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Second NSF Workshop on
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CPACE

Computing and Undergraduate Engineering: A Collaborative Process to Align Computing Education with Engineering Workforce Needs

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CPACE Goals

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- Bring together academics, business and industry, professional organizations
- Create a collaborative process to redesign undergraduate computing curriculum
- Document and evaluate the process
- Prepare CPATH Transformation grant proposal to implement redesign of computing education in engineering programs

Collaboration from the Start

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- Four year engineering programs
  - Michigan State University
- Two year transfer and technical programs
  - Lansing Community College
- Engineering employers
  - Corporation for a Skilled Workforce
    - Workforce Innovation in Regional Economic Development (WIRED)
      - Mid-Michigan Innovation Team (MMIT)
- Evaluation
  - Science and Mathematics Program Improvement (SAMPI) at Western Michigan University

Traditional Curricular Model

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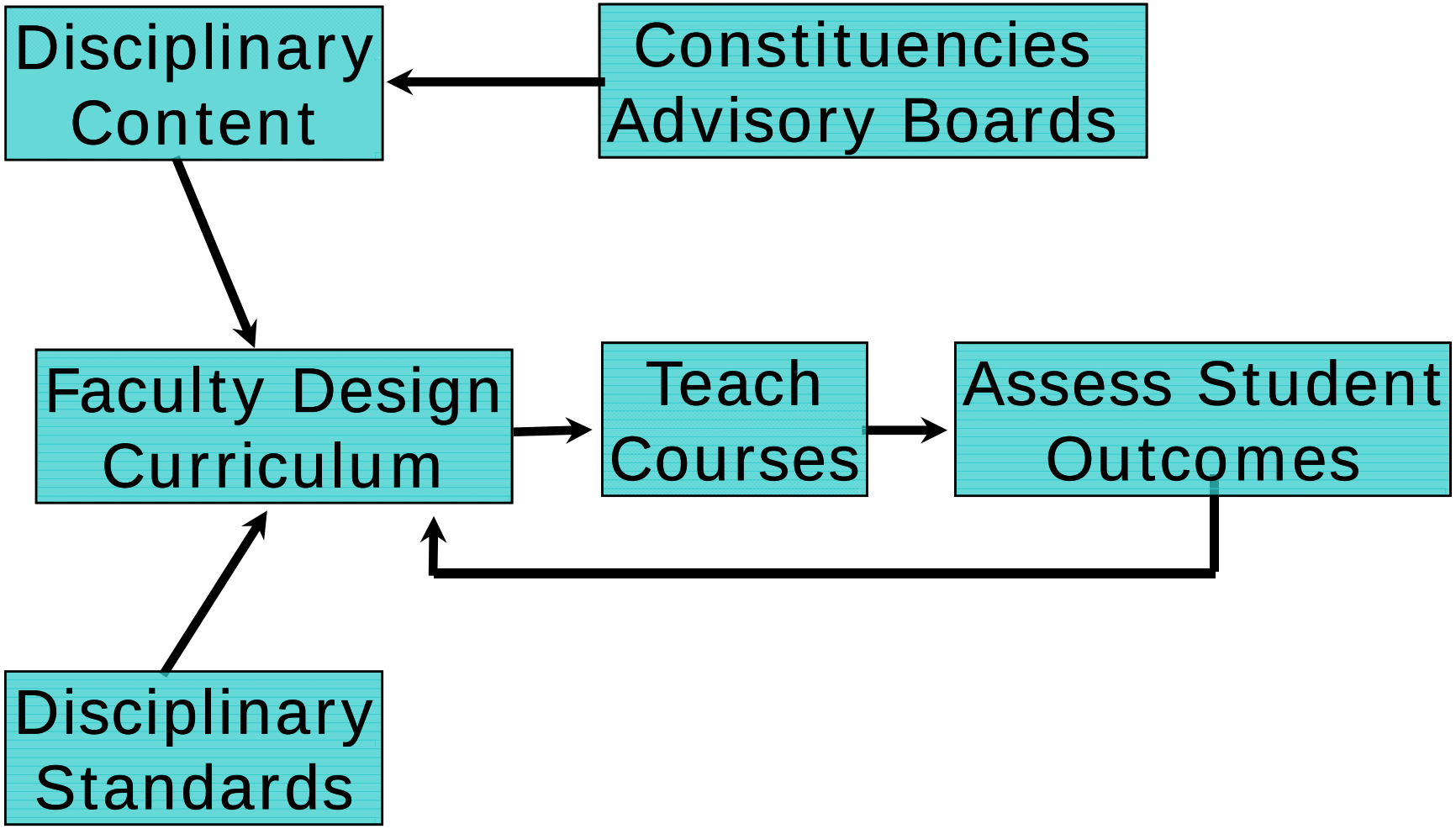

Transformation Model

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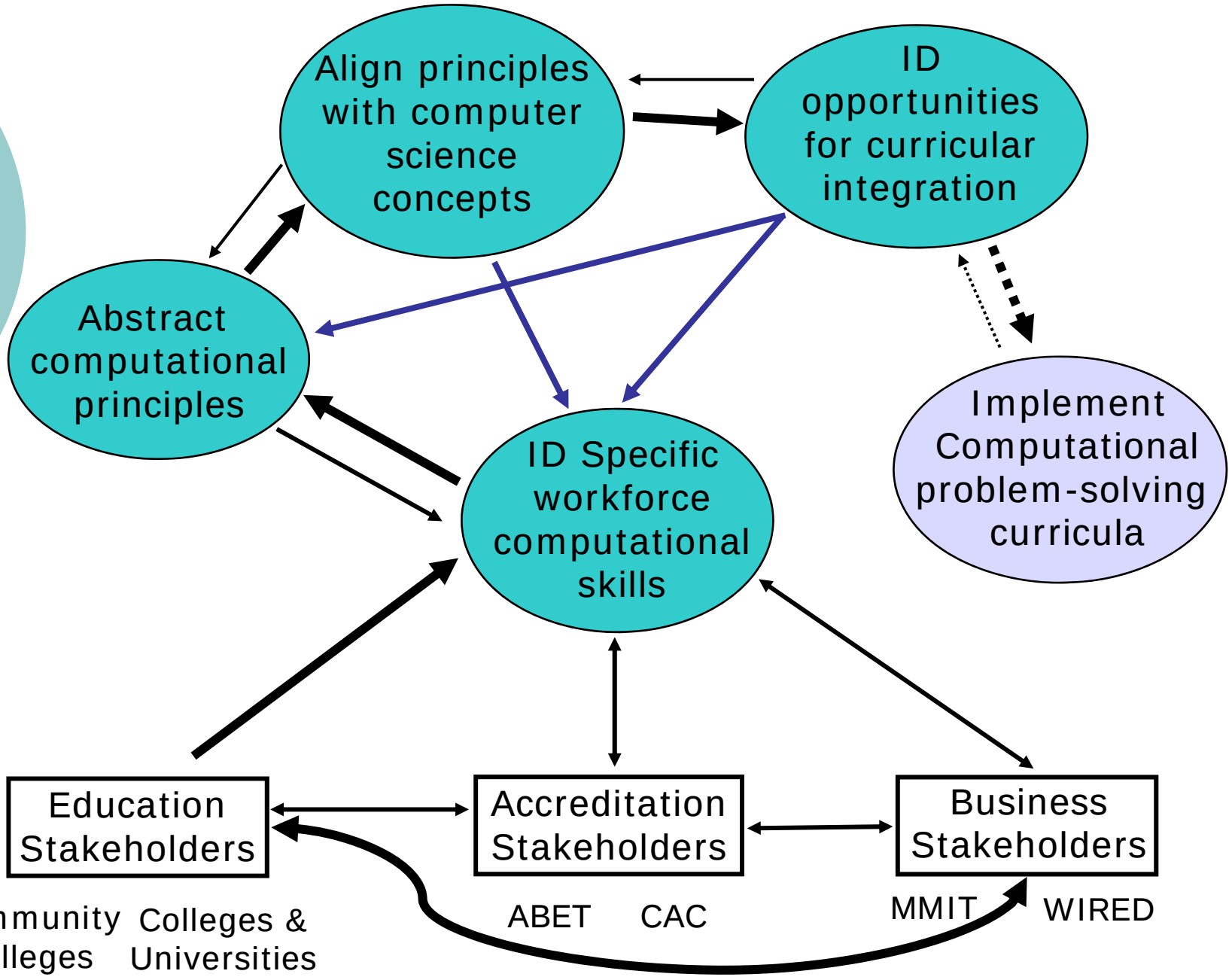

Anticipated Outcomes

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- Develop engagement process
- Identify and engage stakeholders
- Collect data about workforce computational needs
- Identify key computational problem solving skills
- Abstract computing principles and concepts aligned with computational problem solving skills
- Disseminate findings
- Evaluate the project model and prepare reports of each phase of the activity
- Submit full implementation NSF CPATH Transformation grant

Current Status

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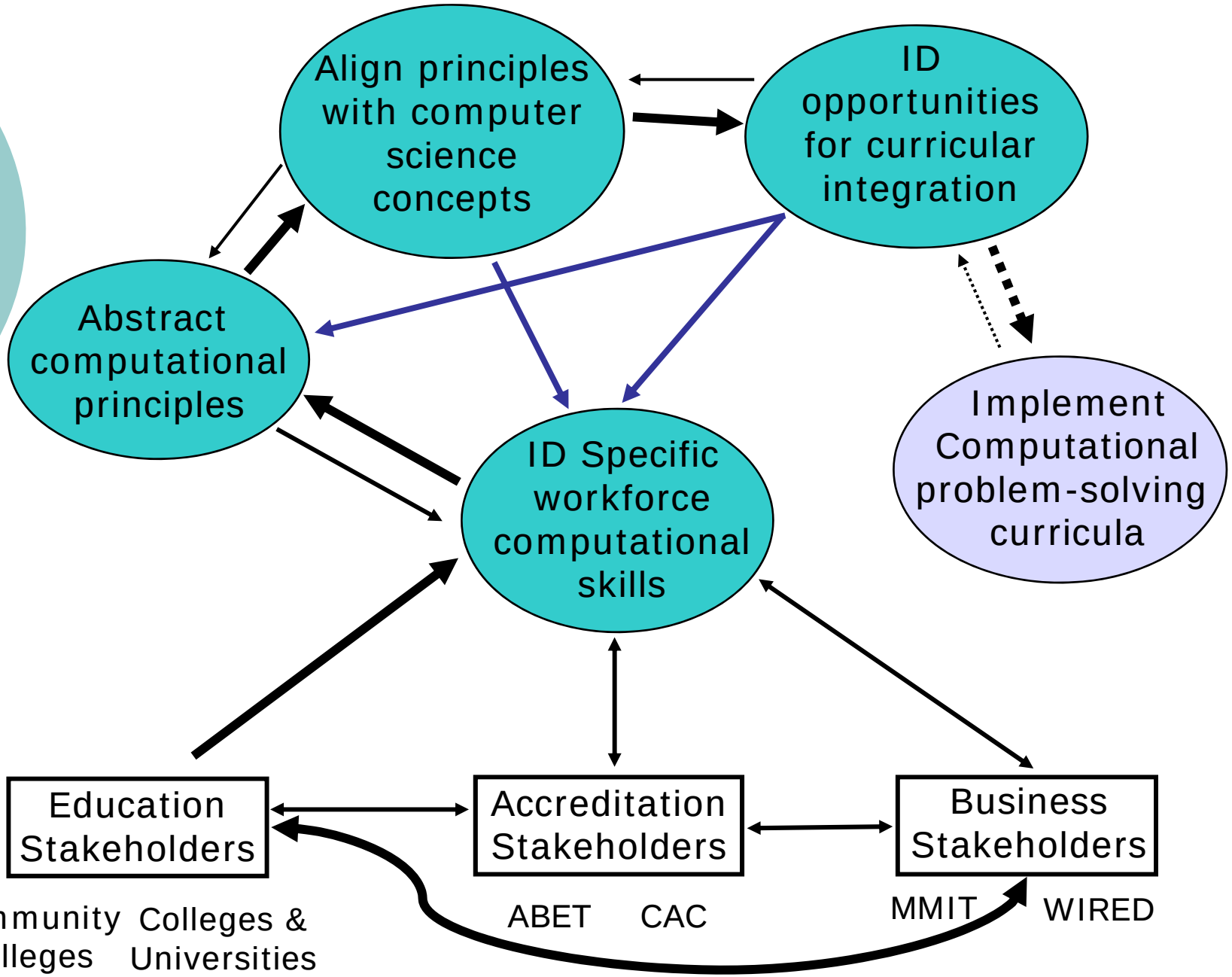

Summary of Preliminary Data

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- Employer interviews
  - Seven pilot interviews
  - Six interviews with companies represented by the AB members
- Focus: Role of technology and computation to meet engineering challenges

Summary of Preliminary Data

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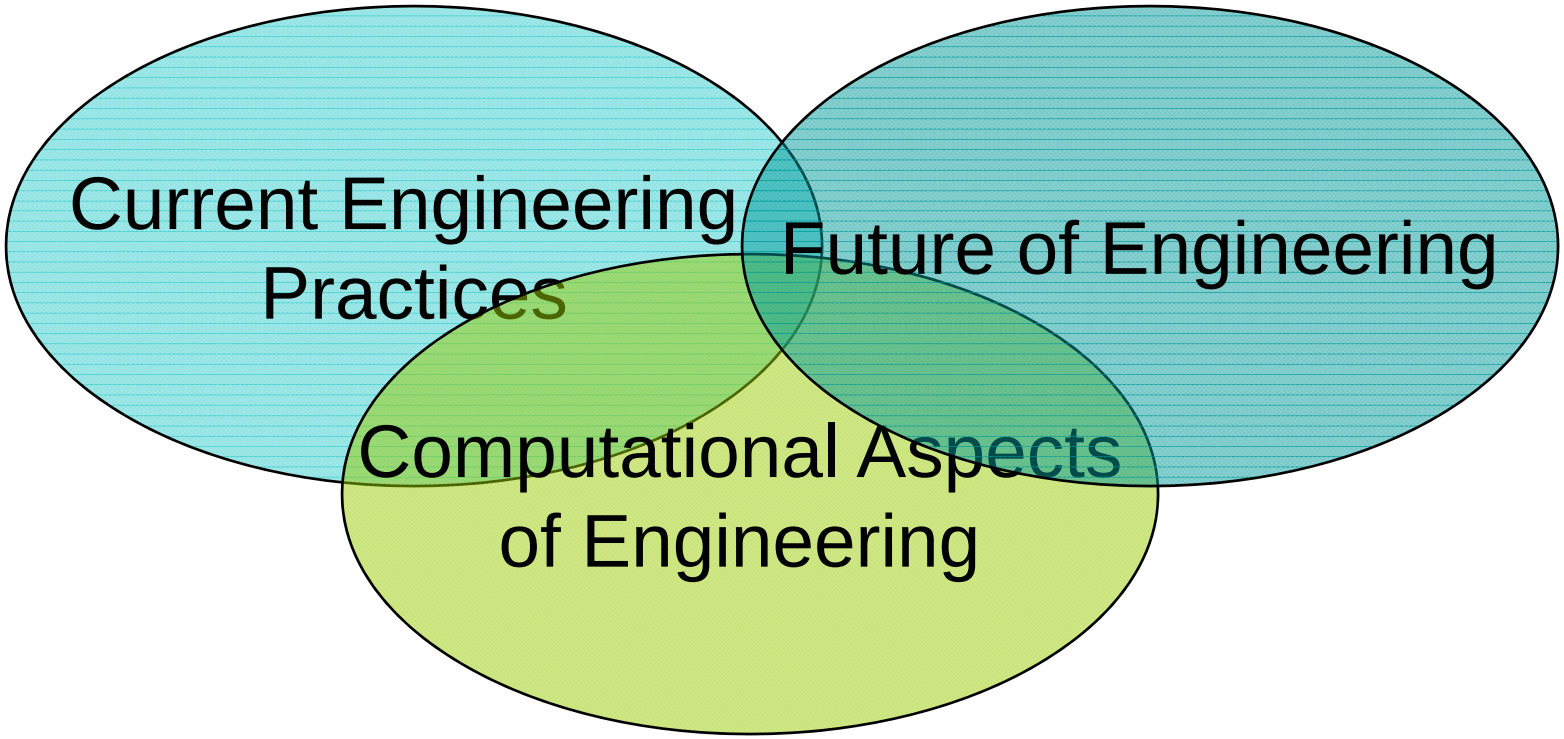

Current Engineering Practices

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- Communication skills.
  - Ability to organize and present data
- Team work
- Critical thinking
- Innovative thinking
- Problem solving; (both conceptual and operational)
- Ability to learn/adapt/multitask
- Ability to move between abstractions in software and physical systems
  - Understanding principles, application and limitations of computational tools
- Need basic computational skills
- Using technology to collaborate across/outside organization
- Using tech to support broad problem solving and decision making
- Understanding business practice

Computational Aspects of Engineering

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- Multiple CAD programs including 3D modeling
- Process simulation packages
  - Design to manufacturing
- Numeric computational platforms
  - e.g. MATLAB, MATHCAD, Mathematica, MAPLE, PolyMath
- Software collaboration tools
- Project management software
- Excel (high level capabilities)
- MS Office
- Knowledge of some programming
  - (e.g. Visual Basic)
- Facile with multiple software systems

Future of Engineering

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- Corporate development, leadership, management skills
- Increasing integration of engineering data across larger systems (i.e., logistics & ordering)
- Globalization
- Design for the Environment (DFE)
- High computational level
  - Programming to an end result
- More experience in R & D
  - New applications for existing materials
  - Material development
  - Electronic communication
  - Next generation of technology?
  - Increasing use of simulation to reduce materials usage in design phase

Process Lessons So Far

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- About the value and effects of the CPACE partnership
  - Each partner brings skills and resources to the project
  - Effectiveness of collaboration when core outcomes and implementation strategies were understood by everyone
  - Considering needs of all partners strengthens partnership
- About collaborating to develop/pilot project materials
  - Establishing “rhythm” takes time
  - Data collection instrument development took a lot of time
- About conducting interviews/surveys
  - Value in broadening number and kinds of participants
    - Engineers must be included in the interviews
  - Interviewees very willing to share ideas, insights, and perspectives
  - Advisory Board provided entré to participants

CPACE Team

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Questions?

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