

Integrating Futures Thinking into First Year Engineering: Learning for Sustainable Futures

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Teachers in Higher Education are increasingly being challenged to help students develop skills, understandings and attributes that will enable them to help create sustainable, alternative planetary futures. There is less advice on how to do this. I am using Futures thinking to inform an innovative one semester unit with a large (300-400), socially and culturally diverse first year Engineering cohort. Surveys and Reflective Journals show that even small scale sustainable futures pedagogy (including environmental principles, future generations thinking, gender issues, sustainable engineering, cultural sensitivity and international responsibility) can lead to significant changes—students who are not just globally portable but capable of becoming Globo Sapiens.

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Introduction

Many academics in universities around the world are faced with the pressures related to "internationalisation." In practice, this often means *ad hoc* responses to the learning needs of increasing numbers of students from diverse social and cultural backgrounds, and "producing" graduates with various specified generic attributes to meet the needs of a global "market." In an Australian Engineering context, we¹ were initially concerned that the students' language and communication skills were poor, there was no real interaction between international and local students, or between local students from English Speaking Backgrounds (ESB) and Non-English Speaking Backgrounds (NESB), the course was not "female friendly" and there was no vision beyond content and skills development.

However, we also wanted to respond to increasingly urgent calls to prepare graduates who understand the huge social and economic changes facing the world and who can work effectively within and outside their own societies to build sustainable futures (IAU 1998; UNESCO 1997; PCAST 1998; ULSF 1999). This means qualities and attributes beyond global portability. This can simply describe knowledge workers "who apply established intellectual and scientific skills in work geared to the ends laid down by the owners or controllers of large scale industrial and administrative complexes" (Kenway 1998). Students need at least global competence—adequate preparation "for the highly interdependent and multicultural world they live in and will work in" (Harari 1992), with skills and attributes desired by the Engineering profession and higher education, able to engage with diversity and the wider and increasingly urgent global agenda for change.

Futures thinking asks: whose agenda? what sort of change? and For whose benefit? My evolving answer to these issues and questions has been towards a more radical and values-based concept, that of reflective, reflexive professionals united by a common sense of global responsibility: *Globo Sapiens*². Graduates with these understandings and attributes should be "sustainability professionals" capable of working towards preferred sustainable futures. The Australian Institute of Engineers (IEAust) supports such efforts. Engineering graduates should be able to function effectively as individuals and in "multidisciplinary and multicultural teams" and show an "understanding of the social, cultural, global and environmental responsibilities of the professional engineer and the need for sustainable development" (Johnson 1996). Since "sustainability is about community and interconnectedness at the core" sustainable futures and multicultural futures are linked.³

“Facing the future is not for wimps” (Tough & Rogers 1996). Implementing Futures thinking in higher education practice threatens a corporatising university that places “greater reliance on the market-place”, quality assurance, IT-based curriculum, and “flexible delivery” and where the student increasingly is conceptualised as customer or client” (Heath 2000). This leads to fears that “what qualifies as worthwhile knowledge will more often be defined on the basis of its marketability rather than its social functions” (Margolis 2001). Challenging this discourse is profoundly radical because it “calls for imagining new grounds whilst “destabilising” old forms” (Heath 2000). Resulting curriculum changes don’t just involve students changing what they know or who they are, but how they perceive the world—transformation. “Achieving sustainability will depend ultimately on changes in behaviour and lifestyles, motivated by a shift in values and rooted in the cultural and moral precepts upon which behaviour is predicated” (UNESCO 1997). Unfortunately, most of us who are faced with this teaching challenge have emerged from the scientific technicist paradigm that created and perpetuates it (Bowers 1995). In the following sections, I outline my teaching context, give examples of how I am using Futures Thinking, how this affects the students and what lessons might be more generally useful. The work and research are on-going. These views are mine as only one part of a large teaching team, and do not reflect any unified “team” view.

Bared Bones: the Teaching Context

In 1999, the teaching team had to integrate a one-semester elective on communication skills (for 30-60 students) into a coherent, new, Professional Studies unit (subject), BNB007, for 300-400 Engineering students. It was complicated since it had subsumed other units; it had to be available in both on-site and on-line flexible delivery mode; it was compulsory; and there was little faith that it would work.⁴ I have designed and managed using Reflective Journals as a foundational and integral aspect of learning and assessment in this unit. The coordinator and I agreed that engineers need to be able to think in terms of multiple perspectives, civic awareness and global responsibility. The unit mission statement was highlighted in students’ written and on-line materials.

“BNB007 is designed to help you identify and develop the skills necessary to be effective, responsible and ethical professionals in a rapidly changing world.”

Here is a summary of the main content and processes of the unit BNB007 to clarify where the Reflective Journals fit and how much formal weighting is placed on them as part of assessment:

1) An introductory “getting to know you” (GTKY) activity, originally part of the lecture in 30-60 student groups, now forms part of the first tutorial session, complemented by:

2) A personal learning agreement and Code of Conduct as the topic of the first reflective journal, backed up by a tutorial on Thinking about Learning.

3) Reflective Journals (RJ). These are written responses (12 x 300 words) to the lecture topics in (6) below. RJ responds to 1 and 2 above and students can use a model supplied to help them begin. This takes the form of open ended sentences. They are assessed formatively in Week 5 and summatively in Week 12 using the same criteria. They are sent and marked via email. They are worth 15% of total marks for the unit.⁵

4) Tutorials that back up lecture themes and help prepare for their team projects (15% for tutorial exercises).

5) Graphics module (hand sketching/AutoCAD) and Computing skills (each worth 15%).

6) Lectures on relevant concepts and issues: team projects (UN Year of Eco Tourism, 2002), project management, problem formulation and critical thinking; professionalism/Australian standards; teamwork; entrepreneurship, innovation and creativity; communication; environmental principles/sustainable engineering; engineering writing; socially responsible technology; negotiation/conflict management; globalisation and engineering; intercultural communication skills; cultural sensitivity and international responsibility; practice presentations—team and oral; Intellectual property and patents; resumes and interviews; history and heritage engineering.

7) A practical group project and report linked to the current United Nations Year. The project must incorporate and build on all the skills learned in all sections of the subject including Computer Assisted Drawing, Computing skills, research skills, communication, cultural aspects etc. Value 40%. From 1999-2001, this was presented at a public EXPO and judged by an expert panel of three, consisting of an academic from the faculty, a member of the Institute of Engineers and a member of the relevant community of the UN Year Of ----- . In 2002, the coordinator changed this to an end of year student conference at which all groups will

both present their own project and peer-review to one other—to acquire the allied but different skills of presenting and evaluating a presentation. Scaffolding (Rosenshine & Meister 1992) is provided to help students to identify and bridge the gaps between their present and desired levels of skills. We do this through practice presentations in tutorials and written guidelines as to what is expected for the Reflective Journals and the project reports.

The Students

BNB007 students are an interesting microcosm of a globalised world, socially and culturally. The vast majority (80%+) are school-leavers 17-18 years of age, over 20% of the cohort are international students (the majority from various South East Asian nations). The cohort have self-identified with over thirty different ethnic backgrounds, represent all major world religions and include, in 2002, several students identifying as Indigenous Australian students (Aboriginal or Torres Strait Islanders). There is an increasing number of mature-age students (12%+ in 2001). There remains a disappointingly low 10-13% females, typical of most Engineering Faculties.

Evidence of Change

Surveys

I have been conducting a pre-and post-questionnaire with each cohort since 2000. The questionnaire contains fifteen statements about issues related to the content of the course. The 2000 data indicated sufficient changes in awareness of the importance of many of the issues in their personal and professional lives to encourage further research. However, the data from 2001 was less clear and since this may have been affected by the events of September 11 and its aftermath, I am repeating the survey this year and will report these results in detail in another paper.

Reflective Journals: Resisters, Accepters and Converts

The Reflective Journals provide compelling evidence that the reflection process is effective at several important levels. Firstly, it improves the often-criticised, poor communication skills of domestic and international students in technical fields (Bolton 1999). For many students, the process of reflection also becomes a means of learning about their learning. Their journals also suggest that transformative learning and “meta-reflection” does take place. (Barnett 1997) argues that a “critical space has

to contain the three orientations of “epistemological space, personal space and practical space” in order to develop critical perspectives (1997:173). Moreover, students must be actively encouraged; a “permissive space” is insufficient (*ibid*). At a more significant level, this new self-awareness supports students to acquire “the social learning that will be necessary to navigate the transition to sustainability.”⁶

Challenging students to think differently is complex and often painful. The three broad categories of responses, “Resisters,” “Accepters” and “Converts,” are terms I have given to similar responses as they have emerged from reading the journals since 1999.⁷ The “Resisters” tend to say similar things in similar ways. They claim to speak for the “overwhelming majority,” who dislike the unit, hate the journals and only write what they have to in order to pass. They see no need for communication skills and in place of assessed tutorial exercises would prefer an examination. In 2001 they wanted Reflective Journals replaced with “tutorials concentrating on the subject matter taught in class, with questions designed as to (sic) make the students think.” In other words, they want what they are used to, but their chosen profession is saying that this is no longer good enough. Here is a typical Resister comment. In all student comments, I have made no corrections. (ESB is English Speaking Background, NESB is Non English Speaking Background.)

I have really detested writing these Reflective Journals, personally I have found them a great waste of time. ...most of the topics are hypothetical garbage. I didn't come into this degree to turn out a hippie, I thought I went into engineering to become a cold hearted bastard who got all the know how to make the world a better place but has realised that it's a waste of time and may as well be squandered. ...Out of all the people I know all of us believe that this subject and the Reflective Journals in particular are a joke. (Male ESB 2001)

In response, I read the two hundred and thirty (x 12 entry) out of three hundred and eighteen journals from 2001 to which I had electronic access. These included all those which I had permission to quote in my research (145), as well as many of those for which I did not. Two hundred and three were positive, twenty two were negative, and five included both positive and negative comments. This overwhelmingly positive response fitted previous years' patterns and the 2002 journals to date.

Resistance is due in part to lack of fit between some students' idea of engineering and the personal learning approaches we use. The journals

also address the issue of power. In Action Learning terms, they create an equalising situation in which most students are “comrades in adversity” (Passfield 1996). As such they are more able to take part in “development of self by the mutual support of equals” (ibid). Action Learning “stresses the need for someone from a different culture to question our motives, repudiate our assumptions and to search our conscience” (ibid p.23). The large first year Engineering cohort includes many whose previous experience has predisposed them towards a narrow, one-dimensional view of engineering (Kelly & Messer 1998). This forms part of the “Litany,” (in CLA terms) or “artefacts” (in Action Learning terms) of engineering students. Challenges to it (through gender, culture, age, and religion) are correctly perceived as threats and strongly resisted by those who prefer the status quo, as the following two anonymous evaluation comments to the two female lecturers from students in the 1998 cohort show. “I come from a family of military engineers and I bet they didn’t have to deal with this crap.” “Are you two lesbians? In which case there are help places for people like you.”

The majority are Accepters, who welcome the content and process and acknowledge but willingly embrace the challenges; or Converts, who realise, gradually or suddenly, that even if they don’t like Reflective Journals or the unit, they have benefited.

The learning agreement has a great positive effect on students like myself. It encourages positive attitudes towards learning, in a process to convince students to set personal goals and strive to achieve them. (Female NESB Resident 2001)

...these journals have helped me reflect on what I have gained from this subject but I guess that is what this section is all about. All in all when I started this subject I thought it would be a waste of time but I guess I was wrong. (Male NESB Resident 2001)

The Reflective Journals do not bring about change by themselves. They support and are supported by other integrated elements of the unit design, some of which I highlight below as effective strategies.

Effective Strategies

We Are Serious about Valuing and Respecting Diversity

It is easy to say that a unit or course values diversity and to use the rhetoric of “internationalisation” as a publicity gloss. Commitment needs

to be formally stated and embedded in assessment, lecture content, consistent lecturer/tutor attitudes, tutorials and projects before most students feel confident enough to incorporate their culture or gender-based experiences as a natural part of their work. The BNB007 unit outline and website formally acknowledge and welcome the great diversity within the cohort itself and invite students to include knowledge of culture, and consult family and community:

"Please note: We acknowledge the diversity of the group in terms of age, gender, work experience and cultural backgrounds. We encourage you to include this as part of your journal responses wherever you feel it is appropriate."

We Are Serious about Engaging with Others and with Ourselves as Other

We require engagement with others through a *Getting To Know You* activity in the first tutorial and support this through the teamwork project. In 2002, I changed the review journal (looking back at journals 1-5) into a journal based on a peer interview about the journals, with a fellow student from a different course, background or experience. I provided a template to help students with questions. In the hundred journals I have read so far, this has proved popular and rewarding in terms of crossing perceived cultural boundaries.

Such strategies push students out of their comfort zones to acknowledge not just the "other" but that "everyone is someone else's other" (Ellsworth 1989). The "cultural osmosis" model of Internationalisation is based on the convenient myth that if you dump students together in a geographical or virtual space, they will communicate with or learn from each other. They don't. (Volet & Ang 1998; Smart, Volet & Ang 2000; Biggs 1999). The picture emerging from Smart *et al's* research shows that domestic and international students in our universities are learning "in parallel streams...with little or only superficial contact and interaction (2000:9). This has led to "disillusioned" international students returning to their home countries with a degree but little real contact within or real understanding of the culture they lived in for several years. Moreover, both in Australia and the USA, "patterns of self-segregation are more prevalent among white students, contrary to widespread reports of this pattern among students of colour," and that ... "opportunities for serious engagement of diversity in the curriculum positively impact racial attitudes, interactions among students of different racial and ethnic backgrounds, cognitive development, and institutional involvement" (Firebaugh &

Miller 2000). There has been little noticeable response either to the notion; that academic staff are responsible for creating environments which support cross-cultural communication (Volet & Ang 1998), or to the idea that genuinely inclusive, or preferably responsive, teaching is good teaching is good teaching for all students (Biggs 1999; Heath 2000).

Reflective Journals Build Skills and Confidence

Most students find Reflective Journals difficult to write at first, for differing reasons. There is a lot of evidence that RJs work to help students improve writing skills (Beveridge 1997; Minnis 1999; Tuan & Chin 1999; Palmer, Cozean, & Olson-Dinges 1999; Scoggins 1999; Walker 1999). These skills and this confidence is carried over to other areas of students' study and they say so.

"writing these journals gives me the opportunity to realize what I have learnt. I think that I will continue to write journals each week. I really do think that they are a worth while activity to do and that they can have a really positive effect on personal thoughts and also on how I feel towards certain topics."

If I didn't write these Reflective Journals, then I would most probably forget most of the work that we done. It also helps me to realize what I really learnt, liked, disliked, and thought was a waist of time.

My views and beliefs have changed considerably, as compared to those that I had at the beginning of the semester. This is thanks to the journals. For I have been able to open my mind to the possibilities of various opinions. Such, that I may come across in my professional life.

The journals are particularly useful for students from NESBs who believe, correctly or incorrectly, that their language skills are poor. In this unit, they include the best and the poorest writers⁸. One of the effects of stereotyping is that all students from Asian backgrounds may be perceived to have "language difficulties." This is partly because, for many, their writing in a second or other language is still developing. It is also part of a deficit concept about these students, (which many of them have internalised.)⁹ This is encapsulated in the very common slip I hear among Australian academics, when they refer to students from *Non English Speaking* Backgrounds as Non English Speaking students, which is a very different thing. Many students from both ESBs and NESBs feel very unconfident about their writing. Some admit they have chosen Engineering specifically because they thought they could avoid writing or having to express themselves.

Gender Is an Issue

I remain concerned that we do not stress issues of gender enough, but it is built into the unit through the fact that the Coordinator of the Unit, the coordinators of the on-line site, the tutors and markers of the RJs and professional practice tutorials are women¹⁰. The assessment and tutorials promote a communicative, cooperative model. We stress that the university requires them to use non-sexist language in written work. The effect was obviously clear to this astute female student in the 2002 cohort, who remarked on the Personal Learning Agreement in the clearest (and very Australian) way.

"...it was great to read something as abstract and emotionally searching in an engineering subject. I was pleasantly surprised and really encouraged because I sometimes feel completely left out, or rather singled out because I am not one of the boys. I honestly didn't expect that studying in such a male dominated area would be so challenging and unwelcoming. Hopefully with concepts such as the ones raised in BNB007, some of the other male students will wise up, grow up, or piss off." (Female ESB Mature Age 2002)

It was also clear to this mature age Resister, who later became a Convert,

"...what a lot of piffle, just what the world needs - another talk feast. Save us from the secular Liberal humanists and bleeding heart feminists. "My priorities are Race, Class, Gender, when the first two are fixed then I'll have a little more sympathy for the latter. And what do we hear from our comrades anyway? Nothing but reverse sexism. (Male ESB 2001)

Another young woman reflected on her previous semester's experience in another unit and said,

"I often felt unappreciated as my thoughts and ideas were not acknowledged until their tenth uttering. On several occasions, it was my ideas that got the problems sorted." (Female 2001)

This is compatible with US research identifying Engineering faculties as peopled with those who often see no need for change and many of whom benefit from a status quo that still favors "men over women and some forms of manhood over others." (Tonso 2001)

The Ethos Encourages Trans-generational Thinking

Trans-generational thinking means “preparing students to be knowledgeable and respectful participants in [the] process of carrying forward (which means both to conserve and to renew) memory that will serve as a guide to the future” (Bowers 1995:177). Here is one example of many reflections in which students demonstrate their growing confidence to share and process the harmonising of their cultural knowings and experiences, whatever their backgrounds may be (Baker & Taylor 1995). Here a student is a) sharing his life experience, and b) critiquing and re-thinking his usual casual dismissal of his father’s village life in Europe, to embrace the positive aspects it offered.

“Today I realized just how much I take technology for granted. When I got home I talked to my dad. He is 53 years old and when he was born most of these things weren’t even invented. He gets offended when I laugh at the games they used to play and how he had to tend to the animals. It was so different then. But is our world any better than my dad’s childhood. For the right price we claim to have anything anyone could ask for: television, food cooked in only a few minutes, and you could keep on going and going describing the different things that you could HAVE. But we never mention what we can’t have. My dad ate all natural food from the family garden, milk from the family cows... while today we do not have any food that hasn’t been processed in some way or changed in another.” (Male NESB resident 2001)

Many of the students have understood that we are also making decisions for future generations.

“Your international responsibilities that you are bound to when working in a global industry are based on the fact that everything that you do can and will effect someone else in some way. What you are doing to the land and environment will have a great effect on future generations and it is very important that you keep it in mind. The world is not yours to take but for every of all generations to look after and enjoy.” (Male ESB 2001)

I wanted to gain additional insights into what was happening at the various levels of change I was observing. Causal Layered Analysis seemed the most useful method.

Causal Layered Analysis

Causal Layered Analysis (CLA) is a new futures research model and theoretical framework developed by Sohail Inayatullah (Inayatullah 1998) and Richard Slaughter (Slaughter 2002) "as an effort to use post-structuralism...as a way to conduct inquiry into the nature of past, present and future" (Inayatullah 1998:816). CLA suggests analysing issues at four levels: the Litany; Social Causes; Discourse/World-View; and Myth/Metaphor (Ibid:820). The Litany or Pop Futures level is the most common expression of problems or issues. It is often oversimplified, exaggerated and devoid of analysis. The Social Causes level identifies problems and short term causes and offers practical responses, often based at policy or regulation level. It is the focus of most futures work and it is deficient in that it "lacks the depth and critical power to do much more than rehearse existing patterns and structures" (Slaughter 2002:14). The Discourse level delves deeper and more widely to show how "the discourse we use to understand is complicit in framing the issue" (Inayatullah 1998:820 *ibid*). The fourth layer, Myth/Metaphor, is usually ignored. "These are the deep stories, the collective archetypes, the unconscious dimensions of the problem" (*ibid*). Slaughter uses slightly different terms; "*Pop Futurism*" for Litany, "*Problem Oriented*" for Social Causes and combines Inayatullah's third and fourth levels of Discourse/World-View and Myth/Metaphor as "*Critical and Epistemological*." CLA is more than simply critical. Creating distance and exposing underlying myths could lead to change, especially in areas of power relations, gender, etc. Ideally, these changes are then reincorporated into a re-invigorated and re-informed Litany level, at which not just learning, but un-learning takes place. CLA also integrates the post-structural concepts of "deconstruction," "genealogy," "distance," "alternative pasts and futures" and "reordering knowledge" in a "post-structural futures toolbox" (Inayatullah 1998:818-819). I have used some of these tools and concepts to challenge the students to think about alternative futures and their possible roles in them.⁶

The Litany or Pop Futures Level

For many students, the process is successfully challenging the stereotype of "engineers" as it was described by the first cohort as "big tough men who build stuff and drink a lot."

"I now understand that engineering is not only an individual job, but it is about team work and partnership. Instead of always being competitive

"with others and being contemptuous on those who I am better of, I now know I should collaborate with others and help those who simply doesn't have that much advantage as me."

"Gone are the days when as long as it does the job it'll be right.. I have learned that there are so many more factors to take into consideration than that. Ethics, sustainability, cultural considerations, environment and appropriate technology to name a few. I can understand how each one of these factors is very important."

"At the completion of this BNB007 unit finally I am beginning to understand that I was looking at the profession of engineering as merely a pay packet instead of a way to further the community and myself as a person. Also the qualities that are needed to become an engineer involve more than just the equations, formulas and in the end a piece of paper to stick on the wall." (Male ESB 2001)

Social Causes

At the social causes level, we are successfully addressing identified "problems" in cross-cultural skills and in other communication and learning skills. We are thus improving students' competencies for the interconnected, globalised world in which they have to work. The institution and the students have the reasonable expectation that this is one primary teaching responsibility. International students, in particular, are paying large amounts of money for their degrees.

"At first, I find it extremely complicated and hard to glance someone right in the eye because it gave this weird feeling that make me turn away. However, during this semester I have developed this skill and now have the ability to look at someone straight in the eye when I'm having a conversation with him\her." (Male NESB resident 2001)

Cultural awareness is not just one way.

"western culture, (in particular Australia) does not lend itself to good communication skills... in groups we are always talking over the top of one another in what seems almost a fight to say what we must." (Male ESB 1999)

"This lecture made me reflect on the sense of isolation that Australians have about cultural differences. It seems that we assume that everyone

acts the way we do. Because we are an island continent we have little interaction in our daily lives with people from other cultures. If we do we often expect them to conform to our cultural norms." (Male ESB 2001)

Changes and insights are important but we need to move beyond a cultural differences level of understanding to challenge the assumptions and worldviews behind them. At a deeper level Reflective Journals support a vision of graduates as "citizens first and employable graduates second" (Heath 2000:44; Messer & Kelly 1997). This concept of citizenship is about "connection and responsibility for self, for others, for changing what we do not like about our world" (Heath 2000:45). In this sense, it is also education for sustainability.

Discourse/Worldview

Engineers are very susceptible to the powerful official and entrenched "progress" discourse which makes a virtue of the kind of "development" which involves (among other things) the destruction of habitat and cultures in Australia and elsewhere. I try to use examples from various cultures to "distance" them from the present in order to question what is "normal." The issue here is "how truth functions in particular policy settings, how truth is evoked, who evokes it, how it circulates, and who gains and loses by particular nominations of what is true, real and significant" (Inayatullah 1998). I use two main examples that juxtapose an official view of "development" with the views of the Indigenous people whose lives have been devastated by it. One is Australian and the other is the Bakun Dam in Sarawak, that beautiful place, which from the air, now looks like a dog with the mange. Another example I observed in Sarawak, was a photo caption in the Forestry Museum in Kuching epitomising this discourse and lauding the new technology used to destroy previously inaccessible areas. "Helicopter logging made it possible to winch out trees from steep slopes, thus using trees that *would otherwise have been wasted*" (emphasis mine).

Myth/ Metaphor

"Helping students understand how the dominant culture developed along the pathway of basing progress on the degradation of natural systems is only half of the teachers' curricular responsibility. The other half confronts teachers with even greater challenges because it involves the identification of practices and patterns both in the dominant and

marginalised groups that are ecologically unsustainable”(Bowers 1995). So for example, the demand for some traditional medicines, combined with global markets, threatens extinction for creatures on land and in the sea (Spillius 2002; Parry-Jones 1998).¹²

The clash between any of our cultural practices and ecological sustainability is not just a legitimate topic for university courses, as I first thought, but an essential one requiring fundamental changes in ourselves and how we teach. Because values are culturally conditioned, they are “neither inherent nor inevitable” (Raskin et al 2002). Great knowledge, skill and sensitivity are required to juggle the need to provide the moments of discomfort necessary to jolt perspective change, with an underlying respect for the person. “Reflection is the obverse of transparency. In the routine act, the world has receded from the view of the actor. But if the action is interrupted, the world returns to the actor’s consciousness” (Ehrenfeld 1999, np). In this sense CLA can be used as a meta-reflection, reminding us that reflection can be a profoundly unsettling process (Tough & Rogers 1996) for those we teach and for ourselves.

At the myth/metaphor level i.e., that of the deep stories, the collective archetypes, the unconscious dimensions) our teaching approach is based more in a “partnership” rather than a “dominator” model.¹³ These terms “describe systems of belief and social structures that either nurture and support—or inhibit and undermine—equitable, democratic, non-violent, and caring relations” (Eisler 2001; Raskin 2002). There are still areas of what we are doing that undermine a partnership model; the set readings often emerge from the development-equals-progress paradigm while problem based learning often includes the kind of military examples and metaphors that are so dominant in current thinking and that Bowers (1995) criticises so effectively.

A decade before the 21st century, he warned that the challenges of this century are different from the previous three (Bowers & Flinders 1990). If the main concern is “repairing the damage to the ecosystems caused by the Western mindset and with responding to the resulting disruptions in the fabric of life” (ibid: 226), then the students we teach are the ones facing mindset change. So what qualities will they need in order to become the kind of *Globo Sapiens* needed? Whether teachers have the qualities to support them is a critical issue needing more attention.

Developing Globo Sapiens

I am working on a definition for *Globo Sapiens*.¹⁴ At the least, they will be reflective, reflexive professionals united by a common sense of

global responsibility. Readings are gradually suggesting characterising qualities and I am using the students' journals here to bring these to life. I have observed these qualities across cultural, gender and age groups.

S/he Will Be "...Sensitive to the Different Ways We Learn from Each Other and Know the World." (Inayatullah 2002).

Consider these exemplar comments from students in the 2001 cohort relating to September 11. What struck me was their heartfelt efforts to understand *why*, despite all the publicity actively discouraging thoughtful responses.

"I don't think BNB007 could have come into my life at a more appropriate time, as it has helped me to understand the World trade centre incident. After deeply reflecting on cultural and religious differences in the journals, I know why it happened, I am able to understand and respect the anger of the Muslims, but because America believes they [the USA] are innocent, I also understand their retaliation."

"The tragedy in the United States was terrible, 4000 lost souls, but just think ten times that amount of people die everyday from AIDS in Africa, and it never makes the news and no one really cares." (Female NESB 2001)

"Why do the Afghanistan people and many Muslims hate the Americans so much? I think that they see it as the Americans putting their noses into every countries affairs whether it is to solve disputes, relief for natural disasters, or just so they can help improve their living conditions. By doing this the Americans are affecting the way these people live and work by bringing in their American ways which I think makes some of these countries feel dependent on the Americans while they are trying to be independent of them. In my opinion the Americans are just trying to help out these countries." (Male ESB 2001 MA)

S/he Will Show Evidence of Global Consciousness

Many of these students' journals show evidence that they are on the way to showing a degree of "global consciousness" that Markly (2002: 340) defines as having two elements, "expansion of consciousness beyond the confines of an egocentric sense of self..." and a functionally adequate awareness of ecology as a whole system of physical and non-physical interactions across time" (ibid).

"The world can accomplish great things when the strengths of people around the world can be accumulated."

"After writing about various issues in my journals, I became more aware of situations in the "real world" that are affecting people all around the world." (Female ESB 2001)

"The responsibility of fixing some of the problems created by previous generations undoubtedly rests on the shoulders of the new generation of engineers. However, our decisions may, in turn, become the basis of unseen problems in the future. We must then, do our best to predict and consider all possible repercussions of our actions and decisions prior to their implementation in order to protect future generations and the lives of others throughout the world before."

The environment is a sensitive ecosystem and with one small change it can cause detrimental effects to the environment. Thus the future generations cannot enjoy what is alive today. (Male ESB 2001)

S/he Will Be Able to Contemplate Changes to Their Current Way of Life, Rather Than Taking Its Continuation for Granted

Changing our thought processes and values to develop an ecologically sustainable culture, "would represent the abandonment of the middle-class vision of unlimited economic prosperity and technological progress" (Bowers & Flinders 1995:230; Raskin et al. 2002). This may be the most difficult change for these privileged young people to contemplate. They are bombarded by images and messages telling them that escalating consumption is their rightful reward for a university degree, a Four Wheel Drive (Urban Assault Vehicle) future for all who succeed—to protect them from all those who can't.

"If these facts are correct, then I believe that we should be making changes very quickly. It amazes me that even though the world is facing an enormously huge problem, we are still driving around, burning up all what is left of our natural resources. This could lead to world-wide chaos and be a huge potential disaster that will affect us all."

"...one of my career goals is ease the burden that the human race is currently putting on our planet. At the moment, I picture the human race as a colony of fleas, unwelcome in their feeding off their host, our planet. I would like to see the human race lose their flea-like nature and begin to

nurture and care for the host on which their survival depends. What I really hope for is the same attitude to be present in my fellow engineers. Sure, one person can make a difference, but hundreds, even thousand of people can make a huge difference. If this difference does not take place soon, then the area of sustainable development won't even be an option for our future generations." (Male ESB 2001)

"Finding one's own voice and expressing it-in thought and in action-requires the moral virtues of courage, independence and persistence." (Barnett 1997:173)

S/he Will Be Capable of Trans-generational Thinking

As well as engaging/re-engaging with their own cultural background/s, many students now recognise and understand the concept of Future Generations. All other species feature less often.

"As future engineers, we must respect our natural environment so future generations can also enjoy it. Having become aware that our environment should be treated with respect the concept of sustainability has emerged."(Male NESB 2001)

"I believe we should all look into the future and think of our children's children, and visualize what the earth will be like for them, and their lifestyles. They have just as much right to have just a lifestyle as most of us have now in the 21st century. If sustainability of the environment isn't implemented properly then these generations will be effected in a big way, both in the environmental aspects, and an overall lifestyle of living. I believe it is everyone's job to do this, but engineers have their jobs to do, that other citizens with lack of knowledge can not. I would like to be a part of this, and do what I can, but I know it has to be a worldwide effort and not one single person could do it on there own."(Male ESB 2001)

"A sustainable environment is a happy environment, and a happy environment increases the social capital of humans and animals alike." (Male ESB 2001)

"By researching genome, we are increasing our chances of growing organs that can be used for transplants, and could save thousands of human lives. But is it right to test on animals, turning them into freaks, and creating animal viruses that could then be introducing to humans." (Male ESB 2001)

Conclusion

This work suggests that integrating futures thinking and methods into pedagogy can help students towards the directions essential for alternative, sustainable futures. All societies are confronting or about to confront the consequences of unsustainable practices and will need to bring about rapid changes in their technical and professional education. Most of us have neither the training nor the opportunity to teach Futures Studies. If this small one semester intervention is successful in bringing about desired changes in a multicultural cohort of local and international students, then the work may be useful to teachers elsewhere.

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Notes

1. I say "we" here because I began working in this Engineering context at the request of a female coordinator in charge of the original elective subject. I offered different expertise, advice and team teaching support. I use "we" to indicate I did not work alone. I own the views expressed by using "I".
2. The credit for this wonderful neo-Latinate term goes to Pentti Malaska who used it in his keynote address at the 1999 WFSF conference in Brisbane. He actually coined a more grammatical *Global Persona Sapiens*. Antipodeans like abbreviating. I am informed that the credit for the short version may go to New Zealander, John Hinchcliff. Malaska used it as an overarching term for potential future bio organisms and humanlike non-humans, a term he attributes to Jim Dator. I have linked it only to the human qualities I perceive in it. The term is rich in healthy connotations, evident in the delighted recognition when people hear it.
3. My current preferred definition of sustainability, expanded from the 1987 Brundtland definition by Ehrenfeld et al (1999, Pp.11) is, "a possible way of being in which individuals, firms, governments and other institutions act responsibly in taking care of the future as if it belonged to them today, sharing the resources on which the survival of human and other species depends and in assuring all who live today and in the future will be able to satisfy their needs and human aspirations."
4. The course coordinator and I have described elsewhere some of the practical challenges and responses to what we did (Kelly 2001, 2002; Kelly & Messer 1998).

5. The assessment issue is complex. Beveridge (1997) regrets the increasing pressure from the university and from students to produce well-defined criteria. It can stifle creativity and defeat the purpose of openness. It can be seen as an academic Iron Maiden. Everything must be brought under control and back to safe formulae. We try to find a half-way solution in our formative and summative approach in order to make assessment a "tool for learning and growth" (Heath 2000:46).
6. I have written about the Reflective Journals in much more detail in an online journal <<http://www.pantaneto.co.uk/issue5/front5.htm>>.
7. This is letting the data speak, as in grounded theory.
8. This picture is complicated by the fact that the cohort includes international students from many countries for whom English is a second or other language, Australian-born students for whom English is a second or other language, and students who are Australian residents and have received some but not all of their education in Australia.
9. Students who speak English as another language often apologise for their poor English. I have yet to hear an English speaking background student apologise for being monolingual.
10. As Tonso also notes, females do not have to do very much for it to seem very confronting to male students or colleagues, for that matter. To conserve energy, it is sometimes better to not attempt to challenge too much at once. This results in compromises.
11. This is a small and imperfect intervention. However, most changes begin in this way. The real challenge is maintaining energy to continue and trying to gain support for initiatives that at the core, are not expressed in "market-speak" and do not serve the same vision.
12. Spillius reports on the plight of the Pangolin. "Surging Chinese demand for the meat and scales of the pangolin...as an aid to sexual performance and long life is threatening the animals with extinction." At present rates of smuggling, Thai authorities estimate it could be wiped out in 5-10 years.
13. I don't think we articulated it in this way when we began making changes. The changes were driven by our own dissatisfaction with classroom manifestations of what Eisler articulated as the Dominator model. Using CLA on one's own teaching actions can reveal such motivations.
14. I am interested only in the human-kind version, since the humans reproduce themselves in the computer programs. Malaska's original divided into human and non-human branches that eventually coalesced into a hybrid internet "global mind with superior intelligence and wisdom." The qualities needed would be similar.

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