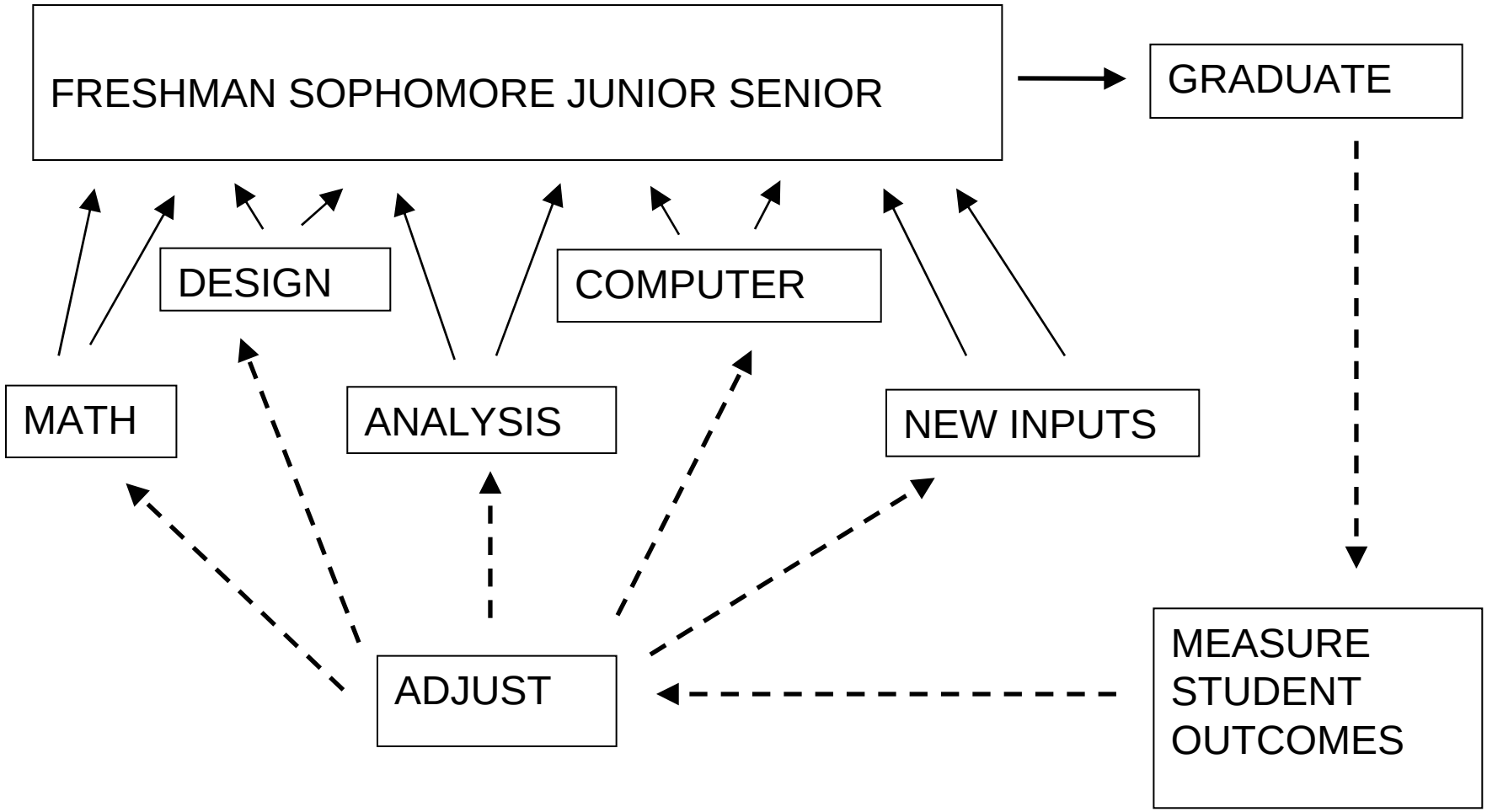


# Non-Assessment Model

Providing a Strong Traditional Curriculum Should Yield
Knowledgeable and Marketable Engineers



# Assessment Model



# Change in Reference Point

**MEASURE CURRICULUM INPUT**

**MEASURE STUDENT OUTPUT**

# Student Learning Outcomes

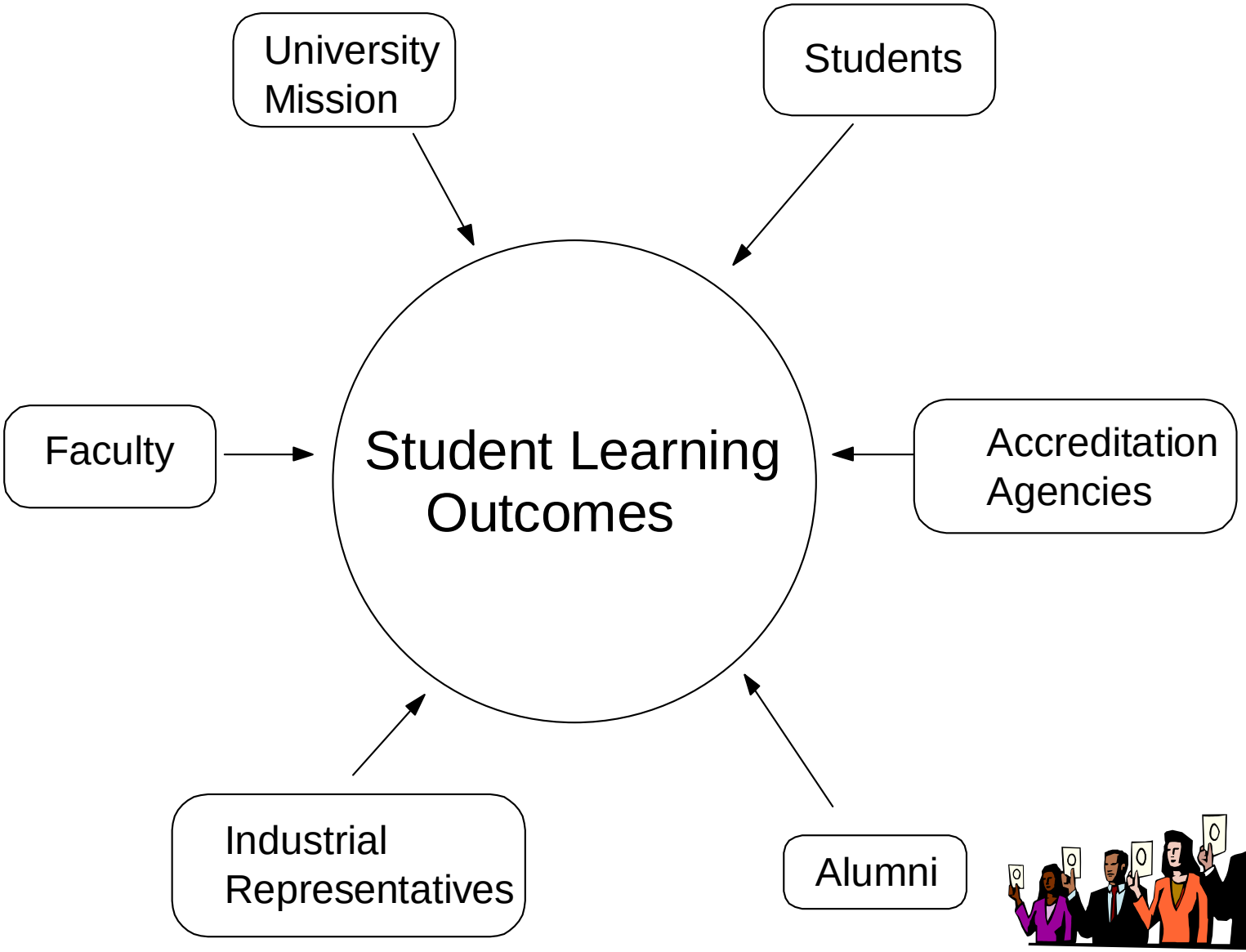
- Student learning outcomes are defined in terms of the
  - knowledge,
  - skills,
  - and attitudes

  that students have attained as a result of their involvement in a particular curriculum
- They must be specific and measurable

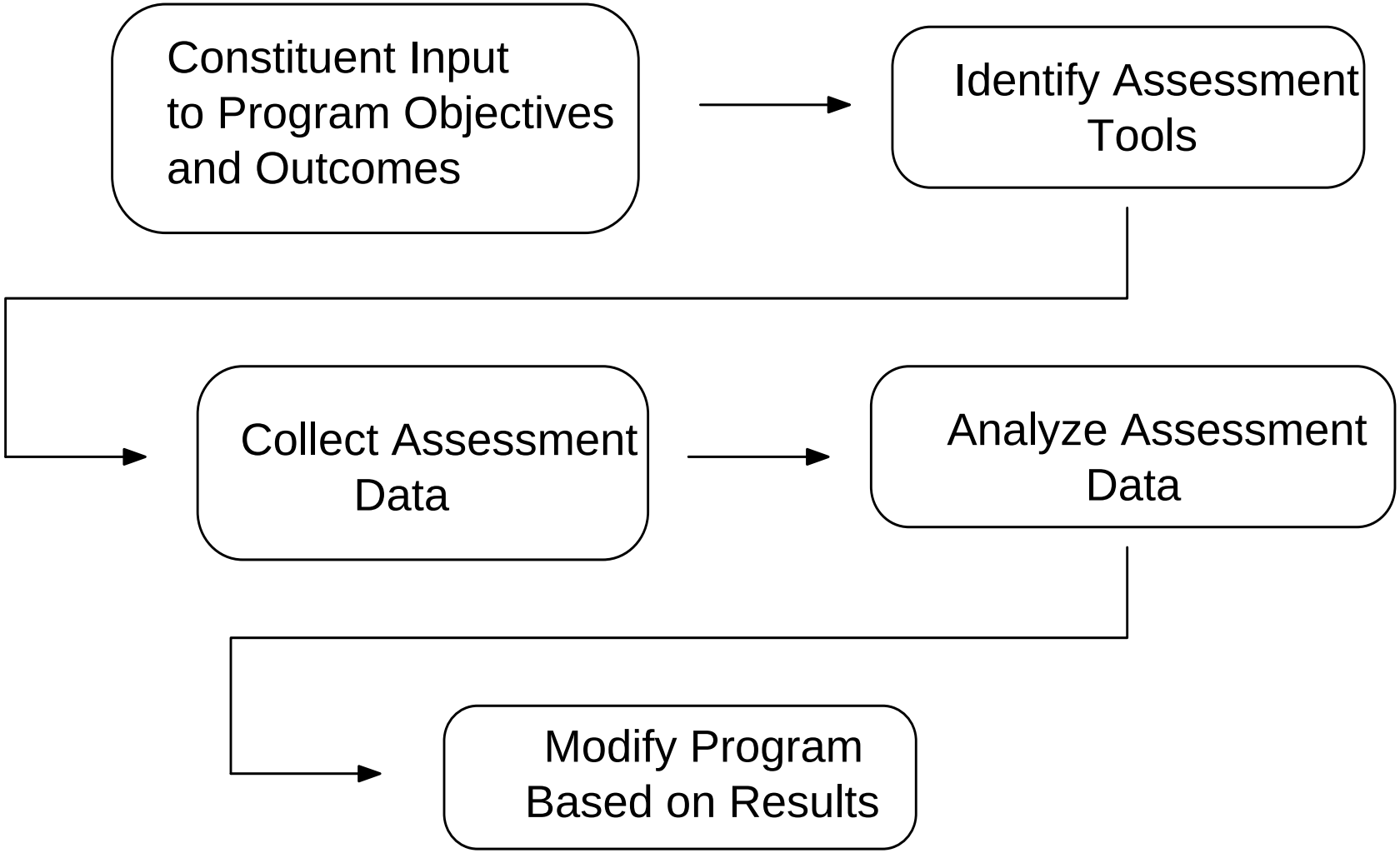
# CSULA's Format

- Objective statement about knowledge
  - Knowledge outcome #1
  - Knowledge outcome #2
- Objective statement about skills
  - Skills outcome #1
  - Skills outcome #2
- Objective statement about attitudes
  - Attitude statement #1
  - Attitude statement #2

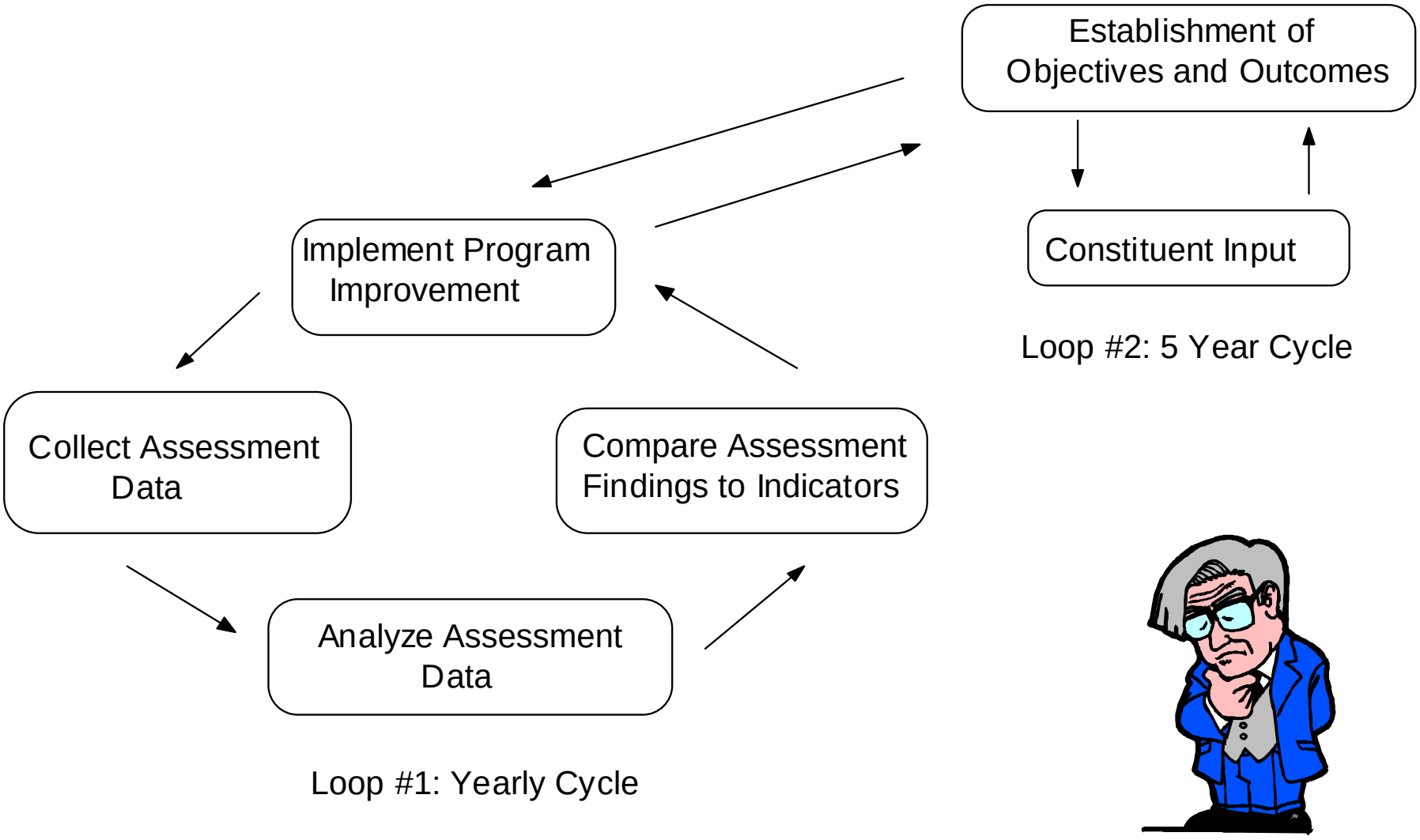
# Constituents



# The Initial Process



# The On-Going Progress



# Yearly Cycle

**Data Collection and Analysis**

Needs to be able to withstand external scrutiny

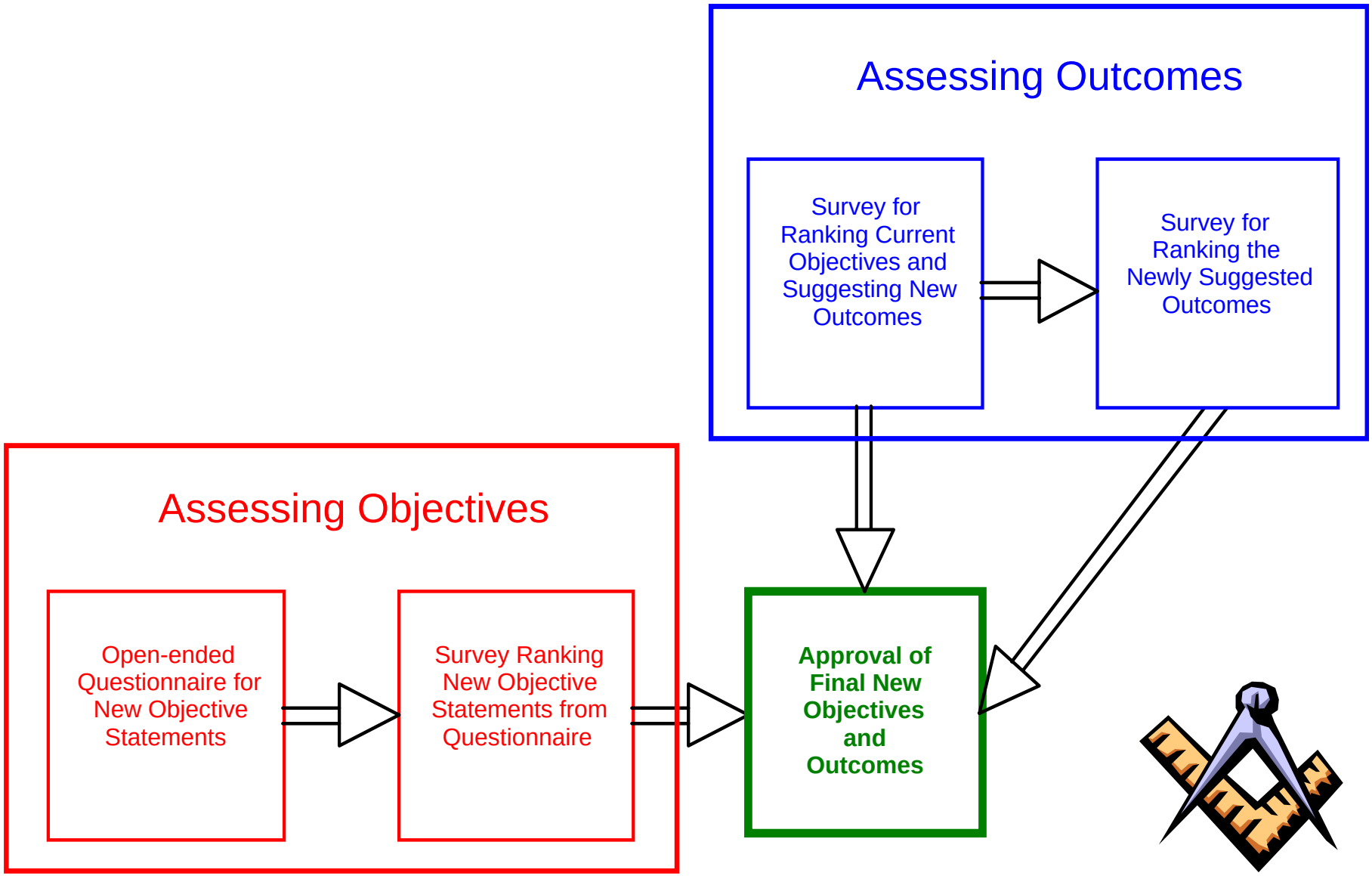
**Assessment**

Program strengths
1.
2.
3.
Program areas for improvement
1.
2.
3.

**Improvement**

Program changes for continuous improvemer

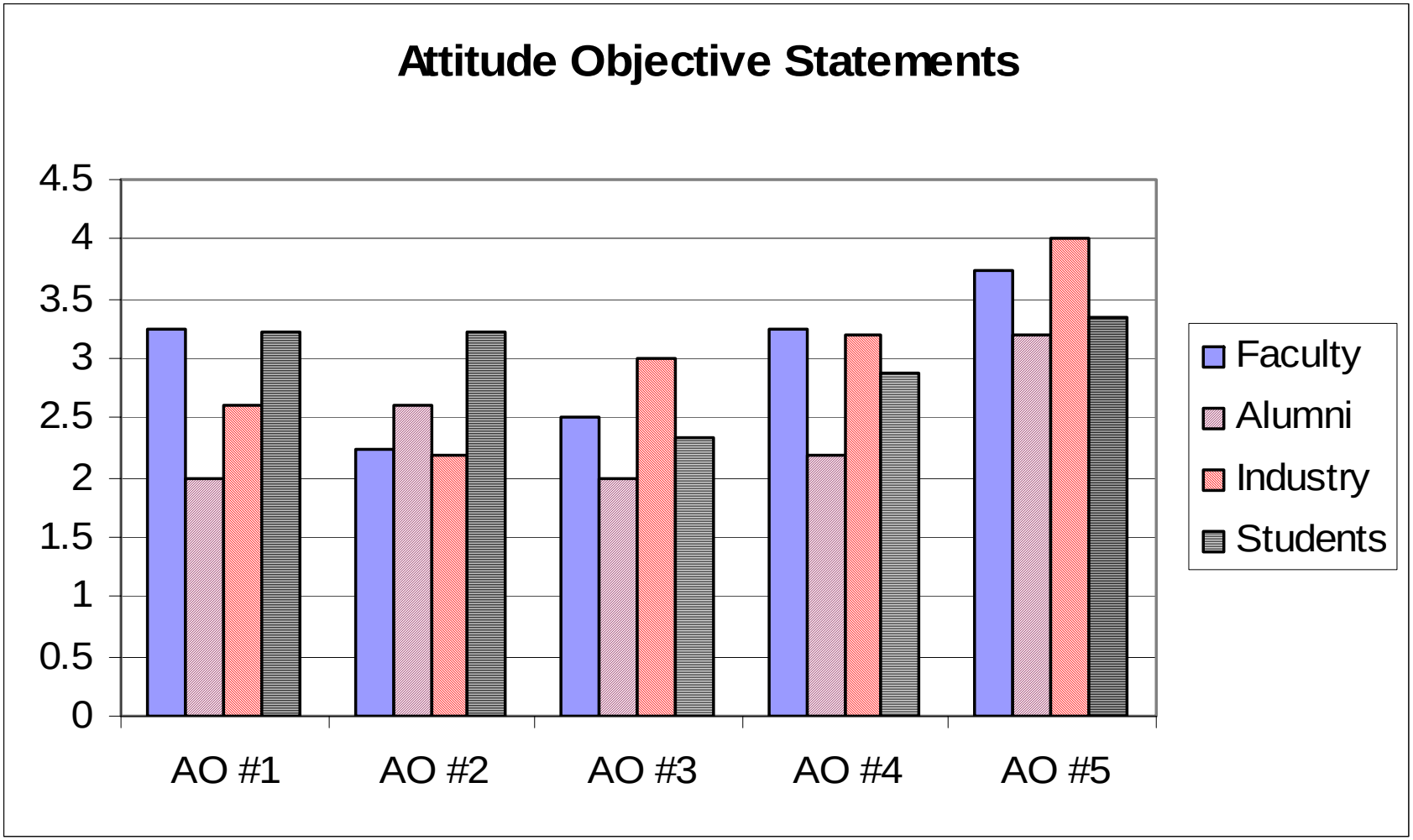
# 5 Year Cycle


Assessing Outcomes
Survey for Ranking Current Objectives and Suggesting New Outcomes
Survey for Ranking the Newly Suggested Outcomes
Assessing Objectives
Open-ended Questionnaire for New Objective Statements
Survey Ranking New Objective Statements from Questionnaire
Approval of Final New Objectives and Outcomes

# Potential Attitude Objective

1. Graduates of the Mechanical Engineering program ... successful in industrial, academic, and governmental positions … continued professional and personal development throughout their careers.
2. Graduates of the Mechanical Engineering program … will have a positive and inquisitive outlook on life and continuous learning, necessary to promote their professional and personal development ...
3. Graduates of the Mechanical Engineering program will be adequately prepared to face challenges … in industrial, academic, and governmental positions …
4. Graduate of the Mechanical Engineering program will be able to seamlessly adapt to different employment settings and engineering tasks in industrial and governmental positions ….
5. Within three to five years from their date of graduation, our alumni will be … successful in industrial, academic, and governmental positions. .. inquisitive outlook on learning…

# Sample Objective Data



# Sample Potential New M.E. Outcomes

Knowledge

- Ability to apply common sense
- An understanding of newer disciplines such as biomedical and electro-mechanical
- A knowledge of project team management
- A knowledge of electro-mechanical fundamentals
- A knowledge of the financial and managerial aspects of project engineering
- A knowledge of quality standards
- A knowledge of geometric dimensioning and tolerances
- A knowledge of computer aided design and simulation software
- A knowledge of measurement and manufacturing techniques
- A knowledge of how mechanical engineering integrates into inter-disciplinary systems

# Sample Potential New M.E. Outcomes

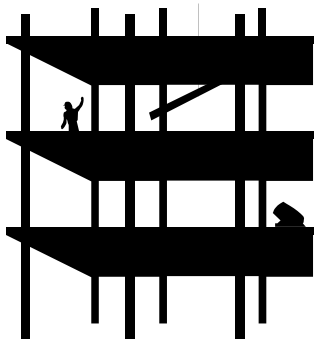
Skills

- Ability to perform manual sketching and drafting
- Ability to manage people and show leadership
- Ability to understand the “engineering language” effectively
- Ability to think in a logical, holistic process
- Ability to interact with supervisors and equals in a professional and honest way
- Ability to apply a “business model” to engineering
- Ability to present oneself well on a resume and during an interview
- Ability to select materials and manufacturing processes
- An ability to visualize designs from engineering drawings
- An ability to think in a logical sequential process

# Sample Potential New M.E. Outcomes

Attitudes

- A recognition of the benefits of diversity in human resources
- A desire to have critical thinking and organizational skills
- An understanding of responsibility and accountability
- A desire to be a professional who exhibits values, dedication and a need for continual improvement
- A desire to be a flexible and adaptable team player (collaborative attitude)



# Faculty Participation

(for this to work, all faculty must play)

- Chair
- Department Assessment Coordinator
- Department Assessment Committee
- Department Implementation Committee
- Course Coordinators

# Team Structure

**Assessment Task Force**

**M. Roden, Chair (Assoc. Dean)**
**D. Guillaume, ME Assessment Coordinator**
**R. Purasinghe, CE Assessment Coordinator**
**C. Liu, EE Assessment Coordinator**
**J. Dong, EE Assessment Coordinator**

Civil Engineering
Program Improvement Task Team

**R. Purasinghe, Chair**
**H. Hashemian**
**R. Jeng**
**C. Khachikian**

Electrical Engineering
Program Improvement Task Team

**H. Boussalis, Chair**
**C. Liu**
**J. Dong**
**R. Ramchandani**

Mechanical Engineering
Program Improvement Task Team

**M. Mirmirani, Chair**
**D. Guillaume**
**L. Hsia**
**A. Sharif**

# Effort in Obtaining Data from Constituents

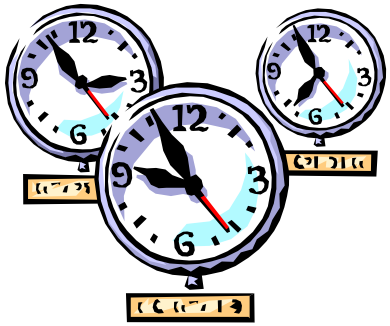
- Students — easy
- IAB — easy
- Alumni — hard
- Faculty — medium

# Making Assessment Part of the Culture

- Participation in assessment activities should have a positive effect on tenure and promotion files
- The Department committees should have membership created by ballot for fixed terms with equal weight and prestige as other University and College committees

# Release/Assigned Time

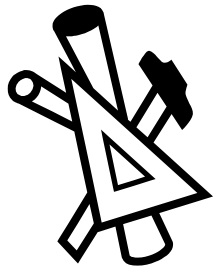
- Outcomes based assessment is very time consuming
- Faculty need time in their schedules
- Assessment based continuous improvement will not continue if it is left as a background activity



# Assessment Tools

# Measurement Tools

- Surveys
- Collection/Presentation of Sample Work
- Exams/Tests
- Capstone Course Experience

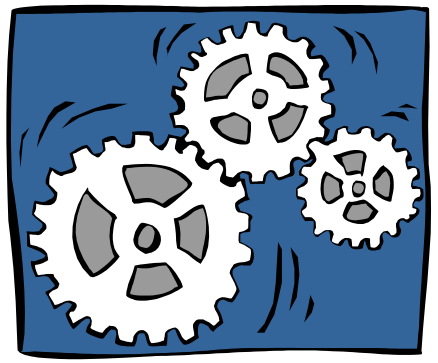


# Surveys

- Created by Faculty
  - Better tailored to fit needs
  - Could have some bias or other flaws
  - Faculty has to process data
- Purchased from Vendor
  - General questions
  - Data are processed when delivered

# Created by Faculty

- For each outcome we asked:
  - Student performance
  - Outcome importance
- Target
  - Faculty
  - Students
  - Industry
  - Alumni
- We attempted Alumnus-Employer Link



# Alumnus-Employer Link

- Plan was to contact alumnus
  - ask for his supervisor's name and permission to contact
  - Send supervisor a survey
- Not a successful tool
  - Most alumnus said no (too threatening)
  - Most supervisors said no (concern about the legal ramifications of an assessment of an employee shared with a third party)

# Purchased from Vendor

EBI:  Engineering Benchmark Inc

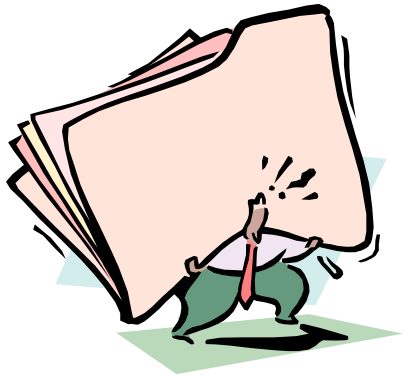
- Questions directed at engineering outcomes (see survey)
- Survey can be customized with program specific questions
- Allows you to pick 6 other schools and compare results

# EBI Participants for 2004

- Auburn University
- Boston University
- Bucknell University
- **California State University-Los Angeles**
- California State University-Northridge
- Carnegie Mellon University
- Christian Brothers University
- Columbia University
- Dartmouth College
- Duke University
- Florida Atlantic University
- Geneva College
- George Mason University
- Gonzaga University
- Grove City College
- Kettering University
- Louisiana State University
- Loyola Marymount University
- Northeastern University
- Northwestern University
- Old Dominion University
- Prairie View A & M University
- Rice University
- Santa Clara University
- **Smith College**
- **Stevens Institute of Technology**
- Syracuse University
- Texas A & M University-Kingsville
- Texas Christian University
- The University of Texas at Austin
- The University of Vermont
- Universidad de Monterrey
- University of Alabama
- University of Arkansas
- University of California-Riverside
- University of Connecticut
- University of Dayton
- University of Delaware
- University of Houston
- University of Illinois at Chicago
- University of Kansas
- University of Missouri-Columbia
- University of New Orleans
- University of Notre Dame
- University of Rochester
- University of Southern California
- University of Texas at Dallas
- University of Toledo
- University of Utah
- University of Virginia
- University of Wisconsin-Madison
- Vanderbilt University
- Villanova University
- Walla Walla College
- Youngstown State University

# Collection/Presentation of Sample Work

- Student work to be evaluated by constituents
- Web based portfolio (Webfolio)
  - Resume
  - Essay on contemporary issues
  - Essay on life-long-learning
  - Sample lab report
  - Abstract from senior design project

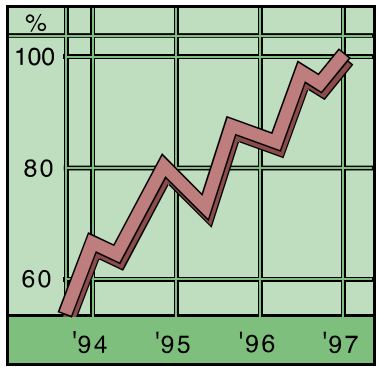


# Webfolio

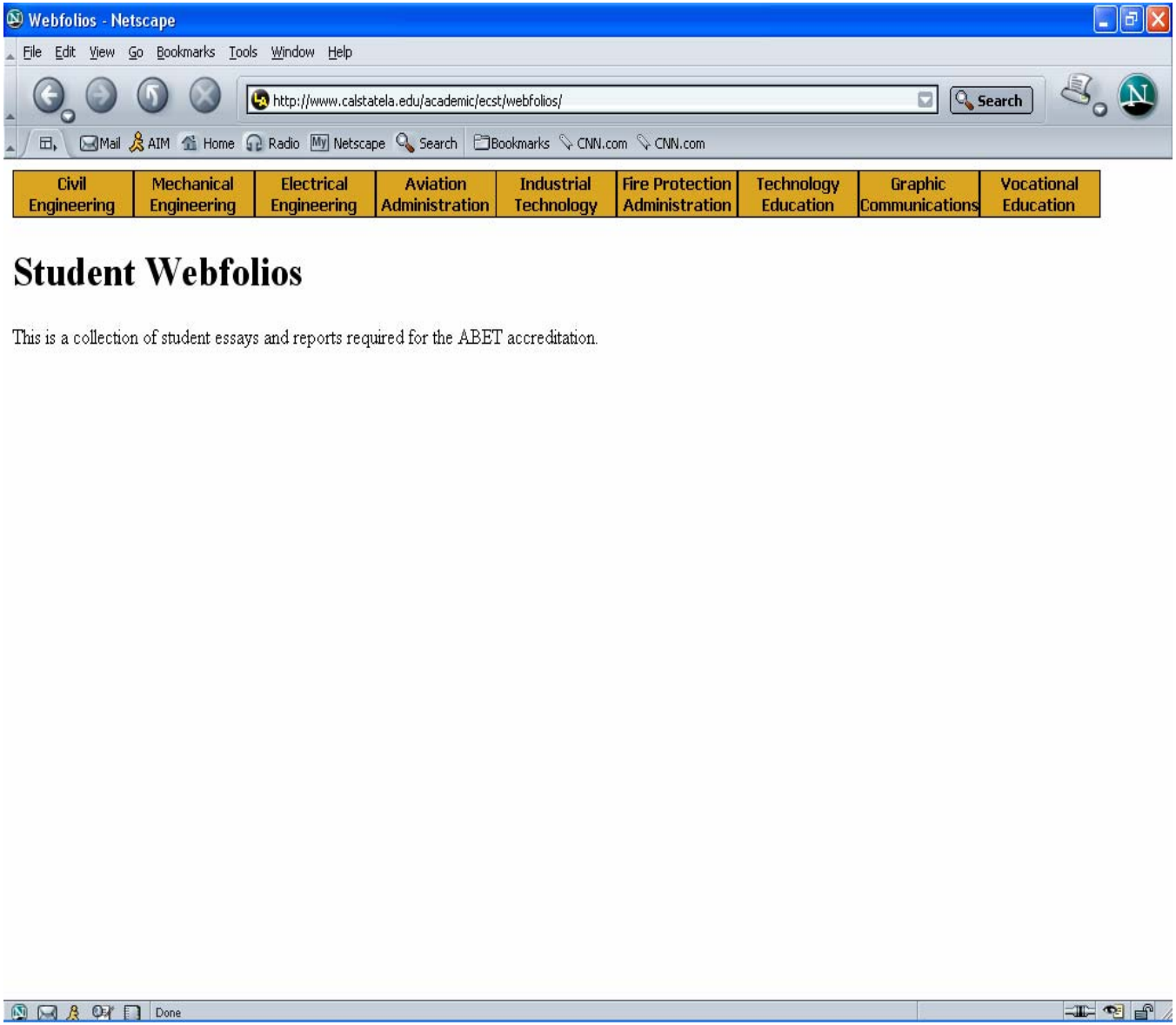
- Website sent to constituents

  http://www.calstatela.edu/academic/ecst/webfolios/

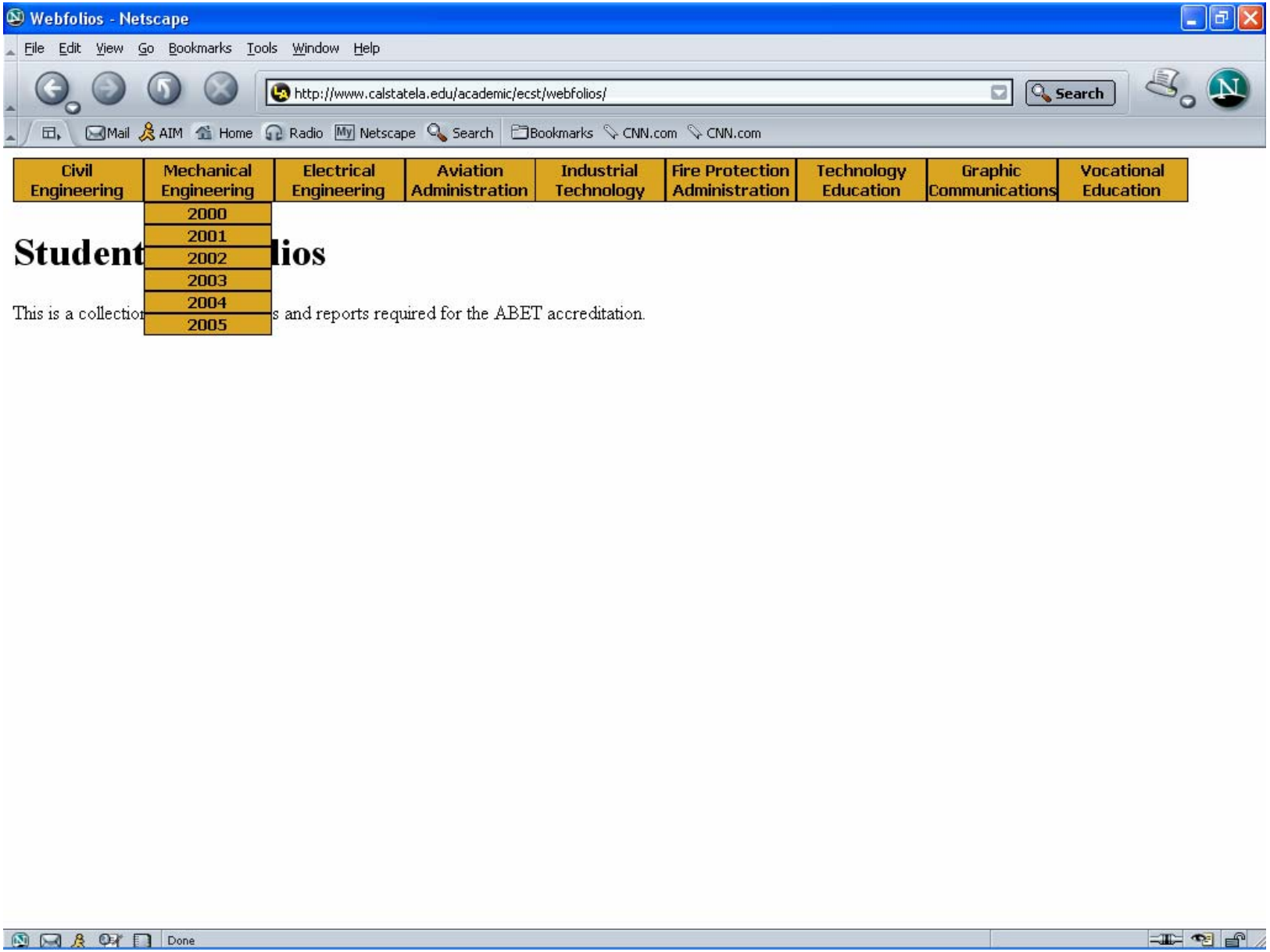
- Password provided
- Assessment rubric included



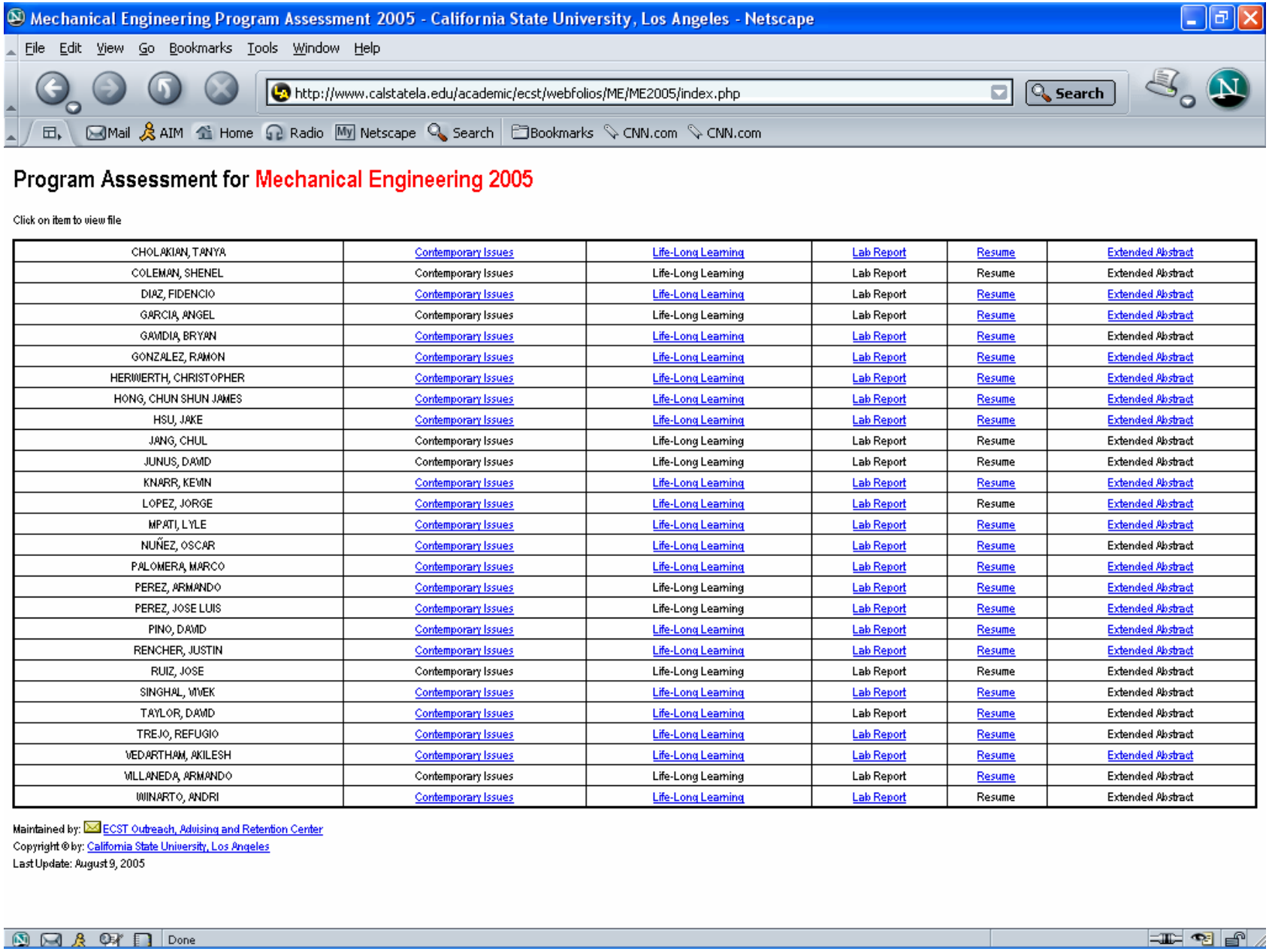
# Screen-Capture Backup #1



# Screen-Capture Backup #2



# Screen-Capture Backup #3




## Program Assessment for Mechanical Engineering 2005

Click on item to view file

| | | | | | |
|---|---|---|---|---|---|
| CHOLAKIAN, TANYA | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| COLEMAN, SHENEL | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| DIAZ, FIDENCIO | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| GARCIA, ANGEL | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| GAMDIA, BRYAN | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| GONZALEZ, RAMON | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| HERWERTH, CHRISTOPHER | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| HONG, CHUN SHUN JAMES | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| HSU, JAKE | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| JANG, CHUL | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| JUNUS, DAMD | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| KNARR, KEVIN | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| LOPEZ, JORGE | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| MPATI, LYLE | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| NUÑEZ, OSCAR | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| PALOMERA, MARCO | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| PEREZ, ARMANDO | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| PEREZ, JOSE LUIS | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| PINO, DAMD | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| RENCHER, JUSTIN | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| RUIZ, JOSE | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| SINGHAL, VIVEK | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| TAYLOR, DAMD | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| TREJO, REFUGIO | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| VEDARTHAM, AKILESH | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| VILLANEDA, ARMANDO | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |
| WINARTO, ANDRI | Contemporary Issues | Life-Long Learning | Lab Report | Resume | Extended Abstract |

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# Exams/Tests

Direct assessment (indirect are surveys)

- Course Exams
- Prerequisite Examinations
- Engineering-in-Training Exam (F.E.)
  - Externally controlled
  - Nationally normed

# Prerequisite Examinations

- Not a successful tool
- Purpose was to test students' knowledge of prior completed courses at the beginning of the subsequent course
- Very threatening to faculty

# Engineering-in-Training Exam

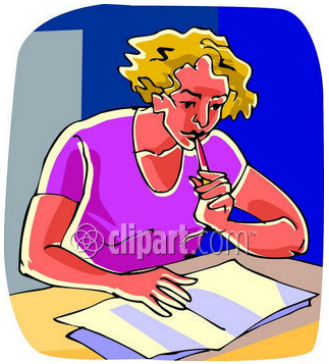
- Certification as an Engineer-in-Training (EIT) is the first step required under State law towards becoming licensed as a professional engineer
- U.S. Citizenship is not required. However, you must provide a social security number or an individual taxpayer identification number

# EIT Requirements

- Three years of course work in a ABET-approved engineering curriculum

OR

- Three years or more of engineering-related work experience anywhere in the world



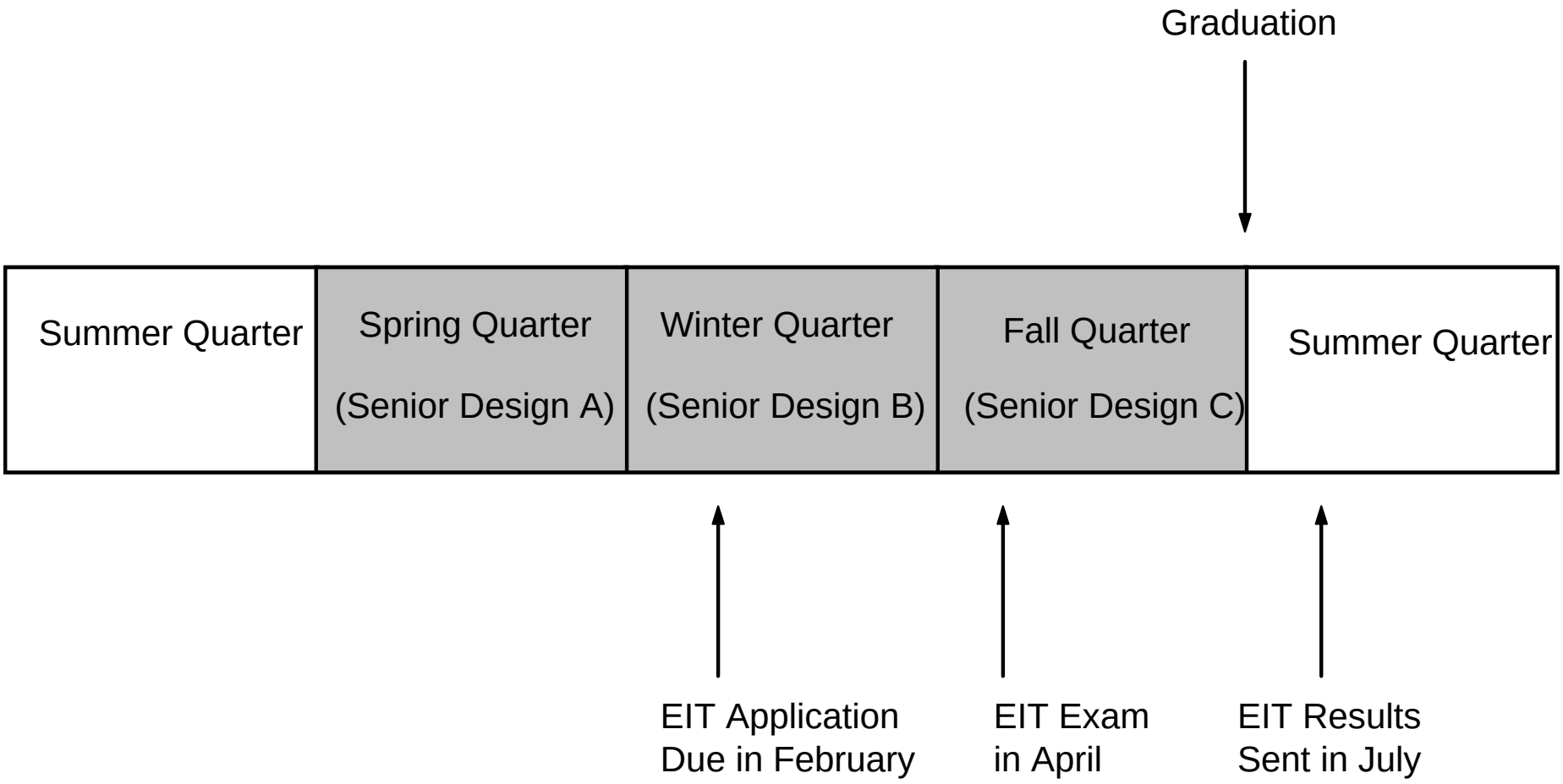
# EIT Scope

- Exam covers fundamental engineering subjects including mathematics and the basic sciences
- Two sessions:  Four-hour morning and four-hour afternoon
- In the morning, all examinees answer the same 120 questions covering the breadth of knowledge in engineering.
- In the afternoon, examinees choose one of seven subject areas

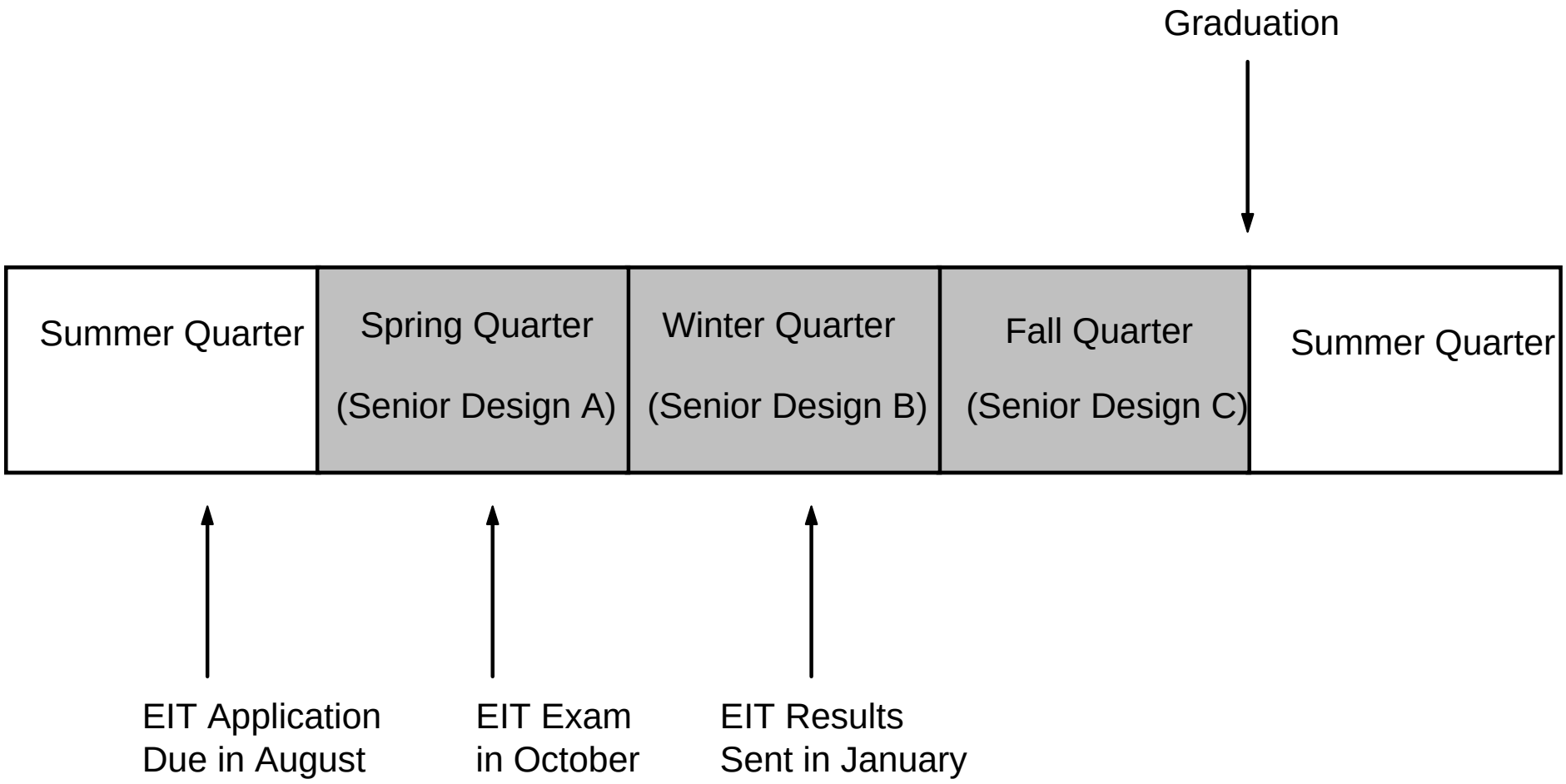
# Implementation of EIT

- How do we make it required?
  - Students will not attempt without motivation
  - Required during the capstone (senior design) course
- How do we entice students to take it seriously?
  - Effort to do well will be reflected in scores
  - Reimburse students who pass

# First Attempt at Enforcing EIT

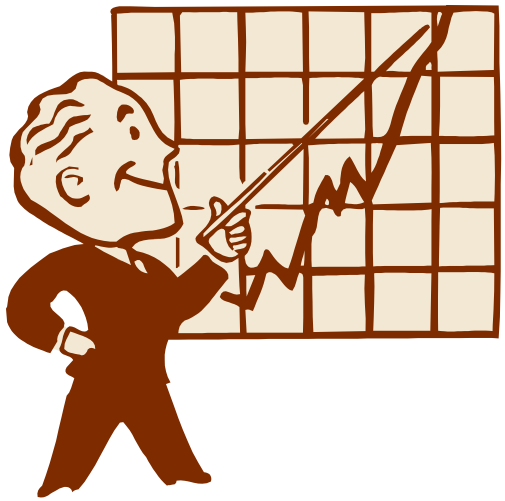


# 2nd Attempt at Enforcing EIT



# EIT Results

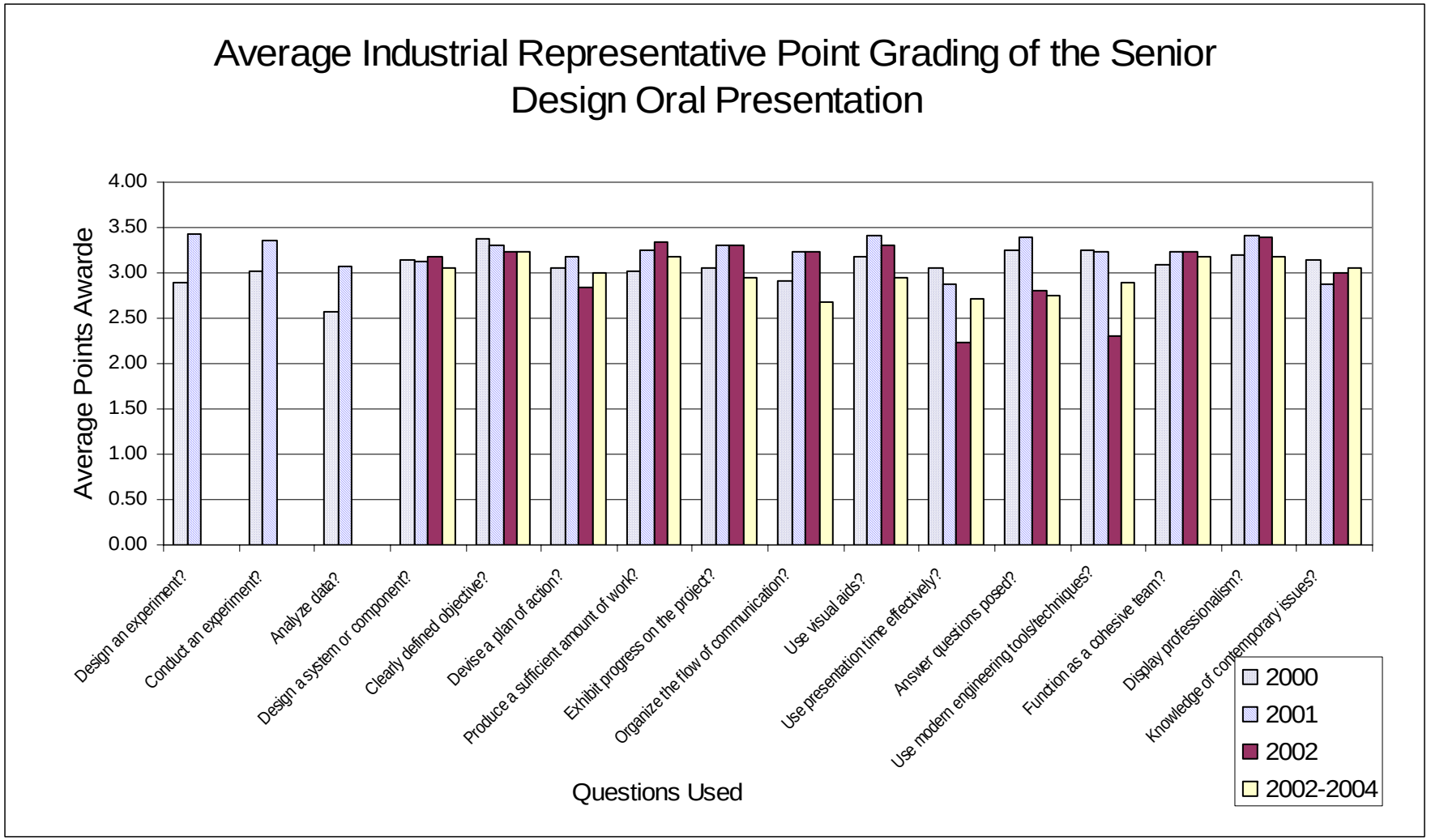
- Pass/Fail for Overall Examination
- Unanimous Statistics Sent to Dean
  - Subject (fluid mechanics, statics, etc.)
  - Average number of questions answered corrected by:
    - Your Program
    - State wide
    - National



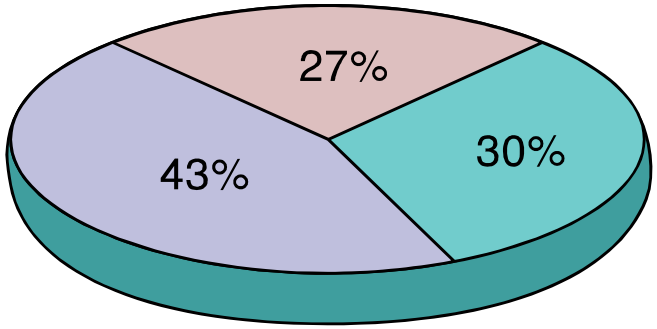
# Capstone Course Experience

- Students are hungry to finish program (a little more motivated to help us)
- Students have completed most of the program
- Good opportunity data collection
  - Senior survey
  - Writing sample
  - Final oral presentation

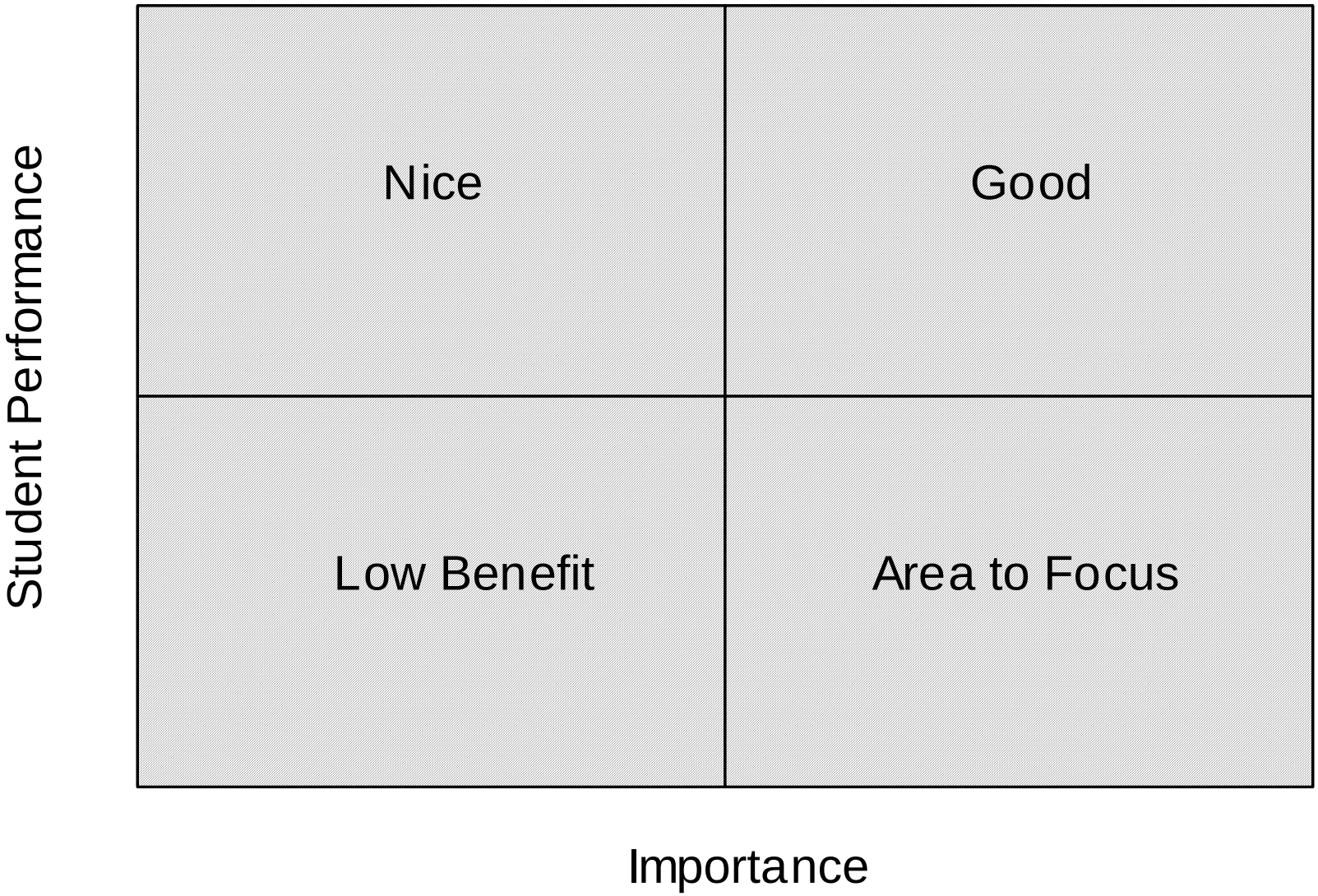
# Sample Presentation Results



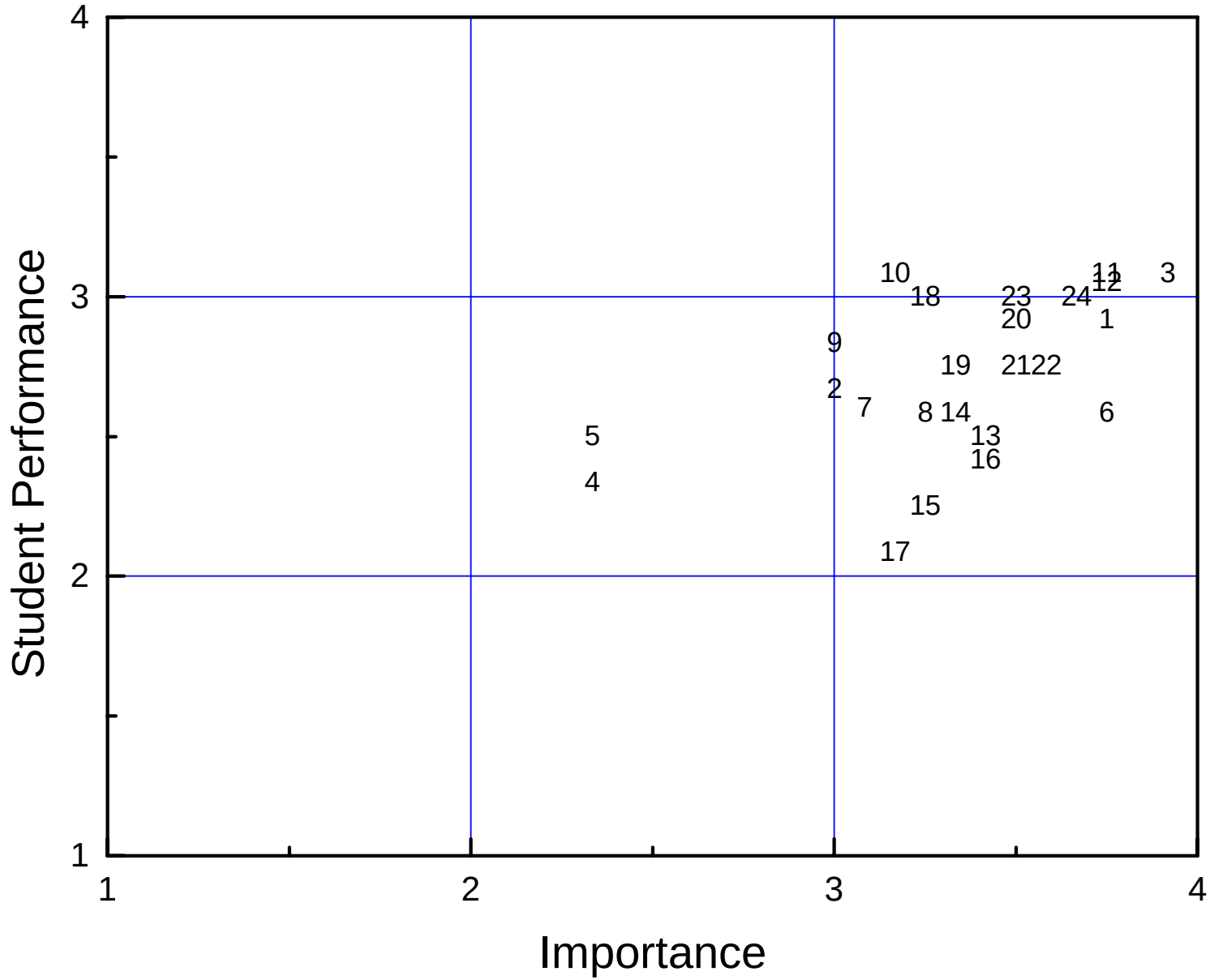
# Analysis



# Scatter Graph Interpretation



# Sample Survey Results



# Weighting Factors #1

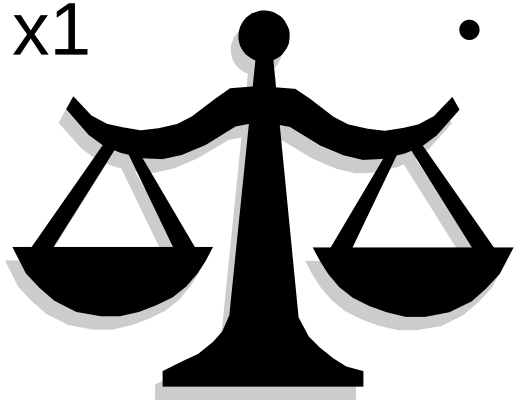
## How Do We Decide How Much Value to Place on Each Constituent?

Equal Weighting:

- Faculty Vote x 1
- Indust. Reps. x 1
- Alumni x 1
- Students x1

Unequal Weighting:

- Faculty Vote x 10
- Indust. Reps. x 20
- Alumni x 15
- Students x 5



# Weighting Factors #2

## How Much Value to Place on Each Tool?

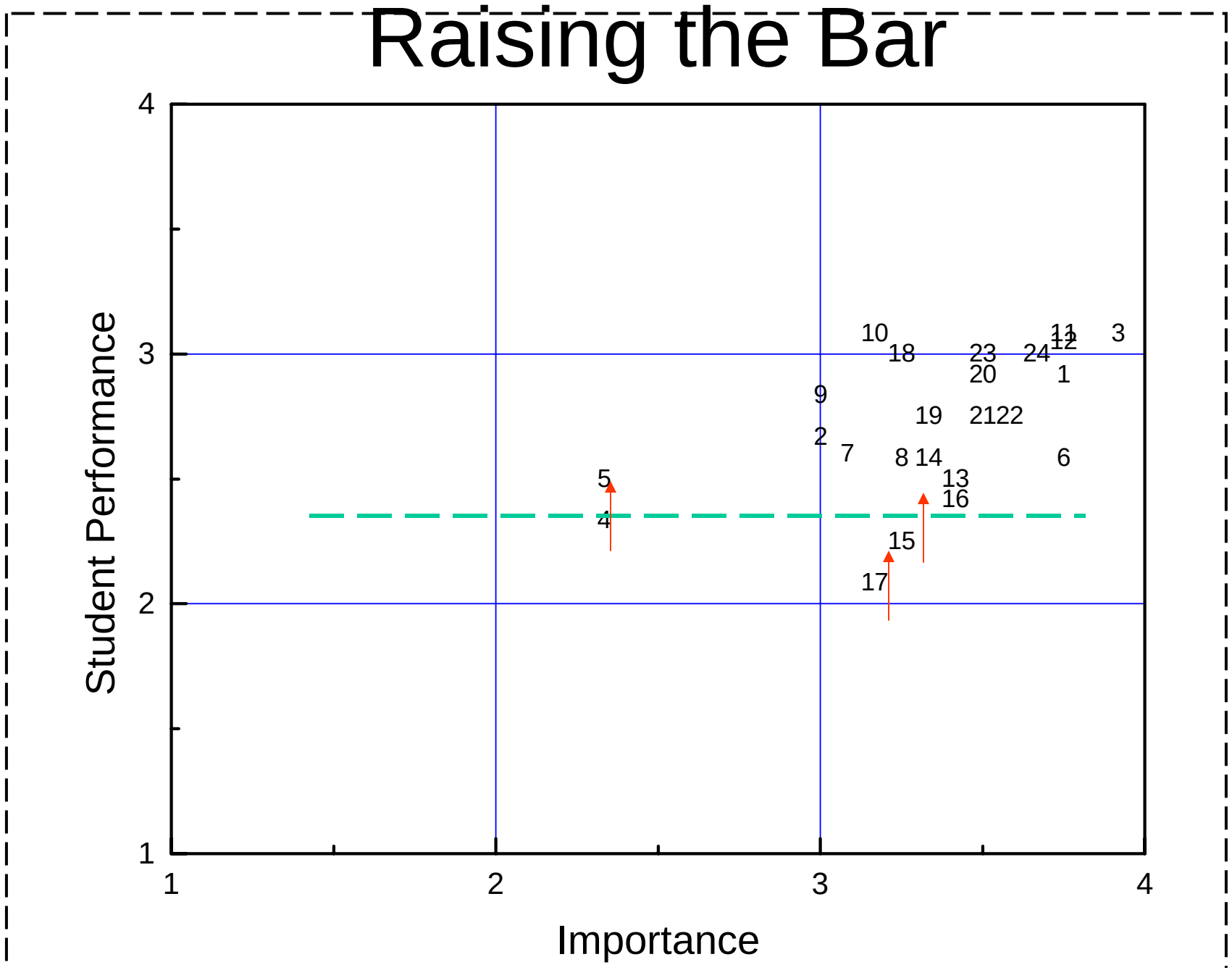
Equal Weighting:

- Survey Vote x 1
- Webfolio x 1
- Exams x 1
- Capstone x1

Unequal Weighting:

- Survey Vote x 10
- Webfolio x 20
- Exams x 15
- Capstone x 5

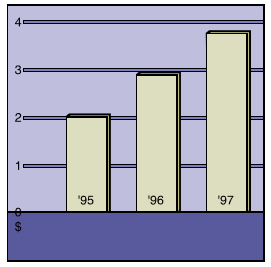
# Raising the Bar



# Program Modifications

# Strengths / Areas for Improvement

- Identifying strengths are great
  - Uplifting to faculty so see things working
  - Can be used for recruitment of students
- Areas for Improvement need action
  - Change is difficult
  - Some changes make things worse
  - A wrong modification is better than no modification



# Examples of Program Modification

- Minor (changes to existing courses)
  - Students now design their own experiments in lab courses
  - Increase group activities in classes
  - Assign current-engineering event projects

- Major (adding/deleting courses)
  - A second dynamics/kinematic course is now required
  - A technical writing course has been added

# End Result

- Participation from all constituents
- Data collected on a regular basis using assessment tools
- Data analyzed, and strengths and weaknesses identified
- Programs modified to address weaknesses