Chapter 82

Developing Engineering Students' Communication and Information Retrieval Skills Utilizing Capstone Projects

Aaron S. Blicblau
Swinburne University of Technology, Australia

Jamal Naser
Swinburne University of Technology, Australia

ABSTRACT

The pedagogy of engineering requires a better understanding of the requirements of students' abilities to learning the skills necessary for working in the engineering community. 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 incorporating information retrieval and subsequent communication skills. The current work provides details teaching and learning approaches to enhance student abilities and expertise involving research skills, communication skills, and information retrieval integrated within capstone projects. Findings from this the work indicated that both domestic and international students benefited from the intensive tutorial activities involving computer based information retrieval skills. The implementation of active tutorial sessions resulted in increased grades for the majority of students, high-lighting the importance of intensive active learning events for final year capstone engineering students.

INTRODUCTION

Project work is considered to be a vital part of an engineer's training (ENAEE, 2015; EA, 2013; EA, 2012; Keet, 2011; ABET, 2014; Connor, Dench, & Bates, 2000) and is often the major component of the capstone course in the final year of engineering. The capstone course challenges the student's personal and professional skills. The nature of the course forces us to accept dimensions of professional practice that go beyond technology by also including societal considerations. The capstone course should include

experiences that benefit the graduate or senior undergraduate student, by incorporating "practicing oral and written communication skills" (Hoffman, 2014).). 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 a 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; O'Sullivan & Cochrane, 2009; Sjorberg, 1996). Students select a project from a list prepared by academic staff, or may suggest their 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 regularly meets 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.

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 they students are confronted with the challenge of finding and collecting relevant references, evaluating their importance, and then can cite these in a consistent and appropriate referencing style. 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? The last part of this study investigates capstone students' perceptions about their 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 pinnacle 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

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