Required for Networking	
15 credits from	BCCS301 – Network Technologies (15 credits) BCME351 – Communications Engineering II (15 credits)
8 credits from	BCCS391 – Contemporary Issues in Networking (8 credits)
14 credits from	NDOS653 – Operating Systems (Windows Client) (7 credits) NDNM611 – Network Admin Applied -Active Directory (7 credits) NDNM630 - Network Infrastructure (7 credits) NDNM640 - Fundamentals of Security (7 credits) NDNM612 - Network Admin Applied -Advanced AD (7 credits) NDNM614 - Network Admin Applied –Environment (7 credits) NDNM616 - Network Admin Applied -Directory Services (7 credits) NDFP700 - Firewall/Proxy Server (7 credits) NDGS700 - Groupware Server Administration (7 credits)
8 credits from	Level 6 Programming Courses in BICT
Compulsory for Degree	BCCS153 – Computer Architecture (15 credits)

Table 3 – Structure of BICT Networking Stream from 2007

	5	4	3	2	1	0	Score	Weight	Total
Part A								2	
Part B								3	
Part C								5	
								Total/50	

Table 6 – Example of a Rubric for Assessing Degree Assessment (without the detail of the text in each grade range column)

	5	4	3	2	1	0	Score	Weight	Total
Part A							3	2	6
Part B							2	3	6
Part C							4	5	20
								Total/50	32

Table 7 – Completed Rubric for Assessing Degree Assessment (without the detail of the text in each grade range column)

	5	4.5	4	3.5	2	0	Score	Weight	Total
Part A							4	2	8
Part B							3.5	3	10.5
Part C							4.5	5	22.5
								Total/50	41

Table 8 – Completed Rubric for Assessing Diploma Assessment (without the detail of the text in each grade range column)

BCIT251	Multimedia Application Development	15 credits
BCIT351	Multimedia App Dev & Management	15 credits
	Level 6 Programming	15 credits
	Elective #1	15 credits
	Elective #2	15 credits
	Total	75 credits

Table 9 – Courses Completed By Multimedia Students Aside From Compulsory and Business Courses in Original Multimedia Stream

BCIT252	Multimedia and Animation Development	15 credits
BCIT352	Multimedia Development Project	15 credits
BCIT391	Contemporary Issues in Multimedia	8 credits
	Level 6 Programming – which could be BCPR216 (Introduction to Multimedia Scripting in Action Script)	8 credits
	Elective #1 – which could be DG600 (Dynamic Graphics from DipICT)	14 credits
	Elective #2	15 credits
	Total	75 credits

Table 11 – Courses Completed By Multimedia Students Aside From Compulsory and Business Courses in Proposed Multimedia Stream

Invited paper

Every Graduate Education for Sustainability one year on

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Abstract

Otago Polytechnic has set itself a goal of "every graduate may think and act as a sustainable practitioner by 2009". This paper reviews progress towards this goal with the intention of identifying approaches that could be adopted in computing education. The initiative is based around the notion of the sustainable practitioner, and the application of this to each discipline is considered in turn.

Keywords: education for sustainability, EfS, vocational, sustainable practitioner.

1 Introduction

In this paper we explore the progress towards Otago Polytechnic's goal of "every graduate may think and act as a sustainable practitioner. The intention of this paper is to identify emergent themes, strategies and practices that might be useful for adoption in computing education. Computing itself at the institution is purposefully not included, Sustainability for Computing Education is considered elsewhere (Mann and Smit 2007a,b).

We first survey the drivers for this Education for Sustainability (EfS) initiative before examining the Academic Board statement that lies behind the strategy. The progress towards understanding what it means to be a "sustainable practitioner' in each discipline is discussed, along with consideration of steps towards implementing changes to teaching and learning in that discipline.

1.1 Drivers

In Mann and Smith (2007) we described national and international imperatives for the development of Education for Sustainability. This is the Decade of Education for Sustainable Development, recognising the pressing need for "education for sustainable development" as "a life-wide and lifelong endeavour which challenges individuals, institutions and societies to view tomorrow as a day that belongs to all of us, or it will not belong to anyone." The call for sustainability in education is not new. Nicolaides (2006) reviews a long history of international efforts to promote links between sustainability and education.

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An important distinction is the one regarding "all professionals". Cortese (1999) states:

> *Unless higher education responds quickly to ensure that all of their graduates, regardless of their fields of study, are environmentally literate, then it is unlikely that our future leaders will demonstrate the analytical thinking, the will or the compassion to adequately address complex issues such as population, climate change and social equity.*
>
> *Environmental specialists alone will not help us move toward a sustainable path. A compartmentalized approach further reinforces the assumption that environmental protection should be left to environmental professionals. All humans consume resources, occupy ecosystems and produce waste. We need all professionals to carry out their lives and activities in a manner that is environmentally sound and sustainable.*

Locally, the Tertiary Education Strategy 2007 – 2012 introduces sustainability as a key direction from the first line: "Tertiary education and research underpin the realisation of New Zealanders' goals and aspirations and the sustainable development of New Zealand's economy and society" (Ministry of Education, 2007). At a primary and secondary school level Law and McConnell (1999) provide a framework for integrating sustainability across the curriculum.

We have then, a strong call for a cross disciplinary, sustainable approach to higher education. Unfortunately (or perhaps fortunately), as Nicolaides (2006) adds, "it is far from a being a simple matter to include an ecological dimension".

This initiative is based on the goal of incorporating education for sustainability (EfS) across all disciplines and programmes and as an integrated core competency for all training outcomes. This educational integration is based on the idea that sustainability should be similarly integrated in all activities of daily life, and therefore should also be part of tertiary and vocational training. We refer to it as an "every graduate" approach, as it intends to prepare every graduate of the institution with education for sustainability which is relevant to their individual field.

Unfortunately (or perhaps fortunately), as Nicolaides (2006) points out, "it is far from a being a simple matter to include an ecological dimension" in higher education. In this paper we focus on how education in sustainability can be woven through teaching and learning.

2 Academic Board statement

In 2007 Otago Polytechnic's Academic Board approved the development of core capabilities. "Sustainability" is one of these capabilities (A62/07). In August the following policy was adopted:

> *The skills and values of Otago Polytechnic graduates contribute to every sector of society. Our curriculum, teaching and learning therefore is pervasive and influential with global impact. The Otago Polytechnic sustainability vision is that our graduates, our practitioners and our academics understand the concepts of social, environmental and economic sustainability in order for them to evaluate, question and discuss their role in the world and to enable them to make changes where and when appropriate. Our goal is that every graduate may think and act as a "sustainable practitioner".*
>
> *Moreover, educators must take a lead in sustainability so that our graduates can be encouraged and supported to promote sustainable practices in their chosen career. This can primarily be achieved by fostering education for sustainability in all our qualifications and by re-visioning and changing our approach to teaching and learning to model a transformative context for all learners.*
>
> *As a consequence sustainable practice becomes a context and a process for learning and recognised as a core capability within each discipline.*
>
> *Creating a philosophy of Education for Sustainability will be enhanced if undertaken within a context of institutional operational practice. We will then be seen to be modelling good practice.*

This statement benefits from unpacking.

> *The skills and values of Otago Polytechnic graduates contribute to every sector of society.*

Being a vocational institution with a wide range of disciplines, our curriculum, teaching and learning therefore is pervasive and influential with global impact.

Otago Polytechnic has 3,658 EFTS comprising 12,060 students in per year in certificates, diplomas, degrees and post graduate programmes.

> *The Otago Polytechnic sustainability vision is that our graduates, our practitioners and our academics understand the concepts of social, environmental and economic sustainability in order for them to evaluate, question and discuss their role in the world and to enable them to make changes where and when appropriate.*

Our approach to sustainability is inclusive in people and concept. We loosely define sustainability as having three components. The broad role of what we would like our people to able to do think creatively and critically and be able to make transformative changes. Jansen and Schack (2005) argue "our point of departure is that relevant answers to environmental problems are not only a matter of quantitative changes (less consumption of resources, less transport by car, less electricity consumption, etc.), but also (and maybe more so) of qualitative changes. Therefore, the aim of environmental education is to make students capable of envisioning alternative ways of development and to be able to participate in acting according to these objectives".

> *Our goal is that every graduate may think and act as a "sustainable practitioner".*

This is the critical sentence. It sets the goal. It states our "every graduate" approach. This means that everyone who studies at Otago Polytechnic should have these characteristics. A consequence of this is a focus on students in every discipline and every level of education. We are also developing stand alone courses but these are secondary to the wider goal of "every graduate".

"may think and act" was very carefully worded. Much as we might have liked to use the word "will", an educational institution is not in a position to prescribe behaviours following graduation. This is akin to the "can address" described by Tilbury *et al.* (2005) but goes further than Machen's "sensitivity" (in Carlson 2006). "Think and act" highlights the balance between cognitive and action capability (Jensen and Schnack 1997, Jensen and Neilsen 2003).

> *Moreover, educators must take a lead in sustainability so that our graduates can be encouraged and supported to promote sustainable practices in their chosen career.*

This important statement sets our position that sustainability will be a part of careers and that the institution does have a role in promoting such values. We recognise that some theorists have a different view on this (eg Fish "save the world in your own time" http://fish.blogs.nytimes.com/).

> *This can primarily be achieved by fostering education for sustainability in all our qualifications and by re-visioning and changing our approach to teaching and learning to model a transformative context for all learners.*

Following Jensen and Schnack (1997) "Education for democracy, or political liberal education, is, in itself, a fundamental educational task. We do not believe in educational efforts in relation to the environment, health and peace which are divorced from this fundamental perspective…democracy is participation. In a democracy, the members are not spectators, but participants; not equally active participants in everything all the time, naturally, but always potential participants who decide for themselves in what and when they will be involved".

In other words, it is not possible to provide opportunities for transformation without a fundamental examination of both what we teach and how we teach.

> *As a consequence sustainable practice becomes a context and a process for learning and recognised as a core capability within each discipline.*

The core capability places sustainability at the same level as other generic competencies: literacy, numeracy etc. (or, as we are fond of describing: "reading, writing and sustainability").

Creating a philosophy of Education for Sustainability will be enhanced if undertaken within a context of institutional operational practice. We will then be seen to be modelling good practice.

For reasons of hidden curriculum and because it is the right thing to do (Willard 2005) the institution needs to be an exemplar of sustainable practice.

The decision was made to integrate sustainability education into every programme, rather than develop a stand-alone course. This is showing Otago Polytechnic's belief, that the goal of sustainability in the world, will only be achieved through everyone learning to live and work sustainably.

The Academic Board motion that followed the approval of this policy statement set the timeline for implementation. We are endeavouring to achieve 'every graduate status for the intake of 2009. To accomplish this goal, we need to have formal academic approval processes completed by September 2008.

The process to accomplish this transformation can be described as both top down and bottom up (Figure 1). From the top each discipline area is working to articulate how that discipline interacts with sustainability. In most cases this has involved working with local industry advisory groups, and with national professional/trade bodies. This then progresses down through graduate profiles, and learning outcomes to actual teaching and learning practice. We are also attempting to facilitate "bottom up" development, supporting individual lecturers, students and student groups with "grass-roots" initiatives (Figure 2).

3 Sustainable Practitioner

The concept of the sustainable practitioner is fundamental to our approach. Each discipline is coming to terms with what it means to be a sustainable practitioner. These are expressed as a statement starting "A sustainable practitioner in <discipline> is someone who….". This is accompanied by some short narratives that describe desired behaviours.

In describing these behaviours we are trying to go beyond the trivial, the things that every worker should do (recycling office paper, walking up stairs etc) and get to the difficult questions.

We characterise this by asking departments to consider their equivalent to this story: forestry worker attending a hypothetical Level 2 chainsaw maintenance course. As part of that course the future chainsaw operators are taught all about being careful when changing the chainsaw oil, not spilling it and collecting it for recycling. With some modification to the course we could even certify the graduates as "sustainable". What is going to matter, perhaps more so, is what our graduate does at the first 'smoko' when, after a morning of carefully changing oil, he is roundly abused – 'just chuck it in the stream, you're holding up the whole gang'. And what do we expect our graduate to do when on the first day on the job our graduate is told to go and chop down the last Kauri tree. The answer isn't as simple as saying no (he'll get fired and someone else will chop it down), nor is as simple as saying 'yes' (surely unsustainable). Nor is the answer that we'd teach integrated catchment management – such material is perhaps Level 7. Instead the answer is something about polite questioning and discussing alternatives.

Given this scenario, which readily translates to other disciplines, each department is working with its stakeholders to identify behaviours expected of their own graduates.

4 Departmental progress

4.1 Framework

In the following sections we explore the progress made by departments across the institution towards the goal of sustainable practioner by 2009. To facilitate discussion, a framework of three questions is used, simplified from the agenda given in Table 1.

1. What does it mean to be a sustainable practitioner in your field?

2. How is this being reflected in your programmes (Graduate profiles, learning outcomes etc)

3. Evidence of how this is making a difference in teaching and learning.

In May 2008 each respective Head of Department contributed to a half-day session that brought together the progress from each discipline. The descriptions that follow are summarized by the authors. The departments are listed here in no particular order.

4.2 Social Services

In the past year, Social services has consolidated a myriad of programmes under a single structure: human services. This could be considered best practice in transformation. For these programmes Sustainable Practioner is enmeshed in a discipline understanding of social justice. Key is social justice and sustainable relationships within contexts of economic relationships, Ecological social justice resources etc.

The Diploma philosophy statement includes:

> *Students are encouraged to act with integrity, honesty and congruency in all aspects of their study. Sustainability, encompassed in social justice and establishing and maintaining healthy community relationships to promote positive change, provided the opportunity to access pastoral care, supervision, support services and work together to ensure maximum opportunity for success in this programme.*

4.3 Nursing

The School of Nursing argues that health is intrinsically about sustainability of communities. The school works closely with the Nursing Council where the descriptions of professional responsibility include (NCNZ 2007)

> *competencies that relate to professional, legal and ethical responsibilities and cultural safety. These include being able to demonstrate knowledge and judgement and being accountable for own actions and decisions, while promoting an environment that maximises client safety, independence, quality of life and health*

The School believe EfS is already embedded in the graduate profile and learning outcomes through their holistic approach. The SPICES model adopted within the school represents the dimensions of nursing care: Social, Physical, Intellectual, Cultural, Emotional and Spiritual. Many course outcomes include aims like this one:

> *The aim of this course is to prepare health professionals to practise in an holistic context. With reference to anthropological and sociological concepts it is intended that students will develop an understanding of the richness of human diversity and develop attitudes commensurate with culturally safe practice (BN107000).*

In practice areas the school has examined processes. For example by encouraging the reuse of disposable equipment such as plastic tubing in practical classes, both cost savings and sustainability objectives were met.

4.4 Design

Design encompasses degrees in product, fashion, interiors and communication (plus significant numbers of students in foundation courses).

The Department of Design has signed up to the Designers Accord (http://www.designersaccord.org/). This is "a coalition of designers, educators, researchers, engineers, business consultants, and corporations, who are working together to create positive environmental and social impact". The vision of the Accord is a "creative community where the principles of sustainable design are seamlessly integrated into all practice and production".

The Accord makes some strong statements about the role of the designer, including being proactive: "all adopters to engage in the conversation about social and environmental impact with every client and customer, and integrate sustainable alternatives in their work".

The Designers Accord and the earlier Design Manifesto (Barnbrook 2007) make clear the wider responsibilities of designers:

> *The idea of the designer 'transparent communicator' is redundant. It was formulated before the rise of corporate power, globalisation, and before cool brands that graphic designers love to work for exploited and abused cheap foreign labour.*

Other transformations include Cradle-to-cradle design (McDonough and Braungart 2003). Design has adopted sustainability as a core concept in its teaching. Figure 3 from Pat Maguire, for example, shows the role of sustainability in the Master of Product Design.

1. Work with the wider community to envisage and articulate a role for each disciplines' practitioners for a sustainable future.
2. Work with the wider community to articulate a discipline response to sustainability. This may take the form of mission statements (etc) from professional societies.
3. Work with the wider community to identify expected behaviours for practitioners for sustainability challenges.
4. Develop an understanding of the current status of sustainability (values, awareness, knowledge, skills & behaviours) of all our stakeholders (students, intake, stakeholders, staff, graduates, professional/trade connections and our respective Iwi partners).
5. Identify sustainability statements for graduate outcome and core competency for graduate practitioners. This should be both incremental and transformative.
6. Develop learning outcomes integrated into courses looking simultaneously at course specific issues and holistic approaches.
7. Identify and promote exemplar resources and teaching strategies, this includes the pre-existing knowledge of sustainable practices and aspirations for iwi Māori locally.
8. Identify and address sustainability related areas missing from current curricula.
9. Assess lecturer expertise and skill requirements in education for sustainability and establish a development plan for the department.
10. Integrate sustainability into quality assurance processes (curriculum documents, moderation and monitoring checklists etc).
11. Frame "for sustainability" as a core driver for research. This means research aimed at increasing the sustainability of the discipline and promoting "<the discipline> for sustainability". Both of these will require a wider interdisciplinary approach to research.
12. Establish a network of sustainability champions to promote Education for Sustainability (EfS) as legitimate and mainstream areas of the discipline.
13. Undertake activities to raise the awareness of sustainability in the discipline.

Figure 1: Agenda for implementing education for sustainability.

Otago Polytechnic is committed to an "every graduate" approach to sustainability. We have adopted sustainability as one our "core capabilities". This means that we're putting in place teaching and learning opportunities so that every graduate (regardless of programme or level) may think and act as a "sustainable practitioner". In addition to being the "right thing to do", these values and skills will put you in a strong position for your career.

As we transform our teaching over the next couple of years you'll be seeing more and more examples of sustainability in your courses. The aim is to make this part of what you are learning, not something bolted on as an afterthought.

What "act as a sustainable practitioner" means will be different according to each discipline's role in a sustainable future.

So, depending on your chosen career, you can expect assignments on equipment purchasing to include sections on environmental options; or lectures on fish cookery to include sustainability ratings of different fish stock; or… whatever is dictated by a philosophy of sustainability for your programme.

<Policy statement goes here>

Some ideas to get you started in preparing yourself for your role as a sustainable practitioner:

- talk to your lecturers about what your discipline is doing to ensure a sustainable future. What are the challenges sustainability presents to your discipline? What are the opportunities?
- think about the actions you would like to take (now and in your working life) to ensure a sustainable future. Talk with your colleagues and lecturers about ways of making these happen
- be critical and creative in your assessment work. Challenge existing ideas to promote ideas of redesign, reduce, refuse, return; reuse; recycle.
- look for opportunities to enhance your learning through Education for Sustainability. Take part in the Sustainable Habitat Challenge, or the Imagine Cup, or work with a low decile primary school for a class project.
- think of ways of transferring your learning to include the bigger picture. Think about the impact of what you are learning across scales: in longer terms, in different places and on different communities.
- expect some programmes to change significantly, human services, for example is adopting "social justice" as a foundation principle for all learning.
- join a group (or better yet, form a group) to promote sustainability within your chosen career. GreenGeeks anyone?
- challenge your lecturers with different ideas. Ask for classes on cradle-to-cradle design, or discuss how ways of doing business are changing.
- participate in discussion: in class, out of class, OPSA, on the web. Here's a question to get you started: is the iPod a must-have or deliberately unsustainable act intent on driving consumption and with the clear side effect of premature disposal"? (Blevis).

Figure 2: Sustainability material from student handbook (along with tips for recycling etc)

In other programmes, EfS is both integrated, specific courses and elective options

Design for sustainability is a strategic design activity finalised to conceive and develop sustainable solutions. That is systems of products and services that enable people to live better consuming (far) fewer environmental resources and improving (or, in many cases, regenerating) their physical and social contexts of life. The paper focuses on EcoReDesign strategy to improve the environmental performance of manufactured products.

And;

Students clarify their professional goals and design philosophy in this course. Some students chose to investigate and identify their position relative to sustainable design as a future practitioner. These students researched design practitioners as influences, their own backgrounds and philosophical positions producing a set of related documentation that informed their final pitch where they identified a professional direction they wished to embark on when they finish their degree- i.e. wrote their own graduate profile.

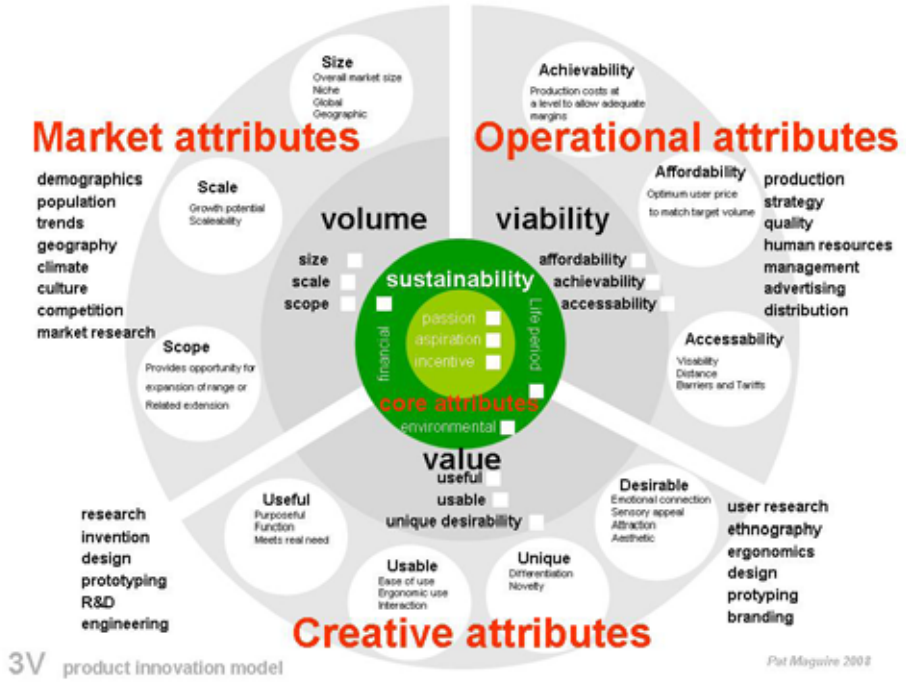

Figure 3: Sustainability as core principle in Master of Product Design (Pat Maguire)

Within many courses, project work has a decidedly sustainable angle; human powered vehicle; sustainable living; sustainable business plan; content rating;

And practices are changing too, with focus on digital prototyping, changing casting methods, and so on.

4.5 Midwifery

Midwifery is seen as sustainable practice. The underlying philosophy of Midwifery is aligned with sustainability. Midwifery promotes low resource use and minimising unnecessary intervention. Midwifery practice is about community based primary health, strengthening family relationships, health promotion etc. To some extent, the rise of sustainability is seen to be giving credence to the Midwifery approach (Davies 2007).

The school has taken the decision to integrate EfS, starting with a new foundation course: BMSD107 Sustainable development. Sustainability is then integrated into all second year courses with specific objectives in each course. In practice courses there is an added focus to advocate practices such as breast feeding, health maintenance, education of whanau, birthing in primary maternity facilities or home birth etc. In third year, sustainability is applied to midwifery practice via a course, 'Sustainable Midwifery practice'. This course picks up sustainable practice in terms of managing a small business, sustaining self in practice and sustainable practices in midwifery practice. The challenge is in promoting sustainability and midwifery as a primary health model in a context where medicalisation dominates the maternity services.

Significant changes to programme next year with a new programme design and delivery model is about making midwifery education sustainable for both students and midwifery staff; it is about keeping students in their home locations and utilising local maternity facilities and resources as much as possible. Working in collaboration with CPIT ensures best use of resources which are shared.

4.6 Occupational therapy

Occupational therapy, as a profession, has always maintained a core focus on sustainable practice. The profession has its roots in the Arts and Crafts and Moral Treatment movements, with extrinsic activities seen as being the way we communicate our intrinsic beliefs to the world. Hence it is a core belief that humans need to be involved in meaningful activity and that we gain connection to the world we live in via activity e.g. establishing place through constructing a home or cultivating a garden. We are interested, as occupational therapists, in manipulating activity contexts, social, physical, vocational etc, rather than people. The aim being to meet person/s goals wants or needs in relation to sustained involvement in meaningful activity (self care, vocational, social). We want our clients and patients to be as independent as possible, with intervention focused on doing with, or doing independently, rather than doing for. If we change the context a person operates in it should be for the betterment of and independence of the client, strengthening their day to day supports. As a profession we need to be very mindful of the resources and materials we use or put in place to sustain activity and not burden services or clients.

At the last PEAC meeting in April members were asked to describe what a sustainable occupational therapy practitioner would look like, their comments included:

- advocates of human rights/social justice/occupational justice
- prepared to accept/embrace change
- therapists consider the work/life balance of their clients and themselves
- use of leisure and play as primary occupations
- utilise real environments not simulated
- value time, both theirs and the clients - making every encounter count
- understand professionalism
- ensure equipment is carefully chosen, taking into account client needs, and sustainable practices

The school has set up a Social and Sustainability Committee comprised of both staff and students. The focus of this group is to foster, support and sustain our school community for staff and students as well as to support, introduce and encourage any notions or ideas which encourage sustainable practice within the school.

Notions of sustainability and the management of resources and materials are addressed in a number of stage one courses, notably Adaptive Living Occupation, Humanities for occupation and Fieldwork 2. All of these papers have a focus on humans' involvement in activity and what sustains this involvement. A constructivist approach is taken here with students often doing or teaching activities.

In Adaptive Living Occupation students start to investigate humans' involvement, both presently and historically, in activities broadly grouped under the categories of food and horticulture, games, craft and engineering and design. Students are first involved in activity workshops which look at participating in selected activities under these headings (including two weeks with Horticulture department). At all times there is a focus on doing from scratch, making do with limited resources and not wasting resources or materials. In the second half of this course students then have to plan, resource and present six activity workshops to members of the general public with the above focus being prevalent.

In Humanities for Occupational Therapy, students investigate, via imaginative literature, film, guest speakers, art and poetry, the commonalities and expressions of human occupations and what sustains them. We consider notions of human as makers and sustainers of place and the ways we connect and maintain our place in the world through labour, work and play. Students are asked to present on and involve their class in an activity they partake in, considering the history of this activity.

In Fieldwork 2 Students spend 3-4 hours per week for 14 weeks with a community with in the Dunedin city region. These communities all have a focus on meeting an occupational need for a selected group of people. Students are expected to fit in to the community as participant and facilitators of meaningful activity. They are expected to develop an understanding of how activities are managed, resourced and promoted, and how this enables the sustenance of these communities and those whom attend.

Other courses include Adaptive Living Technology Stage 1 and Design for the Individual Stage 2: Look at the design of equipment and accommodation, focusing on concepts of inclusivity. In case of buildings students consider how a home or public building is designed so as to limit the number of physical and other barriers that lead to the need for substantial subsequent adaption, consider designs which allow for the greatest flexibility of use. Equipment is considered in terms of reuse, modularisation etc. Students also look at suppliers of equipment and consider their policies for sustainability.

4.7 Sport

Adventure offers the first step in developing a motivation for sustainable practice through helping students to develop a connection with the natural world. A sustainable practitioner in Adventure would have a local focus and a minimalist approach. A sustainable practitioner in Sport is being articulated through Staff and PEAC discussion.

Sustainability is inherent in outdoors ethos, and similarly in the systems approach to sport performance. Yet, adventure is primarily a transport intensive activity and sports focuses on human centred performance. This poses significant dilemmas in both areas.

There are many examples in the Diploma in Outdoor Leadership and Management including a full 2nd year paper - Environmental Science and Education. In this paper students investigate a current environmental issue and present it to the class, calculate either their own houses or one of the courses ecological footprint, keep an 8 week diary on what they did to live lighter on the earth, run environmental education activities for another group of students, deliver an interpretive lesson on a local natural environment, learn about Tikanga and Te Reo Maori and a Maori view on the natural world, do some action for the environment. During the first year of this course students do an environmental issues module within a paper that also includes some action for the environment.

Staff training has now been initiated to help staff understand their own actions. The aim is to continue internal discussions on how to instigate sustainable practices throughout our programmes and within the staff and students via individuals, department actions and curriculum. From this discussion a strategic plan is as follows for 2008:

The school has set a series of goals specific to the school and an action plan to realise these. Under theme of personal awareness, personal change, course development and curriculum development

- For staff to become aware of what sustainable practice means to them individually on a personal and work level.

- Continued meetings on the development and education of this. Sustainability to become a permanent agenda item on staff meetings.
- build sustainable teaching tasks into course outlines that relate to sustainable practices regarding social, environmental and economic issues. These will be incorporated through the usual pre-moderation processes

4.8 Veterinary nursing

Veterinary nursing practice teaching is based on use of best practice standards. While these are largely health and safety focussed, there are elements of sustainability.

The School is taking a paper to the Animal Nursing and Technology Board on the subject of sustainability in relation to all our veterinary nursing programmes and what we are doing to ensure the veterinary industry is producing graduates that are sustainably confident. They will suggest to ANTECH could approach their ITO to specifically include sustainability within the national qualifications.

Firstly, sustainability should not be looked at in defined box it should be looked at "holistically" in conjunction with health and safety, Treaty, internationalisation, flexibility in teaching and facilitation, financing, resourcing, teaching, curriculum development and in particular developing all of these areas into the core competencies etc..... and if these things are being done responsibly this should lead to sustainable practices.

Specific behaviours include a commitment to innovation. Working effectively for the future means constant adjustment to future needs within the veterinary and animal related industries, as they are developed or identified. Progress in veterinary science and veterinary technology, animal welfare, academic thinking and current best practice within education and the veterinary industry will be reflected in the updated content of all components of the National Diploma in Veterinary Nursing and all programmes offered by the School.

The term “intellectual sustainability” may be new, but the concept is not. For many years, a cornerstone of Otago Polytechnic philosophy has been the production of a “life-long learner”. The National Diploma in Veterinary Nursing (as all programmes in the School) is inherently focused on the production of life-long learners. Specific behaviours include engendering a commitment to students taking responsibility for their own learning and developing values such as self-awareness and self motivation to stay up-to-date in a fast, challenging and ever changing industry.

As mentioned at the meeting sustainability is hidden within all our veterinary nursing programmes however it needs to be articulated more within the curriculum and through assessment. When we are teaching health and safety and ethics sustainability is inherently taught - without saying it - we need to start "saying it"!

The School has expended considerable resources and continues to work in conjunction with Educational Development Centre (see Appendix 15) and incorporate into its Business Plan new initiatives and strategies to ensure maximisation of sustainability practices. All staff within the School of Veterinary Nursing encourage students daily to take responsibility for and perform to “best practice standards” and become aware of the effect and/or impact on the environment of “non-best practice standards” within the veterinary industry. In particular, students are encouraged to think about the choices they are making on a daily basis and how this will affect other students, the community and the future.

All staff implement environmental sustainability by using resources carefully and respectfully. Waste is minimised, correct disposal methods are practiced to avoid damage or harm to the environment or others, and recycling and/or reuse is encouraged by all staff and students. All course materials have been redeveloped to be compatible with electronic delivery whether directly face to face or via distance. This has ensured continuity of information to students taking advantage of the differing modes of delivery, and the proposed future development of the National Diploma in Veterinary Nursing as a fulltime programme.

Specific behaviours include a commitment to innovation. Working effectively for the future means constant adjustment to future needs within the veterinary and animal related industries, as they are developed or identified. Progress in veterinary science and veterinary technology, animal welfare, academic thinking and current best practice within education and the veterinary industry will be reflected in the updated content of all components of the National Diploma in Veterinary Nursing and all programmes offered by the School.

4.9 Architecture and Engineering

As we noted last year (Mann and Smith 2007a,b), Engineering as a profession has worked to address sustainability. It is explicitly in the IPENZ (2005) code of ethics (although is somewhat narrowly defined as “environment”).

IPENZ code of ethics rule 4

Sustainable Management and Care of the Environment: Members shall recognise and respect the need for sustainable management of the planet's resources and endeavour to minimise adverse environmental impacts of their engineering activities for both present and future generations.

Under this clause you should have due regard to:

4.1 Using resources efficiently.

4.2 Endeavouring to minimise the generation of waste and encouraging environmentally sound reuse, recycling and disposal.

4.3 Recognising adverse impacts of your engineering activities on the environment and seeking to avoid or mitigate them.

4.4 Recognising the long-term imperative of sustainable management throughout your engineering

activities. (Sustainable Management is often defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs).

Alignment with The Dublin, Washington and Washington Accords will require further embedding of sustainability at a learning outcome level.

4.10 Hospitality

Hospitality combines the elements of sustainability from both manufacturing and service industries. Hence a sustainable practitioner in these disciplines operates from a systems view of processes is combined with behaviour change opportunities.

A rewriting of the programme document for the National Diploma in Hospitality (Management) (Level 5), for example, has seen explicit statement of sustainable graduate profile: Graduates will have an awareness of sustainability issues in the hospitality industry and will be able to apply principles in practice.

Sustainability will be integrated into the delivery of the programmes and will be modelled directly for students by the behaviour and attitude of teaching staff. Thus teaching staff must use resources responsibly in the classroom and in their personal work.

Several specific areas of sustainability have been identified for the both awards:

• Demonstrating a continuing commitment to best practice through stressing those hospitality methodologies that have been found to be most efficient and productive for example reducing power outputs, using seasonal products, composting waste and reducing washable linen usage.

• Using local products where available and coffee that is roasted in New Zealand.

• Demonstrating a commitment to and encouraging students to consider the advantages of recycling and using environmentally friendly products.

• Increasing provision of materials to students on-line rather than in hard copy.

• Maintaining intellectual currency in the discipline.

• Encouraging the construction of professional networks and support structures.

• Encouraging ownership and responsibility. Students need to realise that social sustainability is the result of everyone's actions, and each of us must consider the impact we are having. Students will at times be making choices and decisions on their own (rather than simply taking instruction from staff), and will see the outcomes of these decisions, both good and bad. They can experience this in a safe and controlled academic environment. When they are then faced with similar decisions in the "real world", they will better understand the causal relationship between their behaviour and the state of their communities.

This last outcome is significant in representing the impact sustainability is having on the institution. A year ago, in response to the chainsaw analogy (section 3) – suitably modified to unsustainable fish stock – was met with 'in the kitchen you do what you are told, the best we could hope for is that graduates would hold onto that knowledge for a few years until they are in a supervisory position'. Now, even within the acknowledged hierarchical structures of the kitchen, there is recognition of personal responsibility.

4.11 Art

Visual Arts programmes encounter sustainability issues in a very wide spectrum. The visual arts have a major role to play in the ways in which communities operate. The experience of art is one of validation and critique, celebration and mourning. The wider contextualisation of art in the programme ensures that students understand the ways in which their work both cements and critiques the social order.

On a more practical level, the pragmatics of healthy and viable art practices have led to the gradual movement from toxic to non-toxic materials in all subject areas and the development of understandings of the correct use and disposal of chemicals and other waste materials. Artworks may be designed to endure for a long time and consideration is given to the ways in which they are made and conserved. Other artworks are necessarily temporary in nature and consideration must be given also to the question of the disposal and re-use of the material used in their construction. The developing visual arts industry in the field of the digital arts has also led to an increased awareness of how communities are created and maintained in the digital environment and the sustainability of the digital infrastructure.

Graduates will have an understanding of the principles of sustainability. They will be able to evaluate the relative value of their work in relation to its socio-economic contexts and the ways in which it supports the social fabric and will recognise strategies for mitigating environmental and social harm in the conceptualisation and creation of their artworks and their practice as a whole.

The graduate profile includes an understanding of the role artists play in sustaining the cultural and spiritual life of the community and its cultures, and the pragmatic elements of the philosophy of sustainability in issues of care and conservation of resources and health and safety.

The School of Art at Otago Polytechnic maintains a regular programme of public seminars, lectures and workshops within which the principles concerning sustainability find direct focus. Examples of recent and immediately upcoming (2007-08) seminars, lectures and workshops on the above issues are:

- Mary Modeen (Glasgow School of Art staff) Spirit and Place: Working with Nature

- MFA June 2008 Workshop: Sustainability Today in Arts Practices
- Prof. Estelle Maré (University of South Africa) Sustainability Design and Empathy
- Dr Patricia Wallace (University of Canterbury) Kitenga hou: New Ways of Seeing Traditional Māori Dress

Within the MFA Programme, specific research projects focusing on sustainability issues include:

- *Vanishing Ice* project focused on the sustainability of New Zealand glaciers.
- *Tokū Haerenga* project focuses on Māori values and the use of resources in an arts practice today.
- *Beading my Amoeba* recycling project uses waste materials to argue for the aesthetic translation of rubbish materials.

Issues of sustainability are integrated into supervision, feedback, recommended reference material and the theoretical and practical framing of research projects.

All staff members in the School of Art are aware and proactive concerning sustainability issues. Artists and arts enquirers within the contemporary sphere are arguably more attentive to these issues than most other groups of teachers in tertiary environments. Reasons for this vary from the critical role of the artist in contemporary society today to the need to protect oneself and students from toxic substances in the studio. The current focus on sustainability at Otago Polytechnic provides an opportunity to scope the field of focus within the School of Art programmes. Through this process, it has become clear that this focus encompasses a wide range of concerns, from everyday vigilance on a practical level to the embeddedness of socio-political criticality within teaching, learning and research.

4.12 Other departments

Other departments are not covered in detail here. These include:

Educational development: development of permaculture design course; developing an education for sustainability (teaching practitioners course); Continuous investigation of various approaches to community engagement in sustainability development; Designing and proposing an initial framework for an informal and formal curriculum for developing sustainable capacity, community engagement and integrated and applied study.

Cromwell: The regional campus is grappling with sustainable practitioner questions in all three areas (Natural Resources, Adventure and Hospitality), working to develop a Certificate Sustainable Practice. Cromwell has developed multidisciplinary collaboration: a "closed loop" with students from horticulture and hospitality working together.

Computing: The issues surrounding sustainability in computing are wide and are covered in other papers (Mann and Smith 2007, ab, Love and Love 2008, Mann and Smith 2008).

5 Integrated initiatives

The discipline work is supported by several multidiscipline initiatives. Some of these are introduced here.

5.1 Survey

Leonard and Cronan (2005) examined shifting attitudes of students towards ethical influences. While Leonard and Cronan's focus was on a subset of what might be considered sustainability, it has important implications here. It is apparent that we do not have a baseline of acceptable behaviour in terms of sustainable behaviour (Fukukawa *et al.* 2007). Consequently, we do not have a model of how these attitudes are formed, and lastly, we do not know how these factors might change over time.

A survey has been undertaken of all incoming students. The survey is based on international benchmarks,: the New Ecological Paradigm (Dunlap *et al.* 2000), the Young Person's Survey (Fien *et al.* 2002) and Personal Meaning Mapping (Storksdieck *et al.* 2005). Results from this survey (n=587 will be published in July).

5.2 Living Campus

The Living Campus project melds all the components of the sustainability initiative through the development of an interactive sustainability museum and education programmes within a vibrant, productive community garden. It is envisaged that the Living Campus will become the hub for sustainability-oriented community education services. Staff and students from across the institution are collaborating with the wider community to convert the entire campus to a productive community garden.

5.3 Shac09

The Sustainable Habitat Challenge (ShaC 09) is a national collaborative project for teams around New Zealand to design, develop, and build sustainable housing in their local community. Otago Polytechnic is hosting and organising the challenge and has two teams involved.

5.4 Generic profile statements

Generic graduate profile statements are currently under development. Key sustainability curriculum areas (for example systems thinking, ethics, behavioural strategies) as developed by Second Nature (Second Nature, n.d.) are linked with NZQA level descriptors to produce exemplar learning outcomes for education for sustainability.

6 Observations

The introduction of the sustainability initiatives has seen a wide continuum of approaches to teaching sustainability across the campus, from EfS101 to full integration of sustainability concepts in existing courses. Both ends of the spectrum are acceptable as teaching staff interpret the concepts of sustainability in ways that complement their curriculum area.

For many lecturers and schools, this has been a validation of what they are already doing. In others it has been a challenge to reframe existing courses to take the sustainability concepts into account. The most progress has been made in areas where sustainability is seen as a core principle, not an add-on. The most progress is being made where sustainability is seen as a context for learning. Experiential projects involving sustainability are proving successful in many areas.

Our approach has been one of empowerment – supporting people who are transforming their teaching practice. To this end, institutional support in areas such as adding footnotes to moderation checklists has been vital: "All Otago Polytechnic assessments may include elements reflecting our commitment to the generic capabilities of literacy, numeracy, sustainability…".

Focussing on the role of the sustainable practitioner within each discipline is fundamental to our approach. By starting with recognising the contribution of the discipline to an improved future focused we have had almost no resistance from any academic area. The anticipated "this is nothing to do with us" response has not eventuated. Instead the responses are more "how can we contribute?", "this is so important to our area" and "at last, someone is listening". While based solely on our observations, we firmly believe that an alternative an approach that may have seen us starting with an audit of learning outcomes for "sustainabilityness", followed by wholesale adding of "…and sustainability" to outcomes and assignments would not have had the positive progress we have witnessed.

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