

SUMMER 2010

From the Editor

This is our sixth issue of *Advances in Engineering Education*. We have now had over 200 submissions, and are publishing our papers 32 through 38. We have two special issues in the works—one on NSF’s Department Level Reform initiative edited by Mandar Dewoolkar and the other on e-learning edited by Maura Borrego. Watch for a call for papers to be included for a third special issue on engineering applications at the K-12 level that will be edited by Tamara Moore and Larry Richards.

This issue consists of seven papers including three with international aspects, illustrating the globalization of engineering education in more ways than one. The papers in this volume cover a wide range of topics of interest to the broader engineering education community. They describe true “advances” in engineering education, which, is the purpose of this journal.

The paper by Yehudit Judy Dori and Arlindo Silver describes a Product Design and Development (PDD) course—part of the graduate curriculum in Engineering Design and Advanced Manufacturing (EDAM)—one of four focus areas within the MIT-Portugal Program (MPP). The MPP is a special initiative of the Portuguese government involving six universities in Portugal and the Massachusetts Institute of Technology that was created because of a concern that Portugal was lagging behind in its economic development. The Dori-Silver paper describes their assessment of the EDAM course format—two concentrated week-long periods with a six week break in between—compared to a regular semester based on faculty and student feedback. They concluded that the students in the concentrated format actually had a higher level of learning compared to those students who underwent a more traditional approach. Further, teamwork did not suffer from having to carry out assignments by geographically dispersed team members, but they did find it was critical for team members to know each other in person prior to the beginning of the project. A major finding was that the project-based learning approach introduced in the MIT-PDD course has been instrumental in successfully incorporating hands-on activities and students-faculty interactions into the formerly teacher-centered Portuguese education.

Bill Riddel and colleagues at Rowan University describe an integrated technical writing and design course that was developed using aspects of project-based learning and recent discussions about design education, as well as pedagogical approaches from the write-to-learn and the writing in the disciplines (WID) movements. What emerges is a course where both writing and design instruction are highly integrated. Students are presented with the concepts and vocabulary to understand their design assignments, and are then asked to discuss their design in written reports. In this format, writing informs design instruction as much as design informs the writing instruction. Design projects

are chosen such that they increase in complexity and duration, allowing students to master certain design skills before moving on to other skills. The end result is improvements in both the students' technical writing and engineering design abilities.

Erin Crede, Maura Borrego and Lisa McNair focus on preparing graduate students for faculty positions. The three co-authors – Erin a PhD student and Maura and Lisa—assistant professors—in Virginia Tech's Department of Engineering education demonstrate how theory can inform the design of a program to prepare graduate students for faculty careers. Their explicit application of "Communities of Practice" and "Stewards of the Discipline" represents a novel approach to career preparation. They describe a teaching fellowship program that spans three years of increasing instructional responsibility, and present assessment data to describe the role of faculty mentoring and peer networks in student identity development. They suggest that their model could be adopted by other research universities at modest cost.

A collaboration of faculty from the U.S., Australia, China and Japan describe PRIME (Pacific Rim Experiences for Undergraduates Project) – an integrated research program. The goals of PRIME are to: develop an integrated and sustainable undergraduate international research program that serves as a model for 21st Century undergraduate education; prepare students to become effective global professionals and citizens; and, give students a head-start on careers in science, engineering and technology research. The paper discusses the design and motivation for the scheme, the salient implementation details, issues related to student recruitment, finding mentors, and language issues. The authors present the outcomes to date and address the challenges of scalability and sustainability.

Jim Gleason and his colleagues at the University of Alabama describe their Engineering Math Advancement Program (E-MAP). E-MAP was developed in an effort to reduce engineering student attrition due to mathematics. This informal, interactive, and interdisciplinary five-week summer residence program aims to increase retention by both better preparing students to be successful in calculus and exciting them about engineering. In addition to a nontraditional math class, the program includes hands-on "Living-Lab" experiences, field trips and a community service project led by professional engineers. The non-math aspects of the program strengthened mathematical skills indirectly through engagement of the students in laboratory and real world engineering problems, in the idea that solving skills are best nurtured through hands-on experiences. E-MAP improved retention of students in STEM fields overall by approximately 12% after three years. Of particular note is the 36% increase in retention of students who entered with placement scores within the program's target range.

Christina Scherrer, Renee Butler and Shekinah Burns studied student perceptions of on-line education at Southern Polytechnic State University, a special-purpose institution in the University

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System of Georgia, with a mission to offer bachelors and masters degrees and continuing professional development in science, engineering, technology, and related fields. Many of the university's nearly 5,000 students are considered nontraditional. Three of its departments offer on-line degrees ; three additional ones offer on-line certificates, and still others offer additional on-line or hybrid courses. The authors surveyed more than 300 students and analyzed their responses. Although almost every survey participant agreed that on-line courses are more convenient, there were significant disagreements and different perspectives about on-line education among the groups. Their study confirmed many of the popular beliefs about students who are likely to take on-line courses. Students who live further away from campus or who work full-time while going to school reported more interest in on-line courses. Overall, students were more interested in taking qualitative courses on-line than quantitative or lab-intensive courses. More than two thirds of students surveyed expressed an interest in taking on-line courses in the future. Further, age, gender, class standing, and major did not seem to affect student perceptions, implying that on-line programs appear to be equally attractive across broad demographics.

A team of four colleagues from the Universidad Nacional del Comahue (Buenos Aires, Argentina) led by Germán Mazza conducted a pedagogical experiment with an interactive text (IT) focused on better understanding of homogeneous chemical reactors analysis. The IT was built using Mathematica software with the aim of providing students with a robust computational tool. They found a significant degree of student acceptance of the interactive text. As the course went on, students demonstrated a higher motivation level than that of a traditional class for carrying out the same task; they connected this increased motivation with the computer support. Students could reflect, draw conclusions and manage their own time. All remarked on the high level of interest they had experienced when studying the topics, since they had to discover different concepts by means of self-generated graphics and examples. The results of the evaluation show an average score significantly higher than the results achieved in an undergraduate course carried out with the traditional teaching methodology. As a result the authors strongly recommend the use of IT in undergraduate Chemical Engineering courses.