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From the Editor

This marks a fourth issue and the completion of a cycle. We are publishing five papers that again demonstrate the breadth of AEE. This issue's peer-reviewed papers cover embedding laboratory experiences with lectures, using cognitive load theory to enhance computer programming skills, introducing experiential learning in mechanics of materials, using structured writing to improve the performance and attitudes of engineering teams, and using problem based learning to deliver digital electronics lectures. This last paper, from colleagues in India, once again demonstrates the reach of AEE and the international interest in improving engineering education.

The paper by Jim Morgan, Luciana R. Barroso, and Nancy Simpson—Embedding Laboratory Experience in Lectures—describes an effective way of enhancing student learning by including laboratory experiences within the classroom. Their paper presents a model for infusing demonstrations into an engineering classroom and demonstrates how it might be used. Key to this is active student engagement in what is a guided laboratory experience within a lecture setting. Students discuss the purpose of each demonstration, predict what should result, discuss underlying theories to help explain the results, and compare their observations to predictions. The authors have used these demonstrations at three different stages of a course topic presentation: introduction, wrap-up and as an aid during the class discussion of the topic. They propose that different learning outcomes can be achieved in this manner. Assessments are included from both faculty and students.

Tom Impelluso introduces cognitive load theory (CLT) to a broader engineering audience as a mechanism to enhance computer programming skills for mechanical engineers. The result is a redesigned hybrid course (incorporating distance learning technology), which has led to an improvement in the learning experience. To maximize the germane (motivational) learning load, the author has introduced vertical scaffolding for course material, connecting various language syntax constructs to each other as well as connecting together application algorithm constructs. He also used horizontal scaffolding to connect language syntax to application algorithm. In addition, application algorithms are connected to such examples of simulation science and engineering as finite element, multi-body dynamics and computational fluid mechanics. Comparative evaluations found improved student learning outcomes, streamlined and enhanced course delivery, and improved instructor evaluations, in addition to real departmental cost savings (both instructor and equipment costs), and increased enrollments.

Rani Sullivan and Masoud Rais-Rohani combined theoretical/mathematical approaches with active learning exercises to improve student understanding and retention. Their particular topic area is a beam testing system (BTS) to improve learning of mechanics of materials. Students in their experimental group could verify their analytical predictions by conducting experiments using the BTS while those in a comparison group only performed the analysis portion of two exercises. Not only did the experiential group perform better on a common examination, but they also indicated a higher degree of satisfaction with the class projects than did those in the comparison group.

Kevin Dahm, Roberta Harvey, James Newell, and Heidi Newell describe their efforts to develop metacognition in engineering student teams by exploring personal learning patterns, and then introducing ongoing biweekly journaling exercises. Students in their experimental and comparison groups worked on semester-long projects as part of the Rowan Engineering Clinics. The Learning Connections Inventory (LCI) was used to determine student learning patterns, with the writing assignments used in an effort to improve team dynamics. Four groups were studied (covering the various treatment combinations): the LCI followed by with faculty advisors; structured writing assignments (focusing on team dynamics and logistical barriers to success); both the LCI instruction and writing assignments; and neither. The authors found that those students who received instruction on their own and their teammates learning patterns performed better on the semester-long team projects and reported a significant improvement in their attitude towards teaming skills. Although the structured writing assignments seemed to benefit performance, they were less popular with students.

A team from a relatively new Indian engineering school—Archana Mantri, Sunil Dutt, J.P. Gupta and Madhu Chitkara—used problem based learning (PBL) to improve course deliver in Digital Electronics. Their pilot experiment demonstrated the viability of PBL to enhance learning when compared to more traditional teaching methods. The paper also discusses how quasi—open—ended problems can be designed for use with PBL.