From the Editor

We are delighted to publish our eleventh issue, and, coincidently, with its eleven papers. The topics cover the wide spectrum of engineering education, from freshmen through graduate students, with an increasing number of papers that focus on the use of technology to improve learning. The authors also represent a wide range of institutions from across the U.S. and internationally, demonstrating that *AEE* is becoming more widely known and, hopefully, more widely read.

Naomi C. Chesler and her colleagues at Wisconsin describe *NephroTex*, which provides first year engineering students with a simulated, but virtual design experience. Using the simulator, student teams are guided through multiple design-build-test cycles by a mentor in a virtual internship. Their assessment documents that this virtual internship was successful in both educating and motivating first-year engineering students.

A second freshman design "advance" authored by Rebecca Rosenblatt, Andrew F. Heckler, and Katharine Flores, utilizes a "tutorial design process" to design curricular materials for improving students' understanding of important introductory materials science concepts. Their project, which involved over 1000 students, included extensive interviewing, testing, and iterative classroom implementation over a period of three years. Here they describe certain identified student difficulties, the tutorials designed to address those difficulties, and the results. They found a significant valued-added effect of the recitations on final exam performance, suggesting that such tutorials can be effective in helping students learn difficult conceptual material, and that their process should be adaptable to a wide range of STEM courses.

Elliot Douglas and Chu-Chuan Chiu at the University of Florida describe the implementation and testing of an active learning, team-based pedagogical approach - Process Oriented Guided Inquiry Learning (POGIL) - based on the learning cycle model. Here students work in teams to complete worksheets that guide them through the learning process. Rather than lecturing, the instructor acts as a facilitator. Students are actively engaged in processing the information and have the opportunity to utilize and develop teamwork, communication, and critical thinking skills.

Sean P. Brophy, Alejandra J. Magan and Alejandro Strachan also describe the use of simulation, in this case online molecular dynamics simulations (MD), to enhance students' abilities to understand the atomic processes governing plastic deformation in materials. Their target population is sophomore Materials Science and Engineering students at Purdue University. Here traditional lectures were followed by inquiry-based simulation lab activities using research-grade computational tools. Students needed the visualizations provided by the simulation to evaluate the atomic processes responsible for plastic deformation. Initial results showed that participation in the background and/or pre-laboratory lectures supported their abilities to recall specific facts and behavior of materials explicitly taught during instruction. Most students who participated in the laboratory experience demonstrated the ability to transfer what they had learned to predict how an unfamiliar material would behave at the molecular level. The authors suggest that their instructional approach can be generalized to other learning experiences to help students apply abstract engineering principles to a larger context of unfamiliar situations.

In a third paper focused on freshmen engineering, Kinda Khalaf and her co-authors from Kalifa University of Science, Technology and Research in the United Arab Emirates describe an interdisciplinary, freshman design-and-build course created to improve placement, content, and pedagogy. Their course aims to promote expert design thinking by using problem-based learning (PBL). Students are actively engaged in the various phases of a prescriptive design-and-build cycle using ill-structured, open-ended problems inspired from industry, and supported by technological tools including robotics kits and rapid prototyping machines. Of note is their integration of the prescriptive design cycle with PBL to promote effective inquiry and the systematic, iterative interplay between divergent and convergent questioning as part of the engineering design process. The authors' post-analysis revealed that graduates of the course were more likely than other engineering students to express attitudes consistent with professional engineers in the engineering design process, and the teams' adherence to the course's prescribed design cycle are correlated with the quality of the finished design, as measured by in-class demonstrations.

Jeff Frolik and his colleagues from six universities (literally across the U.S. from Vermont to Hawaii) document that targeting adaptation of innovative materials and methods may be more successful than complete adoption. They suggest that if faculty from multiple institutions are involved in the development of innovative coursework, then their agility across diverse academic requirements and institutional cultures can inform that process. Here they focus on the development of online learning modules based on individual areas of expertise, but all related to wireless sensor networks. Their modules integrate learning of systems thinking with traditional sub-disciplines in electrical and computer engineering and are delivered in a blended-learning format.

Ipek Bozkurt and James Helm have developed a systems engineering-based framework for designing an online engineering course. Their framework provides a structured methodology for the design, development and delivery of a fully online course. They suggest that by utilizing a life-cycle approach, a smooth transition is ensured for faculty who are in the process of modifying their curriculum to meet student and industry demands. Results are presented for a fully online course that was designed and developed for the Engineering Management Program at University of Houston Clear Lake.

Traditional curricular approaches within engineering education tend to be fragmented, with opportunities for content- and meta-level synthesis being mostly limited to freshmen and senior year design courses. Here, Nadia Kellam and three colleagues propose a curricular model, the Synthesis and Design Studio, to combat fragmented curricula. Their approach attempts to negotiate the realities of fragmented curricula by providing an integrative learning component that exposes students to open-ended projects; their intent is that students will develop an integrated understanding of their courses, lives, and professional futures. Their focus area is environmental engineering.

A second paper focused at the sophomore level is by Kevin Dahm and three co-authors from Rowan University. Of particular interest here is the integration of entrepreneurship into the required engineering curriculum before senior capstone design; in this case, into a multidisciplinary sophomore-level design course. This provides an opportunity for students to further pursue their entrepreneurial ideas through a junior/senior level, project-based course. The paper describes two entrepreneurial assignments that have been integrated into Rowan's Sophomore Clinics: a white paper, and an open-ended semester long design experience in which students propose their own entrepreneurial projects. While the Sophomore Clinic structure is unique to Rowan University, the entrepreneurial assignments themselves are readily adaptable to other engineering programs.

The last two papers focus on graduate education. Rachel Kajfez and her colleagues address using ePortfolios (EP) to assess graduate engineering programs, which may be both flexible and individualized. Their results demonstrate that the EP assessment systems were directly affected by the graduate programs' culture and vision of graduate engineering assessment, and that the EPs are flexible based on departmental or program needs. Their conclusion is that EPs are appropriate for assessment in graduate engineering programs and that a systematic process of development can be used.

The final paper, by Sohum Sohoni, Yoonjung Cho and Donald French is focused on assessing graduate teaching assistants (GTAs), who often possess little pedagogical knowledge. In response, they first surveyed GTAs, faculty, and students on the importance of each of 24 GTA roles and responsibilities. The resultant statistical analyses found four-factors that accounted for 54% of the total variance - clear communication, student management, preparation for feedback and assessment, and course management/policy knowledge. Correlations with an empirically-validated teacher motivation measure indicated the four factors were positively related to GTAs' intrinsic motivation. Their results can be used to improve the training of GTAs and the resultant undergraduate courses.