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International and culturally inclusive curricula – an engineering management unit audit case study

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Abstract: SEB421 Strategic Issues in Engineering is a final-year engineering management study unit at Deakin University in which the enrolled student population has grown to include significant numbers of international students. Given this change, it was considered timely to conduct a review of the unit, with regard to principles of international and culturally inclusive curricula. Despite the historically white Anglo-Saxon male culture of engineering education in Australia, there are a wide range of international and cultural aspects related to engineering education. A review of the literature reveals a diversity of interpretations of ‘internationalisation’ and ‘cultural inclusiveness’. From a pragmatic perspective, it is noted that organisational policy can provide guidance for academic staff seeking to make courses more inclusive. From a review of the literature and relevant university policies, a list of ‘international and culturally inclusive curricula’ guidelines for engineering management education was developed. Comparing a prior audit of SEB421 to these guidelines revealed progress on international and culturally inclusive curricula, but, identified opportunities for improvement. The guidelines were applied to the curriculum/syllabus, content/study materials, conduct and assessment of the unit, to identify further opportunities for improvement. A plan for improvement of the unit and an associated timetable for this work were developed. It was noted that some changes can be made immediately, while others are contingent upon the timetable imposed by university systems. It was further noted that issues of change within a single study unit intersect with wider issues of program curriculum, and, while pilot activities can provide a start, eventually the wider issue of international and culturally inclusive curricula across the entire undergraduate engineering program needs to be considered.

Keywords: Internationalisation, culturally inclusive curricula, engineering management

Introduction

SEB421 Strategic Issues in Engineering is a final-year engineering management study unit at Deakin University that addresses the topics of technological forecasting and assessment, policy design in engineering organisations, and, issues in productivity improvement. Originally developed for on-campus undergraduate manufacturing engineering students from the state of Victoria in Australia, the student enrolment in this unit has grown dramatically in size and diversity to include approximately equal numbers of on-campus (primarily from secondary school), off-campus (primarily mature age) and off-shore (primarily based in Malaysia) students. Though not delivered online, the unit incorporates significant online
support using the university online course management system Deakin Studies Online (DSO). Given the change in the composition of the enrolled student population since the unit was originally developed, it was considered timely to conduct a review of the curriculum/syllabus, content/study materials, conduct and assessment of the unit, with regard to principles of international and culturally inclusive curricula ((IC)²), and, with the aim of developing an action plan to improve the unit.

**International and culturally inclusive curricula**

In the context of higher education, there is (perhaps appropriately) a diversity of interpretations/meanings of (Stier, 2004), rationales for (Knight, 1997), and, aspects of (Curro & McTaggart, 2003), ‘internationalisation’. Knight (1997) proposes a typology of approaches to internationalisation (activity approach, competency approach, ethos approach and process approach) that describes an organisational journey from individual activities to institutionalised systematic processes. Curro & McTaggart (2003) identify two complementary elements of internationalisation - i) making the curriculum more relevant to students from different cultures, and ii) preparing ‘local’ students to live and work in different cultures.

The second component of (IC)² is ‘cultural inclusiveness’. Again, there is a diversity of elements that may be encompassed under the umbrella of ‘culture’ (Dimitrova, Sadler, Hatzipanagos, & Murphy, 2003). A recent Deakin University focus group examining ‘cultural diversity in online learning’ produced the following non-exhaustive list of the dimensions of culture:

<table>
<thead>
<tr>
<th>Race</th>
<th>Ethnicity</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning style(s)</td>
<td>Age</td>
<td>Mode of study</td>
</tr>
<tr>
<td>Religion</td>
<td>Reason for study</td>
<td>Work/employment</td>
</tr>
<tr>
<td>Interests</td>
<td>IT literacy</td>
<td>Pre-conceptions/confidence</td>
</tr>
<tr>
<td>Socio-economic status</td>
<td>Geography/place</td>
<td>Disability</td>
</tr>
<tr>
<td>Teaching culture</td>
<td>Education (prior background)</td>
<td>Family/social structure</td>
</tr>
<tr>
<td>Institutional culture</td>
<td>Language</td>
<td>Attitude to technology</td>
</tr>
<tr>
<td>Discipline area</td>
<td>Understanding of the role of the teacher</td>
<td></td>
</tr>
</tbody>
</table>

In the interests of brevity, organisational relevance and pragmatism, rather than seeking a particular definition of (IC)², the direction regarding (IC)² given in Deakin’s (IC)² operational policy was adopted:

Deakin University will incorporate international and intercultural perspectives and inclusive pedagogy into its courses in order to prepare students to perform capably, ethically and sensitively in international and multicultural professional and social contexts.

(Deakin University, 2002a)

**(IC)² and engineering education**

It is often claimed that science and technology are ‘context-free’ and apply universally, and, therefore, they are not the appropriate place for considerations of international and cultural issues in higher education. However, there is a growing awareness that course content, even in the ‘objective’ disciplines of mathematics, the sciences, and engineering can broaden the views of students regarding diversity and global interdependence (Morey, 2000). Certainly, in Australia, it is a requirement for accreditation of undergraduate engineering programs that they develop in their graduates an, “…ability to function … in multi-cultural teams…[and an]
understanding of the social, cultural, global and environmental responsibilities of the professional engineer…” (Engineers Australia, 2005, p. 7).

Even though there are many ‘international/cultural’ aspects related to engineering education and practice, including:

- national and international engineering professional bodies that provide for international recognition of qualifications and right to practice;
- national differences in undergraduate engineering education;
- multi-national engineering organisations and opportunities for international employment;
- the need for culturally and geographically appropriate technology in international engineering projects; and
- the growing presence (and financial importance) of international students in Australian engineering schools,

engineering education in Australia has a history of being primarily mono-cultural, with the dominant culture being that of the white Anglo-Saxon male (Doyle, 1997; Swarbrick, 1997). The first major action on an issue of ‘culture’ in engineering education was ‘women (or the lack thereof) in engineering’. Over the years, there have been many attempts to change the attitudes and academic preparation of female students to ‘better suit’ engineering study. More recently there has been an acceptance that it is engineering education itself that needs to change to be more attractive to a broader student audience (Swarbrick, 1997). Almost certainly due to the existence of international recognition of Australian engineering qualifications, fee-paying international engineering students have become important for most engineering schools (Parsons & Dowling, 2004). There has been a recognition that engineering education needs to address the needs of these students, or put in jeopardy the relevance of their education and the revenue that they bring. This issue appears to have been especially highlighted by the push of some Australian universities to establish campuses in other countries, and deliver their engineering programs ‘off-shore’ embedded in a different culture (Kok-Soo, 2004; Stäuble, 2004).

Engineering is one of the internationally mobile professions that, somewhat paradoxically, has a strong national flavour due to national accreditation (Knight, 1997). There is a growing range of regional and international mutual recognition treaties in engineering (to the point that some overlap and ‘compete’ for pre-eminence!) that provide a means for graduates from a diverse range of national education systems to enjoy some freedom to practice internationally. Concern has been noted about the possible educational homogenisation that can be the result of over-emphasising common international standards (Knight, 1997), and, it has been noted that international accreditation treaties have led to many Asian engineering curricula being ‘Westernised’ and, at the same time, inheriting many of the institutionalised Western gender and cultural biases (Stäuble, 2004).

Contrasting it to the inherently ‘localising’ activity of the engineering design process (the selection of one method (from many) to solve a specific and unique set of problem requirements), Newberry (2004) explores the meaning of ‘globalisation’ in the context of engineering education. He identifies:

- a ‘descriptive’ meaning based on providing engineering students with a few additional skills to operate more effectively internationally;
- a ‘normative’ meaning based on explicitly defining what is meant by globalisation, and, the educational implications and impacts that flow from this process; and
- a ‘transformational’ meaning based on the opportunity to radically re-think the engineering curriculum to produce graduates who can effectively serve the global
community (Newberry, 2004).

Development of (IC)² guidelines for engineering management education

There exist many sources of suggestions for addressing (IC)² in teaching and learning. It has been identified that corporate policies can inform academics and provide guidance on making courses more inclusive (Ayre & Nafalski, 2000). Looking to the opening statement from Deakin’s (IC)² operational policy given above, it appears to suggest a primarily ‘descriptive’ interpretation of (IC)², however, closer inspection of the statements of ‘principle’ contained in the policy show evidence of a somewhat more sophisticated interpretation of (IC)², including:

- Valuing cultural diversity;
- Review, improvement and self-evaluation;
- Integration throughout a course;
- Appropriateness to the field of study; and
- Awareness of values and purposes (Deakin University, 2002a).

The policy also identifies Deakin’s (IC)² Procedure (Deakin University, 2002b) as a key document supporting the implementation of the policy. The Deakin University ‘Guidelines for Developing the Attributes of a Deakin Graduate’ also provides a range of practical suggestions for addressing (IC)² (Deakin University, 2003). More generally, there is a vast literature related to this topic. Drawing on these various resources, and, as directed by the Deakin (IC)² Operational Policy, taking into account the ‘appropriateness to the field of study’, (engineering management), the following (IC)² guidelines have been synthesised:

- diversity in materials/media and assessment can accommodate different learning styles;
- clear statement about meaning of plagiarism, provision of model assignment submissions;
- make explicit the cultural and moral implications of the practice of engineering;
- allow students to self-select an article that is topical in the discipline, describe it, then critically evaluate it, asking students to make an oral presentation on their topic/article;
- be overt about valuing cultural diversity;
- use guest presenters with international experience in the subject area;
- inform students of the graduate attributes that the unit will develop, and how;
- use group work/assessment to require students to interact with other students;
- use international case studies in course materials and assessment tasks;
- discuss cultural/regional differences in the values/assumptions influencing engineering;
- explore comparative professional practices and their relationship to cultural values;
- provide concise lecture notes as visual aids to aural comprehension;
- avoid negative, superficial or stereotypical descriptions of other nations or cultures;
- include topics on the ethical and cultural issues arising from globalisation;
- actively discourage non-inclusive language or behaviour;
- include self-reflective writing that encourages students to consider their own backgrounds;
- materials that reflect a diversity of Australian perspectives, including indigenous ones;
- assessment tasks explained in plain language without colloquialisms and acronyms;
- use of the Internet to (virtually) expose students to practices and customs of other cultures;
- draw on the cultural diversity of the students in the unit to build cultural awareness;
- promote opportunities for student overseas experiences; and
- be aware that compulsory online course elements require students to be self-directed.

Prior (IC)² development
In August 2004, as part of a Faculty-wide audit of course compliance with university (IC)² policy, the following existing ‘(IC)² aspects’ of the content, delivery and assessment of the unit SEB421 were identified:

- identifies the effect of cultural relevance on the development and diffusion of technology;
- uses a range of international case studies, including international comparative case studies, to illustrate course material;
- discusses Australian national productivity, but places it in an international context;
- identifies the international comparative/competitive aspects of national productivity;
- identifies the impact of culture on workplace practice, and that practices from one culture are not automatically transferable to all other cultural contexts;
- includes a labour organisation critique of the 'international-best-practice' approach to productivity improvement, including identifying international alternative approaches to achieving improved productivity;
- discusses productivity measurement and improvement in other than 'for-profit' organisational contexts, i.e. public and not-for-profit organisations;
- explores the findings of the Karpin Report on Australian management skills (Karpin, 1995), including:
  - the need to capitalise on the 'talents of diversity' and to make the profile of senior management more reflective of the mix of genders and nationalities in the general population; and
  - identifying the likely 2010 profile of senior managers as being of either gender, a wide range of ethnicities, having a global focus, having lived in at least two countries, etc.;
- employs the use of a reflective journal for students to develop and document their own understandings of the course material;
- includes detailed explanation of acceptable use of information sources versus plagiarism;
- detailed explanation of assignment requirements, including the provision of sample submissions where appropriate;
- students using the DSO online Discussion area are referred to University guidelines on the acceptable use of online discussion areas (‘netiquette’); and
- uses student-selected case studies for some assessment items, to help place course content in a personal context of interest and relevance to the student.

With the newer and expanded understanding of (IC)² issues developed here, it is now possible to identify that the unit SEB421 also addresses the following guidelines:

- includes a range of material media formats - lectures, printed study guides, online summary lecture notes and online digital video resources; and
- includes a range of assessment formats - reflective journal, individual work, group work, oral presentation, case study report, computer-marked multi-choice test and examination.

While this might be viewed as a reasonable start to addressing (IC)² issues in this unit, in reality, the presence of these aspects was not the result of a conscious effort or deliberate design. It is expected that more could be done with a conscious and deliberate effort to apply the identified (IC)² guidelines.

**Identified opportunities for improvement in SEB421**

Based on the developed (IC)² guidelines identified above, and allowing for prior (IC)² developments, the following opportunities for improvement in the unit SEB421 have been identified.
Curriculum / Syllabus

Inform students of the graduate attributes that the unit will develop, and how. The unit guide should explicitly identify the Deakin graduate attributes relating to (IC)² as ones that will be developed in the unit, and, it should identify the methods by which these student outcomes will be addressed.

There is a need to consider that any new material/resources introduced into the unit that are not clearly part of the ‘official’ study resources, or assessed in some way, will be considered ‘optional’ by some students. Just shovelling in ‘extra’ (IC)² study resources that are not clearly connected to the unit outcomes, existing material or assessment is unlikely to be effective - students already have plenty to do, and are strategic in their approach to study (James, McInnis, & Devlin, 2002).

Course content / Study materials

There is a need to avoid negative, superficial or stereotypical descriptions of other nations or cultures. It has been previously noted that the unit material contains some references to international/cultural differences - these need to be carefully reviewed. In one instance, an existing review question asks, “What is the most appropriate business strategy for a very large Korean shipyard?” - the ‘correct’ answer here is premised on certain ‘commonly held’ assumptions about the Korean economy. In class, an example to illustrate the importance of ‘strategy’ presents the case of the tactically successful, but, ultimately, strategically unsuccessful American armed forces in the Vietnam War - the use of such ‘ideologically loaded’ examples needs to be carefully considered.

There is a need to reflect a diversity of Australian perspectives - national ‘cultures’ are not homogeneous. For example, the current unit material contains no examples based on Australian indigenous technology and culture. In addition, there is a need to examine the materials for ‘absences’ of alternative views, approaches and examples. While the unit contains a range of international comparisons of economic and productivity performance, the information presented relates primarily to Western countries, as this information is comparatively easy to obtain from bodies such as the Organisation for Economic Co-operation and Development, which is composed of primarily Western member countries (Organisation for Economic Co-operation and Development, 2005).

Over time, develop more digital video resources relating to the unit material, particularly looking for videos that address (IC)² issues. During 2005, a number of video segments were captured ‘off-air’ from commercial broadcast television, from which a number of digital video segments that relate to (IC)² issues were produced – including two videos on Australia’s comparatively poor performance in promoting women to senior management positions, the growth in the export of white collar jobs to high-skill/low-cost nations such as India, and, the cultural and ethical issues associated with the development of pet cloning in the US. This collection will be expanded further.

Unit conduct / Teaching

As with the explicit statement of unit objectives in the unit guide, there is a need to be overt/explicit in the conduct of the unit about acknowledging and valuing cultural diversity. While (and, perhaps, because) outcomes relating to (IC)² are not key learning outcomes for this unit, there is a need to highlight these issues in the ‘class’, be it real or virtual.

There is the possibility of using guest presenters with international experience in the subject...
area. Guest presentations by practicing professionals are a good idea for all sorts of pedagogical reasons. In a related second year unit that covers human resource management, previously, colleagues from engineering companies that operate in several countries and cultures have been invited to discuss the human resource issues in their organisations. In many cases, this topic alone has provided surprising (IC)^2 insights for those students.

There is the possibility of capitalising on the ‘international’ composition of the class. This unit is often taken by international engineering exchange students (primarily from the Americas), and, normally has a large number of Malaysian students, whom visit on-campus at Deakin when the unit is in progress in semester two. There may be additional opportunities to capitalise on this international student mix in the classroom.

**Assessment**

Assessment tasks should be explained in plain language without context-specific meanings. Feedback from some local and international students has revealed some problems with interpretation of the requirements for one assignment in the unit. The question, “In your report describe…the nature and impact of the technological change caused by the innovation on the organisation…”, has previously caused some problems for non-native English speakers, who have used a literal interpretation of the term ‘nature’.

**Plan for implementation**

The different opportunities for improvement identified above have inherently different timetables for change. Changes to unit assessment require the approval of the Faculty teaching and learning committee, and, normally, can only be implemented for the following year. However, improvements to the wording of existing assessment tasks can be implemented immediately, and will be done for the next offer of SEB421 in semester 2 of 2006. The conduct of classroom activities is primarily at the discretion of the lecturer, and, again, within reason, can be acted on immediately. The aim to collect additional (IC)^2 video resources is an element of an on-going task of compiling digital video resources, and can be added to online resources for SEB421 as they are collected. The more general changes to the unit content will have to be sequenced to match the School’s revision cycle for unit print materials - for SEB421 the next print revision cycle is scheduled for editing work in 2007, to be ready for unit delivery in 2008. Of course, it is possible to plan, research and draft revisions to the course materials now, for handover to editors in 2007, and, in the interim, supplemental unit resources can be provided to students online via DSO.

Issues of changes to unit syllabus and outcomes intersect with wider issues of program curriculum and graduate attributes, and, highlight that changes to engineering curriculum are not achieved in the classroom alone, but, require the participation of a wide range of stakeholders (Walkington, 1997). While pilot activities are valuable, and may be the preferred way to start to address (IC)^2 in the program curriculum (Curro & McTaggart, 2003; Walkington, 1997), eventually, the wider issue of (IC)^2 across the program curriculum, and beyond academic matters to organisational support (Knight, 1997), will need to be addressed by the School. It is noted that ‘diversity’ initiatives in engineering often encounter strong resistance, even from some engineering leaders, and, that leaders play a central role in overcoming this resistance (Burack & Franks, 2004). In the longer term, consideration should be given to evaluating the effectiveness of these planned (IC)^2 initiatives - there is guidance in the literature on methodologies for (IC)^2 evaluation (Krishnamurthi, 2003).

**Conclusion**
(IC)² issues come to the fore in Australian engineering education due to the intersection of the profession’s white Anglo-Saxon male cultural heritage, the international mobility of its graduates, the need to reform the profession’s culture if it is to be an attractive career choice for a broad range of students, and, the growing (financial) importance of international students. Through reference to university policies/procedures and investigation of the literature, a set of ‘good practice’ guidelines for curriculum/syllabus, course content/study materials, unit conduct and assessment relating to (IC)², in the context of engineering management education, were developed. Following an ‘(IC)² audit’ of the unit SEB421, a range of additional opportunities to improve SEB421 in regard to (IC)² issues were identified. A timetable for the implementation of these changes was also developed. It is hoped that this ‘case study’ may be useful in furthering a wider consideration of (IC)² issues in engineering education at Deakin University.

References


