

Northwestern Center for Engineering Education Research

NCEER Newsletter No. 8

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News

- We are pleased to announce that Jennifer Cole, Assistant Chair of Chemical and Biological Engineering, has been appointed to be the Associate Director of NCEER. After her PhD in Chemical Engineering at the University of Illinois, she came to Northwestern to work with Ann McKenna and Rob Linsenmeier on engineering education research. She maintains an interest in education research, and serves ChBE in several roles, notably teaching design. Her appointment will allow NCEER to be more active in the next few years.
- Several Northwestern faculty members attended and presented papers at the ASEE 2015 conference from June 14-17 in Seattle, Washington. The ASEE Conference Highlights section of the newsletter showcases some of the sessions and papers that these faculty members found interesting, with their commentary.
- NCEER is hosting the upcoming conference: **Integrating Cognitive Science with Innovative Teaching in STEM Disciplines: Spatial Learning in STEM**, September 18-19. Cognitive scientists and faculty in the STEM disciplines will meet to learn and discuss how spatial intelligence and spatial skills come into play in undergraduate education in engineering and natural sciences. There is more room for Northwestern attendees. For more information see www.nceer.northwestern.edu/conferences/index.html.
- There is still time to sign up for one of the [Fall 2015 CIRTl courses](#) or the [Fall 2015 CIRTl MOOC: An Introduction to Evidence-Based Undergraduate STEM Teaching](#). CIRTl online courses are for graduate students and postdocs; The CIRTl MOOC is appropriate for anyone who is interested in learning more about STEM teaching, and would be especially good for new faculty as well as graduate students and postdocs. If your students do not know about these offerings, or about other offerings of [CIRTl at Northwestern](#), please clue them in. There will also be a local group convening at Northwestern in association with the MOOC, so we would appreciate it if those who sign up would also contact Rob Linsenmeier.
- NCEER and the McCormick Undergraduate office will be co-hosting a discussion about **Best Practices in Undergraduate Advising**, **Tuesday, September 29, 9:00 to 10:30 AM, in the Mechanical Engineering Conference Room, Tech B211**. Advisors from the McCormick departments along with the freshman advisors will share their advising practices. An open discussion with the audience will provide an opportunity for sharing best practices. Directors of advising for each department are especially encouraged to attend, but anyone who has undergraduate advisees is welcome.
- Additional NCEER discussions on evidence-based instructional practices used to improve undergraduate engineering education will be announced throughout the year.

ASEE Conference Highlights

➤ A study of flipped classrooms and a session on multidisciplinary capstone design, by J. Alex Birdwell

Lape¹, Levy¹, Yong¹, Eddy², Hankel², *Probing the Flipped Classroom: A Controlled Study of Teaching and Learning Outcomes in Undergraduate Engineering and Mathematics*, 10.18260/p.24590 [Paper ID#13462](#)

¹Harvey Mudd College, ²Cobblestone Applied Research & Evaluation, Inc.

Evaluating two courses (Introductory Thermodynamics and Differential Equations), this study compared a flipped section against a traditional section. The flipped section watched recorded lectures and worked problems in class.

The study presented two year's data, and tested many metrics and sub-metrics. Generally speaking, there was no conclusive result that one format lead to higher outcomes over the other.

Some sub-metrics were better in each format, but net scores were similar for students when compared across sections.

Future work (the remaining two years of the study) will look to include additional material into the flipped sections through video lectures and possibly creating a hybrid section, which will combine recorded and in-class lectures.

Multidisciplinary Capstone Design & Collaborative Projects – Session Presentations

Olsen¹, Beyreuther¹, Wolcott¹, Laninga², *Interdisciplinary Design Course Structure: Lessons for Engineering Instructors from a Capstone Design Course*, 10.18260/p.24348, [Paper ID#13673](#)

¹Washington State University, ²University of Idaho

This capstone course is selective (students must apply) and is run by the engineering, architecture, and design schools between WSU and Univ. of Idaho. Projects focus on sustainability and span across the country. Case studies presented covered renovating wharfs in Louisiana and designing methods to contain plant resources in farms in Washington.

Kotche¹, Tharp², *Interdisciplinary Medical Product Development Senior Capstone Design*, 10.18260/p.24350, [Paper ID# 13677](#)

¹University of Illinois at Chicago, ²University of Michigan

BME capstone done at Univ. of IL at Chicago (UIC) that is a unique section of their capstone course. Has only been implemented for the last couple years and is a user-centered design project partnered with their medical school. Students must take a anatomy/medical terminology prep-course during the preceding term.

Students meet with doctors, therapists, and patients to define a problem and ultimately work to develop a design for a prototype. Not all projects deliver a working prototype, however, this capstone seems to follow Northwestern's Design Thinking and Communication (DSGN 106) and DSGN 384 courses.

➤ Disseminating evidence-based instructional practices to our colleagues, by Jennifer L. Cole

Jordan, Pembridge, Williams, Steinhauer, Wilson, Holton, *Knowledge Transfer of Evidence-Based Instructional Practices in Faculty Communities of Practice*, 10.18260/p.24388, [Paper #11440](#)
Embry-Riddle Aeronautical Univ., Daytona Beach

West, Herman, *Mapping the Spread of Collaborative Learning Methods in Gateway STEM Courses via Communities of Practice*, 10.18260/p.24469, [Paper #13097](#)
University of Illinois, Urbana-Champaign

A large amount of research has been focused on the impact of and the best practices around active learning techniques, such as flipped classrooms, collaborative learning, project based learning, and so on. However not as much research has centered around how to transfer these evidence-based instructional practices (EBIPs), also known as research-based instructional strategies (RBIS), to our colleagues.

The Diffusion and Adoption of Teaching Practices session at ASEE discussed how we disseminate EBIPs once we execute the research study, attend the conference, or read the literature. The authors discussed some of the barriers to and concerns about implementing EBIPs, including

- Time commitment for designing activities
- Possibility of losing control of the classroom
- Instructors having a lack of expertise with new teaching methods or they are unaware of their existence
- Need for support from peers, department, and institution

Transfer of knowledge occurs in many forms, from “pop-in” conversations with peers to formal courses or workshops at centers for teaching and learning. One emerging method of communicating EBIPs to our colleagues is the establishment of Communities of Practice (CoP). Members of CoP are faculty from novice to expert level. The communities can be an informal collection of faculty, faculty supported by department, or faculty organized by university group. CoP provide a network of support for faculty members.

While this area of research is fairly new, the authors have suggested that successful strategies for transferring knowledge of EBIPs have involved

- Participation in CoP, or similar community
- Connection of the CoP to a center for teaching and learning
- Support from organization or department (not necessarily funding, but encouragement, opportunities for improvement, and a positive perception of the activities)

➤ Diversity in Chemical Engineering Education: Status and Perspectives, by Arthur Felse

Bodnar, Felse, High, Keith, Minerick, Saterbak, Cole, *Diversity in Chemical Engineering Education: Status and Perspectives*, 10.18260/p.23892, [Paper ID#11650](#)

ASEE’s chemical engineering division hosted a panel discussion titled Diversity in Chemical Engineering Education: Status and Perspectives during the ASEE annual conference in Seattle.

A set of distinguished panelists shared their perspectives on diversity in engineering education and provided anecdotes and data points from their experiences. The panelists were: Cheryl Bodnar, Teaching Assistant Professor, University of Pittsburg; Jennifer Cole, Lecturer, Northwestern University; Karen High, Associate Dean, Clemson University; Jason Keith, Dean, Mississippi State University; Adrienne Minnerick, Associate Dean, Michigan Technological University, and; Ann Saterbak, Associate Dean, Rice University. The discussion was moderated by Arthur Felse, Lecturer, Northwestern University. The audience comprised mostly of chemical engineering faculty, and a significant minority from other engineering disciplines. More than 50% of the audience were men, but very few from the underrepresented ethnic groups were in the audience.

The panel started with a brief discussion on the current status of diversity in chemical engineering education, followed by a spirited discussion on various topics related to diversity. The discussion and the audience engagement transcended all engineering disciplines. The panel had a semi-formal format to foster free exchange of ideas and opinions in order to provide a learning opportunity for everyone involved.

Major take away messages from the panel discussions are:

- Women are severely under represented at the doctoral level in chemical engineering education, while black and Hispanic populations are severely underrepresented at all levels of chemical engineering education.
- Micro inequities – inequities are served in small doses are more prevalent than major discrimination events. Micro inequities needs the immediate attention of engineering education community.
- Decentralized diversity efforts with departments taking an active role in promoting diversity are needed with the help of a centralized support structure.
- Diversity should become a strategic action item for engineering schools and departments.

Based on the panel discussion, the top three challenges for diversity in engineering education are: Pipeline, supportive environment at the department/unit level, and sustained promotion of diversity at universities with sufficient resources. At the end of the panel discussion, both audience and panelists pledged to complete at least one diversity related action during the next academic year.

How to find other great papers from the ASEE conference

If you found these selections interesting and want to read more, you can access the most recent conference proceedings papers as well as archived conference proceedings back to 1996. You may choose to search by conference year, or use a keyword search to find papers from the entire database.

<http://www.asee.org/search/proceedings>

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