

The newsletter of the Northwestern Center for Engineering Education Research (NCEER)

News

- Dean Julio Ottino and Mark P. Mills jointly authored an article in Forbes magazine entitled “We Need More Renaissance Scientists.” In it, they argue that the current mold of graduate scientific education in the U.S. requires basic reform because it encourages only narrow technical and analytic modes of thought. In other words, science doctoral students are typically trained to think only with their ‘left-side,’ logical brain. Mills and Ottino argue for a more holistic model which would complement analytic skills with an emphasis on ‘right-brained’ abilities such as creativity and imagination. These qualities, they argue, are essential for innovation and ingenuity yet are actually discouraged by the current structure of graduate scientific education. The full article is available [here](#).
- The ASEE (American Society for Engineering Education) held their annual meeting in Austin Texas last month. Jennifer Younker and Ann McKenna were recognized as Best Paper finalists in the Design and Engineering Education Division for their paper, “Examining Student Use of Evidence to Support Design Decisions.”
- Associate Dean Stephen Carr is an invited speaker at the Reforming the First-year Engineering Conference to be held at the University of Notre Dame in August, 2009. The purpose of the conference is to equip attendees with both a development process and access to resources needed to design and implement a successful project-based, introductory engineering program, tailored to their institutions. Assistant Deans and NCEER Scholars Helen Oloroso and Joe Holtgreive will also be presenting posters at the conference. Details about the conference can be found at: <http://www.nd.edu/~engineer/ReformingFirstYear/>
- Ann McKenna has been invited to serve as a National Science Foundation Program Director in the Division of Undergraduate Education (DUE), which is under the Education and Human Resources Directorate. She will begin in August and will be at the NSF for next year.

NCEER Project Spotlight – R.P.H. Chang: NCLT

The National Center for Learning and Teaching in Nano Science and Engineering (NCLT), established in 2004, is an NSF funded Center and a partnership between Northwestern, Purdue University, the University of Michigan, Argonne National Laboratory, the Universities of Illinois at Chicago and Urbana-Champaign, Fisk University, Alabama A&M University, Hampton University, U. of Texas at El Paso, and Morehouse College. It is dedicated to bringing instruction in the basic principles of nano-

science to secondary schools and college undergraduates. This is an important mission because while nanotechnology is an increasingly active and promising field, it is found almost exclusively at the graduate level and above – there is currently no recognized undergraduate curriculum, much less any content in secondary school. Bridging this gap is crucial in order to ensure that the insights of nano research become more broadly distributed, and to nurture the next generation of nano researchers. One of NCLT’s central strategies to achieve this goal is the development of a consistent educational process to both map the nano domain and assess learning within it; this is termed Construct-Centered Design. It begins with a ‘big idea’ that is ‘unpacked’ to detect the prerequisite concepts and likely stumbling blocks to learning, and then defines the goals and tasks that should be involved in demonstrating mastery of the idea. Other aspects of the mission involve the identification and explication of ‘threshold concepts’ in nanoscience, such as the relationship between size and surface-area-to-volume ratio and ideas of scale and atomic structure. Grasping these basic concepts is key to understanding what makes nanoscience unique. NCLT interventions have been implemented at the member institutions, at international workshops, and in school districts across the country. More information on NCLT is available at: <http://www.nclt.us>.

NCEER Graduate Student Project Spotlight – Michelle Hallikainen

Michelle Hallikainen is a PhD student in Mechanical Engineering. While the NCLT focuses on the specific learning challenges presented by the nano realm, Michelle is examining the conceptual challenges that engineering students have with problems that simultaneously involve multiple scales (e.g. analysis across the continuum, nano, and quantum scales). Notably, she has integrated this learning research into the cancer-fighting nano-diamond drug delivery system research she is doing for her PhD. Interviews are currently being conducted to document the differences in understanding for varying levels of expertise, including undergraduate and graduate students, post-docs, and faculty. This information will be used to revise Northwestern’s current Multi-scale Simulations course (ME 317), as well as develop materials for teaching the multi-scale nano-diamond drug delivery system to pre-college students. This program will be tested this coming academic year at Evanston Township High School with juniors and seniors participating in a joint Chemistry and Physics course. Undergraduate students Sarah Coppola and Mitchell Lee have been heavily involved in creating and testing these new teaching materials, which include developing tutorials and creating hands-on learning devices to illustrate difficult concepts present in the nano-diamond problem. A better understanding of the difficulties and conceptual hurdles that engineering students face when encountering multi-scale problems will open doors for advancement in teaching these difficult topics. Michelle’s PhD advisors are Profs. Wing Liu, Dean Ho, Wei Chen, and Ann McKenna.

Upcoming Conferences in Engineering Education

- ❖ International Conference on Engineering Education and Research
Seoul, Korea, August 23–28, 2009
<http://iceeiceer2009korea.net/main.html>

- ❖ 6th Symposium on International Design and Design Education (DEC)
San Diego, CA, August 30–September 2, 2009
<http://www.asmeconferences.org/idetc09/CallForPapersDetail.cfm>

- ❖ Annual ASEE Global Colloquium on Engineering Education
Budapest, Hungary, October 12–15, 2009
<http://www.asee.org/conferences/international/2009/index.cfm>

- ❖ Frontiers in Education Annual Conference
San Antonio, TX, October 18–21, 2009
<http://www.fie-conference.org/fie2009/>

If you have any engineering education news to share please send it to Mark Bourgeois at m-bourgeois@northwestern.edu for inclusion in the next NCEER newsletter. We are always interested in learning more about any awards you have received, projects that have been funded, results from your research, or any other news that would be of interest to the community.

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