EAC
ENGINEERING ACROSS CULTURES

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Introduction

Overview

This book is intended for those involved in the education of undergraduate and postgraduate engineers. Engineering Across Cultures has been developed to provide an accessible guide to the ideas around intercultural competency as it relates to engineering education and practice. It goes further than just providing educators with great ideas and useful frameworks for education in this area. This book works in conjunction with a series of learning modules covering several aspects of intercultural competency in engineering. These resources have been created to provide the reader with a starting point for implementing learning activities that support students in their development of skills in this area. They also provide examples of how some of the ideas described in this book work in real life. We hope you find the book and the modules useful, and we encourage you to become involved in the development of new learning modules.

Please see engineeringacrosscultures.org for more details.

Background

Since the release of the report 'Changing the Culture', by the Institution of Engineers, Australia (Institution of Engineers, Australia, 1996), the landscape of engineering education in Australia has been changing. The report recommended sweeping changes to the way engineering graduates were prepared for work in the modern engineering profession. In particular, recommendations 1 and 3, specified a greater emphasis on preparing graduates for a profession that increasingly involved working with communities and other cultures.

The recommendations from this report were incorporated into Engineers Australia's Accreditation program through a set of 'graduate attributes' (Bradley, 2006) that closely resemble sets of graduate attributes (or qualities, or capabilities) adopted by universities around Australia and overseas. As evident in accreditation criteria for engineering programs in Australia (Engineers Australia, 2011, standards 1.5, 3.2, 3.6), the US (ABET, 2011, criteria 3c, 3g, 3h), and other countries with accreditation programs recognized under the Washington Accord (www.washingtonaccord.org), the need for engineers to have the ability to work effectively in multidisciplinary, multicultural and multinational settings is now widely accepted.

This need to foster students' development of intercultural competency is not limited to preparing graduates for the profession. There is also a significant need to recognise the potential impact of changing student and staff profiles on what happens in the classroom, particularly in group based activities. Vigorous marketing by universities over the past decade has led to increasing numbers of undergraduate international students, particularly in engineering. King (2008, p. 34) reports an increase of 14% of international undergraduate student enrollments to make up nearly one quarter of all enrollments in 2006. The move towards greater higher education participation recommended by the Bradley review of higher education (D. Bradley, Noonan, Nugent, & Scales, 2008) is also likely to result in more diversity in engineering classrooms. Add to this the diverse academic staff profile that makes up modern engineering schools and it is clear that domestic and international undergraduates are already working within a culturally diverse environment long before they enter the profession. This means that preparation is required from year 1 of their studies.

Doing new things

The motivation for the project that spawned *Engineering Across Cultures* emerged from initial efforts to reconstruct a first year Engineering subject at the University of Wollongong (UOW). The goal was to incorporate project based learning activities supported by the Engineers Without Borders challenge - http://www.ewb.org.au/whatwedo/institute/ewb-challenge. The unit of study had previously combined engineering design issues with an introduction to technical drawing skills and the change would alter many aspects of how it was taught. A number of new tutorials were designed to tackle the complex issues surrounding the interaction between cultures that often emerges as students develop their EWB Challenge projects.

This initial trial at UOW led to a successful application for funding from the then Australian Learning and Teaching Council (now Office of Learning and Teaching, OLT) to extend the new approach. The three major components for the project were proposed –

1. Establishing the current competency of engineering students and staff in dealing with cultural issues
2. Determining exactly where learning outcomes need to be improved
3. Developing existing interdisciplinary methods and resources for teaching cultural intelligence into activities and resources suitable for engineering education

Defining learning needs

Definitions of the term intercultural competence vary between authors and professional contexts (Spitzberg & Changnon, 2010). One quite simple definition proposed by Ang and Van Dyne (2008, p. 3) states that intercultural competence is *an individual's capability to function and manage effectively in culturally diverse settings*. Through an exploration of this definition in workshops with engineering academics around Australia, we refined three focused statements which guided our understanding of intercultural competency as it relates to engineering practice:

> ***Culture:*** *refers to values, beliefs and behaviours*
>
> ***Intercultural Competency:*** *involves Appreciating, respecting and adapting to other values, beliefs and behaviours and working with differences*
>
> ***Challenges faced by graduates:*** *include Identifying and understanding values, beliefs, and behaviours of one's self and others*

The absence of specific reference to nationality or ethnicity in these statements is an intentional effort to detach the term 'culture' from these concepts more commonly associated with the term.

This eBook is the outcome of the third component of the project, which led to the development of easily accessible teaching materials that expand the concept of 'culture' to include both social and workplace contexts.

Introducing the EAC Study Units

There are twelve units for use with classes at various levels of university study that have been developed to accompany this book. The units are arranged in clusters that address specific aspects of culture, and can be used as a suite of study units or any one unit can be used as a stand-alone module. The EAC materials are not intended to be a sequential 'subject-based' set of units. The topic and mode of presentation for each unit is identified and educators can make their selection in accordance with particular learning goals and study needs. All units are devised in such a way that they can be used with undergraduate classes, while some units are also suitable for adaptation to postgraduate programs.

Individual copies of Units 1-12 [outlined briefly in the final section of this book] are available in portable document format (pdf) online at engineeringacrosscultures.org. Modifiable MS office format files are available by email request from the authors.

A further three units, 13, 14 and 15 were prepared as a guide for educators in the use of the study units. These provide general background information on some of the teaching/learning principles informing their design. These three units are adapted directly from this eBook for distribution as separate components.

Using the EAC Units of Study

Principles underlying the choice of content, and approaches to presenting each unit are based on the principle that *"it's easier to act your way into believing differently than to believe your way into acting differently".* McLain Smith (2012)

In effect this creates a learning cycle that begins with action and engagement, before moving to reflection, analysis and possible application in known and future contexts. The emphasis on action can create a potential for uncertainty in regard to the flow of the learning. Experience to date has shown that students respond positively to increased levels of engagement with learning activities (Goldfinch, Layton, & McCarthy, 2010) – however there will be times when particular students find this difficult to accept. Thus each unit has specific information to assist the educator to prepare fully for the session, and the final three units were developed to ensure that educators have a breadth of knowledge about key principles informing the design process. These provide information about possible indicators of uncertainty and resistance to involvement, and suggest appropriate responses to help educators avoid abandoning the intention to engage the majority of learners.

Targeting Engineers Australia Stage 1 competency standards

The modules are also intended as a tool to assist Australian engineering educators in addressing the stage 1 competency standards that form the basis of Engineers Australia's accreditation of engineering degree programs. The EAC modules have been developed to address many aspects of the professional Attributes required by EA for graduating engineers. In particular, the following attributes and indicators of behaviour are specifically addressed in different ways throughout the units of study:

3.1 Ethical conduct and professional accountability

a) Demonstrates commitment to uphold the Engineers Australia - Code of Ethics, and established norms of professional conduct pertinent to the engineering discipline.
b) Understands the need for 'due-diligence' in certification, compliance and risk management processes.
c) Understands the accountabilities of the professional engineer and the broader engineering team for the safety of other people and for protection of the environment.

3.2 Effective oral and written communication in professional and lay domains.

a) Is proficient in listening, speaking, reading and writing English, including:
  - *comprehending critically and fairly the viewpoints of others;*
  - *expressing information effectively and succinctly, issuing instruction, engaging in discussion, presenting arguments and justification, debating and negotiating - to technical and non-technical audiences and using textual, diagrammatic, pictorial and graphical media best suited to the context;*
  - *representing an engineering position, or the engineering profession at large to the broader community;*

- *appreciating the impact of body language, personal behaviour and other non-verbal communication processes, as well as the fundamentals of human social behaviour and their cross-cultural differences.*

3.5 Orderly management of self, and professional conduct.

a) *Demonstrates commitment to critical self-review and performance evaluation against appropriate criteria as a primary means of tracking personal development needs and achievements.*
e) *Thinks critically and applies an appropriate balance of logic and intellectual criteria to analysis, judgment and decision making.*

3.6 Effective team membership and team leadership.

a) *Understands the fundamentals of team dynamics and leadership.*
b) *Functions as an effective member or leader of diverse engineering teams, including those with multilevel, multi-disciplinary and multi-cultural dimensions.*
c) *Earns the trust and confidence of colleagues through competent and timely completion of tasks.*
d) *Recognises the value of alternative and diverse viewpoints, scholarly advice and the importance of professional networking.*
e) *Confidently pursues and discerns expert assistance and professional advice.*
f) *Takes initiative and fulfils the leadership role whilst respecting the agreed roles of others.*

Culture in the Classroom: Working with Complexity and Chaos

Who dares to teach must never cease to learn.
- John Cotton Dana

Learning is what most adults will do for a living in the 21st century.
- Perelman

The only person who is educated is the one who has learned how to learn and change.
- Carl Rogers

Teachers open the door, but you must enter by yourself.
- Chinese Proverb

Cause and effect are familiar elements in engineering. They also exist in classrooms and workplaces. In the 21st century cause and effect relationships are becoming more complex, particularly in the way engineers must work with clients and colleagues. This unit explores ways in which an understanding of a model of cause and effect relationships can help educators work with concepts of chaos and complexity both in the classroom and more generally.

Engineering Feats – mastering Chaos and Complexity

"In The River" – Chaos

When pilot Sully Sullenberger's cool response to crisis enabled him to land a crippled plane in the Hudson River without losing any passengers or crew, he showed a mastery of 'Chaos thinking'. After a flock of birds disabled both engines, he assessed all the apparently available options as 'impossible' and calmly advised airport control, *"We'll be in the river".* Then he used his knowledge and expertise to achieve the unthinkable – landing a fully loaded passenger plane on water without sinking! Application of planned responses did not assist, and probes for alternate outcomes simply indicated there were no achievable options. His choice to ***act*** in the face of so many unknowns undoubtedly saved everyone, but could not have been anticipated as a viable option at any time before he took it.

"Wheel gone!" - Complexity

When an RAAF F1-11 fighter lost a wheel on takeoff from Amberley Air Force base in Queensland on July 18, 2006, it was successfully returned to earth with minimum possible damage and no loss of life. Those involved used thinking strategies related to those applied by Sullenberger. However, on this occasion, the time factor, capabilities and resources were quite different. The plane had a full fuel tank and was otherwise fully functioning, so the pilot could continue to fly a mission while a team on the ground used the F1-11 flight simulator to design and assess all the possible options for a safe landing. These experts ***probed*** for every possible variation, made sense of the data as it emerged from their explorations, and devised a response strategy that brought both pilot and plane back safely.

Chaos and Complexity Thinking

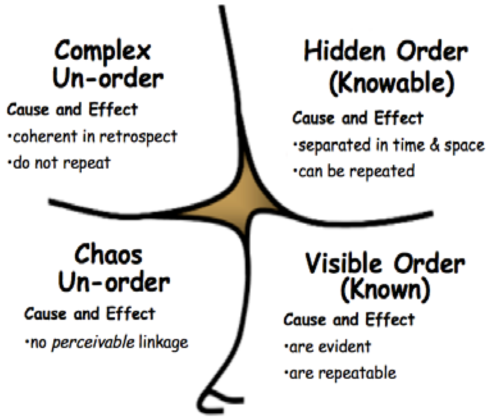
This is the kind of thinking that students are invited to employ in using the Engineering Across Cultures study units. The EAC project set itself a goal of generating new ways of creating and sharing knowledge. As the ALTC proposal document noted -

> *Acceptance of the need for developing cultural intelligence in engineering students is present, and a wealth of cultural knowledge to facilitate this is available. However knowledge of how to effectively educate engineering students on cultural issues is lacking.*

These materials are made available to be adapted - and added to - from your own expertise. Nevertheless a core premise underlying their use is that students are able – and will experience an increasing need - to experience discontinuities and uncertainties in their future workplaces. Therefore they will benefit from learning to exercise and trust their own expertise, while developing a healthy respect for the unknown, with a corresponding understanding that they can move to new levels of awareness and competence through their own efforts.

The Cynefin Domains

Encouraging students to become comfortable with uncertainties and unknowns in real world scenarios requires a different way of thinking about the forces found regularly in classrooms. The way of thinking proposed here uses the concept of cause and effect relationships to explore five different conditions that may be found at different times in education and elsewhere. It draws on the work done by David Snowden and his colleagues, under the general title of the Cynefin Domains of Knowledge (Kurtz & Snowden, 2003).



Cynefin Domains of knowledge showing cause and effect relationships (Kurtz and Snowden, 2003)

In the context of mechanical engineering, 'stress' causes 'deformation', that is, stress is the '*causal action'* and the *'effect'* is the deformation experienced by specific elements. Similarly in the Cynefin model each set of 'causes' has a relational 'effect' on those experiencing their context as a moment-to-moment living environment. Specific relationships between cause and effect, as illustrated in the Cynefin Domains model, indicates the extent – or otherwise - of the "Orderliness" in each context (Snowden & Boone, 2007).

Dis-order - The central 'greyed out' space is a useful starting point for exploring the model. 'Dis-order' refers to the condition in which relationships between cause and effect are (or are believed to be) unknown, or undetectable, and therefore unmanageable. It is the apparent absence of any visible 'cause/effect' linkages that can make this domain 'frightening', and can lead individuals who believe they are 'in' it to experience varying degrees of distress. If an individual or organisation blunders into this Domain (really a mental construct rather than a real 'space'), an essential first step concerns recognizing the need to seek relevant cause and effect relationships with which to achieve resolution of the problem or situation at hand. Failure to do so can lead to severe distress and a retreat to 'safe' havens that are unlikely to be helpful in resolving the problems being experienced. Failure to act effectively can lead to disaster.

The surrounding four Domains provide cause and effect relationships enabling diagnosis of a situation by a designated leader and/or participants before taking action. As shown in Figure 1, beginning with the Domain likely to be most familiar, these are:

Visible Order – familiar situations where cues and indicators are well **known** and Cause and Effect relationships are *evident* and easily *repeatable*. The familiar 'classroom' setting is an example of such a 'Visible Order' domain. Here are seats in orderly rows, display media at the 'front' of the room near a lectern (or a single desk facing all the others), and everyone has an unspoken – but quite powerful – expectation that the 'leader' has the answers and can impart them. Anyone entering this space already knows their 'role' here and behaves accordingly, without need of any reference to additional cues.

Hidden Order – refers to situations where cause and effect are separated in terms of both time and space but can be *discovered* and can be *repeated*. Examples in an educational context include a laboratory, workshop or other space where roles are familiar, but tasks involve direct engagement with tools and materials under the guidance of a 'leader'. Thus the 'hidden' nature of the task is '*knowable'*, can be discovered through action and under guidance of an expert, and, once acquired, can be repeated with the goal of increasing proficiency.

Complex Un-Order – [the 'un' is a humorous, while respectful, reference to Bram Stoker's use of the term 'un-dead' meaning neither 'dead' or 'alive', but in some indeterminate state in between] this domain refers to those situations where 'order' is only found after events have ended; where new knowledge has emerged from grappling with unknown and incomplete data; where the outcomes are not exactly repeatable, although the learning gained from the effort can be acquired and codified to some extent, and may be useful in future conditions, which may be similar but never exactly the same. In education, doctoral and honours work could be thought of as occurring within this domain.

Chaos un-order – there seems to be no perceivable cause and effect relationship in this domain, although this may simply be that the pattern of events is simply too large with so few repeatable factors that humans can only see the chaos. In some respects, key features of the current situation of education and learning could be said to have arrived in this domain. The familiar order of 'professor' and 'student' / 'knower' and 'learner' are under challenge from a range of sources. Technology, easy access to information, exploding rates of data creation and social and life style changes are all challenging the 'known' order of 'teaching' and 'learning'. Medieval conditions relating to knowledge creation and learning gave rise to current university structures and are long gone. Yet the comfort of their familiarity makes it difficult to let them go, while the combination of challenges noted above are making current academic contexts almost unrecognisable descendants of those 'orderly' settings.

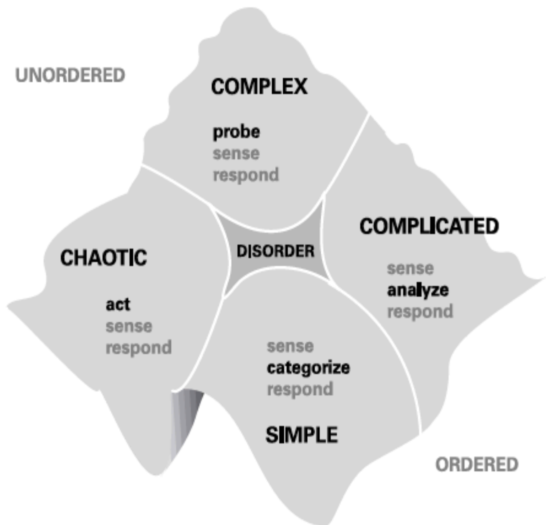


Figure 2 Cynefin Domains showing response sequences relevant to each one (Snowden and Boone, 2007)

So what?

In Figure 2, the Domains are provided with descriptors (Simple, Complicated, Complex, Chaotic and Disorder) indicating their essential nature. The four Domains can also be seen as subsets of two quite different contexts – known as 'Ordered' and 'Unordered'. As leaders, educators and individuals begin to understand the working of differing sets of causes and effects, they are more able to make conscious choices for appropriate responses leading to effective action within in each Domain. That is, we become aware of the need – and potentially more able - to act in ways that Snowden and Boone define as 'contextually appropriate'.

While academic teaching contexts cater effectively for the 'Ordered Domains' – named in Figure 2 as 'Simple' and 'Complicated' - less attention is paid to preparing students for effective responses in the 'Unordered' Domains of the 'Complex' and 'Chaotic'. An emergent problem, arising from this, is that engineering workplaces, and other social contexts, are becoming places where much is unknown and it is accepted that not everything relevant can be known all at once. This, in turn, requires a greater capacity to operate effectively on limited knowledge. And this, in its turn, involves accepting that real understanding may only arrive *after* the event. However, academic contexts are lagging behind in their capacity to provide students with requisite skills for operating in such conditions.

Since it is not possible to 'know everything', effective operation in the Unordered Domain requires a capacity to perform effectively and efficiently in conditions of 'incomplete information'. This may involve the use of *probes* to collect enough data to make sufficient sense of conditions in order to respond appropriately in short time frames. Expert capacity to operate in this mode seems to require a mindset conditioned to working with incomplete knowledge and without the comfort of known outcomes.

The engineers and simulation experts who used the RAAF simulator to *probe* for every possible variation made sense of the data as it emerged from their explorations, and devised a response strategy that brought pilot and plane back safely. This is the kind of thinking that these Engineering Across Cultures study units aim to help educators convey to students. Since culture is one of the most powerful influences on thinking and behaviour, and also one that is simultaneously well known (our own culture) and an almost complete mystery (other people's cultures – and aspects of our own culture that are so ingrained we cannot easily recognise them) the Units of study provide a range of perspectives which educators can use to introduce and guide exploration of 'culture' in all its diversity.

The Cynefin Domains and the Engineering Across Cultures Approach

As noted above, materials for the Engineering Across Cultures project create conditions in which students must learn to work in the 'Complicated' and 'Complex' Domains. The activities encourage them to work just sufficiently beyond current levels of knowledge as to stretch their capabilities for absorbing, managing and responding to new information - and develop their self-confidence while doing so.

It is anticipated that this 'stretch' will enable them to become consciously aware of their current attitudes and beliefs in regard to the value and benefits of acquiring cultural intelligence. Developing the ability to probe for information, recognise the value of taking action and *then* analysing the outcomes extends students' own intelligent awareness of the impact of culture on all aspects of engineering. It is anticipated that these activities will assist students to develop agility in recognising the actual needs of specific contexts instead of relying on habitual responses.

The materials and activities invite students to create experiments, discuss issues and allow patterns to emerge as they develop new thinking habits that enable them to more safely trust their own observations and experiences. Relevant references to a variety of expert sources are included throughout the materials – but the belief underpinning everything is that taking action to engage with information generates new knowledge unique to each individual and therefore more likely to become embedded operating principles as students pursue their engineering careers.

Conversely, the notes for tutors accompanying each Unit of study, and supported by these three Units, provide educators with background information and ideas for stretching their own intellect and awareness. It is hoped that all parties will have encountered a range of new experiences, gained confidence in less familiar learning contexts, and feel more self-assured when facing the unexpected and unanticipated, especially in regard to learning processes and expectations.

Making the Changes – altering current behaviours and expectations

Studying in the 'Simple" Domain

First year university students entering their first lecture theatre do not head for the stage and the lectern. They are able to 'make *sense* of' the setting and without conscious decision-making, categorise themselves as 'students' and respond by heading for the rows of tiered seats. Here they await the experience of 'being told' about their subject's core principles, notions and beliefs.

Encountering the 'Complicated' Domain

Passive 'waiting' may be OK for a lecture; it is less useful in tutorials, and a total disaster if it is the individual's only continuing response. At some point, students must become able to sense the complicated nature of what they are encountering, *analyse* their context and incoming information, and devise conscious responses of their own. As they do so, they develop 'Complicated' thinking capabilities at a level suitable to their context. However, students graduating with a high level of expert-driven 'complicated' thinking, may remain largely unaware of the 'Complex' Domain where there are few certainties and no absolutes.

Continuing reliance on other experts to guide and shape learning eventually creates a sense of dependence that traps thinking and response patterns within the 'Ordered Domain' of Visible and Hidden Order, rendering learners unready for the uncertainties and discontinuities of the 'Unordered Domains' of workplace Complexity and Chaos. As long as they are in roles requiring adherence to pre-set structures and routines, they can depend on previously acquired knowledge and expertise and are safe and able to perform well. However, if/when life and work begin to demand that they operate in situations with increasing numbers of relatively unknown factors, this dependence on expertise – their own and others' – may fail them.

Challenging dependence on 'experts'

Moving beyond 'Complicated' is never a simple process. It involves acceptance that knowledge is not fixed, that uncertainty must become a familiar companion, and even the most trusted experts have not been here before us. In the spirit of operationalizing the Cynefin Domains, we acknowledge that taking students – and ourselves as acknowledged experts in our own fields – into this unknown terrain is a complex task, with dead ends, false starts and abandoned ideas.

In so doing, we celebrate all those creative and innovative thinkers in engineering who have found new ways to use their knowledge and improve the context of our lives. My personal favourite as a young girl was Barnes Wallis, an engineer who worked across naval and aircraft design, pioneered the remote control of aircraft and featured in the movie "The Dam Busters" with his design for a bouncing bomb. The story described in *The Dam Busters* reflected the difficulties Wallis often faced in persuading those in authority or who controlled funding sources to support his ideas *(see http://en.wikipedia.org/wiki/Barnes_Wallis)*.

The story also records his vast capacity to persist against all odds when the purpose was important, and to persuade others to accept his radical and often unconventional thinking. He understood the importance of 'Complex' thinking and was not averse to taking action to press home a point.

Practical Applications

Classroom contexts usually come with an unspoken expectation of recreating a "Simple" domain. Familiarity with the context creates a sense of safety and security; and the orderliness of the relationships usually experienced reduces personal insecurities. If the environment moves away from this by introducing activities expecting students to work independently, the shift in expectations can unsettle 'taken for granted' assumptions and create an atmosphere of distrust and uncertainty. Since this also has potential to generate uncertainty in you as an educator, we offer the following tips and hints to sustain your own ability to work on and in the "unordered Domain." The following table lists events or reactions that may arise as a result of students becoming disoriented or uneasy in 'new' learning contexts.

Alongside each one are suggested responses on which to build your own unique rerpertoire of responses. This is supported by references to research and information for further exploration - either in anticipation of these kinds of events, or afterwards.

Events and Behaviours	**Possible responses**

There is a lot of resistance to moving into groups and an expressed degree of discomfort with group work and activities	• It may be helpful to have groups pre-selected and put sheets listing group member names on the tables before students arrive. Then it is somewhat like a 'party' setting where they have to find their names, and the task itself moves them forward more quickly. • Be Patient. While some gentle urging is useful, demonstrating that you can 'out wait' them is more effective. This may feel like you are 'losing time', but, in fact, you are gaining control of the learning space in a different way, and it seldom takes long for everyone to settle into the next mode of operating • Once everyone is settled, it may be useful to refer briefly to the group-based nature of most workplaces and note that cooperative behaviour - not unnecessary reluctance - is better respected there. • Make it clear that contributing to the activities enhances their capacity for becoming better engineers because of the opportunities to *work with* their knowledge rather than simply *memorising* things. See Wilfred Bion: "The central concept in Bion's theory is that in every group, two groups exist: the "work group" and the "basic assumption group". Bion was not referring to factions or subgroups within the group, but rather to two dimensions of behavior within the group." From http://209.34.253.86/upload/2004_ODN_Conf_Proceedings.pdf http://www.yale.edu/peace/management.htm http://www.eslfocus.com/articles/managing_the_university_classroom_giving_freedom_taking_control-449.html
Student/s become unsettled and demand a return to a passive state where they only have to listen	• Be Patient. Trust that the new operating mode will become a habit after a while – as long as you sustain the requirement for them to work, not simply listen. • Believe in – and emphasise - the value of having them work things out for themselves. The two case studies that open these notes demonstrate that this ability may well be one of the most important things they learn with/from you. • Draw a parallel with learning sports. While information and theory is important 'working with' the ball is the only effective way of acquiring skills and capabilities.

Student/s pretend to do the activity, but, under cover of surrounding noise, talk or joke around	• Be vigilant. This approach to learning does require the educator to move around a lot. Offer your help; observe quietly and unobtrusively. Trust that almost all students are genuinely concerned to do their best.
	• Have relevant consequences available when you need to remind an individual or group about the value of effective participation. These may include:
	    o [short term] loss of marks; delays in returning work; requirement to do additional work;
	    o [long term] delays in final results; missing out on relevant work-related experiences that could be included in a resume; lost opportunities for picking up experience in applying theoretical knowledge.

Student/s do the task in a simplistic	If this is a single group, address the discussion and actions to them only. If it is larger proportion or the whole class, then stop the action and address the

'let's guess' manner and show no apparent concern that they are not benefitting from the experience	issue directly. • Some points to make include: o Practice and theory are two inseparable elements of the role of an engineer. Theory needs to be practised if it is to be of use once they are at work. o Pride in work is the mark of a professional - see the Engineers Australia resources at http://www.engineersaustralia.org.au/sites/default/files/shado/Education/echartered/competency_standards_marchversion.pdf o Collect and have ready examples of engineers who demonstrate high standards and have used their experiences to address complex problems Stephen Brookfield – see http://stephenbrookfield.com/Dr._Stephen_D._Brookfield/Critical_Incident_Questionnaire.html for a tool he uses as a combined reflective and feedback tool His books are listed at http://www.amazon.com/Stephen-Brookfield/e/B001HOEZ68
Student/s do not turn up to class	• If this concerns a few individuals, use your university's communication system and policies to connect with them. If it is a larger proportion of the class, use your online learning system to connect. Stories and case studies about successful application of engineering theory in multi-cultural contexts can help students see the value of the work.
Student/s talk loudly and appear to be ignoring instructions	• It is possible that this behaviour is actually indicative of a degree of nervousness about having to demonstrate a grasp of theory and putting it into practice. • Slow Down. If you are in the process of giving instructions focus attention on yourself – wait for silence and then proceed. • Have plenty of copies of the EAC handouts and ensure everyone is checking them through with you. • Distribute handouts and set the time frame without further ado. This way you can focus on groups where attention is lagging, and allow the rest to get on with the job.
Student/s are silent and sullen, moving slowly to begin tasks, taking a long time to complete them	• Be patient. If you suspect this behaviour is an attempt to avoid work, be clear about consequences for incomplete work. Where the class activity is not included in assessment tasks, focus on such things as the Engineers Australia standards for engineers. • Decide if you want each activity completed within a set time, or whether moving the process through to completion - with the risk of some incomplete tasks – is a better option for this class. • Focus on the positive strengths of engineers who are culturally aware. Point out the difference between "building something" and "creating homes to meet client needs", such as in the case study of Aceh. • Challenge the class to a competition – have rewards of some kind [including an early mark!].
Student/s ask lots of questions	• Acknowledge their right to ask questions – and then assure them that the process itself will answer the questions and they will have gained

about the process and use actual or feigned ignorance to delay or inhibit moves to give them responsibility	experience rather than spent time listening to you. • Announce that ignorance is best overcome through action – and the activity will draw out their knowledge. • Where you have Internet facilities available, or nearby, allow the groups to use these where relevant, and focus attention on the process of acquiring knowledge for themselves.
Students disappointed / dislike the 'teaching' style being used – and say so. They make veiled or overt threats to complain	• Acknowledge their right to express their opinions. • Emphasise that there will be very little 'teaching' once they are working, so every opportunity to learn about their own capabilities to conduct good research and contribute to group work can provide practice for their own future success. • Invite them to think about whether they are self-motivated learners or dependent on someone else for all their direction setting.
Student/s actually lodge complaints about 'not being taught well' in the unit	• Have your work and processes documented fully enough to provide supporting evidence for your use of the EAC approach to teaching and learning. • Invite the students to consider how much 'teaching' they will get once they graduate. • EAC is focused on assisting engineering students to understand how culture – national, business, personal – all influence the nature of engineering work. As such it is working to achieve a balance between imparting facts and assisting individuals gain insight into how 'who they are' shapes 'what they see' and 'how they work'. Such insight has the capacity to impart long-term influence on future behaviour. Lectures and knowledge-driven teaching are less able to do this.

The EAC Units

It is common in this area to focus on issues of international interactions, particularly involving international students (Deardorff, 2011; Spitzberg & Changnon, 2010). The Engineering Across Cultures approach extends the scope of the project to include five perspectives on culture that engineering students and graduates may encounter. These five aspects of culture - as they relate to engineering design, practice, and education – formed the structure for the development of the learning modules:

1. Living culture – Developing awareness and understanding of how engineering fits into social contexts
2. Workplace culture – Seeing how workplace cultures evolve and their effect on work practices
3. Community culture – Engaging with community issues that engineers often encounter
4. Technical/cultural demands – Exploring links between technical and cultural requirements in design and practice
5. Culture in the classroom – Identifying students' priorities and cultivating a classroom learning culture that is open and accepting of new ways of thinking (for the educator).

Conventional engineering education tends to separate the 'social' from the 'engineering'. As Warhafts noted (2005) *"The broader implications of technological innovation are not addressed directly in the engineering classroom. Even in courses that consolidate and integrate knowledge, such as engineering design, the social issues are dealt with narrowly."* The topics, which are the focus of this work, are too often dismissed by students, and some academics, as 'irrelevant for engineering' or 'for arts students, not applicable to the *real work* of engineering students'. To challenge this attitude and assist students appreciate the qualitative side of engineering practice, each EAC module either commences with, or works back to an example of how the focus issues affect – and are affected by – engineering practice.

Four sets of teaching units – one for each aspect of culture identified above – are presented in three components, a student guide, a tutor guide, and supporting resources. The fifth set is specifically intended for use by academics and tutors to address the fifth aspect of culture and does not include student components. The student guides contain an overview of the class activity, learning outcomes, lists of resources and include questions to prompt exploration and guide activities. The intention is to provide students with enough information to aid the tutor in initiating each stage of the class without providing so much information that the flexibility of the class would be limited.

Tutor materials include substantial detail on how to run the class, how to facilitate group discussions, and tips on how to support students in dealing with 'un-order'. There are also strategies presented on how to set up collaborative learning spaces to best support the class activity format. This level of detail is intended to address apprehensions about managing class activities that step outside the comfort and familiarity of the 'ordered' domain. We need to keep in mind that for many tutors, the learning curve encountered in running the EAC classes – and any other class for that matter – can be just as steep as that experienced by the students.

Supporting resources vary in format, content and style among the modules. The intention to provide a high level of flexibility is a particular feature of the modules. Through developing a range of resources and case studies for educators to choose from, the contexts in which the modules can be run can also vary widely.

Presented below is an overview of each of the teaching units, from 1-12. The supporting Units 13, 14 and 15, are essentially covered in this book.

Unit 1 - How people live and the impact of engineering

Outcomes

- Contributing to personal and peer learning
- Establishing and applying roles and responsibilities in this group
- Exploring the impact of engineering on society
- Identifying the variety of engineering needs across cultures and contexts

Approach

Analysis of eight very different types of living spaces introduces concepts of teamwork and learning about "how to learn". The focus is on using teamwork to explore how cultures shape living arrangements.

Unit 2

Outcomes

- Defining cultural dimensions of design problems
- Identifying relevant data and knowledge sources
- Developing a preliminary action plan
- Generating possible solution/s to a problem
- Learning to evaluate solution/s against standard performance criteria

Approach

Student teams work as either clients or consultants. Teams receive a project brief with which to explore how to engage effectively with the kinds of communication processes in such contexts. There are a number of briefs, and the process involves the whole class in considering how different needs can dramatically influence the client/consultant relationship.

Light

What we touch influences how we think

- **MIT Professor demonstrates that three dimensions of touch – weight, texture and hardness – can unconsciously influence judgments and decisions.**

Tactile

Flexibility

Unit 3

Outcomes

- Identifying engineering capabilities on which to focus attention
- Analysing cultural factors inherent in succeeding in engineering projects
- Demonstrating personal responsibility
- Enacting the effort of contributing effectively to teamwork

http://www.pbase.com/minoltaman/image/38296755

Approach

A case study of effective and ineffective responses to an emergency situation is used to guide discussion of the importance of understanding engineering graduate qualities.

Unit 4

Outcomes

- Ability to recognise 'culture' as more than simply a difference in national/geographic origins
- Using observation and analysis to define contextually appropriate behaviours
- Explaining how workplace culture can impact on the quality of engineering practices

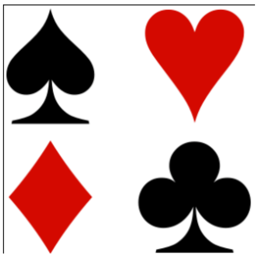
Approach

A range of case studies are provided for analysis. Teams work together to identify factors in workplace culture that have been shown to affect quality of performance. Teams develop and share a visual representation of data to summarise and report on the outcomes of their analysis.

Unit 5

Outcomes

- Experiencing ways in which activities that become routine and habitual may adversely affect behaviour
- Examining how small changes can unsettle reliance on habits
- Considering how to behave when entering different cultural contexts

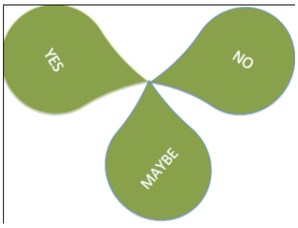


Approach

A well-known card-based simulation creates a temporarily unsettling cultural experience. This is both an active simulation and an intensive analysis of revelations about the effect of familiar social and cultural habits and routines that may be unconsciously driving routine behaviours. While these will appropriate in familiar and known contexts, a variety of problems may arise when the context is no longer known and familiar, which in turn can create uncertainty and inappropriate behaviour.

Unit 6

Outcomes



- Generating discussion about values and beliefs in a non-judgmental manner - in relation to common dilemmas that may be encountered at work
- Opportunities for participants to consider human motivation and perceptions about culture
- Developing greater awareness of underlying personal beliefs and their impact on routine behaviour

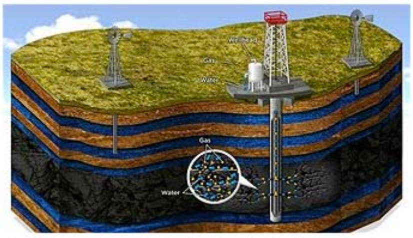
Approach

A unique board game presents participants with situations requiring explicit statements about current beliefs/values based decisions. The activity involves participants in both expressing personal stances and better comprehending others' beliefs and visible behaviours.

Unit 7

Outcomes

- Identifying the kinds of factors that emerge when economic drivers and community cultures collide
- Using research and analytical skills to prepare a case for or against a particular position
- Exploring how perceptions and personal preferences influence actions and beliefs



Coal Seam Gas Mining (ABC Rural)
http://www.abc.net.au/local/stories/2012/05/29/3513166.htm

Approach

Participants work independently to research a current contentious issue with an engineering/ community interface. They are then randomly assigned to debating teams. Drawing on the prior research the teams develop and present an argument from within their assigned perspective.

Unit 8

Outcomes

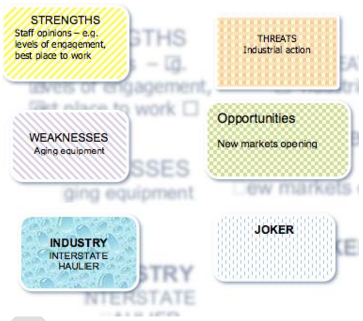
- Exploring how spoken and written language reflects and constructs culture in organisations and countries
- Learning how to read documents in ways that reveal implicit values statements and stances
- Developing capabilities for recognising and describing values as conveyed in official documents

Activity

A brief overview of how values are expressed and enacted through the life cycle of organisations and nations, introduces a case study based exploration of public documents. These are analysed to consider how written statements indicate what is valued - and what is not - and how this may change over time. A consideration of how values are enacted over time may also be discussed.

Unit 9

Outcomes



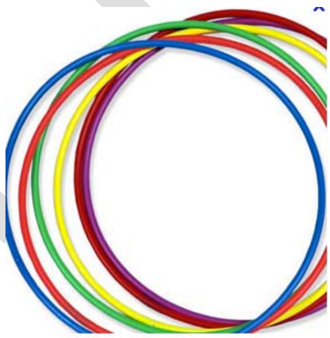
- Understanding interrelationships among technical and human factors
- Appreciating how ‘soft’ and ‘hard’ systems interact
- Improving decision-making for arranging technical and human factors in a business
- Increasing awareness of how to reduce the negative impact of unexpected events
- Understanding how to account for cultural factors in business activity

Approach

A unique card game introduces concepts of a SWOT analysis as participants attempt to build the conditions for a sound business. The focus is on building the culture of the business they want to be part of – and analysing how their decision do – or do not – create that.

Unit 10

Outcomes



- Exploration of factors on which organisational/group cultures are based
- Consideration of ways in which individual behaviours and beliefs contribute to shaping culture
- Examination of some of the complexities of working on large projects where multiple cultural influences will be operating

Approach

An interactive simulation invites participants to research and create a specific ‘cultural’ stance and then develop strategies for achieve a collaborative and mutually beneficial outcome.

Unit 11

Outcomes

- Opportunities for developing personal expressions of beliefs and values as novice engineers
- Using current literature to re-examine emergent stances in regard to the role of engineering in participants own societies
- Exploring how present knowledge may be changed by ‘things not yet known’
- Considering how to develop flexibility and resilience in personal expression of the stance of ‘being an engineer’

University of Washington Society of Women Engineers

Approach

The work of various writers on human values (including Paul Chippendale and Clare Graves) is used to introduce concepts of 'things not yet known'. The activity encourages developing deeper appreciation of needs, goals and context-based limitations. Participants use resources to develop their own statement about 'myself as an engineer' in three time periods – on enrolment to study, on graduation and in five years time.

Unit 12

Outcomes

- Developing skills for using different perspectives to analyse known events
- Gaining insights into how 'reasonable' decisions are not always the best ones
- Considering how factors that appear unconnected by time and purpose may be – or become – closely linked by unanticipated events
- Developing personal insights into how to think as an engineer and an individual in times of stress


http://www.safetyxchange.org/health-safety/july-6-1988-north-sea-oil-rig-fire

Approach

An early – and still one of the worst - oilrig disasters is examined in the light of what became known through analysis but was either not known – or not understood – by those involved at the time. Participants prepare a brief report on the disaster each report using only one perspective [e.g. – survivor, company owners, writers of technical manuals, etc.]

Implementing EAC units - Operating as a Project Portfolio Manager

The main part of intellectual education is not the acquisition of facts, but learning how to make facts live.

- Oliver Wendell Holmes

Getting things done is not always what is most important. There is value in allowing others to learn, even if the task is not accomplished as quickly, efficiently or effectively.

- R.D. Clyde

It is possible to store the mind with a million facts and still be entirely uneducated.

- Alec Bourne, A Doctor's Creed

Teachers are those who make themselves progressively unnecessary.

- Adapted from Thomas Carruthers

The concept of Project Portfolio Management is a metaphor for the role of the educator in classrooms where group-based learning replaces conventional educator-led teaching practices.

When risk is considered as a component of project based activity, successful projects and their sponsors begin with creative and innovative ideas that they believe have merit. Project teams then focus on working to ensure that key project variables [cost, risk etc.] are identified and make every effort to mitigate potentially adverse influences. In this way project teams nurture their chances for success and reduce to a minimum the possibility of failure. This approach is particularly important when developing projects in unfamiliar or culturally diverse settings where a high degree of uncertainty or 'unknowable' elements exists.

What is a Project?

A project is generally a set of tasks, undertaken by a larger or smaller group of workers who combine forces to achieve a pre-defined outcome. It is time limited and circumscribed by the terminating nature of the intentions. As such, 'project management' is a useful description to apply to group based classroom activity. The following table lists key features of projects, and indicates how these align with group work requirements.

A Project	Classroom group work
• Is a temporary enterprise	• Lasts the life of a class or subject - no longer
• Distinct beginning and end	• Begins and ends within the scope of set tasks
• Operates within time limits	• Has session and subject time limits
• Has distinctive goals and objectives	• Links goals and objectives to academic requirements
• Focuses on adding value or change	• Is designed to add value to learning experiences
• Has funding limits	• Limits are shaped by resource constraints
• Is required to deliver specific outcomes	• Outcomes are specific to one subject, but can help students integrate their study

What is a Project Portfolio Manager?

A 'Project Manager' is not required to do the work of the project, but to manage and direct it. A 'Project Portfolio Manager' (PPM) is even less likely to be 'doing the work' of the projects they are overseeing. The PPM is responsible for managing a group of concurrent projects, which share sufficient common characteristics and are being completed by different teams. As a PPM an academic is thus positioned outside the work of the project teams, with an oversighting responsibility for their quality, completeness and achievement of stated goals. This also means there is less emphasis on imparting subject content, and importantly, personal opinions and bias. The professional knowledge of the educator is a background resource rather than the foreground focus of everyone's attention.

Thus PPM provides a useful metaphor for educators in the role of managing complex learning activities. It is expected that Project Portfolio Managers will have – or be developing - the following characteristics -

1. Aware and alert to the behavior and progress of each of the teams in the room, and conscious of their performance and standards
2. Able to develop and maintain a 'big picture' perspective of everything happening in the classroom; alert to the overall quality of the whole class
3. Alert to indicators of individuals experiencing problems within their team, and able to assist the person and the team resolve the problems
4. Ensure that problems – large or small – are identified early and assessed and managed effectively for the best possible learning outcomes
5. Ensure that student, as owners of their own learning – and the engineering program of which this study is a part - all benefit from the experience of completing the study
6. Confident in regard to personal knowledge and capability, and able to share that within an active learning environment - i.e. considers professional knowledge as part of their overall repertoire of capabilities and is comfortable in being challenged, and able to accept the limits of knowledge and work with students to 'find out'.

Leading Projects in the Classroom

Thinking like this about being an educator using EAC study units leads to the following shifts away from conventional thinking -

- As PPM you are in charge of managing the process but are not 'on stage' to display your knowledge
- Groups are definitely in charge of their own processes. They are *learning* to direct their own learning – so unlikely to be 100% perfect and will benefit from guidance not control
- Measures of timing, quality and overall performance are the responsibility of the PPM. Achieving them is the responsibility of the groups.
- Noise and movement in the learning space are less under the control of the PPM – although there are always reserve rights to exercise.
- The opening and closing of each session is the prerogative of the PPM. However timing is crucial to ensure the maximum time for group activity.
    - The opening sets the scene. The PPM is responsible for
        - Creating teams
        - Allocating tasks
        - Ensure space is efficiently used
        - Distribute resources
        - Set time frames
        - Standing aside and encouraging the action to begin
    - The closing focuses the learning and brings attention back to the PPM
        - Groups are / should be ready to report on progress/completions

- Learning outcomes are identified and discussed
- Problems are identified and explored
- Debriefing about the experience is intended to draw out the powerful but often un-noticed quality of the experience
- Next steps in regard to consolidating learning are identified and shared
- Groups conclude their activity and share their responses to the experience both with the team members and the class as a whole

Putting the PPM into Practice

The PPM role is neither simple nor easy. However it enables a clear and achievable transition from a direct teaching role. The concept is relatively easy to convey to a class by use of the concept of groups activities being introduced as projects for completion within the time frame of the class session.

The following steps - when applied thoughtfully – ease the transition and enable both the educator and students to move into the framework required for sustaining the shift in thinking.

1 Set the scene

a. If possible arrive early and ensure the room is arranged for group work, OR
b. Have the students help you rearrange the furniture for group work
c. Assign students to groups, allocate groups to tables and ask them to complete introductions [EAC units include ideas on this]
d. Distribute materials – allow the noise to run, while you do this, to encourage everyone to speak up and make the move into group work feel easier.
e. Once you are confident that everything is in place call for silence and explain the process. They are to work as project teams – you will visit teams to assist them individually. You will not be standing at the front of the room.

2 Introduce the Task

a. Introduce the materials and explain that they outline the tasks to be completed. Many of the EAC unit materials are largely self-managing with the PPM role established as guide and adviser. Emphasise that the time ahead is their own, to arrange the work and meet the time limits, ask for help and prepare their responses to the activities.

3 Step back and let them get on with the job.

a. Allow a few minutes to pass before visiting each of the tables in turn. Where progress is good, simply give them support and encouragement and move on. Watch for groups that are struggling with the task. See the set of notes on group behaviour for tips on observing and intervening in group processes.

Implementing EAC units – Shifting the focus from Teaching to Learning

Never tell people how to do things. Tell them what to do and they will surprise you with their ingenuity.

- George Patton

Give me six hours to chop down a tree and I will spend the first four sharpening the axe.

- Abraham Lincoln

The only way to make sense out of change is to plunge into it, move with it and join the dance.

- Alan Watts

Our deepest fears are like dragons guarding our deepest treasures.

- Rainer Marie Rilke

Pain and suffering are inevitable but misery is optional.

- Anonymous

Understanding How We Learn

We are all different

The EAC project is dedicated to enabling engineering students develop and extend their understanding of cultural diversity. This unit of the EAC materials offers ways to help students focus on their learning so that changing context and circumstances can be managed effectively and sensitively. It complements Units 13 and 14, whose focus is on planning and managing the learning space from the tutor's perspective.

"Dancing her knowledge"

Sir Ken Robinson - a passionate education reformer whose TED (http://www.ted.com/talks) talks challenge dominant ideas of schools, and learning - tells [http://www.youtube.com/watch?v=iG9CE55wbtY] the story of a young girl, considered a 'problem child', whose mother took her to a specialist doctor in the 1930's. He talked to the mother in the girl's presence, then left the girl is his office with a radio on, while he and the mother watched her from outside as she responded to the music and danced around the room. His verdict – *"Gillian isn't sick, she's a dancer. Take her to a dance school."* His advice was heeded and she became a successful professional dancer and choreographer. Her name is Gillian Lynne – see http://en.wikipedia.org/wiki/Gillian_Lynne. That specialist understood the variety of ways in which we express our knowledge and, fortunately for this learner, knew how to provide relevant support.

"Thinking can be seen!"

Howard Gardner published *Frames of Mind* in 1983, introducing his 'theory of multiple intelligences' and identifying an *intelligence* as "*a biological and psychological potential to solve problems and/or create products that are valued in one or more cultural contexts*" (Gardner 2008, http://howardgardner.com/). His work has led many educators to re-think their approaches to learning. For example, Stephanie Martin and a colleague created 'Thinking Keys' to help their young students reflect on their own thinking. The four keys and associated questions give their children – and all of us - a vocabulary for thinking about and discussing thinking. The four keys are:

- Form: What is it like?
- Function: How does it work?
- Connection: How is this like something I have seen before?

- Reflection: How do you know?

This video shows students using the keys to "unlock their thinking" and make connections among patterns.
http://www.pz.harvard.edu/vt/VisibleThinking_html_files/01_VisibleThinkingInAction/01c_VTPoP.html

"How do YOU learn?"

Consider these stories of learner drivers. As the first learner neared 17 years of age, her father offered to teach her to drive. She'd never thought about it, but as it seemed a good idea, she jumped in the driver's seat and with Dad beside her, kangaroo hopped the car down the driveway, eventually gaining control and a license. The second learner knew he wanted to learn, so commandeered the front passenger seat on the way to school and closely observed the driver's habits and routines – before asking for lessons. The third pestered his father for months to teach him to drive. When the father eventually agreed he was hugely startled to be asked, "Now, please, you tell me all you know about the internal combustion engine?" [Father knew nothing!]. The fourth had already had a 30th birthday before encountering any need to drive – then began learning.

Each one approaches learning from a quite different 'preferred position'. The first needs *action* to learn. The second needs *observation and reflection*. The third needs *theory and analysis*. The fourth is motivated by *external prompts* creating a need to learn. To be effective drivers, all of them will also spent time using the other three less preferred approaches to learning, in order to fully embed the required skills and knowledge.

These four approaches constitute the "Action Learning Cycle" as developed by David Kolb. He proposed that learning is a complex and variable process. Other models of learning also worth exploring – a good place to begin is with the work of Smith and Dalton (2005). All models and theories of 'learning styles' share two essential characteristics. First, that human beings access a wide variety of approaches to learning, while patterns and tendencies enable aggregation of learners into groups with similar tendencies and preferences. Second, these tendencies or preferences are 'situation sensitive' – so the context in which learning occurs will impact learners and how they approach the task of learning.

Peter Smith and Jennifer Dalton note there is no 'best' theory about learning styles or preferred methods of learning. In "Getting to Grips with Learning Styles", they offer tips and hints on how to identify and support diverse learning preferences. This booklet is free at
http://www.ncver.edu.au/publications/1600.html

Practical applications

As an academic educator you have your own preferred approach to learning. This has served you well and is by now an unconscious habit. It also influences how you teach and what you assume about how others learn. But your approach is *unlikely* to be appropriate for all students and all contexts. So those useful habits of learning you have acquired may even be counterproductive, just when you need to be most effective.

Expanding your teaching repertoire may not be easy or simple. It may even be quite daunting, yet – as Rainer Marie Rilke (see his words at the opening of this section) suggests - some of your best treasures as a successful academic may come from challenging those dragon-like habits and attempting new and different approaches.

The following suggestions offer ways to explore your own learning habits and preferences at the same time as you work with students to explore theirs.

How do you enable learning in contexts of incomplete information?
At the beginning of each semester, you and the students are both grappling with a series of 'unknowns'. They do not yet know what you know about engineering. You do not yet know anything about what they already know, nor how they learn, or what will be effective ways to help them learn. As Unit 14 suggests, you are all in the Simple Domain of knowledge, where everything seems familiar and all possible 'next steps' can be anticipated. Staying in this domain gives you total leadership and full authority to direct every action. 'Teaching' is the mode. 'Knowledge transfer' is the goal. Dependence on experts like you is the 'hidden curriculum'. Are these the 'expert-dependent' engineers you want to contribute to creating?

Examine your own thinking framework

How do you learn? What has influenced your approach to acquiring new skills, new knowledge and adapting your attitudes and beliefs to changing contexts? Remember that there is no 'right' or 'wrong' way to learn or teach. There are more and less effective ways, and most problems arise when less effective methods - that are familiar and preferred - are applied inappropriately.

Try each of the activities included below for yourself first. Explore some of the web sites in the references list. Write – or recall – some of your own stories about memorable learning moments. How did you begin to learn to drive? Does it parallel any of the four approaches described above? How did you achieve success in your initial studies? In your sporting and recreation activities, how have you learned the skills and knowledge acquired? Was this the same way you gained your professional knowledge?

Do not aim to 'change your preferences' – this is highly unlikely to succeed. 'Preferences' are like a bumper sticker proclaiming "I'd rather be sailing" displayed prominently on a car that, five days a week, takes the same route to work. The driver is affirming a clear preference, and also exercising an equally clear decision to suspend that preference for other purposes.

Do apply different strategies and observe what happens. Accept that not all attempts will succeed equally or be equally well received. Students have their own habits and expectations, and altering how you expect them to operate as learners may disturb their own hidden 'dragons'. Accept challenges as a possibility and stick to your agenda of making great learners out of the students you are with. Abraham Lincoln knew preparation is vital and assigned what may seem a disproportionate time to it. Alan Watts, on the other hand suggests that 'just doing it - 'plunging in' - is equal vital. In regard to enabling students to be more in charge of their own learning requires a balancing act from you. Prepare, prepare, prepare – and then plunge in – and keep going.

Reflective Learning

These questions are useful prompts for exploring the nature of teaching and learning. Take the time to write your answers down.

- What excites and energises you about being in the role of educator?
    - What makes you concerned about being in the role?
- Do you believe you must 'know everything' and be able to answer all questions immediately?
    - If so, how do you set about 'knowing everything'?
- Do you feel comfortable talking in front of a group?
    - If so, what are the advantages for you?
    - If not, how do you prepare for this less than welcome task?
    - When you are leading a tutorial, do you presently use any ways to 'step aside' from the talking role?

"Moving forward" – Coordinating and collaborating Intercultural Competency education

Engineering Across Cultures has been developed as a aide for embedding learning activities that focus on intercultural competency. We have taken a very practical, accessible approach to progressing education around intercultural competence with a focus on engineering. The ideas and resources developed in the project and presented here and at engineeringacrosscultures.org are not the final word on intercultural competency in engineering education. For further, in-depth explorations of intercultural competence, we recommend the work of Mark Freeman and others (Freeman, 2009, see http://www.olt.gov.au/project-embedding-development-intercultural-sydney-2006), and *The SAGE Handbook of Intercultural Competence* (Deardorff, 2009).

Achieving the ambitious graduate learning outcomes identified by Engineers Australia, and as established by individual universities, requires further development of these resources. We extend an invitation to all readers to contribute to the continuing development of these materials by adding to this book, modifying and extending the EAC teaching units, and creating new ones, using the background information provided in this book.

As this iteration of the Engineering Across Cultures project comes to an end, we hope this book provides you with some food for thought and that you find the online resources helpful for use in existing engineering courses and for new concepts and courses you may develop in future!

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