Chapter 11
Developing Personal and Professional Skills in Software Engineering Students

Lynette Johns-Boast
Australian National University, Australia

ABSTRACT

Although industry acknowledges university graduates possess strong technical knowledge, it continues to lament the lack of commensurately strong personal and professional skills that allow graduates to apply their technical knowledge and to become effective members of the workforce quickly. This chapter outlines a research-backed course design that blends experiential learning to create an industrial simulation, the rewards of which go well beyond the usual benefits of group-project capstone design courses. The simulated industrial context facilitates the graduation of software engineers who possess the requisite personal and professional attributes. Innovations include combining two cohorts of students into one, engaging industry partners through the provision and management of projects, and implementing proven education approaches that promote the development of personal and professional skills. Adoption of the suggested practices will help institutions produce "work-ready" graduates repeatedly, year after year, even by software engineering academics who may not have received teacher training and who may not possess significant industry experience themselves.

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INTRODUCTION

During the last century, there have been a number of changes within the domain of engineering education. Traditionally engineering education focused on the practical aspects of engineering. However, the engineering-science revolution of the last century and increasing government emphasis on research has caused a drift from this "hands-on practice to mathematical modeling and scientific analyses" (Froyd, Wankat, & Smith, 2012). During the final decade of the century, industry and academia both expressed concern about graduates' lack of professional skills, such as teamwork and communication, as well as their lack of awareness of the importance of societal influences. Industry was also concerned about graduates' readiness to enter the workforce (Benyon, 2012; Jollands, Jolly, & Molyneaux, 2012; McLennan & Keating, 2008).

This concern lead to the development of the outcomes based accreditation models that are now typical of 21st century accreditation processes. Undergraduate engineering degree program accreditation processes aim to ensure that newly graduated "Professional Engineers" are "professionally competent" (ABET, 2012-2013). In other words, that a graduate's education, training and experience has enabled the development of appropriate knowledge, skills and attitudes. However, despite this evolution of the accreditation process, industry continues to call for improvements (Litzinger, Lattuca, Hadgraft, & Newstetter, 2011).

The new accreditation processes and their associated competency-based frameworks require a "culture change among faculty" and a move away from "the science-focused preparation that has characterized engineering education since World War II" (Passow, 2007). Instead of developing curricula that are content-focused and closely aligned with the discipline, academics must now develop curricula that are not so closely identified with the specific discipline. This requires a change of approach from the more straight forward transmission of knowledge to the more challenging one of helping students to grow and acquire the critical skills they will need to succeed after university (Passow, 2007; Woods, Felder, Rugarcia, & Stice, 2000).

Complicating these required changes to engineering curricula is that "most university professors … were not taught anything about how to teach" (Felder & Brent, 2004). Instead they rely on how their "professors taught, but nobody taught them anything about teaching either. It doesn't make a lot of sense, but that's our system" (Felder & Brent, 2004). The accreditation process and universities themselves require individual programs and courses to develop students' generic graduate attributes. However, academics "charged with responsibility for developing them do not share a common understanding of either the nature of these outcomes, or the teaching and learning processes that might facilitate the development of these outcomes" (Barrie, 2004, p. 263).

Both the literature and the academics themselves consistently identify the importance of these generic attributes (Male, 2010). Nonetheless engineering academics accord the teaching of them low status. The increasing focus on research and the engineering science revolution have placed greater emphasis and importance on theory and analysis of abstract problems. Furthermore, as noted by Male (2010), the "gendered nature" of engineering and engineering education has helped bestow lower status on the "stereotypically feminine traits, such as those related to people and nurture … [while] abstract science has higher status" (p37). This has led to a marginalization of "communication, teamwork, management, definition of problems, practical engineering, and context" (Male, 2010, p. 37). Notwithstanding this, when asked to rank ABET's 11 competencies on their level of importance, academics accord highest importance to the competencies related to problem solving and communication and place only average importance on math, science and engineering knowledge (Passow, 2007).

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