Integrating Professional Practice into the Engineering Curriculum
NSF Faculty Workshop – June 26-28, 2013
NSF-0941768

Introduction

A primary objective of undergraduate computing and engineering programs is to prepare graduates for professional practice. New graduates often find themselves working on large, complex systems that require dozens (or hundreds) of people and months (or years) to complete. Unfortunately, graduates often feel ill-prepared to work on systems of such size and complexity. Educators find it extremely difficult to provide a realistic experience with such systems in an academic environment.

Engineering and computing curricula primarily rely on a senior design course (one or two semesters in length) to teach professional practice. Students are typically organized in project teams to develop a realistic product or service, in which the students engage in various professional practices: such as project management, requirements analysis and modeling, high-level and detailed design, implementation or simulation, quality assurance, project reporting, and use of appropriate engineering tools and methods.

In order to be successful in such a course, students need to know how to use engineering tools and methods, be able to work in teams, communicate effectively with project stakeholders, adhere to budgets and schedules, and deal with complex, vague and ambiguous expectations. Unfortunately, students often are unprepared in these areas. Curriculum developers are challenged by the organization and nature of delivering academic programs: curricula are organized around courses and academic semesters; students must learn foundation material before applying it; faculty have diverse disciplines and background, and many do not have professional experience; and it is difficult to fit realistic professional experience into a single course, or to coordinate over multiple courses.

Increasingly, more engineering and computing programs are implementing features to help solve these problems: including professional issues and a team project for freshman students (possibly in an introduction to engineering course); placing greater emphasis on building team skills; engaging students in active learning activities, which involve them in the exercise of professional practice; and promoting student industrial internships. Unfortunately, such approaches are not widespread or comprehensive enough to adequately address the challenges of preparing graduates for professional practice

Workshop Description

This workshop will address the challenges of teaching professional practice within an undergraduate engineering or computing program, with special emphasis on programs in computer engineering, computer science, software engineering, and systems engineering. The workshop will present background information about teaching professional practice: research in this area, experiences with team projects, and use of active learning techniques such as case study exercises. However, most of the workshop time will be devoted to discussion and group activities related to how professional practice can be integrated throughout an engineering or

computing curriculum. A principal goal of the workshop is to provide the participants with material and experiences that support their increased ability to teach professional practice; they will also be provided with help in preparing action plans to improve the teaching of professional practice.

Workshop Learning Outcomes

Upon completion of the workshop, participants will be able to:

- Describe the key issues in preparing undergraduates for professional practice in computer engineering, computer science, software engineering, and systems engineering.
- Develop plans for integrating professional practice learning activities throughout undergraduate computing and engineering curricula.
- Explain active learning and case study teaching goals, concepts and practices.
- Design a case study activity that incorporates active learning for teaching a professional practice concept.

Workshop Support (Provided by NSF, DUE-0941768)

- Up to $400 for travel to and from Atlanta, GA
- Two nights of lodging at the workshop hotel (selected participants will be asked to stay for third night.)
- Food will be covered throughout the workshop

Intended Participants

- Computing and engineering faculty, who want to improve the quality of professional practice education in their programs; who want to learn more about active learning and the case study teaching approach; and who want to provide their students with more realistic and relevant learning activities.
- Special considerations will be given to junior faculty in an engineering discipline

Workshop Features

- Two and a half day workshop in Atlanta, GA in June 2013
- 20 or fewer faculty participants
- Lectures, Discussions, and Group Work
- Three Instructors

Instructors

- Massood Towhidnejad – Professor of Software Engineering, ERAU
- Salamah Salamah – Director of Software Engineering, UTEP
- Thomas B. hilburn - Professor Emeritus of Software Engineering, ERAU

Preliminary Workshop Schedule

Wednesday June 26 (4:30 – 6:00)

- WS Participants Introduction (0.5 hr)
- Background (1 hr)
  - What is professional practice?
  - What professional practices do we want to teach?
  - Professional Practice Curriculum Issues
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Thursday June 28 (8:30-5:00)

- Group Exercise: Professional Practices challenges and Concerns (1 hr)
- Active Learning and Case Study Based Teaching (0.5 hr)
- Overview of *DigitalHome* Project (0.5 hr)
- Teaching Team Skills (1 hr)
- Lunch
- Group Exercise: Team Problems Case Module *(1.5 hr)
- Teaching Team Project Courses (1.5 hr)
- Group Exercise: Creating a Team Project Course(1.5 hr)

Friday June 29 (8:30 – 4:00)

- Ethical and Professional Conduct (1 hr)
- Group Exercise: Professional Conduct Case Module* (1.5 hr)
- Professional Competency Models (1 hr)
- Lunch
- Incorporating Professional Practice into a Curriculum (1 hr)
- Individual/Group Exercise: Developing a Professional Practice Curriculum Plan (1.5 hr)
- Workshop Assessment (0.5 hr)

*Some of the workshop exercises will focus on a case study based on the development of a "smart" house, called *DigitalHome*. The *DigitalHome* project includes cases study exercises relevant to the practice of computer engineering, computer science, software engineering, and systems engineering. More information on the DigitalHome project is available at http://www.softwarecasestudy.org.