



Letter from the oasis: Helping engineering students to become sustainability professionals

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Abstract

Sustainability scientists call for education that produces ‘sustainability professionals’, who understand the need for sustainability and can work towards it. However, students often have very different ideas, usually based on an expectation of continued unlimited economic growth. This paper, based on research with large, diverse, first year engineering cohorts, argues that a reflective process and on-line support can contribute to a learning oasis—a supportive environment that encourages students to leave their cultural and intellectual comfort zones. In these circumstances, most students will engage with the personal and professional challenges of what it means to be *Globo sapiens*, a wise global citizen and global sustainability professional for an increasingly complex century.¹

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1. Introduction

This paper documents my work with first year engineering students, trying to meet the challenge posed by sustainability scientists “to develop appropriate methodologies, train a new cadre of sustainability professionals and build institutional capacity” [27] as part of a transition to a preferred future.

This is not a value free zone. Working within the integrating ‘metadiscipline’ of Futures Studies, I want to “contribute... to the betterment, well-being, protection and further positive development of humankind within its environment, present and future” [31]. My work also fits an Action Learning (AL) paradigm, expressed as the “basic belief that we can transform our lives, our workplaces and society if we act with integrity in concert with

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¹ An earlier version of this paper was presented at the International Conference in Sustainability Engineering and Science, Auckland, New Zealand/Aotearoa, 6–9 July, 2004 and is included in the CDROM of proceedings from that conference.

others and nature” [25]. The clearly stated values and respect for nature in this discourse² place my teaching within a wider struggle—towards a ‘partnership’ future based on an understanding and appreciation of the interconnectedness of all life [14], while consciously embracing difference as part of ways of knowing also places it within an anticipatory learning approach [17]. At the deepest level, I am motivated by the urgent need to contribute to the change from the un-limited, growth-driven, anthropocentric view of the world which has created the risks now facing our fragile planet and its increasingly damaged ecosystems [34].

After setting the context, this paper summarises some of my learnings under the headings Sustainability Professionals, Reflective Process and Developing *Globo sapiens*. I conclude with some reasons why this kind of work is not ‘airy-fairy’, the most common and damaging criticism, but contributes to a transdisciplinary education based on foresight and long-term thinking.

2. Context

In practice, I have found that, as suggested,

“serious attempts to integrate sustainability into higher education brings academics into whole new pedagogical worlds—experiential, epistemic, and systemic—which in turn brings them into whole new worlds of learning and, indeed, researching” [4]

This work began with an invitation (in 1997) to provide academic support for faculty wanting to improve communication skills in a small Engineering elective. This led to the development of a compulsory first year unit (BNB007) for a large (300+), diverse student cohort. The broader issue was how to help students to integrate their learning into their lives as developing, globally competent citizens and professionals, willing to think critically and assume responsibility for their impact on communities and the planet. Other Engineering educators had similar concerns. “A radical reshaping of engineering education is necessary to green prospective engineering graduates” [5]. Experience and reading led to my increasing dissatisfaction with terms such as ‘global portability’ and ‘global competence’. These seemed inadequate to describe the qualities engineering (or any) graduates need in order to contribute to a values-based vision of humane, sustainable and desirable futures that sees “rights assured, nature treasured, culture rich and the human spirit animate” [28].

3. Sustainability professionals

The more apt term ‘sustainability professionals’ comes from “a group of leading natural scientists, social scientists and policy analysts who met to deal with growing concerns, that meeting fundamental human needs while preserving the life systems of planet Earth will require world-wide acceleration of today’s halting progress in a transition toward sustainability” [19].

² Ehrenfeld (1993) in Passfield (1996), op. cit., expands this to a call for “social transformation through integrity, honesty and recognition of our evolutionary interdependence”.

They described efforts to promote this transition as a new field, Sustainability Science.³ Among other pathways, they called for research “on the character of nature–society interactions, on improving our ability to guide those interactions along sustainable trajectories, and on ways of promoting the social learning that will be necessary to navigate the transition to sustainability” [20]. I realise that sustainability is a contested, ‘messy’ and ‘ill-defined’ term. Wals and Jickling’s work (2002) [37] outlines the many possible uses and misuses of this term and their consequences for higher education. BNB007 is one attempt to meet calls for a different approaches and methodologies. It is not easy to change either the content or the practice of curricula. A lot of work goes into designing and teaching any unit of work and there are vested interests in preserving and protecting the status quo. I see my work as part of a humbled, on-going process of “seeking, rather than setting, standards for education for sustainability” [38]. Having argued the need for sustainability professionals, Section 4 briefly describes the reflective process I use as one way of creating diverse and active spaces that support their development.

4. Reflective process

Using Reflective Journals with first year engineering students has benefits including improved writing skills, increased self-confidence and better interpersonal and intercultural communication in the linked teamwork activities. At a meta-level, there is evidence of growing awareness of their personal and professional responsibilities on a local and global scale [36]. As stated, the aim of the Professional Practice module is “to help you identify and develop the skills necessary to be effective responsible and ethical professionals in a rapidly changing world.” Two linked assignments, Reflective Journals (RJs) and a team-based project⁴ are the way we developed assessment as a “tool for learning and growth” [16]. In 2003, students wrote 11 (×300 word) reflective journals, related to the lecture topics⁵ and at least one set reading per week, in the Professional Practice section of the unit. In Week 5, markers give formative feedback, using the same assessment criteria that are used in the Week 12 summative assessment.

Journals are written and sent in electronic form. The ‘Track Changes’ facility enables fast and legible feedback as well as providing an opportunity for the journal markers to develop a personal and trusting relationship with students. Our experience confirms other research showing that the flexibility of word processing and ease of correcting have positive effects on students’ academic abilities and self-esteem [24]. Word Processing is one of the skills taught in BNB007, and students integrate their growing expertise into journal presentation. 2003 was the first year that I was directly responsible for marking journals rather than being an at-the-margins participant/adviser/researcher. I made a commitment in the first lecture to students, that “no-one

³ An invited international group of natural and social scientists met for the first time to develop the principles of Sustainability Science in Friibergh, Sweden in 2000. This approach is spreading. See Collins, T. (2001) ‘Toward Sustainable Chemistry’, *Science*, 291:48–49.

⁴ The teams must negotiate, create and complete a project related to the United Nations focus in each particular year. In 2002, projects had to respond to the International Year of the Volunteer. These were presented and assessed at a public EXPO. 2003 was the International Year of Freshwater and students presented to peers. Three winning groups presented at Parliament House, Brisbane.

⁵ In 2003, the Professional Practice topics that formed the basis for the RJs were (1) personal perspective on learning; (2) problem formulation and critical thinking; (3) intercultural skills; (4) peer interview; (5) environmental principles/sustainable engineering; (6) socially responsible technology; (7) professional engineering ethics; (8) project progress and planning; (9) entrepreneurship, innovation and creativity; (10) globalisation and professionalism; (11) self-interview on learning.

would fail Reflective Journals because of me”. This led to a huge commitment of time as a (casual) on-line administrator trying to establish a safe environment with a ‘human face’. I wrote over 8000 words in notices during the semester. The following truncated excerpt from one notice gives the flavour of what I was trying to achieve.

Dear BNB007 students, this is a note to let you know that the READINGS for Week One are available in PDF format from the Home Page of this unit. They are both very readable and practical. If you think that you are not very good at planning or time management there is a good goal setting exercise in the second article that you might find useful. ...The first week of a new unit is always a bit overwhelming. Think of it like eating an elephant, just take small bites:)... I would also be grateful for feedback about the notices, whether they are helpful and if not, what would be most useful for you right now. I hope you have a good weekend. Pat

It is essential to show ‘a human face’, to make constructive comments and to respond to personal input. Previous research notes that the response itself encourages dialogue and categorises teacher comments as affirming, nudging, “giving information and personal connection comments” [21]. I received some heart-warming emails from both domestic and international students thanking me for “words of encouragement and advice in your emails”; “Thought you should know your work is helping” and “I was so worried. Your words are so encouraging. I will be doubling the effort for the rest of the journals”. These are from male students.

Reflective Journals and reflective processes are not to be taken on without thought and planning. Boud and Walker (1998) [7] highlight their potential for harm, despite good intentions, particularly in regard to issues of power and trust. Participating faculty need appropriate maturity and communication skills. I made a point of assuring students that there was no ‘party-line’ that they had to toe and that no-one would fail for disagreeing with any reading or topic.

4.1. *Useful strategies*

The most useful strategies developed as part of the RJ process for these first year students include:⁶

- Early scaffolding of writing through providing an open-ended template for writing the first few journals. This is particularly useful for students who, for whatever reason, lack confidence in writing skills.
- Incorporating a Personal Learning Agreement based on a Code of Conduct and an initial tutorial called Thinking about Learning. As envisaged, it encourages students to identify their learning strengths and weaknesses early and to set learning goals for the semester. Many students report this was a critical point in understanding how they learned and in their decision to improve their learning skills.
- The pivotal role of the Peer Interview (PI) in which students share their journals and learning experiences with a peer. Students are strongly encouraged to interview someone from a different background, gender or engineering strand. I moved the interview from Week 5 in

⁶ I have not addressed the issues of resistance to the reflective process in this paper although it is a key aspect of my research.

2002 to Week 4 in 2003 so that students received earlier feedback. The PI has proved extremely popular as a way of relieving anxiety about the journals and of meeting other students, particularly across perceived age, gender and cultural differences [35].

- The formative assessment in Week 5, using the same criteria as the final assessment, but with comments only, also provides timely and non-threatening feedback. The process helps to identify students experiencing difficulties.
- It is important to include one or two set readings each week as an opportunity to introduce students to writers with different backgrounds, perspectives and writing styles. For example, we have used articles from respected Australian Engineering academics, from *New Internationalist* magazine, management magazines and personal development articles, as well as a personal choice from websites about cultural issues. Students say they have discovered things they never would have read otherwise. For example, a short article on the extent of the freshwater crisis proved cathartic for many students in 2003 [15]. At first year level, short, well-written and challenging articles are ideal and focussing questions can help to direct reading—for those who need it.
- Metaphor plays an important role in establishing the vision and atmosphere of such a program. So many of the metaphors used in problem-based learning are military or machine-based [9]. ‘Oasis’ [8] seemed an ideal metaphor for the learning environment that I was trying to establish in BNB007. Our metaphors should be carefully chosen, able to be explained and justified and open to contest. There are no ‘innocent’ choices. As a teacher, I have to make the effort to be conscious of my assumptions and to make these as transparent as I can.⁷ The oasis may remain, but as *my* metaphor. Having explained my choice, I now invite students to choose their own metaphors for their learning.

5. Developing *Globo sapiens*

The notion of ‘sustainability professionals’ is useful, but the concept of a *Globo sapiens* [22]⁸ (which I use only in its ‘humankind’ dimension to describe a wise global citizen/professional), offers a concept capable of integrating the personal and the professional dimensions with a foundation in values and global responsibility and based on a vision of a preferred, sustainable future. So what qualities would *Globo sapiens* have and how do we recognise and nurture them?

Literature, the reflective journals of the last five cohorts and over 20 personal interviews have provided some of the qualities, skills and attributes of *Globo sapiens*. This is work in progress and characterising qualities, as outlined below, continue to emerge and evolve. These qualities are evident across cultural, gender and age groups and extend the ‘dynamic qualities’ identified as allowing students “to critique, construct and act with a high degree of autonomy and self-determination, if not in their personal lives then at least in their professional lives” [26].

Quality 1: S/he will be sensitive to the different ways we learn from each other and know the world.

⁷ As part of my research, I have applied Deshler’s (1990) [12] metaphor analysis to my choice of ‘oasis’ in order to gain a deeper understanding of its implications and potential impact.

⁸ Malaska’s original and more grammatical *Globo Persona Sapiens* envisaged the development of various species that included Human-kind ‘bi-orgs’, as well as non-human *Cyborgs*, *Silorgs* and *Symborgs* that eventually coalesced into a ‘hybrid “Grand Pa & Ma” of conscious Internet—a global mind with superior intelligence and wisdom’ (1997).

I borrowed this quality from a longer quote, “engaging in futures-oriented pedagogy requires sensitivity to the different ways women and men, civilisations, classes, people with disabilities and those without... know the world” [18]. This quality shines through these comments from students in the 2001 cohort as they struggled to understand the 11 September attack on New York’s Twin Towers:

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. (Female, NESB, 2001)⁹

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)

What I find striking are the students’ heartfelt efforts to understand why this had happened, *despite* so much media actively discouraging such thoughtful responses. The Peer Interview appears to be a particularly effective strategy in supporting students to cross perceived social and cultural barriers, as the following example shows.

...it seemed like we knew each other for years. Even though we are of the opposite sex; I am of Pakistani culture and he is Anglo-Saxon; we have never met before and would ideally probably have gone through the whole degree not realizing that we could be such good friends; all this seemed irrelevant, and in the space of a few minutes, we found ourselves agreeing on several different issues that we have come across during our course. (Female, NESB, 2003)

Quality 2: S/he will show evidence of global consciousness.

Many journals show evidence that students are on the way to showing a degree of ‘global consciousness’ with two identified elements, an “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” [23].

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 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)

Quality 3: 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 represents “the abandonment of the middle-class vision of unlimited economic prosperity and technological progress” [10]. This may be the most difficult change for privileged young people to contemplate. And why not? They are bombarded by images and messages telling them that escalating consumption is their right. This consumer ‘hyper-culture’ has been cleverly described

⁹ (NESB) non-english speaking background, (MA) mature age, (ESB) english speaking background.

as the domestication of the ‘seven deadly sins’¹⁰ into the ‘seven marketing imperatives’ [13]. Despite such pressure and temptations, many students demonstrate this quality:

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 further generations and the lives of others throughout the world before. (Male, ESB, 2001)

...one of my career goals is to 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 thousands 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).

Quality 4: S/he will be capable of trans-generational thinking.

As well as engaging/re-engaging with their own cultural background/s and histories, many students recognise and understand the concept of Future Generations. The concept of ‘all other species’ significantly expands this quality and is less evident, possibly because we have not engaged deeply enough with this concept.

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 their own. (Male ESB 2001)

...engineering with a purpose and looking to the future really appeals to me. I know I’d like to think that at the end of the day, as an engineer, I wasn’t just going about destroying things and taking away more from the environment than I am putting back. I’d like to think that I am investing in the future and ensuring that there will be a future for my children. (Female, NESB, 2002).

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

¹⁰ Pride, envy, greed, wrath, sloth, gluttony and lust.

Quality 5: S/he will be able to contribute to a ‘learning society’ through growing “dispositions of generosity, of openness and of serious engagement”.

Students need these dispositions in order to support not simply a changing society but a society based on ‘social wisdom’ [2]. I saw these qualities emerge in 2003 cohort and in their responses to each other. For example, a student from a previous cohort entered the on-line discussion forum under his own name with advice to the year’s cohort to take it seriously and learn from his mistakes and offering help should anyone need it. Another student offered to do a second interview if anyone could not find a partner. In the 2004 cohort, a mature age student has become an informal mentor for a high school student doing the unit under an accelerated learning program. This is not a one way relationship, as the younger student’s dedication (in a second language) inspires the older one. Most of those now in higher years have done the unit in one of its forms and they are now the majority in the Faculty environment. There may be small but significant signs of healthy life at the oasis.

As a result of the topics we’ve been looking at in class, I’ve found myself thinking more and more about the cost to the environment our everyday activities result in. I’m becoming more aware that as an engineer I cannot simply carry on in an ignorant manner, but it is up to me to find means to reduce the impact humans have on the environment. (Female, NESB, 2002)

Quality 6: S/he will be a person of courage

Courage is emerging strongly as a desirable and possibly the most demanding quality for *Globo Sapiens*—and their teachers, in the 21st century.

“Engineering graduates will need to come to terms with the causes of environmental degradation as well as the social and political factors which shape and direct technological change. They will need an education that gives them this understanding as well as the courage and professional integrity to independently pursue sustainability” [6].

Barnett acknowledges that “Finding one’s own voice and expressing it—in thought and in action—requires the moral virtues of courage, independence and persistence” [3]. Sidhu (2004) [29] suggests applying Foucault’s notion of *parrhesia* ‘fearless speech’, with its moral and critical qualities, to higher education. This term also carries a power dimension, since it implies a person with less power having the courage to challenge someone with greater power. Barnett’s example of a ‘critical being’, the lone student facing the tanks in Tian’anmen Square is an extreme example. However, we know that ‘for evil to triumph it is sufficient only for good people to do nothing’. “The hallmark of a university education should be training professionals to be *parrhesiastes*” [30].

One important aspect which I have come to value and appreciate, as a result of reflective journals and the module bnb007, is that my own view of engineering has changed. Before this subject I was really questioning the role of engineers in the global community and their relevance to society in general. I wondered whether this was the course I should be taking as all first semester subjects were maths and science subjects. The subjects weren’t difficult, only a little uninspiring and theoretical. This subject has helped me to further understand what an engineer is and who an engineer is. (Female, NESB, 2002)

Engineers hold great responsibility in the development and implementation of new products and technologies thus the need to put the livelihood of people and

the environment first is important. We need not only to ask, as an anonymous person said, “Can we do it” but also, “Should we do it?” (Male, MA, NESB, 2002)

Students will feel more confident to develop such qualities if we model them through the environments we create and through our own behaviours. This supposes that we are globally competent practitioners prepared to engage with difficult democratic and ethical issues [1].

6. Conclusion

This work is not ‘airy-fairy’, the most common criticism of such values-based education, but models many aspects of a quality Higher Education. I note here that my original version of this paper placed the economic argument as the main justification for this work. This misplaced emphasis was obviously my response to feeling ‘on the edge’—border pedagogy is uncomfortable. The pressure to justify what I am doing in terms of the dominant economic discourse takes energy that should be spent on more significant agenda. I gave priority to the economic, thinking that if the approach I valued did not interest colleagues, I could still justify what I did in terms of the dominant economic discourse they preferred. I was originally addressing engineering colleagues working under the pressure of faculties’ need to earn money, much of which comes from international students. However, reflexivity, among other things, implies continual self-scrutiny. I was rightly reminded that I claimed a primary relationship to transdisciplinarity and long-term futures thinking.¹¹ The language of futures thinking and transdisciplinarity is not a common discourse. Transdisciplinarity has “the aim of embedding various streams of knowledge in one another and seeks to re-create integrated knowledge through doing this” [32]. Somerville criticises most current work claiming to be transdisciplinary as interdisciplinary, which she contrasts as “parallel activities with ethics as an add-on” [33].

In any terms, students in such a unit are getting value for the large amounts of money they are paying for a professional education. I summarise some reasons why, with underlying justifications in brackets, below as:

- Students experience a curriculum that formally welcomes and builds on what they bring with them in terms of work, culture and gender experiences (affective, transdisciplinary, responsive).
- Reflective Journals or a reflective process, if well supported, allow each student, even in large first year cohorts, to feel that someone recognises them as an individual, is listening to what they say and responding (eases transition to tertiary study—whatever they are moving from).
- For international students, the topics have a global dimension relevant to issues affecting their home societies, rather than being solely based on Anglophone societies or First World examples (internationalisation, global competencies, life-long learning). The global dimension engages domestic students with other realities and ways of knowing they are not aware of otherwise (internationalisation, transdisciplinarity, futures thinking).
- Journals lead to demonstrably improved written and oral communication skills for most students, international and domestic (graduate attributes, life-long learning, and transferable skills). International students’ experience is more positive because they learn in an environment which consciously tries to support, value and respect difference.

¹¹ See acknowledgements.

- Both international and domestic students are encouraged to leave their comfort zones in terms of content and process (transdisciplinarity, life-long learning, internationalisation).

The goodwill of satisfied International students is the most worthwhile and long-term contribution to Australia as a desirable Higher Education destination (internationalisation, economic, social, long-term thinking). But, above all, domestic and international students are encouraged to develop the skills, attributes and qualities of *Globo sapiens*, the wise global citizens desperately needed if the world is to make a successful transition to any kind of preferred sustainable future. There is increasing evidence that all societies are confronting, or about to confront, the consequences of unsustainable practices. If we are to respond effectively, Higher Education will surely need to bring about dramatic and rapid changes in technical and professional education, to educate professionals who can heal and sustain rather than damage and exploit.

This unit is a small and imperfect intervention, but most changes begin this way. The initiative has suffered from lack of sustained faculty management interest, support and encouragement. It is being replaced by two new units in 2006. Sustainable initiatives for change need a ‘champion’ at the highest faculty level, as well as recognition and encouragement from relevant professional bodies for work towards the profession’s stated goals. The support of colleagues, through participation, constructive criticism, or simply expressing interest, is also critical for developing, maintaining and improving innovative programs. By way of contrast, one example may indicate the impact of common and unhelpful responses. A colleague I spoke to dismissed the Reflective Journals, saying ‘everyone thought they were a joke’ and that students just wrote what they thought we (the markers) wanted to hear. I have now read over 2000 Reflective Journals. Authentic voices are the norm and very difficult to falsify. When I offered to send the colleague some journals (which I have students’ permission to use for research purposes), the reply was, “Oh, I don’t have time for that”. It was disappointing that colleagues who put such store in evidence would not take the time to test the myth against the journals.

This work involves my own learning as much as any student’s [39,11]. I am not an engineer but come from a humanities background and working closely with engineering students has been personally and professionally challenging. Research in the form of the Reflective Journals and personal interviews has given me respect for these students’ willingness to engage and for their capacities for growth and transformation as they struggle to make meaning of what they learn. I am more convinced of how important it is to expand the few spaces we make in universities “for allowing the life world of the learner to enter the educational process” [12].

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References

- [1] G. Badley, Developing globally-competent university teachers, *Innovations in Education and Training International (IETI)* 37 (3) (2000) 244–253.
- [2] R. Barnett, *Higher Education: a Critical Business*, SRHE and Open University Press, Buckingham, 1997. p. 6.
- [3] R. Barnett, *Higher Education: a Critical Business*, SRHE and Open University Press, Buckingham, 1997. p. 173.

- [4] Bawden, Wals, (2000) in: A.E.J. Wals, B. Jickling, 'Sustainability' in Higher Education: from Doublethink and Newspeak to Critical Thinking and Meaningful Learning, *Higher Education Policy* 15(2) (2002) 129.
- [5] S. Beder, *The New Engineer: Management and Professional Responsibility in a Changing World*, third ed., MacMillan, South Yarra, Vic, 1998, p. 3141; S. Beder, Towards an environmentally conscious engineering graduate, *Australasian Journal of Engineering Education* 7(1); See also S.F. Johnston, Towards culturally inclusive global engineering? *European Journal of Engineering Education* 26(1) (2000) 77–89.
- [6] S. Beder, Towards an environmentally conscious engineering graduate, *Australasian Journal of Engineering Education* 7(1) (1996) <http://www.uow.edu.au/arts/sts/sbeder/enged.html> (Accessed 10 September, 2004).
- [7] D. Boud, D. Walker, Promoting reflection in professional courses: the challenge of context, *Studies in Higher Education* 23 (2) (1998) 191–206.
- [8] D. Boud, D. Walker, Promoting reflection in professional courses: the challenge of context, *Studies in Higher Education* 23 (2) (1998) 198.
- [9] C.A. Bowers, D.J. Flinders, *Culturally Responsive Teaching and Supervision: a Handbook for Staff Development*, Teachers College Press, New York, 1991; See also G.E. Burrowes, *Gender Dynamics in an Engineering Classroom: Engineering Students' Perspectives*, Engineering, Australian Digital Theses Program, University of Newcastle, NSW, 2001.
- [10] C.A. Bowers, D.J. Flinders, *Culturally Responsive Teaching and Supervision: a Handbook for Staff Development*, Teachers College Press, New York, 1991, p. 230.
- [11] S.D. Brookfield, *Becoming a Critically Reflective Teacher*, Jossey-Bass, San Francisco, 1995.
- [12] D. Deshler, Metaphor analysis: exorcising ghosts, in: J. Mezirow (Ed.), *Fostering Critical Reflection In Adulthood*, Jossey-Bass, San Francisco, 1990, pp. 297–313.
- [13] R. Eckersley, Running on empty, *ABN Report* 7 (2) (1999) 3–6.
- [14] R. Eisler, Partnership education for the 21st century, *Journal of Futures Studies* 5 (3) (2001) 143–153.
- [15] Godrej, Dinyar, Precious fluid, *New Internationalist*, March, 2003, http://www.findarticles.com/p/articles/mi_m0JQP/is_2003_March/ai_9923238. Accessed 10 September, 2004.
- [16] P. Heath, Education as citizenship: appropriating a new social space, *Higher Education Research and Development* 19 (1) (2000) 46.
- [17] S. Inayatullah, *Questioning the Future: Futures Studies, Action Learning and Organizational Transformation*, Tamkang University, Tamsui, Taipei, 2002, p. 109.
- [18] S. Inayatullah, Pedagogy culture and futures studies, in: J. Dator (Ed.), *Advancing Futures: Futures Studies in Higher Education*, Praeger, Westport, CT, 2002, pp. 120–121.
- [19] R. Kates, et al., Sustainability science, *Science* 292 (2001) 641–642.
- [20] R. Kates, et al, Sustainability science, in: *Research and Assessment Systems for Sustainability Discussion Paper 2000–33*, Environment and Natural Resources Program, Belfer Center for Science and International Affairs, Kennedy School of Government, Harvard University, Cambridge, MA, 2001, p. 4.
- [21] Krol, Using interactive journal writing as a strategy for professional growth, in: C. Maloney, Glenda Campbell-Evans (Eds.), *Asia-Pacific Journal of Teacher Education* 30 (1996) 40.
- [22] P. Malaska, Inventing futures, Paper Presented at the World Futures Studies Federation XV World Conference 'Global Conversations—What You and I Can Do for Future Generations', Brisbane, Australia, 28 September–3 October, 1997.
- [23] O.W. Markley, Visionary futures: guided cognitive imagery in teaching and learning about the future, in: J. Dator (Ed.), *Advancing Futures*, first ed., Westport, Connecticut, 2002, p. 340.
- [24] B.C. Palmer, Journal writing: an effective, heuristic method for literacy acquisition, *Adult Basic Education* 9 (2) (1999) 71.
- [25] R. Passfield, Action learning—a paradigm whose time has come, *ALAR Journal* 1 (2) (1996) 14.
- [26] P. Posch, Environment and School initiatives, *Environment, Schools and Active Learning*, OECD, Paris, 2002, p. 124. (Cited in Wals & Jickling, 2002, op. cit. p. 124).
- [27] P. Raskin, T. Banuri, G. Gallopini, P. Gutman, A. Hammond, R. Kates, et al., *Great Transition: The Promise and Lure of The Times Ahead*, Stockholm Environment Institute, Boston, 2002, pp. 56–57.
- [28] Raskin, et al., *Great Transition: The Promise and Lure of The Times Ahead*, Stockholm Environment Institute, Boston, 2002, p. 70.
- [30] R. Sidhu, *To Market: Universities and Global Education*, Lawrence Erlbaum Associates Inc., Marwah, New Jersey, 2004.
- [31] R. Slaughter, *Futures Beyond Dystopia: Creating Social Foresight*, RoutledgeFalmer, London & New York, 2004, p. 45.
- [32] M. Somerville, *The Ethical Canary*, Penguin, Canada, 2001. p. 285.

- [34] W. Steffen, et al., *Global change and the earth system: a planet under pressure*, The IGBP Series, Springer, Berlin, Heidelberg, 2004; W. Steffen, UNEP, *Global Environment Outlook 2000*, Earthscan, London, 1999; I. Lowe, *First we have to survive the 21st century*, *Dissent* 13 (2003) 34–38; P. Raskin, T. Banuri, G. Gallopin, P. Gutman, A. Hammond, R. Kates, et al., *Great Transition: the Promise and Lure of the Times Ahead*, Stockholm Environment Institute, Boston, 2002; J. Paavola, I. Lowe (Eds.), *Environmental Values in a Globalising World: Nature, Justice and Governance*, Routledge, London, (2005).
- [35] S. Volet, G. Ang, *Culturally mixed groups on international campuses: an opportunity for inter-cultural learning*, *Higher Education Research and Development* 17(1) (1998) 5–23; D. Smart, S. Volet, G. Ang, *Fostering Social Cohesion in Universities: Bridging the Cultural Divide*, Australian Education International, DETYA, Canberra, ACT, 2000. p. 53.
- [36] P. Walker, N. Finney, *Skill development and critical thinking in higher education*, *Teaching in Higher Education* 4 (4) (1999) 531; J. Scoggins, R. Winter, *The patchwork text: a coursework format for education as critical understanding*, *Teaching in Higher Education* 4 (4) (1999) 485; P. Kelly, *First year engineers-given half a chance (revised)*, from <http://www.pantaneto.co.uk/issue5/front5.htm> (e:journal), January, 2002. P. Kelly, *Not for wimps: futures thinking and first year engineers*, in: S. Inayatullah (Ed) (2004), *Causal Layered Analysis Reader*, Tamkang University, Tamsui, Taiwan, in press. J. Currie, *No need to fit round pegs into square holes*, *The Times Higher Education Supplement*, September 1, 2000, p. 34.
- [37] A.E.J. Wals, B. Jickling, *op.cit.*, 2002.
- [38] A.E.J. Wals, B. Jickling, *op. cit.* (2002) 129.
- [39] A.E.J. Wals, B. Jickling, *op. cit.* (2002) 129.