CPACE Advisory Board Meeting

Thursday, November 11, 2010

Location: Deans Engineering Conference Room, Room 3405, Engineering Building, Michigan State University

Networking Breakfast with 9:30 a.m.- 10 a.m.

Meeting Time: 10 a.m.- 12 p.m.; **Lunch:** 12 p.m. -1 p.m.

Meeting Facilitation: Jon Sticklen, PI, Director, Center for Engineering Education Research, MSU

Agenda:

Welcome and introductions

Jon Sticklen, PI, Director, Center for Engineering Education Research, MSU

Dr. Upda, Dean of the College of Engineering, MSU

- Opening Remarks
- Introductions of AB members and MSU/LCC/CSW project team

Defining Authentic Computational Engineering Problems

- Brief Overview of the CPACE II and AB member Role
  Jon Sticklen, PI, Director, Center for Engineering Education Research, MSU
  Mark Urban-Lurain, co-PI, Director of Instructional Technology Research & Development, MSU
  Abdol Hossein Esfahanian, co-PI, Associate Professor and Associate Chairperson, Computer Science and Engineering Department, MSU

- Overview of the Three Courses
  Louise Paquette, co-PI, Professor, Mathematics & Computer Science Department, LCC
  Daina Briedis, co-PI, Associate Professor, Department of Chemical Engineering and Materials Science, MSU
  Neeraj Buch, co-PI, Professor, Department of Civil and Environmental Engineering, MSU

- Share Authentic Problem Example & Authentic Problem Discussion Activity
  Jon Sticklen, PI, Director, Center for Engineering Education Research, MSU
  Louise Paquette, co-PI, Professor, Mathematics & Computer Science Department, LCC

- Overview of the Authentic Problems Generation Process
  Cindee Dresen, co-PI, Director, Business Industry Strategies & Talent Development, CSW

Higher Ed Change Process Overview

Jim Fairweather, Professor, Higher, Adult, and Lifelong Education, College of Education, MSU

Project Evaluation Overview

Cynthia Halderson, Sr. Research Assistant, Science and Mathematics Program Improvement (SAMPI), WMU

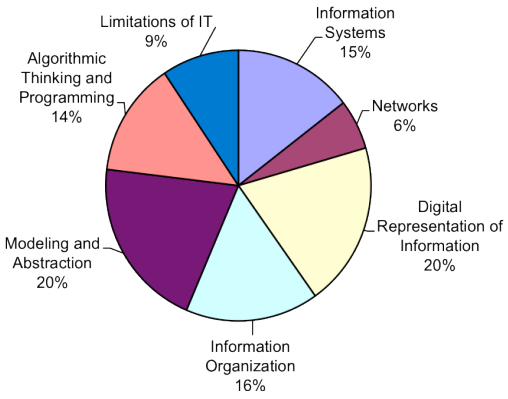
Closing and next steps

Jon Sticklen, PI, Director, Center for Engineering Education Research, MSU

Networking lunch

CPACE II Advisory Board: Sketch for AB Meeting on Thursday, 11/ 11/2010

After completing a three year project (CPACE I) in which we gathered and analyzed detailed industry feedback on the computational needs of employers in new engineering hires, NSF awarded second round funding to MSU/LCC to continue the CPACE project. Our highest goal in CPACE II is to use our results from CPACE I to augment our engineering curricula so we graduate engineers better able to met industry expectations for computational competencies. Our central result from CPACE I is shown in the pie chart to the right that shows the number of times our industry respondents noted a category for computational competency.



Two target engineering programs were selected for CPACE II: Chemical Engineering and Civil Engineering. In these two curricula, we are in the process of augmenting coursework to strengthen outcome computational competencies as needed in industry. We narrowed our specific course targets within ChE and CE to include one pivotal, required course in at freshman, sophomore, junior, and senior levels. Currently we are implementing the augmentation for the freshman course, and designing the augmentations for the sophomore courses.

A key driver of our process is to utilize *authentic problems* from industry that are appropriate for our target classes. The meaning of the term *authentic problem* is simply *a problem that is faced in industry* - as opposed to the standard text-book examples that students are given. Study after study has shown that when students are given problems which are *authentic* their level of engagement in problem solving is substantially increased.

More specifically, our goals in CPACE II project are:

- To implement augmented curricula that integrate computational competencies that are aligned with industry needs across engineering departments.
- To identify *authentic problems* that exemplify engineering industrial problems and whose solution requires the application of computational concepts.
- To develop a change management strategy to promote institutional change to ensure sustainability of the curricular change we develop in collaboration with ChE and CE faculty.

Advisory Board Meeting Discussion

We will present more detail about these findings during the Advisory Board meeting on November 11. Our discussions will focus on:

- Describing our current status in more detail, along with our project goals,
- The process of obtaining from industry the authentic problems needed to drive our process,
- The important role of AB Board members in CPACE, and
- The importance of the institutional change context for sustainability of the innovation that CPACE will introduce in our curricula.

CPACE II : Authentic Problem Generation Process

A chief project objective is to introduce a series of authentic engineering problems developed in consultation with stakeholders from industry, employees, and faculty from engineering disciplines to ensure that the problems are representative of engineering practice, disciplinary context, and computing concepts. To collect these problems we are leveraging the industrial partnerships that we established during CPACE I; Advisory Board members and other employers that collaborated with us during the interview and survey stages.

Based on lessons learned from an initial pilot, the following activities are included in the Authentic Problem Generation process:

Step 1 – Employer and Authentic Problem Targets

- Determine the total number of Chemical and Civil engineering authentic problems sought and the timeframe to obtain them. [Who: MSU/LCC & CSW]
  - Ideally, seek 2-3 authentic problems from each employer.
- Identify the employers to target. [Who: MSU/LCC & CSW]
  - Tier 1 Targets: Chemical and Civil engineering employers interviewed and surveyed and AB members and any other employers they recommend.
  - Tier 2 Targets: Employers and engineering professionals that are part of other networks, associations, societies, and coalitions such as those groups we sent the industry report to.

Step 2 – Employer Outreach

- Make first contact via e-mail communication that will include 1-page project summary. Communication content will include purpose of the outreach, articulate what we are seeking from them, who we would like to speak to such as chemical or civil engineering *practitioners* (this could be management and professional staff), and ask to arrange time for follow-up call. [Who: CSW]
  - If this is a contact we know well, we can call directly if it makes sense to do so.
- Two sample authentic problem sets are developed and updated as needed. [Who: MSU/LCC]
- Hold follow-up call with employer to clarify things as needed and set up first in-person meeting. [Who: CSW]
- Send e-mail confirmation of date/time of meeting immediately after call include sample problem(s). [Who: CSW]
- Identify 2 main points of contact – 1 MSU/LCC and 1 CSW; CSW – meeting coordination and relevant follow-up; MSU/LCC – Authentic problem clarification and follow-up exchange.
- Prep and hold meeting Authentic Problem meeting with employer (ideally in-person, but conference call maybe back-up option). [Who: MSU/LCC & CSW]
  - Packet materials assembled put in MSU folders (PPT handout, 1-page project summary, sample problems, business cards, etc). [Who: MSU/LCC]
  - Meeting attendees include: Jon Sticklen, one civil or chemical engineering faculty, and one CSW representative, and employer representatives.

- Meeting content includes: packet of relevant project materials, discussion will include: overview of project, clarification of our data collection need, role clarification – ours and theirs, timeline expectations, clarify employers preferred method of follow-up (i.e., e-mail, phone), and identification of main employer contact(s).

Step 3 – Analysis of Authentic Problem

- The faculty analyses the problem(s) to determine if :
  - it can be used in the targeted courses
  - it exemplifies relevant industrial scenarios within the discipline
  - the solution requires the application of computational concepts
    - Ideally, several problems can be identified that permeate all levels (freshman to senior). The applications in the different disciplines would change.

  [Who: MSU/LCC]
- After the analysis, a set of specific follow up questions are prepared to make sure that we have a 'complete problem' ready to be used in the instructional design. The questions and the requests (e.g., demo materials, types of data) to each employer are expected to change depending on the type of industry, the courses where the problem can be used. [Who: MSU/LCC]
- Final e-communication is sent to employer thanking them for their time and providing an update on how their problems have or will be used. [Who: MSU/LCC or CSW]

Science and Mathematics Program Improvement (SAMPI),
Mallinson Institute for Science Education, Western Michigan University

Project Evaluation Overview

Dr. Mary Anne Sydlik, Evaluation Team Leader

The purposes of the CPACE II project evaluation are to 1) track the progress of the project; 2) provide feedback to staff to improve programming; and 3) determine impacts of the project on participating faculty, students, and other stakeholders. The table below shows the relationship between specific evaluation questions and project objectives and data collection strategies.

Table 1. Evaluation Foci and Data Collection Strategies

Evaluation Questions	Project Objectives	Measures
1. In what ways has computational thinking been integrated into engineering curricula? What are the nature and effectiveness of the models and associated materials in supporting curriculum changes?	A. Implement new models for undergraduate computing education with focus on CT. B. Infuse CT into two undergraduate engineering programs. C. Develop a change management and OD system to promote organizational change at MSU and LCC.	• Review models, materials • Interview staff, faculty, other key stakeholders • Observe selected course sessions
2. What has been the nature and effectiveness of the CPACE Engineering Talent Development Network? How has it facilitated exchange of information and knowledge among participants?	D. Continue working with the CPACE Engineering Talent Development Network that have a stake in improving the economic, environmental, and social well-being of their communities and can offer appropriate guidance and context for the proposed curricular reform.	• Survey of Talent Development Network members • Interview sample of members • Interview staff
3. What have been the effects of the project on participating students and faculty?	E. Evaluate the efficacy of this approach to curricular CT-focused reform.	• Identify effects on students in capstone courses • Interview faculty
4. What have been the strengths and limitations of the project?	F. Achieve greater awareness and interest in CT from both internal (MSU, LCC) and external (industry groups, other educational institutions, and engineering professional societies).	• Review all evaluation findings • Conduct debriefing interviews with project staff, faculty