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The Integration of Professional Communication Skills into Engineering Education

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ABSTRACT

Conventional Engineering curriculum is strongly focused on the development in students of technical knowledge and skills. However, in recent years, employers have increasingly acknowledged that this traditional preparation of Engineering students' is inadequate, as graduates lack the wide range of written and spoken communication skills required to engage with members of other professional groups and with the broader community. Recognition of the important role that communicative competence plays in professional success within the engineering industry has, as a result, led to a number of tertiary institutions developing curricula to address these needs. This paper presents a successful integrative Engineering Communication curriculum, developed for both local and international Engineering students in an Australian university, which aims to develop both communicative ability and community engagement.

The courses that form the Engineering Communication Program provide for critical awareness-raising of community issues such as ethics, sustainability and gender, English for academic and professional Engineering purposes for both English as an Additional Language (EAL) and English background students and advanced research communication for postgraduate students. All courses are strongly informed by scaffolded learning techniques, systemic functional linguistics and genre theory, and most are run collaboratively by Engineering, Education and Applied Linguistics lecturers. The aims of the Program are to raise awareness in Engineering students about, and to equip them with skills for, their future roles and responsibilities, and to provide the community with engineers whose strong technical knowledge is balanced by an appreciation of the broader social contexts with which they will engage in their professional lives.

INTRODUCTION

The need for engineering students to acquire professional skills, in addition to technical skills, in order to enhance both community engagement and career success has been increasingly articulated by educators and industry professionals alike. Professional skills mentioned variously include teamwork, conflict resolution, and an awareness of social justice, sustainability and ethics. However, as highlighted by Adams and Missingham (2006) the need for improved communicative competence in engineering graduates has been the professional skills area most widely discussed in research and the engineering profession. Increasingly, engineers work in knowledge-intensive fields that require both high level communication and problem-solving skills (Alvesson 2004). In the Australian setting this need is recognised in the National Generic Competence Standards formulated by Engineers Australia, which extensively refers to communicative abilities throughout its descriptors of competencies required by engineers (IE Aust 1999). However, research on employer satisfaction with engineering graduates' communication skills indicates they are below desired requirements, both in Australia (DEETYA 2000) and abroad (Lee 2003). This paper discusses a successful integrative Engineering Communication curriculum, developed for both local and international Engineering students in The University of Adelaide, which aims to develop both communicative ability, and an understanding of the need and ability for community engagement. The paper begins with a brief comparative examination of engineering communication education in other universities, both in Australia and overseas.

COMPARATIVE APPROACHES

The critical role that communicative competence plays in both academic and professional success has, over the past decade, been recognised nationally and internationally in a number of tertiary institutions involved in engineering education (Najar 2001, Riemer 2002, Einstein 2002). A review of literature, relating to engineering communication education, reveals several significant trends common both within Australia and overseas. These trends identify three major areas of academic and professional engineering communication recognised by educators as important skills needed by graduating engineers. The teaching of oral communication, written communication and teamwork skills have been introduced as part of the undergraduate engineering curricula in various Universities world wide (Einstein 2002, Schowm & Hirsch 1999). Whilst the combination of communication skills taught and the methodologies used may vary between institutions one particular theme or approach frequently emerges. An interdisciplinary approach to the teaching and learning of engineering communication (Artemeva, Logie &St-Martin 1999, Jennings & Ferguson 1995) is being practiced by a small but increasing number of engineering faculties and colleges. Examination of interdisciplinary approaches is important in relation to the integrative approach used by engineering and communication educators within the School of Mechanical Engineering at the University of Adelaide. In this respect, learning and teaching of oral and written communication skills in engineering communication curricula have been examined whereas team work skills have not been specifically examined for this particular discussion, as it is considered as worthy of separate dedicated research .

Studies undertaken within Australian universities attest the need for high level communication skills. According to Najar (2001) communicative competence, including teamwork and professional writing skills for example, the ability to 'research, write and format basic research reports' as well as developing formal oral presentation skills is important to prepare students for both 'academic success and the workplace'. Similarly Riemer (2002) claims that whilst engineering knowledge and technical expertise are important attributes the graduate engineer must be able to present this knowledge 'with an excellent standard of communication skills'. However, where Najar emphasises written and teamwork communication skills, Riemer (2002) claims that emphasis on oral communication skills is highly valued by employers. Riemer further elabourates that oral communication and presentation skills are 'career enhancers' which may be considered as 'the biggest single factor in determining a student's career success or failure' (Beder 2000 cited in Riemer 2002). Despite the apparent emphasis that Riemer places on oral communication skills he also acknowledges that there are a number of areas of communication skills which are necessary for engineers, including written communication skills, technical terminology and professional jargon. The later two areas are probably best described in linguistic terms such as genre and discourse, which are indicative that for each specific discipline there is an accompanying language culture.

Internationally, universities are also engaged in the teaching and learning of engineering communication skills. Einstein in his 2002 overview of changes in engineering education at the Massachusetts Institute of Technology (MIT) describes a new approach implemented in the School of Civil Engineering which was developed in response to the view that what was being taught in universities was increasingly divorced from practice. As a result twelve courses were either created or developed in most of which 'regular oral, written and illustrated presentations' were required. Similarly Carlton University in Canada also recognised that the engineering discipline had specific needs in the teaching and learning of communication skills (Artemeva et al 1999). These needs related directly to the transition of engineering students from an 'academic to a workplace environment'. In the case of Carlton University engineering communication studies emphasise written communication skills. The Carlton University approach described by Artemeva et al (1999) is in contrast to Riemers (2002) theoretical proposition on the prominence required in developing oral communication skills for the workplace. One other key difference in Riemers (2002) paper to the approaches suggested by Artemeva et al (1999) as well as Najar (2001) and Einstein (2002), is that Artemeva et al, Najar and Einstein are all overviewing programs of engineering communication already in existence.

A common theme emergent in the literature is that many institutions recommend an interdisciplinary approach to the teaching and learning of engineering communication. Various researchers and educators claim that linking acquisition of academic communication skills to authentic engineering tasks both challenges students negative attitudes, towards what they term ‘learning English’, as well as promotes student motivation. Shwom and Hirsch (1999) claim that shared agenda between disciplines recognises the equal status of engineering and communication, or the ‘equal place at centre stage of the course’. This view is also reinforced by Jennnings and Ferguson in their 2002 study, of communication engineering skills in Queen’s University, Belfast, which states that through linking the study of communication skills to the exploration of engineering issues that communication skills become a key element in the educational process. Furthermore, ‘there is a greater likelihood that students will develop a better overall perspective on their (engineering) subject’. Significantly, many courses which have implemented an interdisciplinary approach have combined the teaching of communication skills with engineering design subjects. In an approach similar to that of the School of Mechanical Engineering, at The University of Adelaide, engineering schools at Northwestern University, USA, Massachusetts Institute of Technology, Harvard and Flinders University, South Australia advocate an interdisciplinary approach that combines engineering communication with engineering design. In reference to the program at Northwestern University, Shwom & Hirsch (1999), claim that design and communication are ‘ideal partners’ and that students ‘combined knowledge of both fields will make them both better designers and better communicators’. Additionally students are convinced of the importance of communication in engineering.

Of the interdisciplinary approach taken at MIT, Einstein (2002) describes design as a synthesising process which requires various visual, written and problem solving skills inferring therefore that it is the natural setting for teaching and learning communication skills. He goes on to state that ‘design (synthesis), coordination and communication’ are regarded as the major features of the MIT , Civil and Environmental approach to engineering education. Najar (2001) discusses the Language in Use (LIU) modules linked directly to engineering design project work at Flinders University. A notable similarity with the approach of Adelaide University’s School of Mechanical Engineering approach is that the development of students engineering knowledge is supported in an integrated way by the acquisition of professional and academic communication skills. Skills common to both universities include; how to communicate orally, how to research, and how to write and format research reports. Similarly the interdisciplinary approach employed in the Civil Engineering Department at Queens University, Belfast covers related communication issues in use of the library (how to research), English composition and technical report writing (written communication) and Public speaking (oral communication). Additionally Queens University covers poster presentation (visual communication) an area that the Adelaide University program covers in fourth year but which is not mentioned in the Flinders University program.

It is apparent from the literature therefore, that the need for communicative competence in engineering education has been recognised in a number of places worldwide. In particular, an interdisciplinary education approach in engineering communication has been introduced in a range of Universities which offer engineering studies. Despite some differences in the methodologies, curricula and elements of communication addressed by different universities, including the University of Adelaide, these studies indicate that the synthesis of engineering design, which is inherently practical in nature, with the need to communicate the design process and outcomes is both an ideal setting and an important factor for positively influencing student motivation and skills in the study of professional communication. By promoting a shared agenda between disciplines the literature also suggests that this may also promote student recognition of the importance of communication in engineering. Regardless of the similarities and differences of engineering communication education taken by the programs discussed here the literature agrees that increased levels of communicative competence relate directly to employability and success in the engineering industry.

THE ADELAIDE APPROACH

Background

The teaching of professional communication skills within the School of Mechanical Engineering at the University of Adelaide has evolved over a number of years since the mid 1990s. This evolution has experienced different iterations with the current approach developing more directly from a combination of initiatives taken both within the Faculty of Engineering and the School of Mechanical Engineering, and by the then Advisory Centre for University Education (ACUE), now the Centre for Learning and

Professional Development (CLPD). These initiatives led to the creation of various courses in Engineering Communication including courses for International Students.

The Faculty wide Engineering Communication (EAL) course was traditionally managed by the School of Mechanical Engineering. In Semester 2, 2006 this course was transferred to management by the Faculty Academic Registrar in order to reflect the Faculty wide nature of the need for dedicated engineering communication course for international undergraduates. Within the School other initiatives led to the teaching of Engineering Communication to 3rd year students. Initially taught as a separate subject this course was combined with the Level III Design in 2004. In the same year the School of Mechanical Engineering also created a new course, Engineering Planning Design and Communication (EPD&C), for entry level students.

The Mechanical Engineering Communication approach consists of a fully integrated, nested curriculum of courses, designed to;

explicitly link communication learning to learning in engineering at all year levels,

- develop students' ability to construct and present logical argument discursively,
- foster language development from sentence level skills to large document written and oral communication,
- encourage active participation through class discussion and response to formative feedback,
- foster the ability to communicate problem identification, formulation and solution to diverse audiences and
- use development in communicative ability as a vehicle for fostering students' insight into and perspective on engineering practice in the community, including the social, cultural, political, international and environmental context of professional engineering practice.

Each course in the program, illustrated below in Figure 1, addresses these aims while embedded within either broader Engineering course curricula or, in the case of Engineering Communication EAL, within a curriculum that employs specific strategies that address the needs of EAL Engineering students (Adams & Missingham 2006).

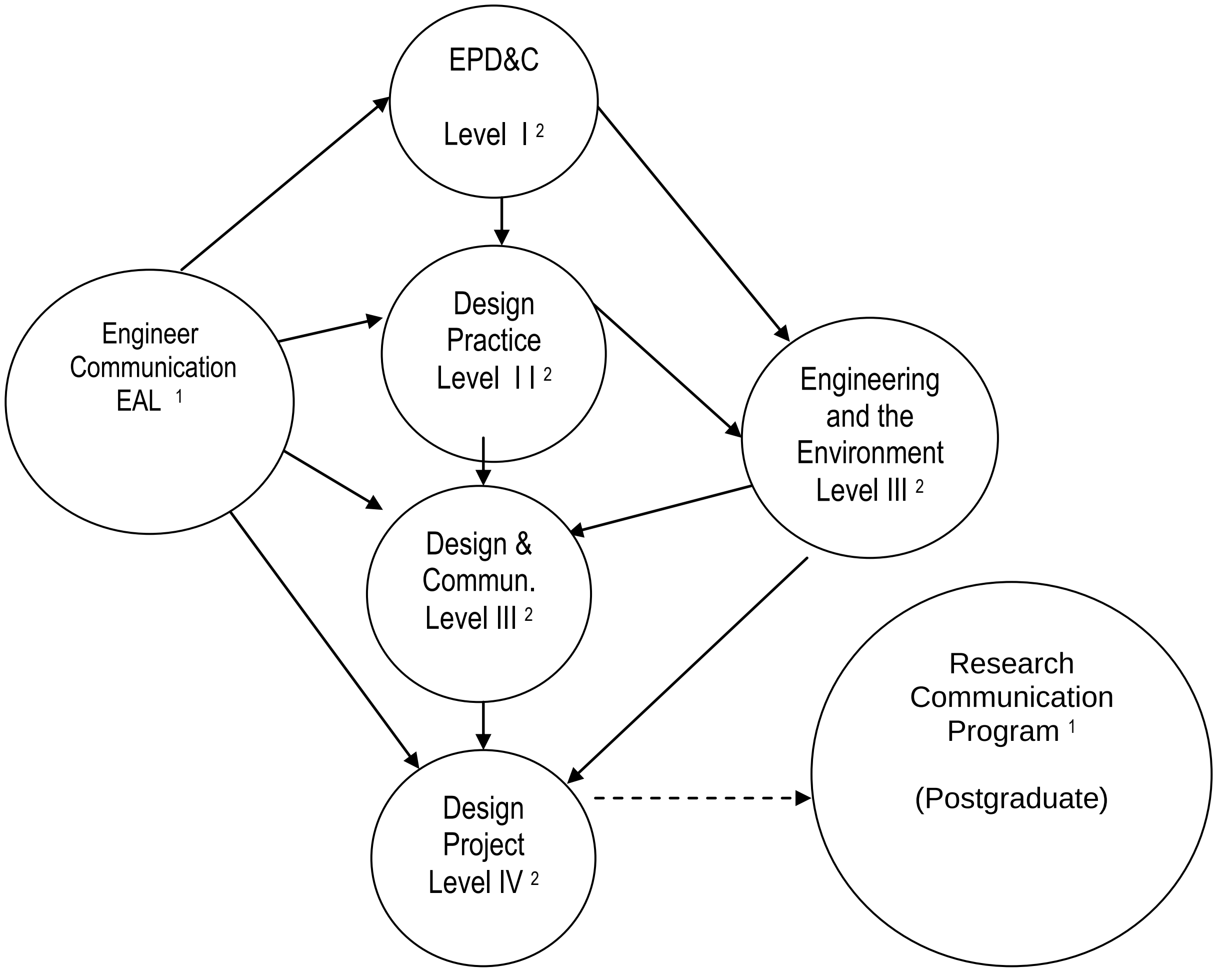

Figure 1: Mechanical Engineering Communication courses showing their relationships to each other and the broader Engineering curriculum.
1 for students enrolled in all Engineering disciplines
2 for students enrolled in Mechanical Engineering

Theory
The theoretical underpinning of the first year Engineering Planning Design and Communication course and the third year Design and Communication course is based on the notion of 'social constuctivism' as advanced by Vygotsky. In particular, Bruners' concept of 'scaffolded' learning (Wood, Bruner & Rose 1975) informs the student based approach that is centred on active participatory curricula which aims at assisting students to develop increasingly skilled levels of academic and professional communication.

Social constructivism grew from a view that educational methods needed to be base concepts of learning beyond rote memorisation, 'regurgitation' of facts and the division of knowledge into different subjects. Early approaches sought to provide appropriate learning situations where teachers allowed students to develop their own knowledge, meaning and truth in a context which would enable them to use the learning throughout their life. Vygotsky developed this philosophy, noting that 'the central fact about our psychology is the fact of mediation' (Vygotsky 1978 p.166). Social constructivists consider that the dynamic interaction between instructors, learners and tasks provides the opportunity for learners to create their own understanding through the interaction with others and is the most optimal learning environment. The constructivist approach, guiding the Mechanical Engineering communication courses is further reinforced in the application of Brunerian notions of the 'spiral curriculum'. Bruner postulated that 'A curriculum as it develops should revisit the basic ideas repeatedly, building on them until the student has grasped the full formal apparatus that goes with them' (Bruner 1960) p.13).

In the School of Mechanical Engineering these theories guide the designing of courses which are aimed at developing generic language skills which can be used as the basis for current and future application within the engineering industry, rather than a language course focussed solely on communicating engineering terms. The learning and teaching of communication skills across all levels of the undergraduate program enables scaffolding of knowledge to be integrated rather than focussing on a short d of student teacher interaction. Through this approach skills acquired in first year communication are reinforced in second year Design Practice, extended and elaborated on in the level III course and then reinforced again through workshops and practice in the fourth year Design Project. Borrowing from neuroscience research into learning. the 2006 Level III and semester 2 EAL students have informed the idea of a concept of developing an habitual intellectual framework. Whilst relying on heavily on scaffolded learning, this concept also aims to redress some of the negative perceptions that engineering student have about 'learning English' by encouraging students to acquire higher cognition learning in communication skills which they can then apply as habit.

PRACTICE AND PERCEPTION

Three dedicated communication courses are provided at undergraduate level, Engineering Communication EAL (English as an Additional Language), Engineering Design Planning and Communication (Level I) and Design and Communication (Level III). The overall aim of the three courses is to provide students with an understanding of the importance of communication to the professional engineer and to equip them with the necessary knowledge, skills, flexibility and confidence to be good engineering communicators. Through the application of Student Experience of Teaching and Learning (SELT) surveys students are able to comment on and assess the effectiveness of the courses to their needs. At the same time instructors are able to monitor student needs and make appropriate changes to the curriculum and methodology if required.

Engineering Communication EAL

Engineering Communication EAL was designed specifically to meet the particular needs of international students and to be complementary to the technical engineering courses students undertake to complete their degrees. Through a variety of formal and informal learning strategies students are introduced to and practice basic research techniques. These techniques include

- locating, critically reading and interpreting academically acceptable sources
- presenting their analysis in the form of evidenced based propositions with sources integrated appropriately
- presenting the argument in both a written and an oral form suitable for an academic audience.

The strategies used emphasise participation and practice as key elements to becoming effective communicators. Therefore, classes are very active, sometimes rowdy and frequently fun with group discussions and impromptu presentations of issues, group and individual exercises integrated with peer teaching/learning through guided presentation of answers to the class, and open class discussion inviting students to academically critique their own and others responses. Student Experience of Teaching and Learning (SELT) surveys consistently indicate that learning outcomes for students are enhanced by 'full participation on (sic) the aims of the course', 'giving feedback to students about their participation', adjusting the teaching 'of various topics accordingly (sic) to the class – enabling faster, more effective learning', 'very dynamic lessons' and being 'able to stimulate my learning'. Formal assessment strategies involve a series of formative assessments which involve students applying feedback provided to a subsequent assignment. Student comments indicate that this approach is highly effective.

Design and Communication courses

The Engineering Design Planning and Communication (Level I) and Design and Communication (Level III) courses are provided for all students undertaking degree programs in the School of Mechanical Engineering. The integration of communication and engineering design was devised specifically to emphasise the importance of professional engineering communication and to ensure that communication is not seen by students as a stand alone subject that can be completed and then forgotten about. The effectiveness of this approach in highlighting the importance of communication has been recognised by students who report that the course(s) 'improves your speaking and writing skills', ‘helps with the written work in other subjects’, they have ‘learnt how to write for university assignments’, and ‘learning academic writing (is) useful to further years of study’. A number of students have explicitly stated that the course taught them ‘to communicate effectively and should be compulsory for all engineer’”. These comments are also consistent with graduate attributes specified as important not only by the Faculty but also by the engineering industry, including

- the ‘ability to communicate effectively’,
- the ‘ability to undertake problem identification, formulation and solution’
- the acquisition of skills to enable the ‘pursuit of life long learning’.

Course material is also designed to be complementary to the Engineering Communication EAL course by providing reinforcement of and extension to the skills learnt. For example, the Level I course provides students with the additional educational framework and the opportunity to apply skills learnt in ESL to the needs of report writing and the oral presentation of progress reports on a Planning and Design project. Student feedback through SELT surveys consistently evidence the importance of these skills, for example, ‘It was great knowing how to structure a report properly’ and the ‘introduction to engineering report writing is very comprehensive’.

A further integrative approach that has been taken in the Level I and Level III courses is reflected in the establishment of the relationships with prior learning and future learning. For example, Level III examines structure, cohesion, critical thinking and analysis, the use of evidence, presenting arguments both in written and oral form and report writing at a more advanced level than the Level I course. The Level III communication course is also an important prerequisite to level the IV Design Project, where all students must write an extensive design report and present a professional seminar on their project.

Challenges and Outcomes

Empirical and anecdotal evidence indicates that engineers are poor communicators and that one of the factors which influences student choice in undertaking engineering studies is the belief they will not need “English”. Therefore, discussions and exercises are designed to encourage students to participate and practice skills, to be flexible in their approach to language and its uses, to contribute their ideas, to build on their strengths and to develop confidence. The value placed on practical evidencing of communication is reflected in a participation mark, worth 20% of the total assessment. As a result classes are noisy and dynamic. Students also find that effective communication can be both useful and enjoyable. For example, SELT comments show ‘I like the idea of students presenting ideas on overheads (transparencies) in class activities’, the course “keeps people interested in tasks that could be very boring’, ‘A good environment for learning is provided’ and ‘interactivity of the class in tasks helps us to gain a better understanding of the subject’.

Similar strategies of regular class and group discussions as well as workshop exercises are used throughout the courses to ensure students regularly practice the skills of communication. Student response indicates that group learning and discussion ‘stimulates learning without placing student under pressure’ and that all students’are able to learn something regardless of language ability’. Individual students and groups are invited to present analyses and answers to the whole class and then to call for comments from their peers. The importance to student learning of this approach is exemplified in the following SELT comment ‘Doing exercises and presentations in class forced me to do the work which I otherwise would not have touched if it had been set as homework. I appreciate that.’

Students are encouraged to form cross cultural groups during classes, so that a greater understanding of diversity and its value in engineering is promoted. At the same time students must undertake practical work in developing effective team work skills in order to be able to complete tasks and class based exercises. Students frequently comment that the group work is the best aspect of the course as it provides opportunity to improve interpersonal communication skills and to gain a real sense of diversity through their interaction with students of different socio-cultural, and ethnic backgrounds. Student comments indicate that working in cross cultural groups encourages ‘acceptance of all ideas’.

Students discuss and at times challenge the characteristics of English for academic and professional purposes as presented in these courses. In doing so, students become increasingly aware of how purpose and socio-cultural factors shape the kind of language used in different contexts rather than viewing language as simply correct or incorrect, or based predominantly on the rules of grammar. Issues of ethics and social responsibility arise naturally in relation to topics and lecturers encourage students to discuss these in class. Similarly communication and management themes highlight the non-technical role aspects of engineering. Students have reflected that 'This (allows you to) practice skills you actually need' and there is a 'good balance for a broad variety of skills' development. Links to industry expectations are also reinforced through guest presentations from graduate engineers, Engineers Australia and industry leaders. In these way students are encouraged to broaden their perception of the engineering industry as a technical culture to include the understanding that engineering is also a communicative culture.

Formal Assessment of Student Work

A series of formal assessments, both oral and written are also undertaken to ensure that students can also apply research and analytical skills in a 'planned and timely manner' as highlighted by engineering graduate attributes. Formative feedback is given on all assignments in order that students may take full advantage of self directed learning. Students who apply the feedback to subsequent assignments are rewarded for both the attempt and the quality of the improvements made. Students report that this approach provides 'constructive criticism' which 'helps each student' to 'check their drafts carefully'. Assessment criteria and their relationship to graduate attributes are fully discussed in both the course notes and in conjunction with exercises, and students have expressed this helps them to place learning in the context of professional and industry expectations, 'when it's explained, it makes sense that engineers spend so much time writing reports, talking to clients and presenting project ideas to meetings'.

RESEARCH TOPICS AND TOPICAL RESEARCH

To broaden student awareness of their professional responsibilities as engineers within society, in addition to operating within a company framework, research topics are carefully chosen to reflect community and industry concerns. In particular the topics chosen provide for critical awareness-raising of community issues such as ethics, sustainability and social justice. For example, the research topic for the current semesters Engineering Communication EAL course is the Role of Engineers, through which students are exploring issues such as personal and interpersonal skills, engineering education and life long learning, ethical responsibilities, social and environmental factors, holistic thinking, entrepreneurship as well as technical skills. Previous topics have included an examination of gender issues in engineering education and the profession, forensic engineering, and the effects of teamwork on the outcomes of engineering projects.

The imbedded nature of the Engineering Communications courses within the engineering curriculum ensures that the research topics are relevant to engineering practice, topical and frequently devised in collaboration with engineering lecturers. Level III Design and Communication research topics, for example, are devised together with the design lecturer and sometimes also with reference to other departmental members. The current semesters' research topic was directly linked to the Design Project topics. These topics and the communication research topic specifically designed to be co-related. Through this collaborative approach aspect of sustainability in engineering practice are reinforced and student skills in critical thinking, analysis and evaluation of research information are further developed. In Design the projects are to design a Formula SAE Car, Bio-Oil Trike, Biodiesel Bike, 1.0 litre Biodiesel Taxi - Tuk-Tuk, Hybrid Solar Electric Vehicle, Biodiesel Boat, Formula SAE Aircraft, Alternative Energy 2-Seater Aircraft, Hybrid Solar/Biofuel Generator, Fossil-Fuel-Free irrigation system or a Nano-satellite. The topic for the Communication assignments is 'sustainability', applied to the chosen design project., as outlined below.

Topic

The broad objective of sustainable development is "to achieve social justice, sustainable economies, and environmental sustainability"(European Conference on Sustainable Cities & Towns, 1994). Australia has a National Strategy for Ecologically Sustainable Development which aims to "meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations" (Office of Sustainability, Department of Environment and Heritage, 2006).

Task

Environmental sustainability is a fundamental aspect of sustainability. For your Communication assignments you should identify how environmentally sustainable features can be incorporated in the design of your project, for example a bio-diesel boat, or alternative energy 2-seater aircraft. In addition, you should compare the effects of these features to a traditionally designed version of your project. You are not expected to justify sustainability. Your research must focus on the specific features of sustainable transport. (Yong & Missingham, 2006)

Previous research topics have included the following:

Investigate an ethical dilemma in an engineering project, and critically evaluate the response of the engineering company or companies involved, in terms of relevant tenets of the IEAust Code of Ethics. (Yong & Missingham, 2005)

Select an example of technological development that is prominent in industrialised society and analyse the benefits as well as the adverse effects of this technology to individuals, society and the environment. (Yong & Missingham, 2004)

A high level of both professional communication skills and an appreciation of community concerns required to be developed by the Level III Mechanical Engineering students. The topic descriptions have also been carefully devised to illustrate to students the inter-relationship of effective communication and an understanding of the social, cultural, political, international and environmental impacts implicit in the professional practice of engineering. These expectations are detailed in the Research Topic paper given below.

'Your research is to be based on a topic which has social, cultural, economic, and/or political implications. Engineers work in every sphere of life. As a professional engineer you will be working in an array of industries, in various contexts, and making contact with many people about professional organisations, government departments and agencies, allied industries and organisations, academics, and others. As an effective communicator and decision maker, you will need to be able to present your interpretation and findings on a range of issues, as will occur in the negotiation and management of projects, the submission of tenders, and the advising of clients. The topic for your research in this subject aims to provide you will strategies to both write and talk about your interpretation and findings about diverse issues. Your writing and your presentations will be an attempt to convince a non-specialist audience of your point of view.

You may choose one of the following areas of research for your project. Topic A – the impact of engineering projects on local communities

The projects you may work on as an engineer could have significant social, cultural, economic, and/or political implications for people and communities who are not directly involved in the implementation of the project. Your research task is to:

Discuss an engineering project which has, or has had, a significant impact/s on local communities
Your research is to examine the impacts and outcomes of a specific engineering project on a community or communities. Examples of engineering projects could be dams or hydro-electric projects, weapons testing, mining, the building and operation of chemical or other industrial plants, building roads and railways, and others. The size of the project is unimportant, rather it is its impact on the local community which will be the focus of your research.

The impacts could be one of the following scenarios, or a combination of scenarios:

- Well recognised and integrated into the planning of the engineering project, yet have provided, or are providing, difficulties in the implementation and outcomes of the project
- Recognised by the local communities or interest groups, but rejected or ignored by project planners and workers
- Unrealised in past projects, with the long-term consequences now the subject of community and/or legal dispute.

Your discussion needs to be an examination, that is, an analysis of the impacts arising from the project. Avoid lengthy descriptions of the history of the project, the engineering technicalities, or merely describing the impacts. You need to read as widely as possible about the project you have chosen, and from your interpretation of the source information provide a discussion of the (perhaps disputed) impact/s of the project. Limit your scope so that you have a specialised focus, that is, analyse only two or three impacts of the project. The word limit set for your assignments means you will not be able to cover all aspects of the project. Your focus needs to be an in-depth examination rather than a broad sweep of issues.

Topic B – the impact of seemingly simple technology on the existence of communities. This topic also aims to examine the impact of (seemingly simple) technology on the existence and quality of life for those who use or used the technology. Your task is to:

Discuss the impact of a seemingly simple technology on the existence of a community

This research topic involves examining the design logic underpinning the technology and importantly the effectiveness of its use. Examples of apparently simple technology could be the boomerang, other hunting implements, for example, harpoons and poison arrows, a specific type of irrigation system, terracing for the cultivation of crops, and others.

Your research needs to take account of:

- The design logic underpinning the technology
- The quality of life and survival provided for those who used the technology
- Any evidence which debates the effectiveness of technology, particularly its long term use.

The technology you are examining may have been beneficial for a community in the short term, but in the longer term, further developments, modifications, abandonment of the technology, may have ensured a better quality of life, even survival, of a community. Long term environmental impacts could be important in your study.

Your discussion needs to be an analysis of the effectiveness, or otherwise, of the technology. Avoid lengthy descriptions of the history or the form of the technology. This information needs to be only brief background information. You need to read as widely as possible about the technology you have chosen, and from your interpretation of the source information provide a discussion of the (perhaps disputed) effects of its use. Limit your scope so that you have a specialised focus, that is, on the analysis of two or three aspects of effectiveness of the technology.

The technology could be from any era, past or even present day. If you are examining past technology, your focus needs to be on the effectiveness, or otherwise, of the technology itself for its intended purpose regardless of other influencing factors such as the introduction of other technology as a result of invasion, colonisation, or economic factors. Alternatively, the technology could be in current use or development, such as reversions to more environmentally sustainable technologies, for example, wind power.'   (Wake, 2002)

CONCLUSION

By promoting a shared agenda between language and engineering disciplines it is suggested that this may also promote student recognition of the importance of communication in engineering. Regardless of the similarities and differences of engineering communication education taken by various programs discussed here, increased levels of communicative competence relate directly to employability and success in the engineering industry. The program developed by School of Mechanical Engineering at the University of Adelaide represents a successful integrative Engineering Communication curriculum, developed for both local and international Engineering students in an Australian university, which aims to develop communicative ability, community engagement and an awareness of the social, cultural, political, international, environmental and ethical contexts in which professional engineers practice.

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