Industrial Advisory Board (IAB) Meeting Minutes

Friday, October 23, 2015
Lory Student Center Grey Rock Room


ECE department: Tom Chen, Margaret Cheney (joint appointment math professor), Andrea Leland, Tony Maciejewski, Olivera Notaros, Sudeep Pasricha, Melissa Reese, and HJ Siegel; and a small group of ECE students.

Guests: RED team members Alistair Cook and Alma Rosales; Dick Toftness, Engineer in Residence coordinator; and Fabiola Ehlers-Zavala, INTO CSU Center Director.

New members: Kin Chan, Keysight; Daniel Guerrero, National Instruments; Matt Hilt, Numerica; Mike Stiles, Avaya Communications; and Ron Vaughn, Nvidia.

1. Introduction and Welcome IAB Guests (Lance Guymon, IAB president)
Lance opened the meeting, welcomed the new IAB guests (outlined above), shared the day's agenda, and then turned it over to Tony Maciejewski, ECE department head, for the department update.

2. Agenda and Department Update (ECE Department Head Tony Maciejewski)
Tony welcomed the meeting attendees and delivered an update on the department, touching on the following topics.
- ECE faculty highlights
- Press about new grants
- First-ever endowed professorship for ECE: Lisa and Desi Rhoden Professorship in Electrical & Computer Engineering
- Result of Best Paper Contest
- Charts and data
  - College of Engineering research expenditures
  - College of Engineering student credit hours (14-15)
  - ECE student credit hours
  - ECE fall enrollment
  - Undergraduate degrees awarded
  - National enrollment trends by discipline
  - CSU engineering enrollment trends
  - ECE freshmen retention rates
    - Overview of retention programs
  - ECE Colorado freshmen enrollment: CO institutions ('10-'14)
  - ECE Colorado undergraduate enrollment: CO institutions ('10-'14)
- ECE freshmen enrollment: CSU, peers, & top 10 U.S. News and World Report (USNWR) institutions ('10-'14)
- ECE total undergraduate enrollment: CSU, peers, & top 10 USNWR institutions ('10-'14)
- Graduate degrees awarded
- Percent of international degrees awarded
- Women in engineering (FA15)
- Women in ECE
- Career outlook for ECE grads
  - For the last decade, EE and CmpE are among top 10 majors in demand for B.S., M.S., and Ph.D. degrees
  - 100% of ECE graduates had employment related to their major, the CSU average is 75%
  - ECE graduates earned the highest starting salaries in the College of Engineering
- ECE median earnings by CO institutions (Ed Pays wage study)
  - CSU EE and CmpE graduates garnered the highest first and fifth year median salaries compared to other CO institutions.
    - 1st year: EE – $63,610, CmpE – $66,654
    - 5th year: EE - $77,186, CmpE – $82,784
- Status of Proposal for M.S. and Ph.D. in Computer Engineering
  - Phase I approved
  - Requested resources
    - New faculty lines to support growth
    - New graduate advisor
    - Recruitment funding
    - Office and lab space for new faculty (no equipment)
    - GRA and GTA lines

Update on spring action items:
- Action item: Continue to emphasize importance of the elevator pitch and being able to explain WHY design projects are important.
- Status: This remains a priority. Ed and Susan continue to help senior design students. Professional Formation efforts should help this effort as well.
- Action item: Facilitate interaction with the College of Business to help teams pitch and market their projects.
- Status: Pilot project begins in spring 2016; market research instructor will identify and supervise COB students.
- Action item: Build on work with risk analysis; ask students to outline lessons learned as part of their projects.
- Status: Requirement for new Open Option projects and ECE 202 projects. Senior design students discuss lessons learned in self- and team-evaluations at the end of the semester.
- Action item: Provide update on Engineer in Residence program.
- Status: Dick Toftness will share an update today.

3. Revolutionizing Engineering Departments: RED (Tony Maciejewski)
Tony announced that the ECE department is one of six schools selected by the National Science Foundation to lead scalable and sustainable change in engineering and computer science education for the nation. The diverse project team aims to radically change undergraduate engineering education because the current system fails in two critically important ways:
  - First, students with the desire and aptitude to become productive engineers are not seeing the relevance of current curricula, and, consequently, they are abandoning the discipline.
Second, those who ultimately graduate from undergraduate engineering programs may not fully understand the role of an engineer and the scope of the field.

Tony outlined the vision and goals for the project, which include pedagogical and organizational innovations that treat the undergraduate experience as an integrated system. As shown in Figure 1, the team is implementing a new pedagogical model that builds on the concept of "nanocourses" and emphasizes knowledge integration – a learning model well-grounded in education pedagogy and supported by research. The approach combines rigor and flexibility to improve student understanding and efficacy through learning studio modules that cross traditional course boundaries.

Aiming to hook students' interest earlier in the program and build a more inclusive environment for individuals of all backgrounds, the new structure moves away from teaching courses in isolation, empowering faculty to work together as multifaceted teams to fully integrate content and map learning to the applied world of engineering. Outlined in Figure 1, newly assigned Integration Specialists lead the effort to synthesize disparate concepts and establish core competency areas for the learning studios, while Thread Champions are responsible for weaving key threads throughout the curriculum: foundations (math and science), creativity (research, design, and optimization tools), and professionalism (leadership, communication, teamwork, ethics, and cross-cultural adaptability).

These faculty teams are using familiar applications such as the smartphone to demonstrate how topics connect across the curriculum and serve as the basis of many modern day and future advancements. In addition to tying knowledge to the real world, the approach shows students how every educational component is interrelated and vital to the overall learning experience.

Striving to be a leader in reversing the attrition trend in ECE and filling the pathway with graduates who are prepared for the grand challenges of the profession, the department's vision creates opportunities to attract talented, diverse students into the field and change longstanding perceptions about what it means to be an engineer. As the department extends its model to other institutions – and promotes the impacts of its innovative work – ECE students will no longer need to ask questions such as: Why am I learning this, and why should I care? Will I ever need this information when I get a job? What does it mean to be an engineer?

Comments from IAB related to the RED project:

- Many board members were able to see how the RED project relates to system engineering; they think the approach has great potential when applied to undergraduate education.
- The board likes how the curriculum can be tailored to the individual and the ability for optimal pathways through the program.
- They were impressed that CSU is only one of six schools selected by the NSF.

4. Engineer in Residence Program – Pilot Project with IEEE (Richard Toftness, IEEE High Plains Secretary and EIR Coordinator)

Dick Toftness shared an overview and update on the new Engineer in Residence program, a partnership between ECE and the IEEE High Plains Section that brings practicing engineers to
campus to share their experience and knowledge with ECE students. Serving as resources for career or technical advice, EiR participants span a range of companies and areas of technical expertise. EiR participants have their own space in the ECE student projects lab, with office hours throughout the week. There were 15 engineers who volunteered in fall 2015 (two females, 13 males). If you would like to learn more about the program, or wish to get involved, please contact Dick Toftness: rtoftness@gmail.com.

5. **Industry Spotlight: Keysight Technologies (Kin Chan, Director of Engineering, ASIC Design Center)**

Kin Chan gave an overview of Keysight Technologies, the new electronic measurement company formerly known as Agilent. In addition to sharing the company’s history and timeline, Kin provided details about the ASIC Design Center in Colorado Springs, for which he is the director, and its product lines.

6. **Faculty Spotlight: ECE Professor Tom Chen**

Professor Tom Chen shared his background and teaching/research areas of focus. He highlighted his research in the electrical engineering and biomedical space, with potential applications for early cancer detection. An exciting cross-disciplinary project, Tom noted that the CMOS has potential to unlock the secrets of biology.

7. **RED Professional Formation Thread (Alma Rosales, Professional Formation Thread Champion)**

Alma shared the history of the Professional Learning Institute, a college-wide lecture series launched in 2007 to provide students with real-world professional skills to complement technical curricula. To prepare for the breakout session, Alma also outlined the goals for the RED professional formation thread.

8. **Breakout Session: IAB Input on RED Professional Formation Thread (Alma Rosales and Lance Guymon)**

Lance and Alma asked the board to break into groups and consider the following questions and areas.

**Challenge questions:**
- Thinking beyond classroom lectures, what are your ideas for weaving professionalism throughout the curriculum?
- How can industry play a role in the Learning Studio Modules?
- What are your suggestions for assessing our professional formation activities?

**Scope:**
- Communication
- Teamwork
- Ethics
- Cross-cultural adaptability
- Leadership

**Key Points and Suggestions from Breakout Sessions:**

**Communication**
- Email etiquette is important and should be addressed.
- Knowing and tailoring communications to the audience should be reinforced.
- Faculty buy-in is necessary for effective assessments – communication should be included in overall grade.
- Provide clear guidelines for effective communication, which could serve as a checklist for students.
- Never underestimate the value of listening.
- Don’t overlook nonverbal communication.
- Mimic modules offered by industry – online resources with tips about effective communication.
• Show students examples of both effective and ineffective communications to help them see the value of communication skills.
• Assign "industry champions" to identify and collect best practices in industry to share with the department.
• When students are doing formal presentations, ask them to identify three points they expect the audience to take away; in turn, ask the audience to share the perceived key points of the presentation, then compare and contrast the responses to assess effectiveness.

Teamwork
• Create a "home room," e.g., cadre of students, to flow through the program as a team. The team will support each other throughout the program, instant study buddies, group homework assignments, etc.
  o A similar approach was used at MIT. They saw attrition rate go down, as well as a drop in the suicide rate.
• Generate an online "body of knowledge" to serve as a resource for students. One idea is to reference IEEE's online code of conduct.
• Design team scenarios that echo engineering practices. On campus, groups are always peers, but it's not like that in industry – there’s always someone in charge of the team.

Ethics
• Ethics material should be relevant and personal to students in today’s context. Make them "feel the pain" of ethical situations.
• The IAB feels that it's important to assess efforts related to ethics, but struggled with how to do it.
• Use case studies to teach ethics, and then encourage role playing to make it relevant.

Cross-cultural adaptability
• It's important to bridge the gaps between generations. One idea: reverse mentoring. Ask younger people to mentoring older colleagues/classmates.
• Don't be afraid to show students examples of what doesn't work.
• Consider resources such as GlobeSmart®, a tool used by businesses to work with colleagues in other countries, to teach cross-cultural skills.
• Beginning the freshmen year, start with early group development that allows students to connect with a diverse group, perhaps outside their comfort zone. One idea is a pre-enrollment program, which might include a retreat before school starts.
• In an effort to connect students early in the program, ask each incoming student to do a poster walk or bio paper to present to fellow classmates.
• Encourage students to develop relationships outside of school to broaden their cultural experiences.
• When working in multicultural environments, it's important to have tools for dealing with language barriers.

Leadership
• Start by defining leadership and expectations. Not everyone is a leader.
• Demonstrate the difference between good leaders and bad leaders.
• Expand industry mentorship to foster leadership skills.
• For team projects, consider rotating leadership responsibilities among team members.
• Experiential learning is the key to becoming an effective leader.
9. **Senior Design Presentations**
   Two teams shared their senior design projects with the board during lunch.

10. **Closing Remarks (Tony Maciejewski)**
   Tony wrapped up the meeting and thanked the board for their participation. He encouraged the board to contact him or Andrea with additional ideas or comments regarding the meeting topics.

**ACTION ITEMS:**
- Alma will consider the board's comments then follow-up with individual IAB members to validate professional formation learning modules and content.
- Follow-up with board to collect best practices used in industry for developing professional skills (e.g., online modules); draw on resources available through IEEE.
- Explore the idea of creating a cadre of students assigned in the freshmen year to flow through the program together. Consider having a retreat or meeting prior to the start of school to acquaint teams.
- Continue to provide enrollment data for the College of Engineering; the board is particularly interested in seeing how mechanical and ECE enrollments compare.

The spring IAB meeting is scheduled for Friday, April 15, 2016.