Education for Engineering Careers

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Overview

- Personal Background
- What Do Engineers Do?
- Education
- Preparation
- WPI's Educational Philosophy
Personal Background

1979  Start college to study computers
1980  Change major to physics
1981  Change major to engineering
1982  Work co-op job as "real engineer:" I can do this!
1983  Graduate with A.B.; look for job during recession
1983-86 Design engineer; Analogic [Wakefield, MA]
1986-90 Design engineer / manager; Adaptive Optics Associates [Cambridge, MA]
1990  Enter Ph.D. program at University of Rochester
1991  Advisor at UR fired, transfer to Boston University
1994  Graduate with Ph.D.; look for job during recession
1994-? Professor at WPI
What do engineers do?

• Solve problems
  - Design products that make people's lives better
  - Smoke detector, medical imaging, communications, ...

• Make jobs
  - Design products that are basis for manufacturing jobs

• Apply creativity
  - "Scientists discover what is ... Engineers create what never existed."  -- T. von Karman, founder Jet Propulsion Laboratory (JPL)

• Make decisions
  - Choose among design options

• Communicate
  - Across disciplines of engineering
  - Across professions

• Work hard
  - Challenging problems, constraints, competitive environment
Educational Background Needed

• Solve problems
  – Science, math: "Language" of technical problems

• Make jobs
  – Social science, economics: Needs, constraints of "real world"

• Apply creativity
  – Humanities, arts: Abstract thinking, curiosity, "mental play"

• Make decisions
  – Critical thinking, logical reasoning

• Communicate
  – Writing, public speaking

• Work hard
  – High expectations, strong work ethic

⇒ EVERYTHING !!
Philosophy of Educational Preparation

- **Broad background**
  - Avoid temptation to early specialization

- **Strong work ethic**
  - Engineers try to solve difficult problems

- **Encouragement**
  - Requires hard work, persistence, coping with failure
  - Let students "dream big"
  - Communicate honestly about work required
    - "You can't do this" → "Here's what you need to do"

- **Flexibility**
  - Engineering technology, economy changes quickly

- **Creativity**
  - Open-ended thinking required for new problem solutions
Challenge to Educators

• Broad Background
  - **Not:** What area to emphasize to get people into engineering
  - **Rather:** Make sure people are not discouraged from an area; keep option of an engineering career open to as many as possible

• Encouragement
  - "A lot of people have been excluded from these fields (science or engineering) or not encouraged to try them in the first place ... minorities, humanists, all who've been made to feel inadequate in either science, engineering or math."
  - Sheila Tobias, author of "Overcoming Math Anxiety"

• **Strong work ethic**
  - High expectations + support

• Flexibility
  - Rush to specialization restricts career choices later
  - Keep options open as long as possible

• Creativity
  - Why no MCAS in creativity?
Worcester Polytechnic Institute (WPI)

- Founded 1865
- Full-time enrollment:
  - ~2700 Undergrad, ~500 Graduate
    - Small size allows close faculty interaction
- University with core focus on science, engineering, and management of technology
- Grants bachelor's, master's and doctoral degrees in 30+ disciplines
WPI's Educational Philosophy

• "Technological humanist"
  - Prepare students for entire career and life path, not just their first job.

• What Makes WPI Different
  - Humanities Project
    • Discover how creativity is expressed in nontechnical fields by exploring, in depth, an area of the humanities and arts.
  - Disciplinary Project
    • Senior year: obtain professional-level experience applying their knowledge to the solution of real-world problems
  - Interdisciplinary Project
    • Junior year: consider the impact on society of their professional work through field projects, in teams, in close collaboration with faculty mentors.
    • Often conducted at one of 12 global sites from London to Bangkok
Conclusion: For an Engineering Career ...

• What will you do?
  - Solve problems
  - Make jobs
  - Apply creativity
  - Make decisions
  - Communicate
  - Work hard

• What will you need?
  - Encouragement
  - Broad background
  - Strong work ethic
  - Flexibility
  - Creativity
Why get more people involved in engineering?

• Good jobs
• Fairness
• Diversity
• Economic Competitiveness
• "Political imperative"
  - "The goal is to break the stranglehold of lawyers and finance people on the power structure of economics and politics and to open those areas to more ... people with different backgrounds, including engineering and the sciences."

  Sheila Tobias, author of "Overcoming Math Anxiety"

  http://www.wpi.edu/About/K12/tobias.html
WPI: Top Employers of the Class of 2001

• Analog Devices
• Compaq Corporation
• EMC Corporation
• Fidelity Investments
• General Electric Company
• Lucent Technologies
• Naval Undersea Warfare Center
• Raytheon Company
• Teradyne, Inc.
• United Technologies Corporation