Chapter 12
Literature Review Skills for Undergraduate Engineering Students in Large Classes

Elizabeth Yong
University of Adelaide, Australia

ABSTRACT

Writing a literature review for a design project, which may be undergraduate engineering students' first encounter with published research on the impact of engineering solutions in a broad context, requires effective skills of interpretation and communication. Engineering Communication curriculum at The University of Adelaide is designed to enhance students' skills in writing literature reviews. This chapter outlines the development of students' skills in interpreting the literature and structuring a literature review; it explains the scaffolded learning approach of an Engineering Communication course, and describes means by which skill development may be facilitated in large classes. Students' skill development can be traced from a descriptive, 'cut-and-paste' approach, to a relatively critical use of evidence from peer-reviewed sources, integrated into a well-structured discussion. A scaffolded approach to learning supports students' improvement of their skills through staged-design of materials, and detailed feedback on draft attempts, according to highly specific assessment criteria. The process can be facilitated in large classes by the creation of online learning resources, including model texts and model seminar presentations.

INTRODUCTION

Students need literature review skills to inform their project work at university, and to prepare for their role in the community as professional engineers. Literature review skills are important for students' understanding of the impact of engineering solutions in a broad context, which is recognised internationally among signatories of the Washington Accord (ABET, 2011; Board of Engineers Malaysia, 2011; IES Engineering Accreditation Board, 2011; Engineers Australia, 2011) and the European Network for Accreditation of Engineering Education (ENAEE, 2011) as vital for graduate engineers. Furthermore, an understanding of the impact of engineering

solutions places expert engineers in a position to make well-informed judgements about solutions they implement, to present cogent arguments to stakeholders, and to contribute positively to cross-disciplinary community debate about sustainable development.

This chapter outlines ways in which the Engineering Communication curriculum at The University of Adelaide is designed to enhance undergraduate students' skills in interpreting the literature and structuring a literature review, within large classes. Students' skills are seen to improve in a learning environment that includes feedback from the lecturer and external assessors on their practice oral presentations and draft papers. Skill development can be traced from a descriptive, uncritical 'cut-and-paste' approach by some students, to a relatively critical use of evidence from peer-reviewed sources, which is integrated into a well-structured discussion.

Firstly, the approach to enhancing literature review skills within a particular course is presented, and observations reported of the improvement in students' skills. Explanation follows of a scaffolded learning approach, by which students' learning is supported through detailed feedback. Thirdly, discussion focuses on facilitation of the learning process in large classes through provision of online learning resources, which are designed in stages specific to the target skills. Finally, future work to improve learning outcomes is proposed.

ENGINEERING SYSTEMS DESIGN AND COMMUNICATION COURSE (ESDC)

The Engineering Systems Design and Communication course (ESDC) combines engineering systems design skills and communication skills for Level 3 students in Aerospace, Automotive, Mechanical, and Mechatronic programs of study. This course covers various stages of the design process, fundamentals of good design practice, and

effective communication skills, over a 12 week semester. Learning objectives include development of innovative and creative problem-solving skills and understanding of the engineering design process, as well as improved skills in teamwork and project management, and skills of effective communication in writing and seminar presentations, relevant to students' engineering program of study and their professional careers. Assessment in the ESDC course is built around a team design project (for example, 'Hybrid-electric vehicle' or 'Commuter bicycle'). The team's design project is weighted at 40%, with a further 20% allocated to individuals' concept evaluation and drawings. Secondly, an individual literature review on the energy cost of their team's design, for example, is weighted at 40%. Individuals present their literature review in both a seminar and a research discussion paper, and use this work to contribute to the team's larger literature review in the Design Report. Due to constraints of timetable and administration of groups, oral presentations are scheduled in specific sessions that students select to suit their own timetables, and so the audience is classmates, but not necessarily team mates. Team mates are selected by the students themselves in the lecture group, irrespective of which tutorial class they have enrolled in. Therefore, workshopping of the written literature review, (plenary discussion of individuals' research and analysis) in a tutorial class does not necessarily include their team mates. In this sense, the individual work is quite separate from the teamwork on the project. However, since the topic for the project is identical for each team, and therefore the scope of the individual literature reviews is similar throughout the class, the mixed audience in tutorial classes and seminar presentation sessions is not perceived as an obstacle. Currently, students select their own teams and all teams meet weekly in a single 3 hour practical class. An alternative approach would be to form teams within the tutorial classes, which would bring teams together when drafts of the individual literature reviews are workshopped,

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