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Sustainability: The education driver

Category   Philosophy, policy and practice

Introduction

This paper draws on the practices of sustainable technologies and shows how education is an integral driver in this evolving and transformative process.

We argue that the increasing profile given to sustainable practices and products both globally and locally is giving rise to new societal demands, that can only be satisfied if both the private and public sectors of industry have a supply of new entrants versed in this aspect of technology. Currently, there is a gap of critically thinking practitioners in this area who have a combination of the passion for a sustainable future and an understanding of the practical realities needed to effect that change. This means that educational organisations, from primary schools right through to tertiary institutions, have a significant role to play in providing opportunities for their students to develop the desirable values and skills. In turn, this will produce graduates who will become influential members in technologically sustainable businesses, professional tradespeople who have learnt across boundaries from a socially critical perspective.

Educating for sustainability

Education for sustainability is an emerging concept that 'encompasses a new vision of education that seeks to empower people of all ages to assume responsibility for creating a sustainable future' (UNESCO, 2002, p.5). It is not teaching *about* sustainability, but rather learning *for* sustainability (Parliamentary Commissioner for the Environment, 2004). This approach builds on earlier models of environmental teaching that provided the learner with facts and warnings but did not involve them at the level of their emotional intelligence nor did it emphasise ways in which they could make a positive practical impact. Significantly up till now, environmental education has focussed directly on the problems created by human practices and tended to lead to feelings of alienation and hopelessness.

On the other hand, while education for sustainability does not overlook the downside to man's impact on the planet, it stresses the need for each participant to develop a proactive approach to positive outcomes.   It does this by allowing learners to see a wider picture, to be able to visualise where their own actions can contribute to a sustainable future. In essence, therefore, it becomes a transformative learning experience.

According to the Parliamentary Commissioner for the Environment (2004, p.44) educating for sustainability has to be a 'future-focused' pursuit:

> People should not just be able to critique unsustainable practices. They need to be encouraged to contribute to positive outcomes … It involves learners in an examination of probable and possible futures.

From this it can be seen that educating for sustainability will be a continuously evolving process, involving learners as collaborative participants who integrate critical thought and reflection on practice across the entire curriculum.

The programme

The UNITEC Bachelor of Applied Technology was developed to provide a niche for professional tradespeople to extend their capabilities within a holistic learning environment. Because this degree focusses on systems and system processes, it became the ideal vehicle to enable participants to appreciate the significance of sustainable technologies in their own area of work, however different their own trades may be.

The reason for this is that different systems have common features and applying an underlying philosophy of systems theory encourages an educational approach that examines these interconnections. Indeed, according to Heylighen and Joslyn (1992) systems theory is,

> … the transdisciplinary study of the abstract organisation of phenomena, independent of their substance, type, or spatial scale of existence. It investigates both the principles common to all complex entities, and the models which can be used to describe them.

Fundamental concepts in systems theory are the notions of emergence and interaction. If a new quality – sustainable practice – is to emerge, it is important that learners from diverse disciplines such as transport technology, electro-technology and building, all share and debate concepts of environmental, socio-cultural, economic and governance aspects of sustainable practices. This enables a plumber, for example, to become aware of issues that arise in a range of other specialisations and have the opportunity to see ways that techniques normally only taught to students in mechanics or marine construction can be applied in his (or her) own professional area. Moreover, the societal demands and constraints on their practice are brought to the fore through their understanding of values, perspectives and issues prevalent in the society in which they work (McKeown et al, 2002).

Case study

In UNITEC Applied Technology Institute (UATI) the holistic system theory approach is emphasised throughout the three years of the new Bachelor of Applied Technology degree in all of its disciplines ranging from Plumbing and Electrotechnology to Building, Marine and Automotive Transport. In the third year of this degree all learners are required to undertake a course called 'Sustainable Technologies' the aim of which is to enable students to investigate both global and local aspects of

sustainable technology practices and then integrate their knowledge into local settings. The key element of this course is that it is based on authentic and directly observable situations for which students are required to design creative sustainable technological solutions in individual, community or workplace settings.

The case studies used by students are real, developed with the cooperation of New Zealand, and in some cases Australian businesses, that are part of the wider sustainability community. The findings that students discover will be fed back into those industries. In addition, learning is student-centred, integrated with their developing understanding of technological processes and the application of suitable alternative technologies. Moreover, wherever possible, a collaborative approach is encouraged, based on the premise that working together is the ideal medium for learning about the effects of actions in a societal context and one that leads to reflection on trades practices. Such a collaborative approach also has a strong educational basis in that working together is recognised to foster higher levels of thinking and improves the performance of the individuals within the group (Tang, 1998).

There is one additional aspect to this New Zealand-based course that makes it unique and that is summarised in the final learning outcome. This outcome requires students to integrate the implications of the Treaty of Waitangi into sustainable technology issues. As most New Zealanders are aware, the Treaty of Waitangi, signed in 1840, is a living agreement between Maori and the Crown that in theory regulates the laws that any government of the day may enact. As a result of this, education for sustainability, in addition to being locally relevant, must also highlight issues that integrate Maori perspectives into case study analyses. Examples of issues examined with these protocols in mind might range from pollution of fishing areas to specific planning needs associated with designs appropriate for Maori homes. The integration of the concerns and practices of the indigenous people or tangata whenua in the New Zealand context is one that resonates with the premise of education for a sustainable future and can also be seen in some courses in other parts of the world, such as in the Institute for Sustainability and Technology Policy at Murdoch University, in Western Australia.

One of the sustainable case studies examined at Murdoch University were the issues and opportunities offered by the increased development of indigenous tourism which were examined in conjunction with Aboriginal officers from the Australian Department of Conservation and Land Management. The authors of this report (Ruane & Nannup, 2002) emphasised that careful conservation and a continuing awareness of cultural differences must be kept to the forefront if indigenous tourism was to become of greater economic significance to the Aboriginal people of Western Australia.

The case studies explored by participants in the Sustainable Technologies course are also backed up by a versatile range of practical research currently being undertaken by the lecturers in UATI who are working on topics as wide ranging as:

- Wall boards, incorporating the use of flax fibres,
- The use of Bio-diesel and alternative fuels,
- Magnetic Maximisers for increased fuel efficiency,
- Renewable Energy Converter power modules and fuel cells,

- Multi-component vane compressor pumps and the development of wind turbines for domestic use, and,
- The utilisation of non-toxic marine paints.

Educational approach

Learning for sustainability demands that students are able to develop critical thinking skills in order to evaluate information they have obtained from a wide variety of sources, and then generate a range of ideas within their subject area demonstrating deep engagement with the knowledge they are acquiring (Vardi, 1998). Vardi states that this will result not only, 'in the development of argument, but also in the development of systems, models, experiences, solutions to problems and so forth'. In the past this educational approach has often relied on theoretical problem solving techniques that may leave critical skills gaps for many students and fail to influence resulting trades practices. However, Vardi has claimed that combining verbal or written argument with observations and experiences of real-world phenomena encourages the growth of both evaluative and creative thought, producing the 'future-focused' graduate called for by the Parliamentary Commissioner for the Environment (2004).

Such a graduate is then able to synthesise and evaluate a number of different perspectives of any situation and compare different viewpoints. This also enables them to readily recognise the societal and cultural implications of different technological developments and be able to adopt a solutions based approach that contributes to their learning from experience.

In UATI the sustainability theme is emphasised throughout the three years of the new Bachelor of Applied Technology degree in all of its disciplines ranging from Plumbing and Electrotechnology to Building, Maine and Automotive Transport. The rationale of sustainable technology and its characteristics are examined within industry initiatives locally and globally, and students are required to design creative solutions for sustainable practices in individual, community or workplace settings.

The theories of critical thinking have been translated into the reality of the Sustainable Technologies course through a three-stage process. This enables the Triple Bottom Line, comprising environmental, socio-cultural and economic practices to be examined in combination with the +1 factor of governance (using the RMIT model) both practically and with regard to its underpinning theories.

Having initially examined rationale for sustainable technology on a global basis, integrated across a range of natural and human systems, participants will then individually evaluate sustainability practices in regard to their application within a local case study in their own area of specialisation. An example of this might be a case study of toxic processes used currently in boat building, critiquing both positive and negative aspects of the situation under review and then developing soundly argued recommendations for possible new techniques.

Lastly, having completed this review, groups of students from the same specialised area are required to mutually critique and reflect on aspects of their case studies through the medium of an online discussion forum. Chong (1998) explained that this

online method, using authentic cases, has the potential to support the development of students' analytical and critical thinking skills, as well as their ability to construct logical arguments. The process of online discussions is a far cry from mere chats or conversations. If facilitated effectively they become logically disciplined dialogues that are able to provide a stage for creative endeavour. According to Lipman (2003, p. 256), 'The community of deliberative inquiry establishes conditions evocative of critical, caring and creative thinking, and such thinking in turn furthers the objectives of both the community and its members.'

This technique of critical thinking through online social discourse is particularly relevant to the nature of education for sustainability as such a process enables learners to transform their frame of reference (Mezirow, 2000), a concept that directly addresses the transformative educational demands of the education for sustainability (PCE, 2004, McKeown et al. 2002). Graduates who have experienced such learning opportunities are more likely to be empowered to contribute to sustainable practices during their working lives.

Conclusion

Systems-based learning for sustainability can contribute to the transformation of the values of learners in a number of ways. Firstly, by alerting learners to the impact of their own actions and raising their awareness of self and society. Secondly, an understanding of sustainable processes and their interdependencies can prepare professional tradespeople to respond to the societal and financial opportunities offered by this new perception. In other words, the values, learning skills, and perspectives gained by participants of this degree may guide and motivate them to seek sustainable livelihoods.

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