Chapter 4
Enhancement of Student Learning for Effective Capstone Project Outcomes

Aaron S. Blicblau
Swinburne University of Technology, Australia

Jamal Naser
Swinburne University of Technology, Australia

ABSTRACT

It is commonly accepted that today’s engineers are required to deal with a whole range of matters involving scientific, technological, and importantly communication issues, and so need to be educated with these aspect in mind. The pedagogy of engineering requires a better understanding of students’ abilities to guide their approach to learning the necessary skills of working in the engineering community. Consequently, there is an ever-increasing need for engineering graduates who are able to communicate effectively. In many engineering courses around the world, one of the key aspects required of the students is that they complete an independent project in their final year of studies. This chapter examines student abilities and skills required to successfully develop capstone projects which involve research skills, communication skills, and information-retrieval abilities. Findings from the work show that, although local and international students benefited from the intensive tutorial activities, it was the NESBC students who found the active learning events to be the most beneficial. The implementation of the active tutorial sessions resulted in increased grades for the majority of students. The procedures followed to achieve these findings highlight the importance of intensive active learning events for final year capstone engineering students.

INTRODUCTION

Project work is now considered to be an important part of an engineer’s training (ENAAE, 2013; EA, 2013; EA, 2012; ABET, 2010). The capstone research methodology, the comprehensive writing, and the extensive literature retrieval and evaluation process have been incorporated into a formal subject as an enhancement of student skills into the early stages of final year capstone project for students from all backgrounds. The enhancement process comprises a series of interactive seminars.
and active tutorial actions and has been developed to provide the students with generic skill and capabilities. This process provides a systematic approach to the research, writing and reviewing process procedure. Students enrolled in their final year of mechanical engineering at our institute are required to undertake and complete a final year project also known as major or capstone project (Ku & Goh, 2010; McDermott & Machotka, 2006). Students select a project from a list prepared by academic staff, or may suggest their own topic based on individual interest, or arising from their period of Industry Based Learning. The project may be university based or industry based. The project may take various forms involving technology research and development, experimental work, computer analysis, industry liaison and business skills. Students are expected to conduct literature and state of the art surveys, formulate and define problems, generate and select solutions, and analyze and prepare designs. Where appropriate, students build and test their design. Projects are undertaken under the close supervision of a staff member who meets regularly with the students to discuss and assure progress. Total student time spent on the project is expected to be a minimum of 160 hours which is expected to be 25% of their final year of studies over two semesters. Either a major report or a technical paper is prepared and submitted for assessment, a poster is prepared for display, together with an oral presentation is delivered in a conference format.

This current work focuses on the implementation of a pedagogical enhancement process to improve student learning through capstone projects. We emphasize the relevance of a variety of skill enhancement processes incorporating approaches to research methodology, research writing, and retrieval involving bibliographic software, and oral presentations.

We further explore the research question: how does class use of bibliographic software and mode of instruction affect students’ perception of their ability to access, manage, and integrate information into written research reports? Although it is well established that engineering students have strong technical skills, many may not have had the opportunity to develop research skills during their course. Information retrieval skills are scaffolded throughout the engineering program, but it is not until the capstone project year that students are confronted with the challenge of finding and collecting relevant references, evaluating their importance, and then has the ability to cite these in a consistent and appropriate referencing style. The last part of this study investigates capstone students’ perceptions about their own referencing skills. The overall results will inform future approaches to teaching the conduct of capstone projects incorporating research methods, information literacy skills and associated writing capabilities for capstone project students in mechanical engineering.

BACKGROUND

Since it is widely accepted that today’s engineers are required to deal with a whole range of matters involving scientific, technological and importantly communication issues, they need to be educated with this in mind. It is well established that the zenith of the project work is the writing of a thesis or report and an oral presentation of the work together with an e-poster to peers and frequently to members of relevant industries or professions (EA, 2012; Hurst, 1993). The ability to deliver an effective presentation is prominent on lists of graduate attributes (ABET, 2010; Bradley, 2006a; 2007; EA, 2011: EA, 2013), but the development of effective teaching practices to develop such skills has received little attention in the scholarship of teaching and learning. In many engineering courses around the world one of the key aspects required of the students is that they complete an independent project in their final year of studies (Blicblau & Dini, 2012). Project work is now considered to be an important part of an