Evaluating a B.S. Program in Mechanical Engineering – Six Years of Surveys

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Quantitative Surveys for Program Improvement

- Based on an agreed definition of knowledge and skill goals
- Quantitative surveys measure our delivery of knowledge and skills
- Further clarification from focus groups and qualitative surveys
- Knowledge and skill goals are subject to possible revision

Specific Knowledge Topics

- Mathematics/sciences
- Mechanics
- Materials science
- Thermodynamics
- Heat transfer
- Fluid mechanics
- System dynamics
- Machines/mechanisms
- Design
- Manufacturing
- Numerical computations
- Exposure to practice
- Professionalism, ethics, society, environment

Specific Skills

- Product design and realization
- Math modeling
- CAD modeling and tools
- Sound engineering judgement
- Choose and evaluate materials
- Choose and evaluate manufacturing processes
- Communication skills
- Ability to work in teams

The Survey

- Qualitative information
- Emphasis on knowledge and skills rated by
  - Career Importance (Scale of 1- 5)
  - Importance in UB Program Coverage (Scale of 1- 5)
- Percent "Short Fall" combines the two importance measures:

$$100 \times \frac{\text{Career Importance - UB Importance}}{\text{UB Importance}}$$

Survey History

Surveys before program revision

- Graduating seniors
  - Classes of 1999 and 2000
- Alumni (conducted in 2000)
  - Classes of 1994 - 1998

Continuing surveys since revision

- Graduating seniors
  - Classes of 2001, 2002, 2003 and 2004

Initial Survey Conclusions

(in 2000)

- Weaknesses in
  - exposure to practice, manufacturing, design, prof/ethics/env/society
- More focus on skills, especially
  - CAD, communications skills, manufacturing processes, engineering judgement
- Graduating seniors and alumni in general agreement

Targeted Program Additions

(effective in 2001)

- **Introduction to ME Practice** (MAE 277)
  - Reverse engineering, design projects and communication skills: for sophomores
- **Design in a CAD Environment** (MAE 377)
  - Mechanical design projects using AutoCad and ProE: for juniors
- **Manufacturing Processes** (MAE 364)
  - A traditional course in manufacturing
- **Design Processes** (MAE 451)
  - Original course expanded from 2 to 3 credits
- **Applied Math for MEs** (MAE 376)
  - Specifically for ABET requirements in linear algebra and statistics

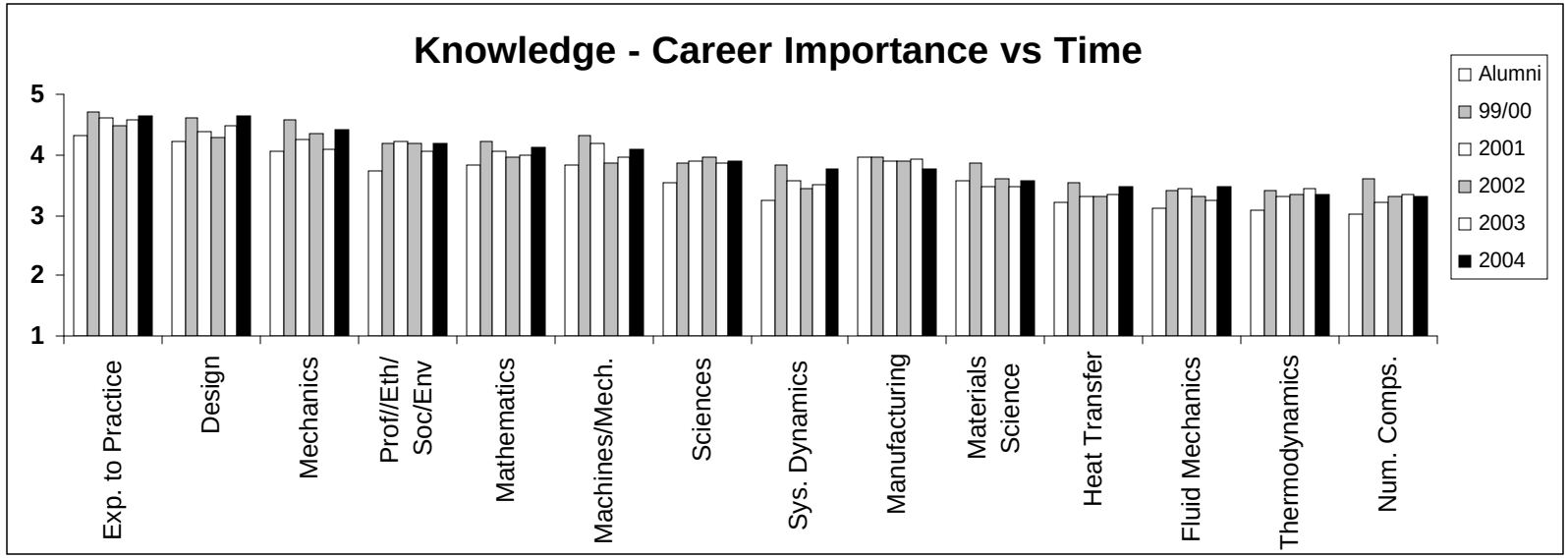
BSME Program
(after revision)

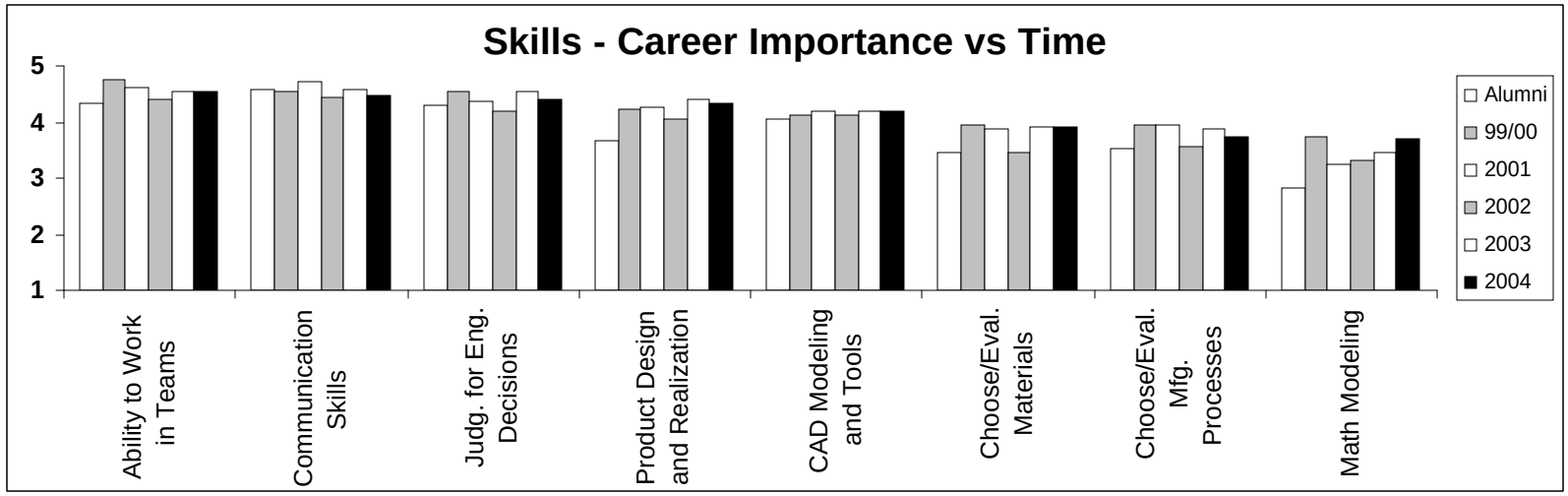
- **Math, Physics, Chemistry** (8 courses)
- **Engineering Fundamentals** (7 courses)
  - Drawing, Programming, Thermo, Statics, Dynamics, Strength, EE Concepts
- **Design/Practice** (4 courses)
  - ME Practice, Design with CAD, Design Processes, Capstone Design
- **Mechanical Engineering Basics** (10 courses)
  - Instrumentation, Fluids, Materials, ME Math, Dynamic Systems, Heat Transfer, Machine Design, Manufacturing
- **Laboratories** (4 courses)
  - Instrumentation, Materials, Systems, Fluids/Heat
- **Electives** (5 courses)
  - four technical, one applied math
- **General education**

Year by Year Survey Results

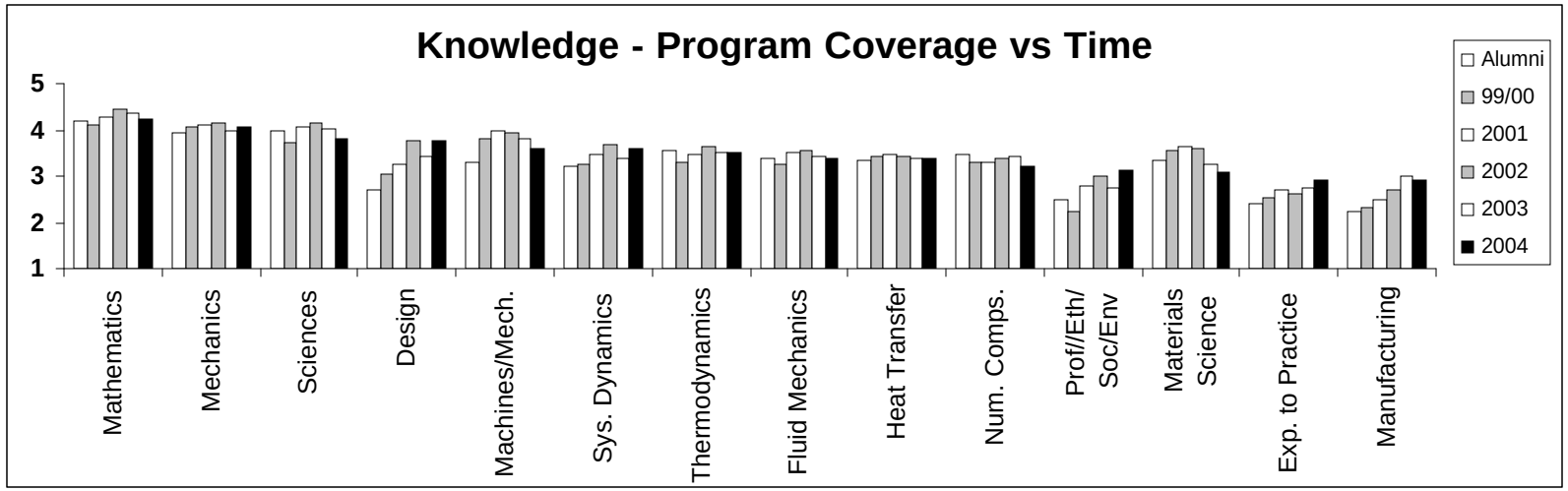
- Career Importance surveys show consistency from year to year
- UB Importance surveys reflect the targeted program changes
- Short Fall results since revision show improved
  - Design, manufacturing, CAD
  - Practice, professionalism, judgement
- Short Fall results since revision show little effect on traditional technical and science topics

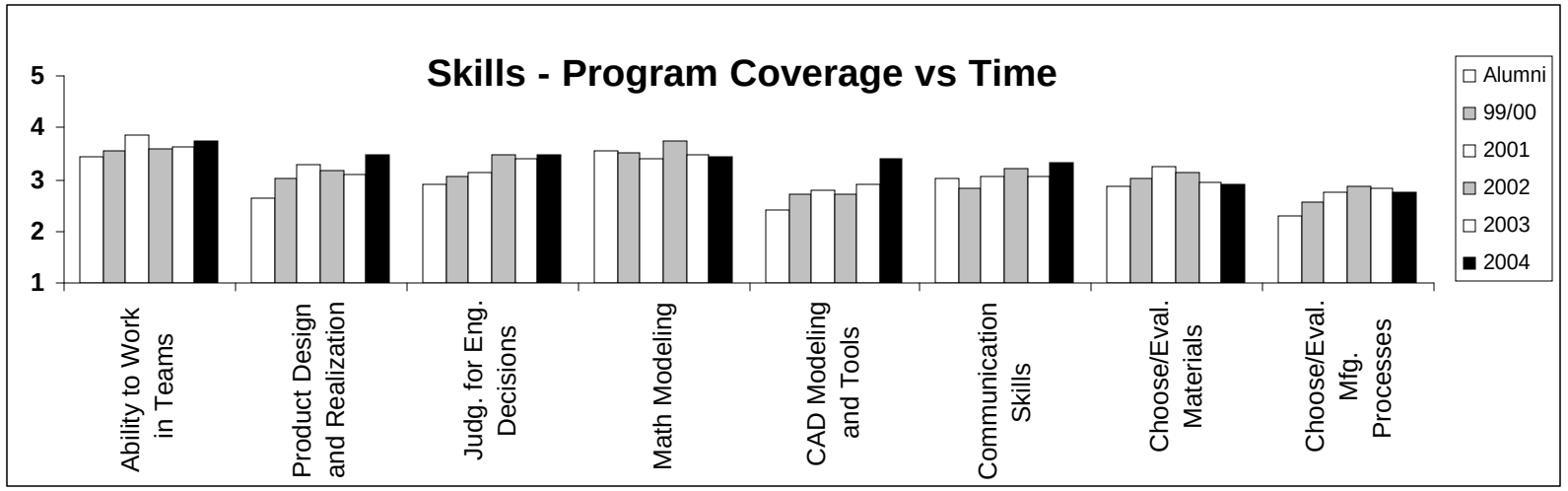
Career Importance Plots



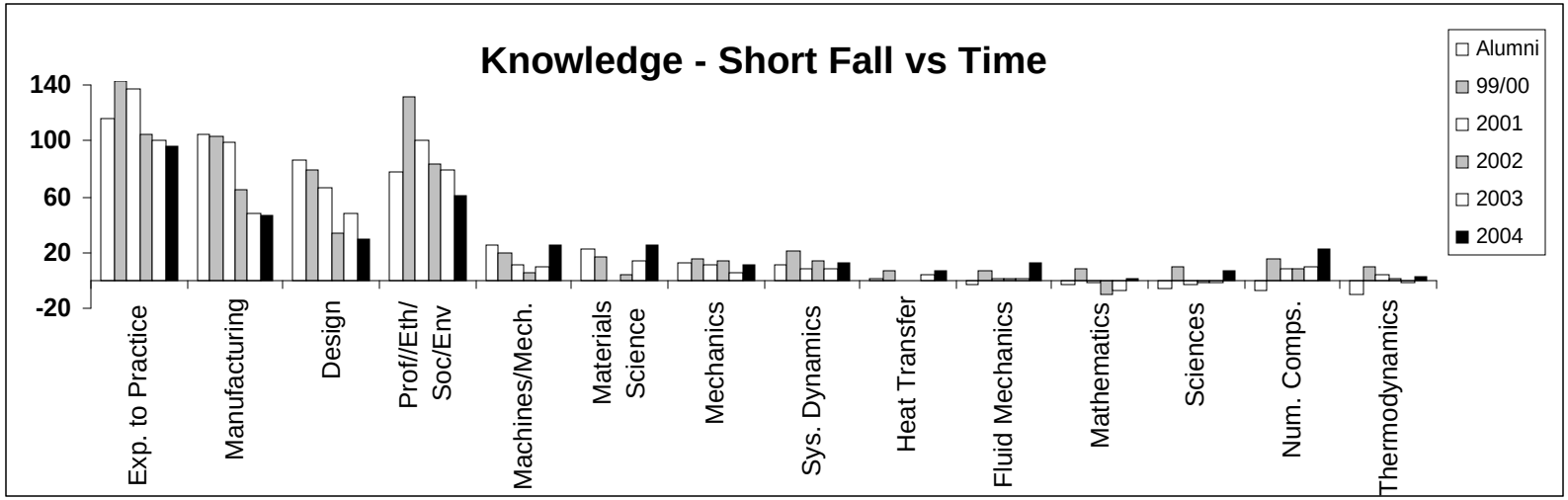


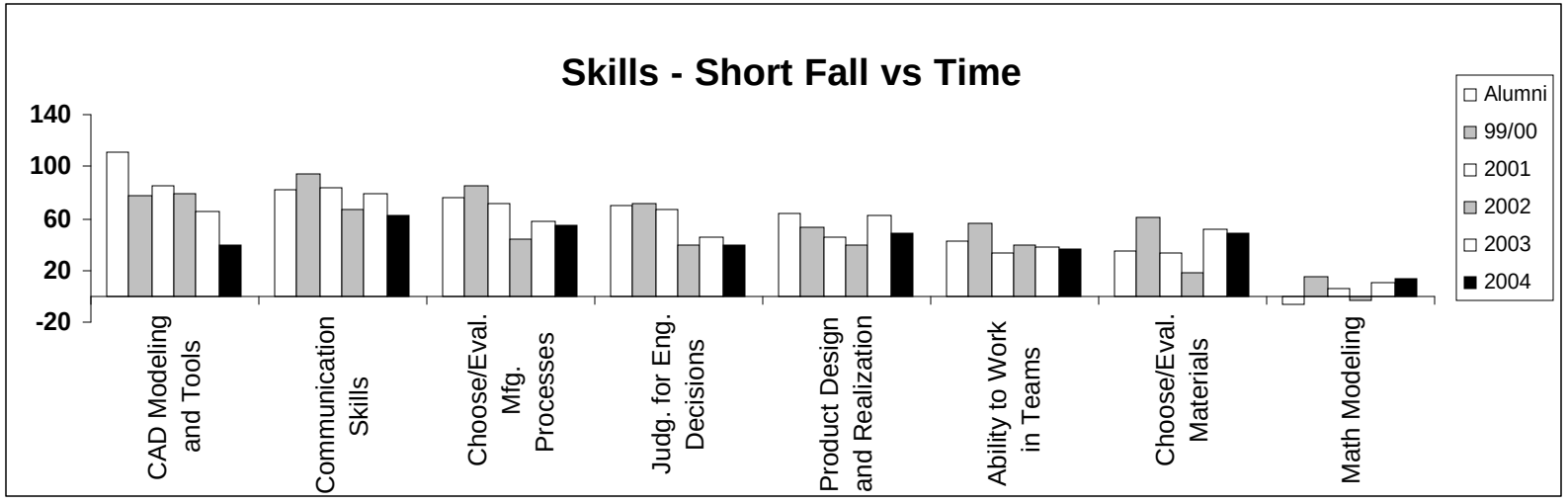
Importance in UB Program Coverage





Short Fall


Knowledge - Short Fall vs Time
140
100
60
20
-20
Alumni
99/00
2001
2002
2003
2004
Exp. to Practice
Manufacturing
Design
Prof//Eth/ Soc/Env
Machines/Mech.
Materials Science
Mechanics
Sys. Dynamics
Heat Transfer
Fluid Mechanics
Mathematics
Sciences
Num. Comps.
Thermodynamics


Skills - Short Fall vs Time
140
100
60
20
-20
Alumni
99/00
2001
2002
2003
2004
CAD Modeling and Tools
Communication Skills
Choose/Eval. Mfg. Processes
Judg. for Eng. Decisions
Product Design and Realization
Ability to Work in Teams
Choose/Eval. Materials
Math Modeling

Closing Comments

- Our current program emphasis is on further improving
  - exposure to practice, professionalism, communications
- Second five-year alumni survey planned for 2005 (classes of 1999-2003)
- The quantitative survey approach has been a valuable tool for understanding student needs and overcoming faculty inertia