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English for Engineers

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ABSTRACT

Engineering graduates require an ever-increasing range of skills to maintain relevance with the global environment of the new millennium. Communication skills are a vital component of this, recognised by academia and industry alike. It is one of the key outcomes required by an undergraduate engineering programme in the ABET Engineering Criteria 2000. Such skills are essential for an engineer who aspires to carry out his/her professional practice in the global arena. Multi-lingual skills are considered a salient element in the make-up of the new global engineer. Yet there is ample evidence that graduate engineers lack the required standard of communication skills, particularly when compared to the needs of industry internationally. Communication skills are a regular feature of an engineer's job in industry; some graduates employed in industry have identified that education in communication skills needs to be improved given the demands encountered in industry. Indeed, communication skills are considered to be a valuable career enhancer. Inadequate and ineffective communication skills reflect badly on the individual and the profession. An insufficient level of communication skills instruction in engineering education generally only serves to undermine the whole profile of the professional engineer. This in turn affects recruitment and retention in engineering studies. It has been stated that communication skills should be fostered in engineering education because they are qualities that employers look for should be part of any tertiary education. Communication is multifaceted and incorporates various elements, such as oral, written, listening, visual, intercultural, interdisciplinary, etc. These need to be considered when examining communication engineering education.

Key Words: communication, culture, international, language, specific purpose, skill, student

INTRODUCTION

English for Specific Purposes

There is a clear necessity for effective English communication skills for engineers in the current globalised environment. A course in English for Specific Purposes (ESP) will enhance English language training and an engineering student's communication skills. It will also aid in the globalisation of education and the internationalisation of practicing engineers. The concept of ESP achieves more in the education of engineering students by focusing the learner's attention on the particular terminology and communication skills required in the professional field. Various examples in the engineering field can be found, including computer science, maritime engineering's seaspeak, aviation's airspeak and the railway's railspeak.

While English is currently a prime language in facilitating communication between international cultures, particularly intercontinental, the increasing growth of regional languages indicates that native English speakers need to learn additional and communication skills, preferably in at least one of the regional tongues. In this case, monolingualism is likely to be an impediment for future graduate engineers in a world where intraregional connections provide stepping stones to facilitating globalisation.

English Globalisation and Engineering

In this age of globalisation, international projects are increasing, and cross-cultural communication and collaboration is rising; especially in the now international practice of engineering. English is accepted as the most widespread language in the world (of the most widely spoken). The number of people who speak English with at least some degree of proficiency exceeds any other language. This is important for engineering students as this indicates that English may be more useful

internationally than almost any other language due to its spread. English is cited as the major language of international business, diplomacy, and science and the professions. English is the prime means for communication, and can often serve as the global language between two people from two different cultures where English is not the native tongue. For example, French engineers communicated with Egyptian engineers in English during the building of the Cairo subway.

Some multinational firms with bases in continental Europe use English as the prime form of communication in the office. In this sense, multinational corporations can be seen to indirectly influence the educational policies in foreign lands by their value creation of particular languages through global economic power. This also delivers a strategic advantage to those institutions in non-English speaking countries with effective English language instruction.

European students, when recently surveyed, stated that they felt working in a foreign language was a necessary activity in an international career. The implications of this are apparent; the English language maintains extremely strong relevance now and in the future, particularly as a secondary language to facilitate communication between two cultures.

Future engineers need also be aware of the potential for so-called cultural imperialism, which involves the systematic penetration and dominance of other nation's communication and informational systems and educational institutions. This goes beyond language hegemony.

However, the importance of multilingualism for the global engineer is not confined to learning English. Multilingualism in an engineering course is increasingly focusing on regional communication skills, where the main languages from within that country's region are becoming just as important as learning English.

Foreign Language Skills

Jensen states that employers want a number of new competencies, with an emphasis on an increased ability to communicate and good foreign language skills. This is reinforced in Grünwald's study of competences required by the engineer of tomorrow, which includes hard skills like good foreign language skills. He goes further to claim that cross-disciplinary language skills are not sufficiently taught. This indicates a lack of a direct fit between graduate skills and those required by industry.

Engineers can relate the same theories of mathematics, of mechanics and technology, but the modern engineer must also be able to communicate effectively in a shared tongue. This is especially important given that engineering projects are now planned and implemented across national and cultural borders.

India has a resilient monolinguistic culture of instruction in English, which may well impact on that nation's future competitive capacity internationally. There seems to be a similar culture in Australia where multilingual education is somewhat of an advantage, but is not compulsory. This differs to the compulsory education in the English language education established in many mainland European schools. However, monolingual dominance is brought into question at a time when employers are demanding new competences, including communication and foreign language skills, and not just from engineering candidates in European nations.

Graddol found that regional languages will become increasingly important in the 21st Century. He identified the big languages to be Chinese (Mandarin), Hindu/Urdu, English, Spanish and Arabic, with the regional languages being Arabic, Malay, Chinese, English, Russian and Spanish. The future scenario indicates the reduced prominence of English as an international language in favour of the regionalised language dominance of Chinese, Hindu/Urdu, Arabic and Spanish. Such a future would mean that students' and industry needs in English as a First Language (EFL) countries would be best served by fostering additional language skills so that engineering graduates can operate across borders in an increasingly globalised and multinational industry and society. As such, this is an important issue that must be addressed in engineering curricula.

Possible areas for further research in this area include the following:

Identifying where and how second language skills can be fused in the already packed engineering curriculum;

Fostering engineering students' understanding of international linguistic diversity and the need for broader language skills given the increasing level of globalisation;

Identifying dominant regional second languages and how many engineering projects are developed in these linguistic areas;

Cataloguing instances of international engineering projects and how communication was facilitated;

Developing cross-institutional opportunities regarding second language instruction, particularly where one institution has greater strengths in one language instruction than another (eg. Mandarin at one institution and Spanish at another)

Encouraging student exchanges with countries that have the dominant regional language as the main form of communication;

Facilitating increased opportunities for foreign language immersion for students as a component of the curriculum (eg. during semester breaks);

Recognising that those dominant regional languages identified by Graddol potentially provide the most opportunities for expanded communication skills (an important consideration for students and curriculum designers), but not to the exclusion of less widely spoken languages.

The prime language of Internet sites is becoming increasingly regionalised. Although English remains the dominant language with regard to Web content, it is interesting to note that the proportion of non-native English speaking online population has steadily increased and surpassed that of native English speakers. This has clear implications for engineering education. Language will no longer be the prime determinant for access to engineering education based on traditional European structures because large, previously under-represented communities will gain greater representation. Furthermore, this expanded access to the Internet builds a new dimension in the education process in this era of globalisation: by combining language education with technology education. This also generates a greater element of regionalisation as these large underrepresented groups in Asia and Africa demand the skills required to operate competitively in the world. However, language still remains a strong barrier.

Communication Issues

Four sources of weakness that can significantly impact on an engineer's communication skills education were identified as:
Students' attitudes to communication;

Insufficient course content;
Deficient or inappropriate teaching methods;
Lack of opportunity for engineering students to practise communication skills.

Oral Communication Skills

The burgeoning importance placed on oral communication skills by employers has been echoed internationally for a decade or more and across disciplines. Knowledge and technical know-how are clearly important, but these must be presented with an excellent standard of communication skills, particularly oral. Indeed, oral communication and presentation skills are considered one of the best career enhancers and to be the single biggest factor in determining a student's career success or failure. Communication skills development has been demonstrated through the use of various methods, such as class discussions and others.

Experiential methods have generally yielded better results than purely didactic means. Examples include presentations, peer review, role-play, video of student presentations with individual feedback and up-to-date training in key software used in presentations by graduates in industry (eg. PowerPoint, Word, Excel, etc).

Engaging learners will help facilitate and stimulate effective and purposeful learning by students. In particular, involving learners directly will engender a stronger sense of responsibility in future graduates that they can take beyond the university and into the work arena. This is especially important when engaging learners of English as a Second Language (ESL) and English for Specific Purposes (ESP) as it involves new vocabulary.

Written Communication Skills

Written communication skills involve a more active, rather than passive, learning method. Writing can enhance critical thinking and problem-solving skills, as well as serve to identify and confront personal misconceptions. Graduate engineers have reported an increasing written communication workload over time. Writing in this instance refers to composing material that is to be read and includes typing.

One Polish study found that engineering students displayed greater difficulties in written communication than with oral; this was despite the students having completed various written tasks before (eg. laboratory reports, projects, etc). In this case, students required help in organizing and structuring reports and arguments.

Ineffective and poor written communication in engineering workplaces were found to lead to misinterpretation, inefficiency and time wastage, thereby adversely affecting problem resolution. Such miscommunication was then found to contribute to mistrust and aggression, as well as appear unprofessional and be unproductive . This indicates that poor communicators will have trouble in the workplace, potentially contributing to problems rather than solving them.

Written communication needs to be relevant, properly implemented and of a quality standard that can be benchmarked; it should also generate feed-back and provide accurate assessment, as well as make a positive and permanent impact on student learning. Examples of written communication include: engineering reports, technical writing, essays, reflective journals, peer review, and mock and student conference papers.

A networked digital library of theses and dissertations was recently launched in Lithuania, which serves to enhance graduate education by allowing students to produce electronic documents, utilize digital libraries and understand issues in publishing. This initiative significantly increases the availability of students' research for scholars, preserving it electronically. This also makes it possible for students to convey a richer message through the use of multimedia and hyper-media technologies.

Empathy

Various authors have cited empathy as a key skill for effective leadership and management. Managers and leaders who displayed empathy skills were able to communicate honestly and proactively and had very good listening skills; this permitted them to success-fully steer their organizations in times of difficult transitions. This provides a lesson for engineers, particularly those in management roles, that empathy skills are required in managing interpersonal relation-ships in the workplace with colleagues, clients, customers and other stakeholders. Goleman also highlights the connection between fluency in non-verbal skills and empathy. Non-verbal cues and awareness are an important component of communication that is not restricted by language. Goleman goes on to state that mastering this empathic ability smooths the way for classroom effectiveness. Evidence indicates that listening skills directly contribute to empathic skills. Listening to another person's state helps the listener become more aware of the other person's needs and wants. This is especially important for engineers engaged in the design and construction process.

Communication Skills Development

A review of literature indicates that oral communication has been identified as a learnable skill and that experiential methods have generally yielded better results than purely didactic means. Students will not place any great emphasis on presentation, and with it oral communication skills, if presentation and communication is not allocated a significant share for the exercise's marks. Furthermore, as much as many students dislike giving presentations, it is better that they experience a dry run in their education than to be suddenly confronted in the workplace. An Irish study found that 78% of sampled practicing engineering graduates were required to give oral presentations as part of their work, often on a regular basis. Group projects and presentations encourage and enhance the interpersonal skills of the student members and should be emphasized early in the education curricula. This should be considered as teamwork is recognized as a core skill in industry, and communication with team members needs to be effective.

CONCLUSION

Language and communication skills are recognized as important elements in the education of the modern engineer. Those institutions that have already implemented multilingual and communication elements will be at the forefront of providing the demands of industry and society. The already crowded engineering curriculum still needs to incorporate additional competences, notably workplace and international/intercultural skills, especially communication. Fitting in a new subject will, in most cases, be difficult, but also less enduring with regard to the competence being taught. The integration of communication skills, as can be found in various business curricula, will serve to reinforce such skills like communication across different contexts, particularly if students recognize this as an important component if part of the overall grade is attributed to it. The incorporation of language and communication improvement courses is an important element of continuous learning, and will ultimately contribute to the process of life-long learning. This should facilitate advancements in engineering and, indeed, engineering education through streamlining fundamental communication skills. Ideally, students' skills in communication and EQ, which reinforces these competences, should be initiated and inculcated at least at

the secondary school level. However, if this is lacking in the national school curriculum, then it needs to be fostered at the tertiary level, particularly as such skills can still be acquired as adults and will contribute to the life-long learning process.

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