

Integrating Education, Research, and Outreach: Exemplars from the NSF Distinguished Scholars Program

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Abstract - Engineering education is reaching beyond the traditional bounds of teaching engineering to engineering students. As engineering pervades everyone's life, it is becoming increasingly important to teach engineering to non-engineers, to bring engineers and non-engineers together in dialogs around technological topics, to integrate teaching and cutting-edge research, to link engineering students and faculty across national boundaries in new integrated research and educational environments, and to bring engineering into pre-college settings. This panel explores the approaches seven NSF Distinguished Teaching Scholars have taken to integrating their work across the dimensions of education, research, and K-12 outreach. These projects serve as exemplars for how we can stretch the boundaries of engineering education practice.

Index Terms – engineering literacy, K-12 outreach, multinational projects, teaching-scholars, research, service learning

INTRODUCTION

In recognition of the importance bringing a scholarly approach to both research and education, the National Science Foundation created the Director's Award for Distinguished Teaching Scholars in 2001. To date, 34 faculty from science, technology, engineering, and math (STEM) disciplines have been named Distinguished Teaching Scholars; ten of the awardees are engineering faculty. This panel brings together seven of NSF's Distinguished Teaching Scholars from fields of engineering. The panelists will present brief summaries of their work, address issues of integrating education and research, and discuss the benefits and challenges of expanding the scope and audience for engineering education.

DISTINGUISHED TEACHING SCHOLAR PROJECTS

David Ollis and H. Vincent Poor are breaking new ground in teaching engineering topics to undergraduates outside engineering. Ollis's work at North Carolina State centers on cross-college collaborations that incorporate engineering activities

into courses in Languages, Education, and Industrial Design. His device dissection lab developed for first year engineering [1] and technology literacy [2] instruction is utilized to enrich existing courses in Spanish [3] and Industrial Design [4], with expansion to Technology Education planned for next year.

At Princeton, Poor has pioneered holistic teaching of technical and non-technical topics in advanced technologies to integrated classes of technical and non-technical students. His course, "The Wireless Revolution," has become one of the largest and most diverse courses offered at Princeton. Poor has recently become the founding director of Princeton's Center for Innovation in Engineering Education, which seeks in part to expand this teaching methodology to other technologies such as energy and transportation. The Center is also involved in expanding the accessibility of other engineering-related subject matter, including entrepreneurship and technology policy, to students in the liberal arts, by fostering new courses in these areas designed for mixed classes of technical and non-technical students.

Chris Rogers and Susan Powers are exploring aspects of integrating research with K-12 outreach. Rogers directs the Center for Engineering Education Outreach at Tufts University (<http://www.ceeo.tufts.edu>) [5]. The Center is dedicated to increasing the engineering literacy of all high school and college graduates through 1) research in engineering education [6], 2) developing curricula and teaching tools [7] such as the LEGO[®] "Mindstorms for Schools" product [8], and 3) teacher support. Center members have started a program that teaches students engineering by placing them in local pre-college classrooms to help teachers integrate engineering into their curriculum [9]. Industries (Raytheon, Lockheed Martin, and National Instruments) and other universities (Princeton) are adopting this program. The Center has also developed a series of senior design projects that mix seniors in many different engineering disciplines with seniors in liberal arts [10].

Clarkson University has similar goals of increasing the technical literacy of all and increasing the interest of middle school students, especially girls, in STEM disciplines (<http://>

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