Chapter 7
E–Portfolios as a Quantitative and Qualitative Means of Demonstrating Learning Outcomes and Competencies in Engineering

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ABSTRACT

An outcomes-based approach to engineering education within the tertiary sector is now mandatory in Australia, with the government body responsible for the quality of tertiary education (TEQSA) and the professional body responsible both for accrediting engineering degrees and for registering professional engineers (Engineers Australia) couching their expectations and requirements in terms of outcomes expressed as competencies. In response, the institutions providing engineering qualifications have expressed the outcomes anticipated from successful completion of their courses in terms of graduate attributes. The net effect is that the outcomes attached to engineering education relate to a wide variety of domains, ranging from the spatial (what points on the engineering landscape must be covered) through the agentic (what actions an engineer should be able to undertake) to the temporal (when in an engineering career particular competencies should be evident), but how these translate to practical competencies at the level of the individual student or practicing engineer is not explicit.

INTRODUCTION

ePortfolios are emerging as a powerful means of supporting students and professionals in documenting and demonstrating the achievement of specific outcomes and the attainment of competencies. Yet the fact that ePortfolios are not yet widely used across Australian institutions attests to the difficulties that are being encountered in their implementation, despite the wide-spread availability of most if not all the support required. One of the reasons for this is that academics, students and professionals alike are not made aware of the roles that are necessary for the successful development of an ePortfolio. We present an analysis of these roles and show how they can be operated within a framework of processes to generate ePortfolios that are effective and remain living 'documents' throughout the individual's professional life.

BACKGROUND

What is Professional Practice?

Engineering is a wide and diverse practice-based profession. As a practice it has a long history stretching back to the dawn of human civilization when tools were first created and developed. Over the years there has been a growing culture of professional practice with an associated professional identity. But what exactly does it mean to be a professional practitioner? Donald Schön (1983), who first introduced the term 'reflective practice' (see section below), was deeply concerned with this question. He maintained that there is a crisis of confidence in many professions, and while there may be a rigor in the discipline and epistemology of engineering, he and others have questioned the role of professional engineers and the lack of definition of the ontology, or nature, of practical (professional) competence (Schön, 1983; Blockley, 1992).

Kemmis (2011) proposes that "professional practice" is both complex and multi-layered, shaped not only by the individual and the society of which one is a member, but also by "extra-individual features." Kemmis's view of practice:

- Involves meaning and intention and is informed by a theoretical framework.
- Is always experientially-formed and expresses identity and agency.
- Is always embodied and includes the development of capabilities and competencies.
- Is dramaturgical and temporally-located, unfolding against the narrative background.
- Is systematic and involves the development of professional roles and functions.
- Is always reflexive which stimulates the creation and transformation of identities.
- Always involves practical reasoning in the face of uncertainty.

As a profession, engineering shares a common set of tenets with a number of other practice-based professions, such as medicine, nursing, law, teaching and the clergy, namely that professional practitioners should (Shulman, 1998):

- Provide service that meets the needs of humanity and society.
- Possess a fundamental understanding of the knowledge and skills within the discipline.
- Engage in a domain of professional practice.
- Have the capacity to make judgement under conditions of uncertainty.
- Learn from experience.
- Establish, participate in, and contribute to a professional community.

A three-year study by The Carnegie Foundation examined the imperatives of teaching for professional practice—with an understanding of "practice" as day-to-day work of engineers which are complex, creative, socially responsible, and

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