A Collaborative Process to Align Computing Education with Engineering Workforce Needs (CPACE)

MSU Team - Daina Briedis, Neeraj Buch, Abdol-Hossein Esfahanian, Jon Sticklen, Mark Urban-Lurain, Claudia E. Vergara
LCC Team - Louise Paquette, Jing Wang
Corporation for a Skilled Workforce Team - Cindee Dresen, Kysha Frazier
correspondence to sticklen@msu.edu - website at http://cpace.egr.msu.edu

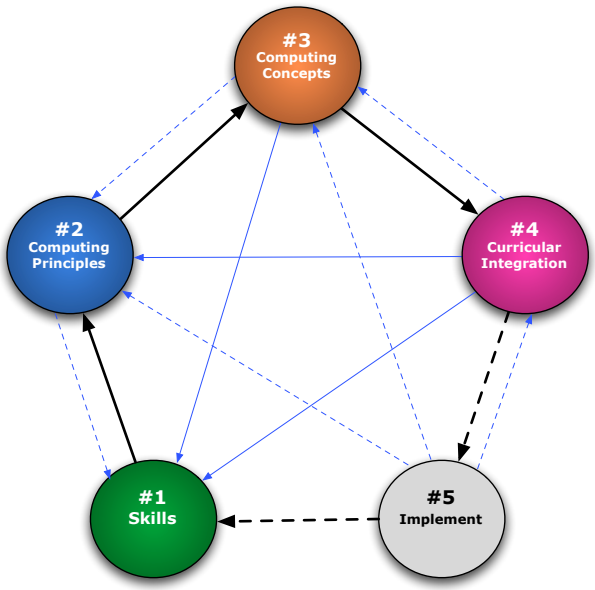
The "flat world" of the 21st century requires developing and sustaining a vital workforce that meets the needs of employers. This is nowhere more true than in engineering areas. The central goal of the CPACE project—funded by the National Science Foundation--is to better align the computational competencies of engineering students with the needs of industry.

Our project implementation strategy is based on the transformational model depicted below which comprises five interactive stages:

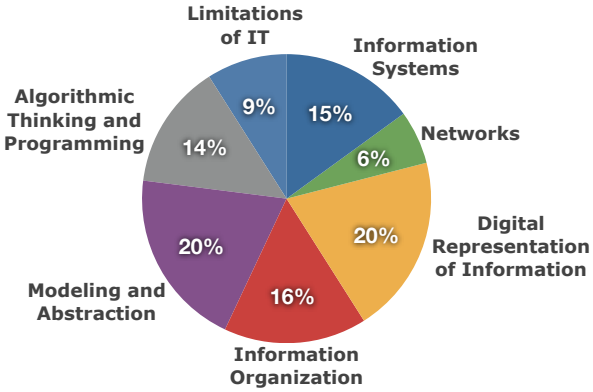
- Interview/survey stakeholders
- Abstract the computational problem-solving principles from interview/survey data.
- Align principles with computer science (CS) concepts.
- Identify opportunities for curricular integration.
- Implement revisions in engineering curricula.

Details of the process and findings are presented in publications [1, 2].

Based on the results of employer interviews and employee surveys we analyzed industry needs for computational competence both at the practical-tool level and at the *computational thinking* level. Our findings show: a) employers place a high value on interpersonal skills such as communication, ability to organize and present data, and the ability to function in a team; b) employers see critical and innovative thinking and problem solving as important attributes; c) employers see trends towards computational globalization, which translate to the need for engineers to understand business practices and the importance of integrating engineering data across larger systems. Details of the process and findings are presented in publications [1, 2].



Following the transformation model, and using the Fluency with Information Technology Report (FITness)



as a framework [3], we translated the computational competencies needs--identified by our employers--into CS concepts that can be used to guide curricular design,. The chart above shows the distribution of these computational concepts [4]. The ongoing curricular implementation strategy includes gathering and developing engineering problems in consultation with employers, and engineering faculty. We are introducing these problems in a set of target courses across all four years of the Civil and Chemical Engineering curricula. These problems help to contextualize the learning experiences for students. A manuscript in preparation will describe the results of the curricular implementation strategy.

References:

[1] Vergara et al., (2009). Leveraging workforce needs to inform curricular change in computing education for engineering: The CPACE project. Computers in Education Journal, Vol XVIIII (4), 84-98.
[2] Vergara et al., (2009, October 18-21). Aligning computing education with engineering workforce computational needs: New curricular directions to improve computational thinking in engineering graduates. Paper presented at the Frontiers in Education, San Antonio, TX.
[3] Being Fluent with Information Technology Committee on Information Technology Literacy, National Research Council. (1999).
[4] Vergara, C. E., Urban-Lurain, M., Dresen, C., T., Frazier, K., et al. (2011). Computational Expertise in Engineering: Aligning Workforce Computing Needs with Computer Science Concepts. ASEE, Vancouver BC, AC 2011-1050.