

Guest Editorial

In his editorial in Vol. 24, No. 5 of 2008, *IJEE* the previous Editor-in-Chief the late Dr. Michael Wald called for “more specific archival publications of education research applied to engineering education practice.” He went on to say, “It would be good to see engineering education publications picking up some research results from engineering and education fields and applying them to engineering practice.” These special issues are the result of that inquiry, and our purpose is to help bridge the gap between researchers and practitioners by providing specific examples of effective applications of engineering education research. The 27 papers comprising our two special issues achieve that purpose well!

When we were initially approached in 2008 by Michael Wald to edit a special issue on *Applications of Engineering Education Research*, we thought it was a timely, worthwhile and interesting topic. The global perspective of the *IJEE* made it an ideal venue for such a forum. Our concern was getting enough good papers for an entire issue. At every step in the process, we have been amazed by the outpouring of support and interest from the community around the world on this topic. We had over 100 extended abstracts submitted by the deadline in January 2009 and more after that. Reviewers from around the world were generous with their time, allowing us to have at least four substantive reviews for every paper. We had many excellent papers submitted resulting in the enviable problem of having too many to fit in one journal issue. Thus our 27 papers—describing unique applications of engineering education research—are appearing in two issues. In this issue, there are 15 papers focusing on “Developing Engineering Competencies,” and the next issue will feature 12 papers that address “Building Engineering Communities”.

Developing Engineering Competencies

The 15 papers in this first issue address topics that are of particular importance for engineering education: design, teaming, open-ended problem solving, misconceptions, writing skills, and self-directed learning. The papers represent a global perspective, with work from Australia, Spain, Sweden, and the U.S.A., and they offer a broad range of ways in which research has been applied to the practice of engineering education. Clearly, the ability to produce good designs is indispensable for engineering. Borgford-Parnell, Diebel, and Atman describe how they use their own research findings to motivate student interest and help students learn about the design process, while Cheville focuses on his efforts to teach design by applying a socio-constructivist theory of learning (the Vygotsky Cycle) to the traditional design process.

Working effectively on student teams is also a fundamental competency and assessing student teams is the topic of the next two articles. Davis and his colleagues present their work with the Transferable Integrated Design Engineering Education (TIDEE) consortium to develop an instrument to assess students’ team citizenship, and Rebollar and his colleagues share their Teamwork Failure Prevention Questionnaire which allows instructors to identify dysfunctional teams early.

Open-ended problem solving is another essential skill for engineering and it is the focus of the next six papers in this issue spanning a range of engineering disciplines. Daniels and his colleagues present the Open Ended Group Project Framework and its role in students’ development of global collaboration skills in an IT in Society course, while Diefex-Dux, Zawojewski, and Hjalmarson write about their development of evaluation tools for open-ended problem solving. Moore and Hjalmarson describe the use of modeling tasks for first year students as a way to document student thinking, the variety of their responses, and the range of performance, and Yildirim, Shuman, and Besterfield-Sacre similarly apply model eliciting activities (MEAs) to upper level courses to both improve conceptual understanding and provide a means for assessing the problem solving process. Next, Mourtos describes ways in which several aerospace engineering courses have been redesigned to help students develop better problem solving ability, and finally, Litzinger and his colleagues present two practical examples in which they applied existing research findings to improve problem solving in Statics and Fluid Mechanics courses.

Identifying and helping dismantle student misconceptions is critical to enabling students to develop true engineering competencies, and the next two papers address these issues. Krause and his colleagues use the Materials Concept Inventory to assess the impact of various pedagogies—differing in their degree of conceptual change—on students’ misconceptions, while Prince, Vigeant, and Nottis describe the development of concept inventories for thermodynamics and heat transfer and the identification of persistent student misconceptions in these fields.

This issue concludes with three papers that address other engineering competencies including writing skills and self-directed learning. The paper by Ferris, Sitnikova, and Duff presents their efforts to increase the ability of masters students (for whom English is an additional language) to communicate research plans, both by integrating the curriculum and assessment process and by providing discipline-specific writing

support. Then Stolk and his colleagues describe results from a study of students' perceptions of self-directed learning experiences in the classroom, and finally Vanasupa, Stolk, and Harding explain why a holistic approach to education (in which ecological factors are key) is required to design effective learning experiences that foster student engagement and growth.

We want to thank Amy Kao-Wester for her incredible contributions. Given the huge response of the community, it was essential that we find a way to manage all of these papers through the review and resubmission process. Amy's assistance with Easy Chair was invaluable to the success of this endeavor. We would also like to thank the authors who produced such outstanding work and the reviewers who helped insure the quality, and we are grateful to current IJEE Editor-in-Chief Ahmad Ibrahim for his support and encouragement throughout this process.

Finally, we are particularly indebted to Michael Wald for the inspiration for this Special Issue and for his reaching out to us to offer this opportunity to collaborate as Guest Editors. We are saddened that he is not still with us to see the final product but hope that his family and friends will be happy to know that his legacy truly lives on.

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