Engineering Education and Outcomes Assessment

Pramod P. Khargonekar
Dean, College of Engineering
University of Florida

Engineering Education - Context

- High school students with strong math and science background tend to consider engineering
- Engineering education prepares for jobs in industry, government (including military), graduate schools in engineering, business, medicine, law, …
- Engineering fields change and evolve
  - Pace of change seems to be increasing

Admissions

- Students admitted to UF – may indicate an interest in engineering
  - Admissions officers consider math/science preparation for engineering students
- SAT Average for Fall 03 class ~ 1305
- Requirements to continue to the upper division:
  - a C grade or better in each *tracking course* (math, physics, chemistry),
  - an average of 2.5 in these tracking courses
  - better than 2.0 overall
- Transfer students from community colleges are also required to meet similar requirements

Structure of Engineering Curriculum

- Math + Chemistry + Physics (Years 1, 2)
- Humanities, social sciences, general education (Years 1, 2)
- Core required courses in the engineering discipline (Year 3,4)
- Specialized elective courses in the discipline (Year 4)
- Key recognition: students need to be equipped for life long learning

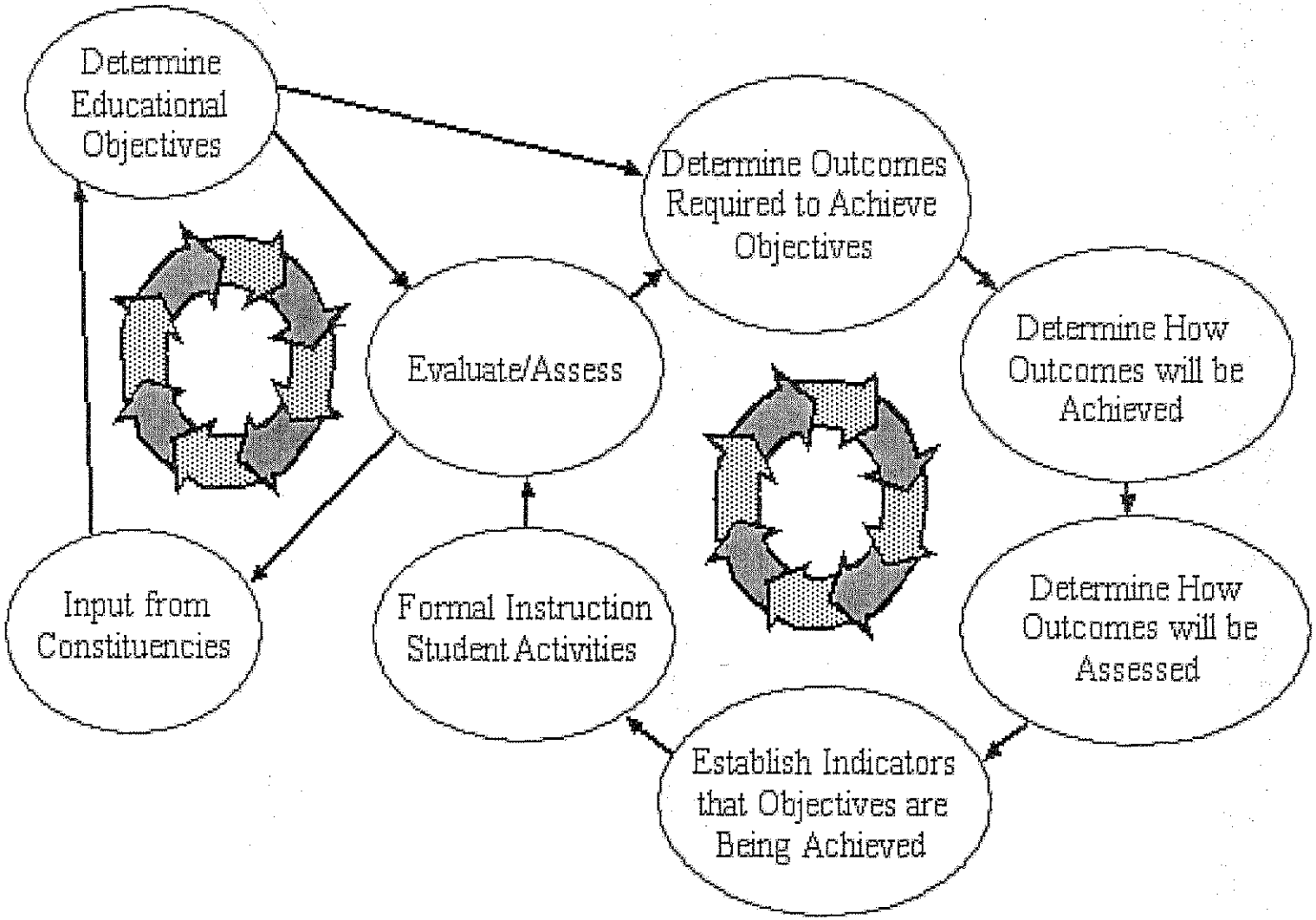
Accreditation

- Engineering degree programs are accredited by ABET (Accreditation Board for Engineering and Technology)
- In 2000, ABET changed from a "bean counting" approach to an outcomes oriented approach - *EC2000*
- Philosophy: A "measurement based continuous improvement process" to demonstrate that appropriate educational outcomes are met

Key Elements of EC2000

- Define institutional mission, college mission, program mission, program educational objectives, and program outcomes
  - For each course, explicitly define expected outcomes; demonstrate that the outcomes are measured
- Define measurements
  - Course grade, degree requirements, student portfolios, employer assessment, alumni assessment, …
- Establish processes for continuous improvement
  - Frequency of measurements, course revisions, degree requirement revisions, advising improvements,

The Two Loops of EC2000



EC2000: Specified Program Outcomes

Engineering Programs must demonstrate that their graduates have:

a. An ability to apply knowledge of mathematics, science and engineering appropriate to the discipline
b. An ability to design and conduct experiments, analyze and interpret data
c. An ability to design a system, component, or process to meet desired needs
d. An ability to function on multi-disciplinary teams
e. An ability to identify, formulate and solve engineering problems
f. An understanding of professional and ethical responsibility

ABET EC2000: Specified Program Outcomes (Cont'd)

g. An ability to communicate effectively

h. The broad education necessary to understand the impact of engineering solutions in a societal context

i. A recognition of the need for, and an ability to engage in life-long learning

j. A knowledge of contemporary issues

k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

+

Specific Disciplinary Knowledge Requirements

Student Progress Monitoring

- Each student has an advisor
  - Required to meet at least once a semester
  - Ensure that the student is making expected progress
- Student portfolio - proof to ABET that any given graduate met all the requirements specified by the ABET criteria
  - A file on each student containing a record of all courses taken, letters from advisor, internship documents,
  - Senior design project report
- *We are required to provide this proof in order to maintain our accreditation*

Professional Organizations

- Each engineering field has a professional body, e. g., IEEE (Institute of Electrical and Electronic Engineers)
- These professional societies set the standards for what is expected from fresh undergraduates in their fields
- Faculty are active members of these societies
- We have student sections of these professional societies so that our students can become involved early in their educational process

Industry Feedback

- Each department has an Industry Advisory Board
  - These boards meet once or twice a year to discuss the departmental activities and provide feedback
- College has an Engineering Advisory Council and a Dean's Advisory Board
  - Provide a higher level feedback on our education and research programs and strategic directions
  - E. g., Issues arising from "outsourcing of engineering jobs" will be discussed at the February 2004 meeting
- Employer surveys through the Career Resource Center
  - CRC & Engineering have developed a web based survey tool to automate the process

Alumni Feedback

- Exit interview with each graduating student
- Alumni are surveyed after they have been away from the College for a certain number of years
  - Get feedback after they have become seasoned professionals

Student Employment

- Companies from all over the state and the nation come to recruit our students
  - Harris, Honeywell, Raytheon, Progress Energy, Intel, Dell, Microsoft, ExxonMobil, Dow Chemical, Ford, Alcoa, …
- A sizeable fraction (~20-25%) goes to graduate schools
- Very strong demand for our undergraduates