

Kelly, Dr, Patricia  
Senior Lecturer, Transnational Staff Development Project  
Faculty of Business  
University of Tasmania  
Australia

**Address:**

5/2 Tamarindus Street,  
Marcoola,  
Queensland, 4564

**Tel:** 07 54505415

**Fax:** 07 54505415

**Email:** [patriciakelly@netspace.net.au](mailto:patriciakelly@netspace.net.au)

**Title: Wise global citizens or McGraduates? Engineering as a civilising influence**

**Introduction**

The UN Decade of Education in Sustainable Development (2005-2015) places sustainability values at the heart of education, where they need to be if we want to survive. Engineers are significant because they are influential community leaders who impact positively or negatively on the global environment. To fulfill their roles as specialists, integrators and change agents, particularly in relation to sustainability and climate change, they need more than multiple literacies. Curricula that treat sustainability as just another content area can only *re-produce* McGraduates, globally portable engineers who “do any job” or at best, globally competent engineers, who do any job but do it “smarter”. Assuming that sustainable futures *are* still possible, they will be created and maintained by *Globo sapiens*, wise global citizens whose education will have helped them to develop the critical dispositions they need to support a transition to sustainable futures or to cope with break-downs.

My preferred future involves a transition from a ‘dominator’ paradigm to a ‘partnership’ paradigm. Riane Eisler’s terms describe “belief and social structures that either nurture and support – or inhibit and undermine – equitable, democratic, non-violent, and caring relations” (2001, p.144). This paper reassesses my concerns about engineering education and the image of the profession. I use Causal Layered Analysis (CLA), a critical futures methodology developed from various theoretical foundations including post-structuralism, to analyse two recent engineering-related reports. The first is the Carrick Institute funded, comprehensive review of the current state of Australian engineering education involving all major engineering stakeholders (Johnston, King, Bradley, & O’Kane, 2008).<sup>1</sup> The second is a ‘Special Advertising Report’ from *The Weekend Australian* newspaper (June, 2008). This featured stories or interviews with engineers and engineering educators in various fields and advertisements from universities, companies and government departments. It was designed to attract students and future employees. I have limited this paper to a brief overall CLA of the two reports. I then use

---

<sup>1</sup> The Australian College of Engineering Deans, Engineers Australia, the Australasian Association for Engineering Education (AaeE) and The Academy of Technological Sciences and Engineering (ATSE) as well as group and individual consultations.

examples from both to explore some issues in more detail, including “soft or fuzzy skills” and “inclusivity”.

*What is Causal Layered Analysis and what can it add?*

CLA uses four levels, *Litany*, *Systemic Causes*, *Discourse/Worldview* and *Myth/Metaphor* to explore any issue (Inayatullah, 2004). CLA does not aim to argue over any particular ‘truth’ but to explore “who gains and who loses” by what any group decides is “true, real and significant” (Inayatullah, 2004, p.7). The *Litany* level is the headlines of the popular media, in which the issues, including quantitative data, are often oversimplified and exaggerated. All systems have their own litany or “uncontested realities” (Inayatullah, 2004, p.11). At this level, we expect some “them”, often governments or corporations, to solve the problems. The *Systemic Causes* level asks what led to the headlines. It identifies the systemic causes of problems, (social, economic, political, etc.) and their effects. This is the level of technical explanations and academic analysis, using quantitative data to find practical responses, often at regulatory level or through stakeholder partnerships. However, the questions are framed within the dominant paradigm and so are unlikely to change patterns or structures. These first two levels operate within short time-frames.

The next two levels are more complex and long term. At the *Discourse* level analysis finds assumptions behind the issue in an effort to re-vision’ the problem (Inayatullah, 2004, p.12). Who are the stakeholders and how do they view the issue? What ideological positions do they hold on what the world is and should be? Each discourse can be used to describe a different scenario, which can question the foundations of the Litany. The fourth layer, *Myth/Metaphor* reveals the deep stories and archetypes behind how we think. It may involve learning, unlearning and re-learning. Thus these deeper levels engage with and challenge paradigms. Using CLA helped me to identify three scenarios for Australian engineering education in the early 21<sup>st</sup> century, Globally Portable (we do the job) Globally Competent (we do it smarter) and Globo Sapiens, wise global citizens (we do better jobs differently) (Kelly, 2006, 2008). Table 1 is a CLA of the ACED Report.

---

Litany	Lack of quality and lack of engineers; attract more women, minorities; meet needs of current global economy; compete in global markets; maintain international profile <b>Solutions:</b> Encourage, buy, bribe
Systemic Causes	Skills shortages, insufficient preparation in maths and sciences; student attitudes and culture; international and mobility issues; engineering culture; graduate outcomes <b>Solutions:</b> Higher education + employers + profession: graduate more engineers with skills needed; train more maths and science teachers, promote more research, industry partnerships, immigration
Discourse/worldview	From proactive (Changing the Culture) to reactive (a move backwards to supply and quality); engineering education as an enabler of different options; Globalisation Discourse: Produce, deal with change, compete globally, add value, maximise impact; respond to changing economic and regulatory forces; Alternative discourses, muted and unspoken
Myth/metaphor	Planet is a market place: Engineers make it, sell it, fix it; Business as usual

---

Table 1: CLA of the ACED Report, 2007

The Litany level identifies the problems of supply and quality of engineers; how to attract more women, high ability students and minority groups into engineering; how to meet the needs of the current global economy and how to compete in global markets (ACED, 2008, p.20; Taylor, 2008). In terms of Systemic Causes, the report identified eleven main issues: evaluating the impact of the 1996 review “Changing the Culture”; the impacts of declining high school preparation in the enabling sciences and mathematics; international and mobility issues; gender balance; graduate outcomes; the value of engineering education as an enabler to different career options; industry-university partnerships; resources; student attitudes and culture; and engineering and education research linkages. The solutions centre on creating more partnerships between Higher education, employers and the profession.

The ACED report’s stated aim is

“To ensure that the engineering education sector across Australia’s universities produces in a sustainable manner, a diverse supply of graduates with the appropriate attributes for professional practice and international relevance in the rapidly changing, competitive context of engineering in the 21st Century”( p.5)

The dominant Discourse ‘respond to the market’ is clear in the key words, “produces, supply, with appropriate attributes for.... rapidly changing, competitive context”. They frame the issues and their solutions. This is a retreat from the proactive 1996 ‘Changing the Culture’ to the reactive, “Addressing the Supply and Quality of Engineering Graduates for the New Century”. This is reinforced by the globalisation discourse. Engineering must change practice in response to new scientific and technological knowledge and to changing economic and regulatory forces. The ACED report calls for greater symbiosis between engineering and business. An alternative discourse would approach engineering education from within a partnership paradigm. What would responsive engineering education do in the face of growing ecological crises? What is the global picture of sustainable engineering education? Where is best practice? What are the differences and intersections between the needs of students, business, universities and the ecology?

ACED’s guiding metaphor is the planet as a no-limit marketplace, in which engineers are innovators, money makers and problem solvers. An alternative metaphor, such as the planet as a sustainable garden, would set limits. This would involve a move away from a ‘what’s in it for me’ approach at personal, organisational and national levels to ‘we’re in this together’. It would reinforce moves away from a ‘Keep out! Engineering is a self-fixing system’ to transdisciplinary/transnational/transmodern alternatives. Work opportunities would abound in maintaining, repairing and healing the planet. The foundations for this already exist in moves towards transdisciplinarity and global cooperation on engineering attributes. I now turn to some specific examples from the report.

#### *Example 1: Curriculum inclusivity*

The content and methodology of many courses have not changed as much as the architects of *Changing the Culture* intended (ACED, p.20). Engineering classrooms are often highly culturally diverse, enhanced by the rising proportion of international students, now around 25% of students in bachelors’ programs. However, women are a shrinking minority, down to below 15% (Ibid., p.33), while their numbers have dramatically increased in other previously male professions. Indigenous students remain “grossly underrepresented” (Ibid., p.65). The ACED Report stresses the importance of role models, as for all minority groups. It quotes a participant at the national Indigenous summer school as having learnt how “engineering can be valuable to

the future of Indigenous communities”(Ibid.). This is important, but there is as yet no sign of an alternative discourse, how Indigenous communities and knowings can be valuable to the future of engineering. Australian Indigenous people and issues are totally absent in the 2008 Special Advertising Report.

ACED repeats the mantra that cultural diversity provides “good opportunities for Australian students to gain intercultural understandings, and for the international students to gain useful understanding of Australian education and culture” (p. 49). It should, but mostly it doesn’t. A permissive space is not enough as Barnett pointed out (1997). Tertiary teachers need the understandings and attributes to create active learning spaces. Moreover, team-work in multicultural contexts adds complexities (Volet & Ang, 1998; Singh, Rizvi & Shrestha, 2007; Kelly, 2008). This links with the need to support the scholarship of teaching for engineering academics (ACED, pp. 61, 85). How many engineering teaching staff have a Graduate Certificate in Higher Education, or see the need for it? One of ACED’s suggested answers is the “adoption of inclusive principles in the curriculum”, including a move away from “over-use of masculine stereotypes and examples, such as automobiles, rockets and weapons” (ACED, p.72). This is hardly new (Burack & Franks, 2004, 2006; Tonso, 2001; Beder, 1996, 1998; Burrowes 2001; Newhouse-Maiden, 2002). The energy spent on more research to tell us what we know, would be better spent on professional development for those already in engineering, challenging and supporting them to become ‘globally competent’ practitioners (Badley, 2000).

My own work on “resistance” in engineering students shows that around 65% will engage with challenges to their attitudes, willingly or grudgingly. Around 25% will be “converts”, who hate it at the beginning but understand the benefits at the end. Problems lie mainly with the 10% who, for various reasons, resist all the way (Kelly, 2006, 2008). The problem is their disproportionate influence. They are so “loud” in their resistance and criticism, it is assumed that “everyone” feels the same way. The ACED Report cites words like “arrogance” and “contempt for non-technical material” as lingering aspects of engineering culture. Resisters are entitled to ‘resistings’ but they and those they work with need to know that they do *not* speak for all students (or staff) and that they have to respect others’ rights to change. Identifying and understanding the causes behind resistings also helps teachers to work with them more effectively (Kelly, 2008). Resistance to challenging the dominant culture is not peculiar to western systems. India is trying various approaches to improve the participation of women and minority groups (Bannerjee & Muley, 2007).

*Example 2: Communication skills: ‘Fuzzy’, ‘soft’, ‘airy fairy’ or multiple intelligences?*

The ACED report also identifies an on-going need to develop all communication skills. This is not new either. It (and other studies) found that most curricula still over-emphasise technical content, at the expense of process and the “fuzzy” graduate attributes called for in 1992 by Agenda21. We know how and why effective communication skills, including cross-cultural skills, are essential to engineers and valued by their employers (Reimer, 2007; Danilova & Pudlowski, 2007; Pulko & Parikh, 2003). Communicating can take up as much as 80% of a professional engineer’s time (Oatheimer & White, 2005). It is not surprising that successful engineering graduates in one survey rated their ability to contribute positively to team-based projects as “the most important of 49 possible reasons for their success” (Scott and Yates, 2002, in Willey & Freeman, 2006, p.2). While employers observe that contemporary engineering

graduates have good verbal and presentation skills and are better team players than previous graduates (King & O’Kane, 2007, p.7), there is some disagreement about adequacy of preparation. Willey and Freeman (2006) offer useful team work strategies. There is a consensus that written communication skills, particularly “business writing” remain poor (ACED Report, p.67). Generally, Carew & Therese confirm that “engineering academics are not researching graduate attributes, or trained to teach them” and query whether fair or valid assessment is possible in large classes (2007, p.5).

My research in large (300+), diverse, first year engineering classes, demonstrated that using Reflective Journals as a scaffolded, formative and summative assessment strategy allowed communication and values to develop and reinforce each other, since the values were in context and the context required communication, including cross-cultural and cross-gender communication. Moreover, I identified many causes behind so many engineering students’ reluctance to write, *why* they saw it as irrelevant and what helped them to overcome this. Behind anger is often fear and one response to fear of failure is to heap scorn on the feared task. Many students found difficulty “getting started”. They reported doubts and uncertainty about their capacity to do the task of writing and their lack of substantive general knowledge. It was a challenge for some to have an opinion at all! Many entrants from trade backgrounds had suffered from negative feedback at school and worried about their writing skills compared with school leavers. Addressing this lack of confidence is significant in light of suggestions to increase the numbers of students from the trades and to increase the number of engineering students returning to study engineering after leaving it.

Carew and Therese used the term “multiple hurdles” to describe the experiences of academics and academic managers trying to embed essential graduate attributes into engineering curricula (2007). The ACED report authors admit that ‘soft-skills’ is an unhelpful term and that these attitudes not only “inhibit” change but “undermine” the changes they see as necessary to attract engineers and improve their effectiveness (p.72). Therefore, engineering and engineers should consciously stop referring to communication skills and efforts to teach communication, in terms such as ‘fuzzy’ or ‘soft’ or ‘airy-fairy’. Burack and Franks suggest “Successful engineers have strong communication and technical skills” instead of “To succeed, an engineer needs soft skills as well as hard skills” (2004, p.86). The President of the US Academy of Engineering models this thinking by valuing the diversity of thought that comes from race, ethnicity, gender, class and religion as essential for problem-solving and creativity (Wulf, in Burack & Franks, 2004, p.79). Sustainable engineering would attract more (and more diverse) students through a combination of intelligences approach.

We are not simply teaching skills or “engineering engineers” as Jacobs put it (2007). Engineers face huge responsibilities in increasingly stressful ecological, social, political, economic and cultural contexts. They need to be grounded in a reflexive sense of global responsibility and civic awareness. Reflexivity means going beyond the metacognitive skill of understanding personal learning styles. Students need ‘metacritical’ qualities, being conscious of one’s own biases and cultural influences and being able to question them and reshape them (Barnett 1997). This transformative process can be emotionally threatening, because we have first to acknowledge and then reconcile two sets of assumptions, those underpinning our current ideas and the new set of assumptions that are creating our need to change (Mezirow *et al.*, 2000).

Institutions shape the values and attitudes of future engineers and leaders play critical unconscious and conscious, positive and negative roles in the formative process (Burack & Franks, 2004). But leadership includes anyone who answers the question “Who are we?” and who creates the “story of the group” in ways that shape and record versions of the group’s ideals and ethos (Alford, 1994 in Burack & Franks, 2004, p.83). This includes the media. The ACED Report includes “increasing positive media coverage” as part of raising the public perception of engineering (p.102). With this in mind, I used CLA to explore what sort of leadership the Special Advertising Report (SAR) offers engineering. Table 2 below offers a CLA overview.

### **The Weekend Australian Special advertising report: careers in engineering**

---

Litany	Get the job done, ride the resources boom, deliver the complete package
Systemic causes	Resources boom, shortage of engineers, new wave of infra-structure spending, developing national markets
Discourse/worldview	Ride the boom, colonialism - boys’ own adventures, business as usual future, techno-fix; wanting to make difference
Myth/metaphor	Planet is an open-cut mine, Engineers are well-paid cogs in the boom machine, consume now, pay later

---

Table 2: CLA: The Weekend Australian’s Special Advertising Report on engineering, June 21-22, 2008

The SAR’s front-page headline is “Getting the Job Done:…From retrieving riches from beneath the earth to building mega-structures above it, engineers are the cogs ensuring Australia’s boom continues”. In this litany, engineers are reduced to invisible cogs in a profit-based, boom machine. The headline is embedded in a full-page image of a large truck driving through the lunarscape of an open-cut mine. It is reinforced by the front page story index 1) cooling towers for saving the planet, 2) the promise of adventure in Antarctica, 3) the “magic carpet ride” for those wanting to work on skyscrapers in the Arabian Gulf and 4) “on the frontline”, an appeal to be part of the “elite Army engineers” - building a sandbag shelter. The Advertising report uses many greed-based, consumption metaphors, “immense appetite for engineers”, “the world’s appetite for commodities shows no sign of slowing” (p.4).

The SAR’s engineering is a man’s world. There are 9 images of men on the front page but no women. Leaving large indistinct groups aside, I identified 50 images of men and 13 of women, 5 in one advertisement. Page 12 does feature an advertisement with two young women from diverse ethnic backgrounds but all defer to a middle-aged, white male expert. The one article on a woman conveniently doubles gender and ethnicity by featuring a young Australian-Chinese female engineer, on the back page (SAR, p.12). It follows a small feature showing that “women still have a way to go” and stating that “part of the problem is that the profession is still male-dominated” (Ibid., p.11)! Betty Jacobs from UTS warns that the “negative and outdated perceptions of engineering in students, teachers and parents” help explain the declining

enrolments in engineering (2006, p.1). Is this report really how the engineering profession wishes to be portrayed in 2008? Professional associations such as IEAust could collaborate with journalists responsible for such Special Reports on how to depict the engineering profession appropriately. Burack and Franks' 'Equity Matrix' could help any engineering faculty, organisation or advertiser to prepare materials for students or the general public (2006, p.7). The matrix has two levels, 'inclusion' and 'aspirations'. Inclusion covers design elements such as font and images. Aspirations include how we characterise male and female professionals. Using it would have avoided the kind of choices, images, placement and writing I have criticised here.

The main discourse touts the rewards of engineering life in the fast lane (money, travel, excitement) through headlines such as "Race to the sky...ASAP" (p.5) which lauds building skyscrapers in new (Middle-Eastern) markets. Ethics are absent in the uncritical approach to development, which ignores the exploited migrant labourers whose squalid conditions support the boom (Abdul-Ahad, 2008). The sub-texts are colonialist, right is might, techno-fix and "Make hay while the sun shines" (p.5). Lastly, there is one healthy but unheralded, emerging discourse of engineers 'wanting to make a difference'. Some examples of these discourses follow.

The unselfconscious colonial discourse is highlighted in a quality assurance engineer's experiences, which "could be ripped from a boy's own adventure story" (SAR, p.5). They include his work on a gas plant project in Pakistan where the local people kidnapped some of the contractors in retaliation for lack of compensation for the use of their land. 500 government troops restored order and a settlement was negotiated. There was no other comment on the issues which caused the problem, nor any discussion of the appropriateness of the heavy military response. In PNG the same engineer worked on an oil refinery, but protective fences were inadequate security and local tribes-people were employed to patrol, using bows and arrows, "You would be surprised how far they can fire those arrows". This reporting reinforces and reinstates the categories of 'superior' white man and 'natives', dangerous or quaint. The Queensland University of Technology (QUT) feature uses a 'globally competent' discourse in which its graduates are products, "the complete package" (SAR, p.3) of business skills and technical skills. Their graduates can go straight out and "market" ideas in "buoyant construction and engineering industries" (Ibid.). Whatever the job, these engineers can do it smarter. A problem here is that being able to manipulate the language and actions of inclusion and consultation can enable more efficient exploitation. Sterling warned some years ago that our learning institutions may be producing just this kind of professional (2001).

*Healthy but unheralded discourse: Wanting to make a difference*

An alternative discourse exists, although incidental in both reports. It is the young engineers who want to contribute to sustainable societies. A business recruiter at the 2004 New Zealand SSES conference stated that many of the best and brightest graduates already want to work for companies that are making genuine efforts towards sustainability. I documented such student responses and I have met practising engineers and planners proud of working this way. In the SAR, the CEO of Engineers Australia states that environmental engineering was attracting young people who wanted to contribute to society (p.2). The Head of the Australian Power Institute, Mike Griffin, calls for universities to concentrate on alternative energy technologies to attract students with a social conscience (Ibid.). However, the covering headline uses a macho, military metaphor "Young guns can make a difference". The sustainability role is optional to the resources boom in the sub-heading, "Australia needs 30,000 engineers to meet the challenges of the resources boom. Along the way, they might also preserve our way of life". Link

Recruitment's spokesman suggests that the more sustainable and environmentally friendly approach of Australian companies, compared with those in developing nations, is one reason for believing that many Generation X and Y students, whom he regards as socially responsible, will choose to stay and work in Australia (p.12). 'Wanting to make a difference' is a healthy, emerging discourse with great potential to attract students and to inform curriculum changes. The ACED report acknowledges the "strong support for engineers taking a high profile in issues of sustainability and the impact of climate change" (p.12) but does not acknowledge or develop this as the *core* of a better vision, based on a long term future of the planet. It describes as "unusual" the former business student who had taken up engineering because there were "much more interesting things to measure than dollars" (p. 92). It is more interesting that they saw this as unusual.

'Changing the Culture' (1996) graduate attributes included "understanding of the social, cultural, global and environmental responsibilities of the professional engineer, and the need for sustainable development". There are still doubts about how to teach this (Macoun, 2005). My research showed how appropriate pedagogy encouraged stages of personal growth, not necessarily but often in this order, 'got connected' (to others and themselves) 'got respect', 'got insight', 'got inspired', 'got courage', 'got healed' and 'got transformation'. I also identified six qualities of *Globo sapiens*, building on the skills of Homo Economicus (globally portable) and the attributes of Homo Globalis (globally competent). Summarised, they are 1) empathy with and sensitivity to other ways of being and knowing; 2) global consciousness; 3) being capable of trans-generational thinking, past and future; 4) having courage; 5) being able to contemplate changes to their current way of life; and 6) working towards healthier futures, from the personal to the spiritual. Healing ourselves is an essential corollary of a healthy planet (Inayatullah, 2002). Carew & Therese suggest that "overstuffing" curricula with technical content will have to be reduced to make time to enable students to experience and reflect in order to learn (2007). ACED's suggested moves to longer degrees and a general first year course may help.

### *Breakdown: the elephant in the room*

Breakdown is an invisible discourse, implied by the presence of the impossible, endless growth in a business-as-usual future. The oil field manager for Clough engineering was happy to state that "clients are keen to make hay while the sun shines" (SAR, p. 5). Another headline urges engineers to "Go to Rio and ride the boom" (Ibid., p.4). "The boom has been going on for several years now and we believe it will go on for several more at the least" (Greene, in SAR, p.4). Current financial crises are a dramatic reminder that boom is followed by bust. Several years are not long-term planning. Many writers identify "breakthrough" or "breakdown" scenarios for humanity (Sterling, 2001; Raskin et al; Diamond, 2005; Lovelock, 2006; Speth, 2008). Since breakdown scenarios do not feature in either of these reports, these questions may provide a start. "What roles would engineering have to play in breakdown scenarios?" "How prepared are engineers for responding to large-scale breakdown scenarios?" and "Is engineering education preparing graduates with the skills and attributes they will need?" Whichever future eventuates, graduates will need "flexibility, resilience, creativity, participative skills, competence, material restraint and a sense of responsibility and transpersonal ethics to handle transition and provide mutual support" (Sterling, 2001, p.22). Nurturing these qualities would help to bring about a preferred future. Institutions, educators and the profession would nurture by *overtly* and consistently valuing the diverse skills and human attributes engineers need. Professor Shih



Choon Fong, President of the National University of Singapore (NUS) identifies two roles for 21<sup>st</sup> century universities, a functional mission (developing intellectual and socio-cultural qualities) and a civilising mission, developing the character of a global citizen and shared values (2007, pp. 4-5). Universities serious about this mission will work

“- to develop character, not just careers;

- to build global citizens, not just global workers;

- to engage in the difficult quest for shared values, and not just share value” (Ibid.).

Australia and New Zealand/Aotearoa should be interested because he shows how small countries can play a global role, potentially influencing large countries such as India and China, who graduate huge and growing numbers of engineers each year (Bannerjee & Muley, 2007).

### *Conclusion*

Dominator paradigm messages keep engineering stuck in out-dated and damaging myths of what engineers are and do, in any country. Emerging crises will affect all cultures at every level, personal, professional and institutional (Inayatullah, 2004). Changing engineering education depends on combining vision, leadership, stakeholder engagement and resources (ACED, p.30). A successful vision needs to “enable” and “ennoble” and to “have champions at all levels of society and organisation (Inayatullah, 2003, p. 11). ACED’s vision is limited. There is nothing ennobling about being “responsive” and “adaptive” (p.101) to short term market demands. An ennobling vision would include a proactive and transformative dimension. It will need decision-makers to negotiate visions that support and reflect major intra- and inter-cultural changes in our attitudes to each other, to the planet and the diminishing species we share it with. We have to reassess our values, because new machines, new regulations and new institutions won’t build sustainable futures (Havel, in Speth, 2008b). We need *Globo sapiens*’ courage to make conscious and *self*-conscious efforts to change what we say, write and do, in the face of powerful overt and covert institutionalised resistance and counter-messages. Engineering education can create a new story (Burack & Franks, 2006) to help us make the crossing from crisis to sustainability. In this new story, engineers are *Globo sapiens*. They will be a civilising influence because they are doing better things and doing them differently. They will also *be* different (Inayatullah, 2004).

### **References**

- Abdul-Ahad, G., ‘We need slaves to build monuments’, *The Guardian*, 8<sup>th</sup> October, 2008, pp.4-7.
- Banerjee, R., & Muley, V. P. (2007). *Engineering Education in India Draft Final report*: Sponsored by Observer Research Foundation Energy Systems Engineering, IIT Bombay, Powai, Mumbai – 400076.
- Beder, S. (1996). *Towards an Environmentally Conscious Engineering Graduate*. Retrieved 7 November, 2003, from <http://elecpress.monash.edu.au/ajee/vol7no1/beder.htm>
- Bryce, P., Johnston, S., & Yasukawa, K. (2004). Implementing a program in sustainability for engineers at University of Technology, Sydney. A story of intersecting agendas. *International Journal of Sustainability in Higher Education*, 5(3), 267-277.
- Burack, C., & Franks, S. (2004). Telling Stories About Engineering: Group Dynamics and Resistance to Diversity. *NWSA Journal*, 16(1), 79-95.

- Burack, C., & Franks, S. (2006). *Evaluating STEM Department Websites for Diversity*. Paper presented at the 2006 WEPAN Conference WEPAN-Women in Engineering Programs and Advocates Network.
- Burrows, G. E. (2001). Gender Dynamics in an Engineering Classroom: Engineering Students' Perspectives, *Engineering*. Australian Digital Theses Program: University of Newcastle, NSW.
- Carew, A., & Therese, S. (2007), 'EMAP Outcomes from Regional Forums on Graduate Attributes in Engineering', Proceedings 2007 AaeE Conference, Melbourne, December [http://www.cs.mu.oz.au/aaee2007/papers/paper\\_31.pdf](http://www.cs.mu.oz.au/aaee2007/papers/paper_31.pdf) Accessed 17/4/08
- Danilova, E., A., & Pudlowski, Z., J. (2007). Important Considerations in Improving the Acquisition of Communication Skills by Engineers. *Global Journal of Engineering, Education, UNESCO International Centre for Engineering Education (UICEE)*, 11(2), 153-162.
- Diamond, J. (2005). *Collapse: How Societies Choose to Fail or Survive*. Victoria, Australia: Penguin Group.
- Engineers Australia (2007), 'A summer of engineering', pp. 30-31 and other related stories on indigenous engineers, *Engineers Australia Magazine*, September 2007, pp 28 – 33.
- Eisler, R. (2001). Partnership Education for the 21st Century. *Journal of Futures Studies*, 5(3), 143-153.
- EMAP (2007), Draft Engineering Graduate Capabilities Continuum, developed from Johnston, A., King, R., Bradley, A., & O'Kane, M. (2008). *Addressing The Supply And Quality Of Engineering Graduates For The New Century*: University of Technology, Sydney.
- Galtung, J. (2008). The State of the World. *Journal of Futures Studies*, 12(1), pp.145-160.
- Inayatullah, S. (2003). stimulus paper- futures :Alternative Futures and Policy Choices. Brisbane: The State Of Queensland, Department of Families, April 2003.
- Inayatullah, S. (Ed.). (2004). *Causal Layered Analysis Reader. Theory and case studies of an Integrative and Transformative Methodology*. Tamsui: Tamkang University, Taiwan.
- Kelly, P. (2006). *Towards Globo sapiens: Using Reflective Journals to prepare engineering students able to engage with sustainable futures*, PhD thesis QUT, from <http://adt.library.qut.edu.au/adt-qut/public/adt-QUT20070403.150024/>
- Kelly, P. (2008). *Towards Globo Sapiens: Transforming learners in Higher Education*. Rotterdam: Sense Publishers.
- King, R., & O'Kane, M. (2008). Rethinking Australian engineering education. *Focus*, pp.7-9.
- Lovelock, J. (2006). *the revenge of gaia*. Camberwell, Victoria: Penguin Books.
- Mezirow, J. (2000). *Learning as Transformation: Critical Perspectives on a Theory in Progress*: Jossey-Bass.
- Newhouse-Maiden, L. (2002). *Hearing Their Voices: Building a Career Development for Women in Engineering*, from <http://adt.curtin.edu.au/theses/available/adt-WCU20040211.122806/>
- Pulko, S. H., & Parikh, S. (2003). Teaching 'soft' Skills to Engineers. *International Journal of Electrical Engineering Education*, 40(4), 243-.
- Riemer, M. J. (2007). Intercultural Communication Considerations in Engineering Education. *Global J. of Engng. Educ.UICEE*, 11(2), 197-206.
- Singh, M., Rizvi, F., & Shrestha, M. (2007). Student mobility and the spatial production of cosmopolitan identities. In K. Gulson & C. Symes (Eds.), *Education and the Spatial Turn: Policy, Theory and Geography*.: New York Routledge.
- Shih, C. F. (2007). *Focus, Collaborate, and Thrive*, [www.nus.sg/president/speeches/2007/pdf/unimelb.pdf](http://www.nus.sg/president/speeches/2007/pdf/unimelb.pdf) Accessed 20/5/08

- Speth, J. G. (2008a). *The Bridge at the Edge of the World: Capitalism, the Environment and Crossing from Crisis to Sustainability*. New Haven, London: Yale University Press.
- Speth, J. G. (2008b). *Re: the role of spirituality and religion in movement building*. Retrieved 6th June, 2008, from <http://www.GTInitiative.org>
- Taylor, P. (2008), Fixing Australia's engineering skills shortage is an urgent and shared responsibility, Engineering Australia media release, 29th Jan.
- Tonso, K. (2001). "Plotting Something Dastardly" Hiding a gender curriculum in Engineering. In E. Margolis (Ed.), *The Hidden Curriculum in Higher Education*. New York and London: Routledge.
- Volet, S., & Ang, G. (1998). Culturally mixed groups on International campuses: an opportunity for Inter-cultural learning. *Higher Education Research and Development*, 17(1), 5-23.
- Willey, K. & Freeman, M, 2006. 'Improving teamwork and engagement: the case for self and peer assessment', Australasian Journal of Engineering Education., online publication 2006 <http://www.aace.com.au/journal/2006/willey0106.pdf> Accessed 17/4/08