

Leveraging Workforce Needs to Inform Curricular Change in Computing Education for Engineering: The CPACE Project

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ASEE Session 1809

Monday, June 15, 2009

Acknowledgements

CPACE Advisory Board

- o Benjamin H. Baker, GMNA Electrical
- o Angie Becker, Global Engine Manufacturing Alliance (GEMA)
- o Thomas Crampton, Mott Community College, Regional Technology Initiatives
- o James B. Cross, Hemlock Semiconductor Corporation
- o Mary Ann Dolehanty, Michigan Department of Environmental Quality, Air Quality Division
- o David Hollister, Prima Civitas Foundation
- o Chris Knapp, Capital Area Information Technology Council
- o Thomas Mathes, U.S. Army Tank Automotive Research Development and Engineering Center
- o Michael McDonald, North America Polyurethanes
- o James Millhench, Bordener Engineered Surfaces
- o Garth Motschenbacher, College of Engineering/Career Services Network, Michigan State University
- o John Polasek, Michigan Department of Transportation
- o Steve Richey, Kellogg
- o Gary Woodrough, Symmetry Medical Jet

This material is based upon work supported by the National Science Foundation under award 722221. Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation (NSF).





Overview


- NSF CPATH Goals
- CPACE Project
- CPACE Research
- Results
- Future Directions



NSF's CPATH Pathways to Revitalized Undergraduate Computing Education

- Transform undergraduate computing education on a national scale
- National calls to revise engineering education
 - Globalization
 - International competition
 - Increasingly diverse population
 - Rapid growth in information technologies





CPACE: Collaborative Process to Align Computing Educating with Engineering Workforce Needs

- Design a collaborative process between businesses, community leaders and post secondary educators
- Identify workforce computational skills
- Propose and implement revised curricula that integrate computational problem solving across engineering

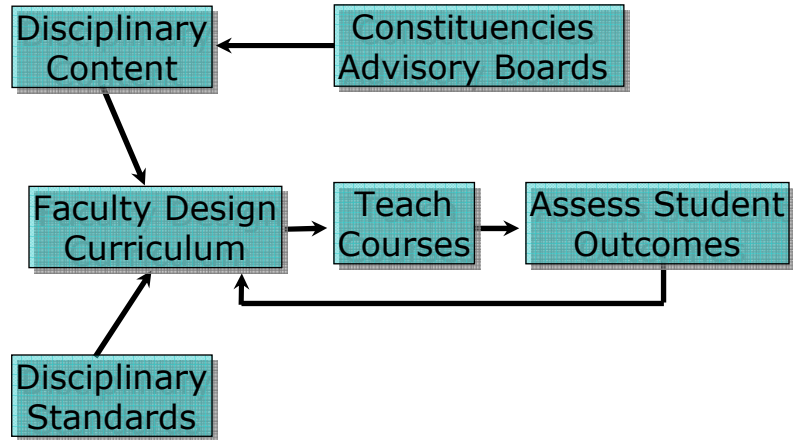


CPACE

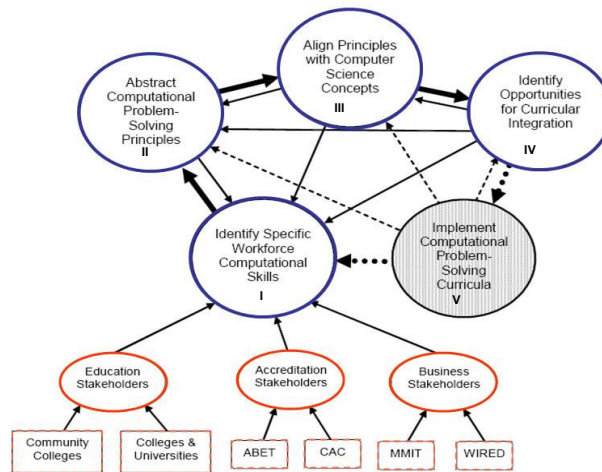
- MSU, LCC, CSW, SAMPI
- Transform undergraduate computing education within the engineering and technology fields
- Collaborative partnership to identify computational skills
- Revise engineering curricula to address computational problem-solving aligned with industry needs
- Document process



Traditional Curricular Model



CPACE Transformation Model





Identify and Engage Stakeholders

- Convene advisory board
 - Federal labor market data on employment sectors and job distribution
 - Represent business, industry and academia
- Perspectives on needs for computation in engineering practice
- Identify participants for interviews and surveys



Engagement: Identify Employers and Employees

- MSU, LCC, CSW and AB recruit employers
- Value proposition
 - Reduced and better-directed training
 - Improved understanding of their engineering workforce and practices compared with other companies.
 - Extending and/or establishing networks.
 - Having a stake in the regional new economy
- Personal contact important





Employer Sample

- 27 employers
- Industry representation
 - National and regional representation
 - Mid-Michigan presence
- Engineering disciplines
 - Chemical engineering
 - Mechanical engineering
 - Civil engineering
 - Electrical engineering



Develop Instruments

- Determine stakeholders' perspectives on engineering computational skills needed in their business sectors
 - Employer interview
 - Employee survey





Employer interviews analyses

- Audio record plus interviewer notes
- Cross check with interviewer notes
- Reviewed by faculty
- Themes
 - General Skills
 - Computational Skills
 - Future Engineering Practice



General Skills

- Communication skills
- Team work
- Critical thinking
- Innovative thinking
- Problem solving (both conceptual and operational)
- Ability to learn/adapt

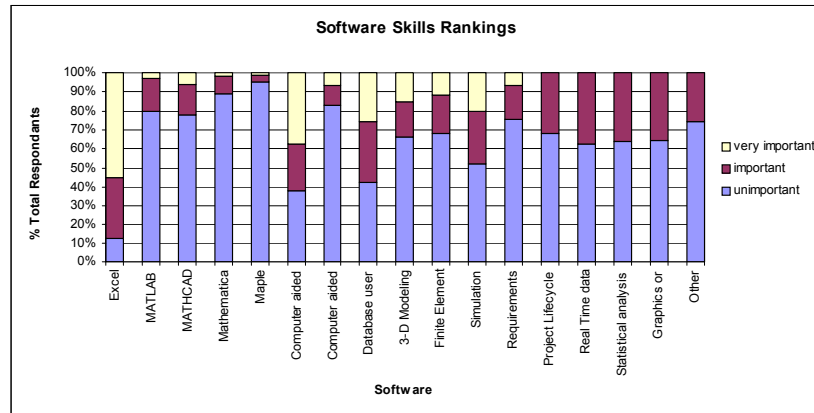


Computational Skills

- Foundation: basic computational skills
- Understanding principles, application and limitations of computational tools
- Collaborate across/outside the organization
- Support broad problem solving and decision making
- Move between abstractions in software and physical systems
 - Multiple CAD programs including 3D modeling
 - Process simulation
 - Numeric computation
 - Excel
 - MS Office
 - Some programming



Employee survey analyses



Future of Engineering Practice

- Integration of engineering data across systems
- More business intelligence embedded in systems
- Data Mining
- Globalization, working with global timetables
- Environmental impact across disciplines
- Research and development
 - New applications for existing materials
 - Material development
 - Electronic communication
 - Next generation of technology
 - Simulation to reduce materials usage in design phase



Industry Report

Aligning Computing Education
with Engineering Workforce Needs

2009 | BUSINESS AND INDUSTRY REPORT



Available for download
<http://cpace.egr.msu.edu>

External Evaluation

- SAMPI
 - Science and Mathematics Program Improvement, Western Michigan University
- Meeting participation
- Focus groups
- Interviews
- Reporting to project team, AB, NSF



Evaluation: Lessons Learned

- CPACE partnership
 - Good mix of perspectives, knowledge, skills
 - Takes time: different perspectives
 - Outcomes and implementation strategies understood by everyone
- Interviews/surveys
 - Engineers must be included in interviews
 - Willing to share ideas, insights, and perspectives
 - Interviews variable across sites
 - Advisory Board provided entre to participants
- Engineering and computer education
 - Employers value critical thinking
 - Importance of communications, team work
 - Engineering courses need mix of computing and other skills
 - Design for manufacturing





Future Directions

- Implementation proposal
 - Integrate computation across curriculum
 - MSU & LCC
 - Chemical & Civil
 - CPACE Engineering Talent Development Network
- CPATH Community Web site



Questions

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