



## TIF 2003 Faculty of Science Project

*Enhancing the employability of Science graduates: increasing the awareness of students and staff to the needs of the employers*

### *Final Report Executive summary*

#### **Overview**

The aim of this project was to put processes in place to encourage students to take responsibility for developing generic attributes that embody the values of scholarship, citizenship and life long learning, and which may be directly related to the qualities sought by employers. As part of the project mechanisms would be implemented to enable students to self-assess the development of these attributes during the period of their degree program.

#### **Outcomes**

The project has produced; *For the Students:*

- a student user-friendly web site *Life Long Earning: matching your talents with employers' expectations* <http://lifelongearning.science.usyd.edu.au>

#### *For the Faculty:*

- a matrix of generic attributes and their associated skills that are considered to be those required for a professional scientist;
- detailed definitions of skills to support the matrix;
- a set of recommendations about how to advertise and market the web site to all students; and
- reports, seminar presentations and conference papers.

#### *For the College:*

- a web site that can be used, with appropriate discipline specific additions, by the Faculties of Agriculture, Food & Natural Resources, Engineering and Veterinary Science.

#### **Use of this report**

This report has three major purposes:

- to report to the funding body;
- to serve as a model of development; and
- to act as a full record of the project's activities.

**Mary Peat, Chris Stewart, Charlotte Taylor, Danielle Merrett  
November 2004**

# Contents

Chapter 1: Overview .....	1
<i>Appendices:</i>	
Skills Awareness Program: Preliminary Report on the pilot, 2002	
TIF 2003 Application	
TIF 2004 Application	
Chapter 2: Project plan .....	4
<i>Appendices:</i>	
Planning Document, January 2003	
Skills Reference Group membership	
Students involved in the trials and providing portfolio materials	
Letter and email to employers asking for their input	
TIF Interim Report December 2003	
Status Reports to the Faculty Teaching & Learning Committee, reports 1-6	
Chapter 3: Literature review and other generic skills web sites .....	14
Chapter 4: Evaluation and web site development .....	20
<i>Appendices:</i>	
Introductory letter to students, May 2003	
Documentation on Interpersonal skills trial, May 2003	
Marketing for trials May 2004	
Survey to students for May 2004 trial	
Evaluation for July-August evaluations 2004	
Chapter 5: Outputs .....	30
<i>Appendices:</i>	
Matrix of attributes and skills for an employable science graduate	
Definitions of skills: Business skills; Communication skills; Interpersonal skills;	
Personal skills; Perspectives; Research skills	
Discipline specific skills: Physics; chemistry; Mathematics and Statistics;	
Geosciences; Microbiology; Biochemistry; Psychology; Computer Science	
Life Long Earning web site home page	
Chapter 6: Reflections and unfinished business .....	32

# Chapter 1: Overview

## Introduction

The Faculty of Science has initiated a number of projects in line with University and external trends towards improving the student experience. It has a strong ongoing commitment to the provision of a positive total experience for its students as evidenced by its Student Transition Workshop, the use of student-centred flexible learning and its use of ICT in teaching, especially in large first year classes. Previous Faculty TIF grants have enabled the Faculty to enhance the quality and relevance of service teaching which contributes to the total experience of first year students in client faculties, to provide a professional development program, for new casual tutors and demonstrators, to help them develop appropriate skills within the classroom, and to provide the Faculty with guidelines for the use of group work activities within units of study. The philosophy for such projects is that they are rigorously evaluated, comfortably sustainable and become core business of the Faculty of Science.

To compliment these developments and activities the Faculty will put in place processes to encourage students to take responsibility for developing generic skills/attributes required for future employment, and the mechanisms to self assess the development of these attributes during the duration of a degree program.

## Background for the project

It is internationally recognised that university graduates need to develop and demonstrate competence in a range of attributes (variously labelled generic, key or transferable skills) which can be applied within the many contexts in which they will work (Lea and Street 1999, Dunne 1999). These attributes can therefore be used within the discipline area but will usually be transferred into new areas as graduates are employed. While a sound knowledge of the principles of the discipline is essential, this will frequently be seen as ephemeral in the constantly changing scientific fields - the skills associated with the scientific and general education will remain during the development and re-structuring of that knowledge, and while engaging in professional practice.

The growing emphasis on generic skills in higher education has several sources. One is the increasing evidence of demand from business and employer organisations for graduates to possess generic skills. There are also various economic, technological and educational arguments that have brought generic skills to wider attention. The contemporary focus is really part of a bigger debate about the purpose of university education and how to develop well educated persons who are both employable and capable of contributing to civil society (Kemmis 1998).

Business and employers are seeking more than generic skills. They are looking for graduates who are employable. Employability depends on several factors, including a self-belief and an ability to secure and retain employment, and being able to improve one's own productivity and income-earning prospects. These require the ability to both compete effectively in the job market and be able to move between positions, and 'learning to learn' for new job opportunities (ILO 2000).

Kirby (2000) puts these ideas into context by emphasising the shift to a knowledge-based economy that is accompanied by some seemingly intangible attributes like creativity, design flair, and innovative marketing. The DETYA-funded report *Employer Satisfaction with Graduate Skills* (2000) adds that employers perceive that many graduates are not employable within their institutions or organisations. In addition, the DEST and ANTA funded report *Employability Skills for the Future* (2002) emphasises the importance of workplace skills such as communication, teamwork, problem solving, initiative, planning and organisation. It also confirms that business and industry now require a broader range of skills than those of the early

1990s with managers acknowledging that personal attributes are as important as other employability skills, and that learning skills and self-management skills should be included in the new skills requirement framework. Hence, students need to be provided with opportunities that foster development of these skills and mechanisms whereby they can determine their own levels of competence.

## **The project**

A pilot program (*Faculty of Science Skills Awareness Program*) was set up in 2002 with the aim of helping students to develop an awareness of the significance of skills as part of their education and subsequent career. The pilot involved staff from the Faculty, the Library and the students in the Environmental Science degree program. The pilot endeavoured to define the generic skills that should be developed but was not able to agree on definitions and interpretations, noting that there were no University guidelines available to help. The pilot also endeavoured to measure student awareness of generic skills and personal competence /confidence but was unable to agree on a suitable set of questions. In addition the pilot discovered that there were too few resources available for students for self-help in practising and improving skills. The report of the pilot program is in Appendix 1.

In 2002 an application to the University's Teaching Improvement Fund 2003 (in Appendix 1) set out a mechanism to address the difficulties encountered with the pilot. The proposal aimed to put processes in place to encourage students to take responsibility for developing generic attributes that embody the values of scholarship and citizenship, and which may be **directly** related to the qualities sought by employers. As part of the project, mechanisms would be implemented to enable students to self-assess the development of these attributes during the period of a degree program.

The project focused on the development of a self-help web site that was student user-friendly to help students to develop a suitable set of attributes by the time they graduate.

The goals of the project were to:

- develop clear explanations of the core generic attributes and defining levels of competence
- provide students with a framework to understand the nature of the core generic attributes by developing a series of case scenarios on them
- help students learn the language of these attributes so that they can identify them in curricula
- help students identify from their learning opportunities the ongoing building of desirable attributes
- develop a mechanism for students to self-assess their awareness and competence for the various attributes
- offer recommendations to Faculty about how to mandate an audit process whereby students self-assess and keep a personal record

## **Deliverables and outputs**

*For the students* the deliverable is a web site *Life Long Earning: matching your talents with employers' expectations*, <http://lifelongearning.science.usyd.edu.au>.

*For the Faculty* the outputs include:

- a set of recommendations about how to advertise and market the web site to all students
- a matrix of skills that are considered to be those required for a professional scientist. This was the subject of much discussion with the reference group during the early stages of this project

- detailed definitions of skills to support the matrix (these became a glossary for the students);
- a literature survey which helped to identify the research background for the team
- seminar and poster presentations

It had been envisaged that a set of recommendations on how degree programs might be encouraged to track the opportunities to develop generic attributes might be developed but this was perceived to be the subject of a bigger project and perhaps might be done at a later date.

## Project Management

The project had an academic team (Mary Peat, Charlotte Taylor and Chris Stewart) and a project manager through UniServe Science (Anne Fernandez January 2003 – July 2003 and Danielle Merrett from February 2004). A Reference Group was appointed at the beginning of the project and their input sought at each milestone. Project management included scheduling regular meetings of the academic team, liaising with the Reference Group, reporting to the Faculty of Science at regular intervals, organising student trials of the web site during its development, documenting the discussions and team decisions, and involvement in the development of the web site from initial design to final product.

## Evaluation

As the main deliverable was to be a web site for use predominantly by undergraduate students, there was a series of trials with students during the development. These were invaluable in guiding the team to develop user-friendly and appropriate resources. Trials consisted of surveys of students and face-to-face meetings to discuss the project as it developed.

## Budget

The funding came in the form of TIF 2003 and TIF 2004 grants to the Faculty of Science from the College of Sciences and Technology (see Appendix 1).

Activity	Budget in \$
Project management salary for half-time over 1.5 years	35,000
Teaching/administrative relief for academic team members	13,000
Web construction	10,000
Consumables	2,000
<b>TOTAL</b>	<b>60,000</b>

## References

- DEST (2002) *Employability Skills for the Future* March 2002  
[http://www.dest.gov.au/ty/publications/employability\\_skills/index.htm](http://www.dest.gov.au/ty/publications/employability_skills/index.htm) (verified 13 December 2002)
- DETYA (2000) *Employer Satisfaction with Graduate Skills: Research Report 99/7* Feb 2000
- Dunne, E. (1999) *The Learning Society*. Kogan Page Limited: London
- ILO (2000) *Training for Employment: Social Inclusion, Productivity and Youth Employment* International Labour Organisation, 88<sup>th</sup> Session, Geneva, 16-20
- Kemmis, S. (1998) System and lifeworld, and the conditions of learning in late modernity  
*Curriculum Studies* 6(3), 269-305
- Kirby Report (2000) *Ministerial Review of Post Compulsory Education and Training Pathways in Victoria: Final Report* (Peter Kirby, Chair). Melbourne: DEET
- Lea, M. R. and Street, B. (1998) Student writing in Higher education: an academic literacies approach. *Studies in Higher Education* 23, 157-172

## Chapter 2: Project plan

The project put in place processes to encourage students to take responsibility for developing generic attributes that embody the values of scholarship and citizenship, and which may be directly related to the qualities sought by employers. The project also provides mechanisms to allow students to self-assess the development of these attributes throughout their degree program. The project built on the work of the 2002 pilot program (*Faculty of Science Skills Awareness Program*, see Appendix 1 in Chapter 1), and takes into account the difficulties encountered. One of the essential features of the project was to develop a student-friendly web site that fulfilled the requirements of the project but that would be sustainable over time with minimal input from the Faculty. This was in line with the philosophy for the development and implementation of other sustainable projects, e.g. the Faculty of Science's Student Transition Workshop and Staff Development Program for new tutors and demonstrators, the former now in its tenth year and the latter having been completed four times in two years.

The project was supported during its development by a project team, a planning committee and a reference group. The Planning Committee consisted of Professor Beryl Hesketh, PVC College who was considered to be a key stakeholder, Associate Professor Cyril Latimer (Faculty of Science), Dr Simon Barrie (Institute for Teaching and Learning), and the project team from the Faculty of Science of Associate Professor Mary Peat, Dr Charlotte Taylor and Dr Chris Stewart, and from UniServe Science, Ms Anne Fernandez (January –June 2003) and Ms Danielle Merrett (from February 2004). The planning committee's task was to help develop the planning document (see Appendix 2). The reference group (see Appendix 2) consisted of colleagues from around the University, mostly from the Faculty of Science but not exclusively. The reference group were sent emails about milestones and asked for electronic feedback as the project developed.

During the implementation of the project undergraduate and graduate students from within the Faculty of Science were invaluable in helping to steer the developments and provide example portfolios. They are acknowledged in Appendix 2.

### Aims of the project

Short term aims included:

- developing a set of clear explanations of the core generic attributes;
- defining levels of competence for the generic attributes
- providing students with a framework to understand the nature of the core generic attributes by incorporating them in a series of illustrative case scenarios
- helping students learn the language of these attributes so that they can identify them in curricula

Longer term aims of:

- helping students identify from their learning experiences opportunities to develop desirable attributes
- developing a mechanism for students to self-assess their awareness of and competence in the various attributes
- developing a set of guidelines for staff to help them to identify skill development opportunities for students within the curricula
- offering recommendations to Faculty about how to mandate an audit process whereby students self-assess and keep a personal record of their development

## Project Methodology

The project was conceptualized within the following framework:

**Preliminary phase**, consisting of:

- Literature review
- Identification of University of Sydney graduate attributes
- Identification of existing generic attributes projects at The University of Sydney
- Identification of generic attributes projects at other universities
- Establishment of a Skills Reference Group
- Articulation of related language used by employers

**Development and implementation phases**, consisting of:

- Articulation of generic attributes and skills to be included in the project
- Identification of opportunities within degree programs where skills may be practised
- Articulation of the scaffolding for students to make linkages relating to generic attributes
- Development of language-related case scenarios
- Documentation of typical tasks
- Interviewing and documenting the perceptions and advice of employers
- Articulation of a process for students' personal audit
- Development of a web site for student use
- Pilots with students in May 2003, August 2003; May 2004, August 2004
- Launch of student tested web site in August 2004 to a selection of degree programs

**Evaluation and reporting phase**:

- Evaluation of use of web site by students
- Evaluation of web site by academic staff in the College of Sciences and Technology and the reference group
- Regular reporting to the Faculty of Science's Teaching and Learning Committee with the production of an interim report at the end of the first year and two-monthly project updates
- Documentation of project and reporting of outcomes

## Proposed Timeline 2003

<b>January</b>	Planning
	Selection and explanation of attributes and skills
	Development of model
<b>February – June</b>	Design of scaffolding
	Development of initial case scenarios
	Development of typical tasks and case studies
	Mechanism for self-assessment – describing examples
	Mechanism for personal audit and creation of portfolio
<b>May – August</b>	Initial trials of paper-based materials for one area of the original matrix with students
	Evaluation of trials
<b>December</b>	Creation of web pages with evaluation changes in place

## Timeline 2004

<b>January – April</b>	Creating web pages
	Writing materials for more attribute groups
	Collecting examples and models from students
<b>May – August</b>	Trials with students and focus groups
	Re-working materials, relative emphasis and 'look' of web pages

	Collecting more examples from students
	Incorporation of Employer interviews
	Incorporation of interviews with students in the workforce
<b>September - November (i.e. 2nd semester)</b>	Evaluation of new web site with students in targeted degree programs
	Writing project report

## Project Milestones (PM)

### *PM 1 - Preliminary phase*

#### *Literature review*

A literature review was carried out to cover four main areas of interest:

- employability attributes (and skills) of graduates
- integration of graduate attributes into higher education curricula
- teaching and assessment of graduate attributes
- resources and staff development implications of introducing graduate attributes

The literature review (see Chapter 3) helped to inform the project group about the focus on graduate attributes at other institutions. During this stage of the project the University's Institute for Teaching and Learning set up its Generic Attributes Working Party (whose function was to help inform the development of Academic Board Policy relating to Graduate Attributes) and this also helped the project in determining the nomenclature used in the development. Chris Stewart was also a member of this ITL Working Party.

#### *Establishment of a Skills Reference Group*

This involved the identification of individuals, both within and external to The University of Sydney, who were to be invited to join a skills reference group, provide valuable discussion and comments during the development. The Skills Reference Group was an e-reference group – no meetings took place, all communications were electronic. As well as email requests to the group, a web site was set up and maintained to disseminate information to all those interested (<http://science.uniserve.edu.au/projects/skills/>).

#### *Articulation of related language used by employers*

This involved the compilation of a list of terms used by employers when referring to the qualities they seek in graduates and the collection of some typical job advertisements. Examples are included on the web site.

### *PM 2 - Development and implementation phases*

#### *Articulation of generic attributes and skills to be included in the project*

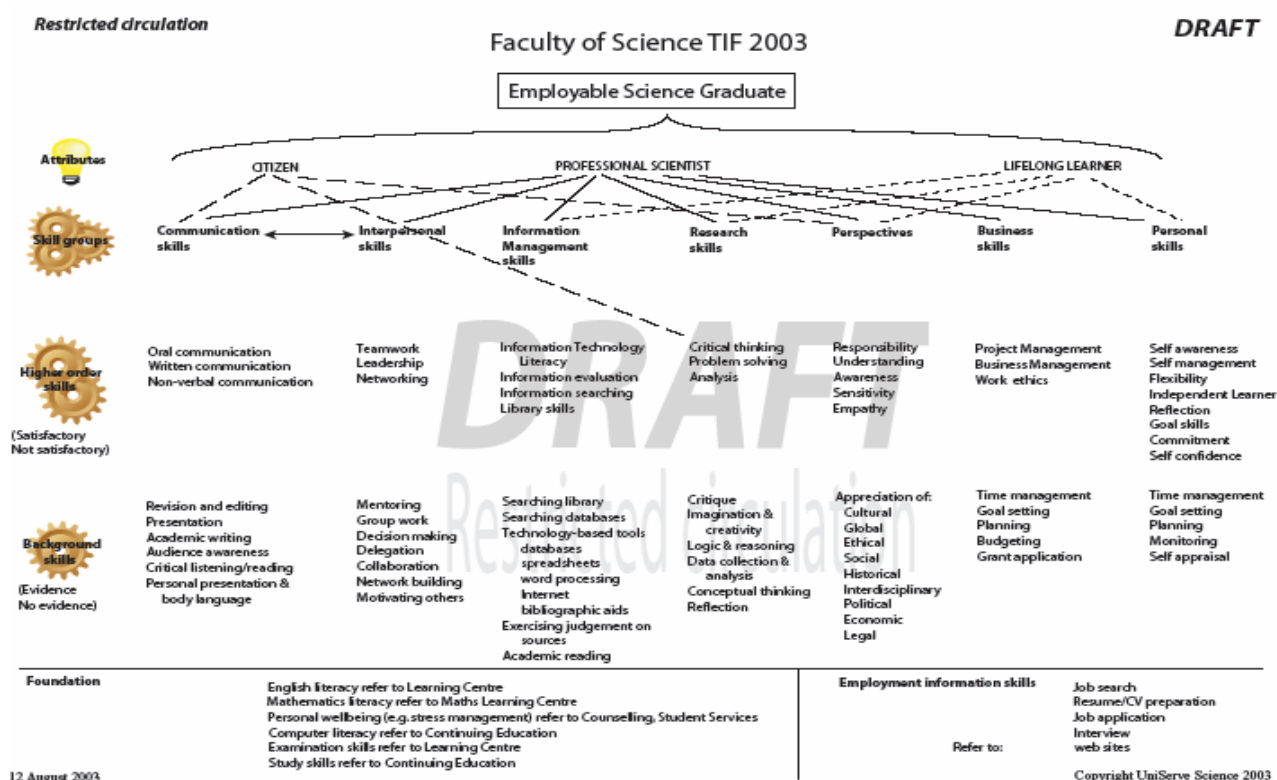
A review of the existing literature on generic attributes was conducted and any current attributes programs surveyed to create a catalogue of generic attributes and skills. At the same time a list of generic skills was created based on those identified as being of importance in teaching in the Faculty of Science. As an adjunct to this list each skill was described and appropriate keywords allocated, as shown below:

Team work	The ability to interact effectively with others in order to contribute to a common outcome, and to take a leadership role when necessary	Collaborative, joint goals
-----------	--	----------------------------

As part of their research the ITL have defined a hierarchical model of the interaction between skills and attributes (<http://www.itl.usyd.edu.au/GraduateAttributes/>). Attributes are seen to be acquired through the mastery of one or more generic skills. Generic skills are seen to range from foundation (e.g. English language), through add-on (modular, unrelated to discipline content, e.g. essay writing), to embedded (linked clusters, related to discipline content, e.g.

problem solving, thinking). The Faculty of Science project has thus integrated such global and professional attributes with skills to define a working model suitable for the Faculty. In the above context discipline specific skills (e.g. ability to carry out a titration, ability to dissect a frog, ability to perform a particular calculation) were seen to be part of the content for a particular discipline and are therefore not part of the Faculty project (or the ITL project).

Once the relationships between attributes and skills had been identified, it was possible to create a matrix showing both this relationship, plus any gaps in our listing, and identifying the way in which skills were integrated within the curriculum. At this point a series of discussions was required to develop alignment between the University listing of generic attributes and the Faculty project matrix. It was decided that some consolidation of attribute categories was required for the matrix and the number of attribute groups was eventually reduced to the five used on the web site.



This mapping process was particularly useful in defining the scope of our project and providing a framework on which to build the materials for students. However at this time it was also acknowledged that the complexity of the matrix precluded it being used as a map for students. Its content therefore had to be translated into a more digestible model for the web site. It was decided to focus initially on creating materials to cover all aspects of description, definition and modelling of skills for one attribute group in the matrix. This could then be used in a preliminary trial of materials with volunteer students (see chapter 4), before the rest of the information was put together.

**Identification of opportunities within the degree program where skills may be practised**

In the original matrix generic skills were seen to range from foundation (e.g. English language), through those adjunct to content material (e.g. essay writing), to those integrated with the content and delivery of courses (e.g. problem solving, thinking). These areas are still present in the web site but are presented as background information for those students who may need it. In general this fits with the student perception that the focus of the site is on job finding and

portfolios, and that most students have a fairly good basic understanding of the skills involved. Foundation skills were defined as those that students would normally be expected to bring with them to university or are outside the degree program structure. It was decided, in the context of this project, that if students did not consider themselves competent in these skills (or were told this during their studies) they could be directed, on the web site, to places such as the Learning Centre, the Mathematics Learning Centre, the Centre for English Teaching, or Continuing Education (e.g. University Preparation Courses, Bridging Courses) for assistance. In addition skills were identified which are usually associated with units of study, but which can be taught in a modular fashion – for example, students could attend a short course or workshop, or may be given a printed guide, such as an essay writing booklet. These initiatives would also be highlighted to students on the web site. Embedded skills are usually associated more directly with units of study and are often incorporated into assignments and assessments. Examples of activities within the curriculum which develop skills have been modelled using examples provided by students. A range of skill development levels has been catered for by using examples from junior and more senior units, with students recognising that simpler or more basic activities will be supplanted in a portfolio by more complex examples as the degree program progresses.

### Research and Inquiry

---

Your ability to take a problem and search for relevant information, suggest solutions and judge their merits is a very valuable skill to an employer. This could be as simple as finding the best price for a new piece of office equipment, or as complex as planning a scientific experiment to test a new theory.

#### How can you improve these skills?

- Take on a research project: many university schools and departments offer research projects in higher years, some during the summer months. Talk to your lecturers about possibilities in areas you find interesting.
- Get more involved: if you are part of a club, sporting team or some other organisation, you could get involved at a higher level and take part in running things. You'll get to practise many research skills, like problem solving, critical thinking and analysis (not to mention your communication skills!)



#### ***Articulation of the scaffolding for students to make the linkages relating to generic attributes***

We appreciated that students will need to be able to recognise the value of the skills, and to take responsibility for practising them and monitoring their progress. Scaffolding has therefore been built into various areas of the web site, but particularly in the portfolio sections to help the students. The degree of scaffolding has been reduced from that originally mapped, as student evaluations indicated they have a broad understanding of what is required when working with a skill group. Instead the concept of scaffolding has become the focus of self assessment, mainly through comparison with student experiences and examples provided.

### ***Development of language related case scenarios***

Student evaluations indicated that information from employers would be particularly useful. This was stressed in terms of understanding how to translate portfolio records into an application for a job or for a CV. Students were also keen to recognise what employers are referring to when they talk of 'employability skills'. The interviews and samples, on the web site, address these needs and also provide a link to the relationship between employability and the generic skills they practise at University. Employers, in science-related fields or organisations, were contacted to arrange an interview at which they would discuss their experiences in the job, and what they would look for in a new employee. This approach proved too difficult in terms of arranging meetings, so a set of questions was sent to each person and their responses to these collated into the interviews documented on the web site, as show below:

**“What advice would you give to undergraduate science students who are looking to become more employable by the time they graduate?”**

Get as good a grade as one can, try to do an Honours and higher degree as soon as possible. Get some work experience in the chosen field in which they should demonstrate to the employer the above attributes. But, above all, be logical, keen, and sharp and work hard.”

The full set of questions is in Appendix 2.

### ***Documentation of typical tasks***

To help students recognise these skills and identify opportunities within the curriculum for their development, examples of typical tasks, probably set as assessments, have been included. As we collect more of these from students they will be added to the site to extend the range of activities and discipline/degree areas.

### ***Articulation of student benchmarking opportunities (self-assessment)***

To be able to self-assess levels of competence, students have been provided with benchmarking opportunities, particularly in the portfolio section of the site. This has involved the production of guidelines, in the form of checklist tables and case scenarios, which students can use to model their own experiences and progress. The checklist in the reflective areas of portfolio building has been identified as very useful for students. It is also acknowledged by the web site developers and the students that the onus lies with the student for collection of materials and subsequent reflection. There is a clear expectation that students will work independently with this resource and it was agreed that the concept of employability is a powerful motivating force for encouraging use of the web site.

---

## Using tables to reflect

One way to reflect on your skills is to use a table to identify any missing skills by placing a tick against each skill you have gained from your activities.

Jane Doe's Skills				
Communication	Information Literacy	Research and Inquiry	Ethical, Social and Professional Understanding	Personal and Intellectual Autonomy
Oral ✓	IT literacy	Critical thinking ✓	Responsibility ✓✓	Independent learning ✓
Written ✓✓	Information evaluation ✓	Problem solving ✓	Understanding	Self management ✓✓✓
Non-verbal	Information searching	Analysis ✓✓	Awareness	Goal skills ✓
Teamwork ✓✓✓ ✓	Library skills	Dissemination	Sensitivity ✓	
Leadership ✓			Empathy ✓	
Networking ✓✓				

Examine how the following activities have been used to complete this table:

- Member of a soccer team, organised the annual trophy night (developed teamwork and leadership skills)
- Member of the Grade 12 High School debating club, runners up, NSW competition (developed written and oral communication skills, teamwork, self-awareness)
- Bush Care Volunteer during years 11 and 12 (developed responsibility and awareness, commitment and self-management)
- Working for fast food outlet during last three years of school (developed responsibility, teamwork, self-management, self-confidence and work ethics)
- Student Point of Contact during O-Week (developed leadership, empathy, sensitivity, flexibility and oral communication skills)

### ***Articulation of the process for creating student portfolios***

The emphasis of the personal portfolio to demonstrate the progress of skills competence has been enhanced in the final version of the web site. This was a move recommended by students and provides additional motivation and hands-on activities for users. This will involve documentation of what students might collect as evidence and the identification and documentation of available tools for maintaining the personal audit. Students will be encouraged to incorporate both curricular and extra-curricular activities into their portfolio. Sample templates of such documents have been provided and case study examples, written by students, are available. It has been acknowledged that students will collect and organise their materials in different ways.

### Matching your portfolio to selection criteria

Here is an example of actual selection criteria used by the ABS to recruit graduates. On the right are a few basic examples a graduate may use to address these criteria.

Graduate Careers within the ABS (Australian Bureau of Statistics)	
<b>Selection Criteria</b>	
Graduates must have a proven record of academic achievement - as a minimum, a three-year bachelor degree, completed before or at the end of the relevant year. Although preference will be given to applicants with formal qualifications for IT Graduate positions, a minimum of two years relevant, and current, work experience may be considered acceptable in the absence of formal qualifications. For Cadet positions, applicants must be eligible to enrol in an honours year in the following year, in either Econometrics, Mathematics/Statistics, or a closely related field.	
1. Sound conceptual, investigative and analytical skills, together with an ability to undertake statistical research projects.	Group research project
2. Well-developed oral and written communication skills, and an ability to explain complex ideas to a non-technical audience including clients, respondents and colleagues.	Poster presentation
3. Good interpersonal and liaison skills, including the initiative, drive and flexibility to achieve results.	Mentor for Computer Science
4. An ability to organise tasks, work effectively in teams or individually and meet deadlines.	Year 12 Peer Support leader
5. A demonstrated understanding of the role of the ABS.	
6. Relevant tertiary qualifications and a demonstrated level of academic achievement.	

A graduate who has constructed a full portfolio from a log of recorded activities will have little difficulty in addressing these criteria.

### *Outcomes*

The project has thus produced:

- a mechanism for introducing students to the skills and attributes at the start of their university studies
- a mechanism for maintaining awareness of skills and attributes as students progress through their degree program
- a mechanism for providing student access to skills materials using a student-friendly web site
- documentation for students, in the form of a glossary, that clearly explains the identified core generic attributes
- examples of typical curriculum-based tasks that foster these generic attributes
- a mechanism for students to self-assess their awareness and competence of the various skills
- a mechanism to show students how to keep a personal audit which builds into a portfolio

The above items have been incorporated into a web presentation which appeals to students' desire to work towards 'getting a good job', and highlights areas which provide the motivation to use the materials.

### ***Piloting with student groups***

Students were involved in the development of the project and the web site at all stages. In May 2003 students were invited to review the project plan associated with how we were going to present ideas about how students should become aware of the need to identify their skill base and know what it means with respect to employers requirements of graduates. From the trial in May a web site was developed to extend these ideas and the group of students was again invited in to work on the way we were presenting the information (August 2003).

The second trial led us to review the structure of the web site and to develop what we thought would be a more user-friendly structure. This was done and then students invited in August 2004 to comment on the web site, its navigability, ease of use, use of icons, etc. At this point the students were able to better express what they thought was of pivotal importance to them and this was, not the extensive identification and defining of attributes into clusters and subsets, but how to think about their individual skills, the development of these, what opportunities there were in a degree program, and how to apply for jobs. The title *Life Long Earning; matching your talents with employers' expectations*, is a direct consequence of these discussions.

The details of the trials and their outcomes are separately reported in Chapter 4.

## ***PM 3 - Evaluation and reporting phase***

### ***Evaluation methodology***

This involves the identification and use of an appropriate methodology for evaluating the level of success of the pilot and the project. Feedback was sought from students, staff, and employer groups, using surveys, questionnaires, interviews, sample audits, and audits of opportunities developed within the disciplines.

### ***Documentation of project and reporting***

An interim report was prepared at the end of the first year of the project and coincided with the submission of an application for further funding. In addition regular reports were sent to the Faculty Teaching and Learning Committee and any queries discussed at its meetings. The members of this committee took on a reference group role.

## ***PM 4 - Disseminations***

During the development of the project and the student web site the project team has disseminated information to a wide audience so that formative feedback could be incorporated into the development. Activities include:

- regular written reports to the Faculty of Science Teaching and Learning Committee (Status Reports March 2003 – May 2004), see Appendix 2
- Seminar to Science Librarians, August 2003, see Chapter 5
- Interim report to the PVC College, December 2003, see Appendix 2
- Poster presented at the VC's Showcase, November 2003, see Chapter 5
- Presentation at the First Year Experience Forum 2004, held by UniServe Science at the University of Sydney, September 2004
- *Life long earning* web site <http://www.lifelongearning.science.usyd.edu.au>

Future dissemination will include a paper submitted to a teaching and learning conference and a paper submitted to an appropriate journal.

### *Summary*

Overall, the initial planning process produced a document and proposals which have been successfully implemented. The way in which the materials and activities originally envisaged have been presented to students has been radically changed following intensive evaluations. This has been a most rewarding process for the implementation team and has resulted in a much more user-friendly and dynamic product.

## **Chapter 3: Literature review and other generic skills web sites**

It was decided at the outset that we would find out the current status of Australian and international higher education sectors, with respect to working on ways to enhance the generic attributes of graduates. This required finding out what other institutions identified as graduate attributes and how they were emphasising the development of such attributes during a degree program. During the project we also made modifications to our ideas and terminology according to the developments within our own institution as the Institute for Teaching and Learning's Generic Attributes Project, began during our first six months, unfolded.

### **Selected Literature Review**

A quick review of the efforts made by educational institutions, employer groups and governments to define the elusive notion of generic skills, shows that there is very little in the way of consensus. The mix of terminology used, including generic skills, generic attributes, graduate attributes, employability skills, graduate capabilities, core skills, key skills, the list goes on, betrays the confused state of discourse around these issues. Bennett, Dunne and Carré (2000) chronicle the history of this discourse, pointing to its origin in the various crises in education over the past few decades, including a crisis in the perceived purpose of university-based education. Employer groups have weighed in, bemoaning university graduates' lack of suitable skills and calling for universities to provide education incorporating long 'wish-lists' of skills and attributes that will make graduates more employable.

One fundamental problem surrounding the discussion of generic skills is the lack of any theoretical basis underlying the choice and definition of the skills themselves. Bennett et al. (2000) argue that curriculum reform should be based on something more than a mostly arbitrary collection of skills seen as desirable by employers. Yet many universities are scrambling to put in place generic skills policies and programs with little solid educational or psychological theoretical base. As the authors put it, 'prescription has outrun conceptualisation'.

With this in mind, this document provides an overview of the state of generic skills initiatives in Australian universities and the UK, with particular reference to those studies that have attempted the difficult task of establishing a theoretical framework for generic skills and their integration into university courses.

### **Defining generic Skills**

#### ***The Australian Push***

The recent Nelson Report (Nelson, 2002a), *Employability Skills for the Future*, follows a series of governmental reports on the need to ensure Australia remains competitive in the 'global knowledge-based economy'. The report states that young people require a set of skills to prepare them for employment and to ensure they are able to retain that employment in the future. The Department of Education, Science and Training (DEST) set up a team to work with a large number of employer groups, using focus groups, interviews and case studies, to identify the skills the employers deemed important, desirable or necessary for success in employment.

The report outcomes list a large set of attributes and skills for employability identified from the research process. Desirable attributes (non skill-based behaviours) included 'loyalty', 'commonsense' and 'sense of humour'. Eight 'key skills' were identified:

- Communication skills
- Teamwork skills

- Problem solving skills
- Initiative and enterprise skills
- Planning and organising skills
- Self-management skills
- Learning skills
- Technology skills

The report includes longer lists of ‘elements’ that define each skill (such as ‘Listening and understanding’, ‘Being assertive’ and ‘Empathising’ for Communication skills).

As lists of generic skills go, this is typical of many of the lists proposed by universities such as The University of Sydney (university policies on generic skills are discussed below). However, the *Employability* report carries the same baggage as other studies of its kind: to what extent is a set of skills identified by employer groups a suitable basis for reform in university education? What theoretical basis underlies the identification of these groups of skills that makes them appropriate for university courses?

The University of Sydney Academic Board responded to the *Employability* report (University of Sydney, 2002a), criticising the report for ignoring or downplaying the particular strengths of graduates from a research-based institution. While recognising that a focus on graduate employability is important in informing the review and creation of courses, the main point of contention between the University’s policy on generic skills (discussed below) and the *Employability* report is that the *Employability* skills do not reference knowledge skills such as having a specialist body of knowledge and scholarship or research skills. The committee states, ‘In our experience, employers of university graduates give more attention than the report recognises to [personal attributes, attitudes and understandings]’. Lifelong learning, curiosity, and the ability to deal with uncertainty, an inquiry-based approach to problems – these are all strengths of graduates from a research-intensive university environment. The *Employability* skills understate the value to employers of the very skills that make university graduates special.

### *The UK perspective*

As in Australia, the problems of defining and addressing generic skills in higher education have been debated for over a decade in the United Kingdom; however, it is only recently that any kind of coherent picture has begun to emerge. Until the late 1990s, policies on generic skills and graduate employability contained a confusing mix of terminology and (typically long) lists of skills amounting to little more than ‘wish-lists’, indicating the pressure upon universities to mould curricula to accommodate the wishes of government and employers.

Bennett et al. (2000) have reported on a lengthy study of academic staff, student and employer perspectives of the skills associated with university education and employment, and how those skills are acquired at university and in employment settings. Their model of generic skills, based on their research findings, is ‘generic in that [it] can potentially be applied to any discipline, to any course in higher education, to the workplace or indeed to any other context’.

The model presents skills in four broad areas of ‘management skills’: management of self, of others, of task, and of information. These four areas break down into sets of sub-skills – for example, management of information includes ‘Use appropriate language and form in a range of activities’, while management of others includes ‘Take initiative and lead others’. The four management skills areas cover most of the skills encountered in policy documents and skills statements elsewhere, but provide a convenient, research based framework for those skills.

Many UK universities have undertaken studies to examine ways to embed generic skills into the undergraduate curriculum. The report *An institutional approach to developing students’ transferable skills* (Atlay and Harris, 2000) describes the University of Luton’s approach to identifying and incorporating generic skills within course programs. The skills were defined ‘after extensive discussion both institutionally and within departments, embracing consultations with the University’s employer partners as well as staff and students’, and fall into four groups:

information retrieval and handling; communication and presentation; planning and solving; and social development and interaction. Module descriptions for each subject were rewritten to make the skills more explicit. A 'skills template' was constructed for each of the skill groups that provides descriptors for various levels of achievement for the different skills, and indicates the operational context where the skill development is expected to occur.

The University of Nottingham delivered their final report of their *Embedding Key Skills within a Traditional University* project, funded by the DfEE (Chapple and Tolley, 2000). The project aimed to embed generic skills into a range of undergraduate and postgraduate courses, and to find mechanisms to assess students' development of those skills. Each discipline nominated the specific skills that were 'naturally occurring' within their existing course structures, and developed ways to make those skills explicitly recordable and assessable. The independent evaluator's report on the Nottingham project indicates that there were serious difficulties encountered in defining and assessing the skills.

### **The GSA: Assessing generic skills**

Once the skills are identified, of course, the question of assessing those skills must be addressed. The Nelson Report, *Striving for Quality*, (Nelson, 2002b), proposed the use of a standardised skills assessment test, the ACER Graduate Skills Assessment (GSA), to measure student performance on generic skills upon entrance to and exit from their degrees. This would provide a way to monitor the 'value added' by universities in terms of skills that promote graduates' employability.

However, a number of educational groups have responded negatively to this report, including the Victorian Language and Learning Network (Clerehan *et al.*, 2002) and the Business and Higher Education Round Table (Hager, Holland and Beckett, 2002). The VLLN response questioned the validity of the GSA test and national testing in general, on grounds of equity and cultural inclusiveness. They note that the skills outlined in *Striving for Quality* are not suited to psychometric testing, and the subset of these skills included in the GSA test – written communication, interpersonal understandings, problem solving and critical thinking – leave out the very skills that universities are geared towards teaching.

The BHERT Round Table policy document addresses the importance of generic skills in university education, as part of a 'bigger focus on the purpose of university education ... how to develop well-educated persons who are employable and capable of contributing to civil society'. However, it recognises that employer-articulated needs do not necessarily define suitable sets of skills for university education, and suggest, 'An important task is to unpack what [employers] are really saying and put it into an education framework'.

The policy document makes sound educational arguments for an increased focus on generic skills in university education, in particular emphasising the strong links between the kinds of learning experiences that foster the development of generic skills, and those that feature 'powerful' teaching and learning environments that lead to deep understanding. It also, however, attacks the notion of measuring isolated skills, such as with the GSA, emphasising instead the contextual nature of generic skills. Transferability of skills is seen as confidence in diverse contexts: 'While we might want to say that university graduates develop a range of generic skills, of more significance is their capacity to deploy suitable combinations of these attributes to deal with the particular professional situations in which they find themselves ... Rather than being viewed as discrete skills that people learn to transfer, generic skills should be seen as learnt capacities to handle an increasing variety of diverse situations'.

## **Incorporating generic skills into courses: the Australian Technology Network (ATN)**

With pressure from government and employer groups for change, the time for considering generic skills in academic environments has come. Many institutions across Australia have implemented policies and programs geared towards defining and developing generic skills within their courses. Some of these are institution-wide, large-scale initiatives, others are at the level of individual degrees or units of study.

Perhaps the largest initiative belongs to the ATN's Graduate Capabilities Project (Bowden et al., 2000). The Network (UTS, QUT, Curtin, RMIT and UniSA) has collaborated on a conceptual framework for the development of programs that incorporate teaching and learning environments promoting a university's nominated set of graduate capabilities. The definition of such capabilities is left to the individual universities.

The ATN project sets out six principles for the development of graduate capabilities within courses:

1. Desirable capabilities are most successfully formulated at both the university and the course level.
2. The development, practice and assessment of graduate capabilities are most effectively achieved in the context of discipline knowledge.
3. Exposure to and reflection on a variety of teaching and learning experiences fosters a focal awareness of graduate capability development.
4. Assessment should align with the course/subject goals and teaching and learning practice.
5. A package for the assessment of graduate capabilities should include items designed for a range of purposes.
6. Students benefit from progressive feedback on their development of graduate capabilities.

The project describes a series of case studies of courses within the ATN where different capabilities have been developed, and provides extensive guidelines for staff developing programs based on the capabilities framework.

While it avoids the theoretical problems associated with defining the capabilities themselves, the ATN project gives a solid framework for the design of courses and the benchmarking of skills and capabilities within those courses. The attainment of capabilities is described at four qualitatively different levels, in order of increasing complexity of understanding: the *scoping* level, the *enabling* level, the *training* level and the *relating* level. University courses, the ATN team argues, should aim at the highest level in this hierarchy.

### **The University of Sydney's approaches to generic skills**

The University of Sydney's Policy on Generic Skills (University of Sydney 1997), passed by the Academic Board in 1993 and revised in 1997, lists the following set of skills:

- Knowledge Skills
- Thinking Skills
- Personal Skills
- Personal Attributes
- Practical Skills

While this list contains many elements that overlap strongly with the Nelson skills list, it is evident from the inconsistencies in terminology and the lack of concrete definition of what is meant by these skills (or are they attributes?) that they are not derived from any deep

understanding of how generic skills are conceptualised. They have, however, led to many different initiatives within the faculties, schools and departments across the University.

The School of Biological Sciences have introduced skills-based resources at various levels, for example, the Intermediate Generic Skills web pages (University of Sydney, 2003a) introduce students to some of the skills required for writing and presenting in biology, referencing academic literature and so on. This is similar to the 'No-frills Generic Skills' web site created in Physiology (Frommer, undated), with online documentation about the scientific method, writing in science and learning skills.

The Faculty of Engineering, Strategic Plan for Teaching and Learning, 2000-2004 (University of Sydney, 2000), states the goal of supporting students in developing Engineering and University generic attributes, through building the attributes into each unit of study, and implementing testing of skills at entry and at graduation to monitor progress. Engineering is also introducing a Faculty-wide first-year unit with some basis in generic skills such as communication and problem solving.

The Faculty of Science has attempted to address generic skills through a series of initiatives (culminating in this project). The Schools of Biological Sciences, Physics and Chemistry collaborated with the library on the development of a Science Skills Course (Taylor, 2003). Initial discussion of the nature of the course debated whether it should be a stand-alone unit or an integrated program within laboratory units in each discipline, and whether it should play a remedial role or be compulsory for every science student. The trial-run of this course, with a small group of students in 2002, encountered serious logistical problems, including the difficulty of interpreting and assessing the generic skills, and a lack of available resources for students (and staff) to make sense of the skills they are meant to be learning.

The Faculty of Rural Management at the University's Orange campus has implemented a plan for first-year students' academic orientation and transition (University of Sydney, 2002b) that includes an objective to 'enhance students' learning by developing their knowledge and skills, including generic skills'. The Faculty has produced its own set of nine 'capabilities', which overlaps in many areas with the University's generic skills.

The Institute for Teaching and Learning has embarked on a project to revise the University's statement on generic skills (University of Sydney, 2003b), and to provide a set of resources to support staff in encouraging students to develop appropriate skills and attributes. In the course of this project they will form a working group, seek a theoretical basis for the generic skills and graduate attributes valued by the University and employers, and suggest processes to benchmark students' development and achievement of the skills.

## ***References***

- Atlay, M. and Harris, R. (2000) An institutional approach to developing students' transferable skills. *Innovations in Education and Training International*, **37**(1), 76–84.
- Bennett, N., Dunne, E. and Carré, C. (2000) *Skills Development in Higher Education and Employment*. Buckingham: The Society for Research into Higher Education and Open University Press.
- Bowden, J., Hart, G., King, B., Trigwell, K. and Watts, O. (2000) Generic Capabilities of ATN University Graduates, Draft Report, <http://www.clt.uts.edu.au/ATN.grad.cap.project.index.html>
- Chapple, M. and Tolley, H. (2000) Embedding the development of key skills within a traditional university. In S. Fallows and C. Steven (Eds), *Integrating key skills in higher education: Employability, transferable skills and learning for life*, London: Kogan Page Ltd
- Cleahen, R., Chanock, K., Moore, T. and Prince, A. (2002) Submission to the Minister for Education, Science and Training, The Honourable Dr Brendan Nelson, on the Ministerial Discussion Paper,

- Striving for Quality: Learning, Teaching and Scholarship*. Submission by the Victorian Language and Learning Network.  
[http://www.backingaustraliasfuture.gov.au/submissions/issues\\_sub/pdf/i66.pdf](http://www.backingaustraliasfuture.gov.au/submissions/issues_sub/pdf/i66.pdf)
- Frommer, M. (undated) No frills generic skills for Physiology.  
<http://www.physiol.usyd.edu.au/students/current/tips/>
- Hager, P., Holland, S. and Beckett, D. (2002) Enhancing the Learning and Employability of Graduates: The Role of Generic Skills. *Business and Higher Education Round Table Position Paper No. 9*.  
[http://www.bhert.com/publications\\_PolicyStatements.htm](http://www.bhert.com/publications_PolicyStatements.htm)
- Nelson, B. (2002a) *Employability Skills for the Future*. Ministerial discussion paper, Canberra: Commonwealth of Australia.  
[http://www.dest.gov.au/ty/publications/employability\\_skills/index.htm](http://www.dest.gov.au/ty/publications/employability_skills/index.htm)
- Nelson, B. (2002b) *Striving for Quality: Learning, teaching and scholarship*. Ministerial discussion paper. Canberra: Commonwealth of Australia.  
<http://www.backingaustraliasfuture.gov.au/pubs.htm>
- Oakey, D., Doyle, M. and Smith, J. (2000) A Strategic Approach to Undergraduate Key Skills Development: Salford Key Skills Project (Final Report). DfEE report, UK.  
[http://www.dfes.gov.uk/dfee/heqe/ks\\_salford.htm](http://www.dfes.gov.uk/dfee/heqe/ks_salford.htm)
- Taylor, C. (2003) Final Report: Science Skills Course. Internal Faculty of Science Document.
- University of Sydney (1997) Generic attributes of graduates of the University of Sydney. Generic Skills Statement, Policy Document, University of Sydney.  
<http://policy.rms.usyd.edu.au/000005o.pdf>
- University of Sydney (2000) Faculty of Engineering, Strategic Plan for Teaching and Learning, 2000-2004. <http://www.eng.usyd.edu.au/about/plan.html>
- University of Sydney (2002a) Employability Skills for the Future: Comments from the University of Sydney. <http://www.usyd.edu.au/su/ab/committees/USC/2002/USCJul02.pdf>
- University of Sydney (2002b) Faculty of Rural Management, Orange Campus. Plan for First Year Academic Orientation and Transition  
[http://www.itl.usyd.edu.au/FYE/initiatives/pdfs/FYE\\_Plan\\_Rural\\_Management.PDF](http://www.itl.usyd.edu.au/FYE/initiatives/pdfs/FYE_Plan_Rural_Management.PDF)
- University of Sydney (2003a) School of Biological Sciences: Intermediate Generic Skills.  
[http://bugs.bio.usyd.edu.au/StudRes/Generic\\_Skills/genskills\\_home.htm](http://bugs.bio.usyd.edu.au/StudRes/Generic_Skills/genskills_home.htm)
- University of Sydney (2003b) Institute for Teaching and Learning Generic Attributes Project.  
<http://www.itl.usyd.edu.au/itl/docs/projects/docs/generic.htm>

## **Chapter 4: Evaluation and web site development**

The development of the web site was driven by a series of student trials. Preliminary focus group and web trials were conducted in 2003 to first evaluate the overall scheme of the project and the material planned for the web site. Development of the actual web site began in January 2004 and was trialled by students in May 2004. Using student feedback, the site was re-developed and again trialled in August. Only minor changes were required from the August trial feedback and after these were made the site was ready for launch in semester two, 2004.

### **First Preliminary Trial: May 2003**

In May 2003 we carried out the first student trial of the project concepts. The objective of this preliminary trial was to evaluate the overall scheme of the project before designing the web site. No web materials were developed or tested in this trial; instead we used focus groups to evaluate some of the information materials, strategies and concepts of the skills project.

From the skills matrix we chose one group of skills to develop in detail for this trial: the Interpersonal Skills group (see Appendix in Chapter 5). The background and higher-order skills were defined in detail, we wrote examples of ‘typical tasks’ – activities which would help to develop a person’s interpersonal skills – and provided a basic method for students to keep track of their activities.

The aims of the trial were to:

- discuss with the student focus group the aims of the project and the method taken
- try out the record-keeping process by asking students to identify an appropriate activity relevant to the Interpersonal Skills descriptions and then to fill out the RoA and Log sheets for that activity
- solicit feedback on this process, focussing on students perceptions of the point of the exercise, the value of keeping records and reflecting on their experiences, the language and style of the material and the overall philosophy of the project
- discuss possible avenues for promoting the final products of the project to students and ways to disseminate information on the project to the diverse student body

The trial was designed as a focus-group discussion. The materials were not prepared as a web site at this stage, since we anticipated significant development and revision based on the students feedback. Instead, the participating students were given a package of printed material, listed below.

#### ***Information and materials given to students (see Appendix 4):***

- Introductory letter
- Outline of project
- Definitions: Interpersonal Skills
- Record of Activity template and examples
- Descriptions of the RoA and log templates
- Log template

#### ***Focus Groups***

Two focus groups were set up with a total of eight students from second, third and honours years, through a combination of personal approaches and advertising around the Schools of Physics and Biological Sciences. The sessions each ran for approximately two hours. The students were offered a voucher from the campus book store for their participation.

The focus groups were held on separate days. Between groups, small changes were made to the wording and layout of the materials given to the students based on the first group's feedback to avoid spending time discussing these minor problems a second time.

### ***Feedback***

The two focus groups offered very helpful feedback on this stage of the project. Overall they believed that the aims of the project were worthwhile and that, if done well, the project should be a valuable addition to the university learning environment for undergraduate students.

Several of the higher-year students mentioned that the trial had made them keenly aware of the sorts of issues they will face upon graduation, and expressed a wish that they could have been exposed to this project early in their studies. Some of them suggested, however, that the project would only become important to many students late in their degree — perhaps too late — and that first-year or second-year students might simply put off reflecting on their skill development in favour of other priorities. The students generally agreed, however, that given enough exposure they would be likely to at least try out a web site based on these ideas.

Both focus groups gave copious feedback on the wording, layout and style of the written materials, mainly concerning clarity and 'student-friendly' language. The groups then discussed ways to make the project relevant to their peers. Many remarked that it would be a challenge to get across to first-years the importance of starting the reflection and record-keeping process early. They emphasised the need to demonstrate clearly the project's value to students. Some of the main points of the discussion are summarised below:

- Emphasise that employers have noted a lack of skills in university graduates and then show ways to develop these skills
- Build the skill groups into unit of study information and evaluation so that students used the language and ideas regularly
- Ensure that the materials are student-centred, using relevant examples and language

The students also gave their opinions about how best to promote the project to students. The main ideas are summarised below:

- Use a variety of methods of communication — email, talks and handouts at orientation activities, workshop sessions ('skills nights'), unit of study web sites, course materials
- Focus communication at the beginning of each semester. Students are more likely to pay attention before assignments begin in earnest, and they are able to reflect on the previous semester's experiences
- Tie in with graduate recruitment programs, info sessions and employment web sites
- Produce a CD based on the web site materials to be given to all students during orientation week

In addition to the valuable feedback gained from students, each participant completed an example RoA and Log sheet based on their own experiences and agreed to allow these to serve as (anonymous) examples on the project web site if suitable.

### ***Summary***

This preliminary trial gave us confidence that students value the overall aims and proposed method of the project. Some of the trial participants expressed great enthusiasm and noted they would have liked to have used such a web site throughout their degree.

The greatest difficulty the students perceived was in selling the project to undergraduate students, first-years in particular. They felt it was the nature of students to focus on these kinds of issues later in the degree, but they also understood the importance of starting to reflect on

skill-development early. Faced with this challenge, the participants offered a number of possible strategies to encourage students to engage with the project.

## **Second Preliminary Trial: August 2003**

After the preliminary focus-group trial in May, we spent several months developing a framework for the project web site. The goal was to create a self-contained information site for students to learn about generic skills, find ways to keep track of their skill development and reflect on their experiences through building a portfolio. In August 2003 we ran a second trial, a pilot of the web site design, to test the suitability of our framework with students.

We decided to develop the framework in detail for one of the skill groups in the matrix: the Interpersonal Skills, as these had already been defined for the first trial described above. The pages for the Interpersonal Skills were designed and written, as were the pages leading students through the stages of developing their portfolio. These are described below.

This trial was designed as a one-on-one evaluation with participating students reading the material and trying the activities while discussing the ideas with one of the project team. The aim was to elicit the students' thoughts on various aspects of the web site as they used it, such as:

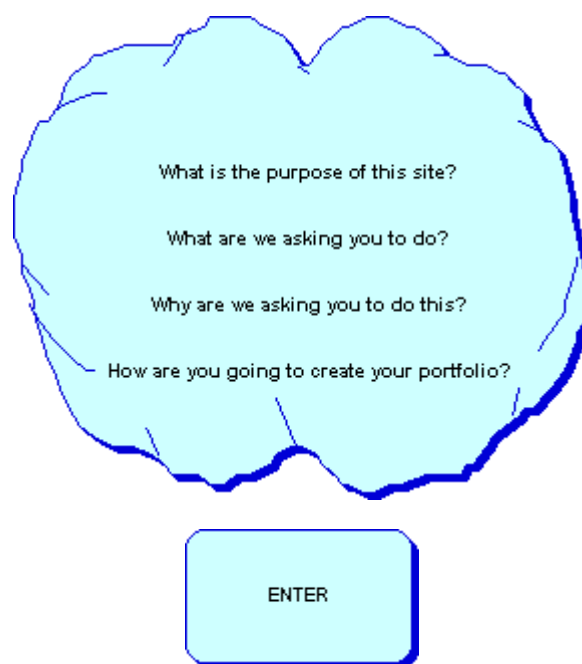
- Ease of navigation
- Logical structure of site layout
- Clarity of instructions and information

We had hoped to run the trial with around six students, however several students withdrew from the trial, leaving just two participants—one graduate student and one first-year.

After a brief discussion of the aims of the trial, the students were each seated at a computer and given around 15 minutes to navigate the site and read through the materials. A project team member then sat with the student as they discussed their experiences with the site. The trial lasted approximately one hour with each student.

## ATTRIBUTES OF A SCIENCE GRADUATE

Being a science graduate is about more than just knowing science. You are developing a range of skills that will support you in your future. During your studies in the Faculty of Science, you are developing a range of [discipline-specific](#) scientific skills. In addition, you already possess a set of [foundation skills](#) like basic literacy and numeracy (and help is available if you need to improve these skills). This site will help you identify and keep track of the generic skills you develop during your degree — skills that will help you to get the job you want when you graduate. Please explore this site!



**Figure 4.1: Pilot web site for preliminary evaluation**

### ***Web site and Materials***

The pilot web site (which served as design templates for the actual web site) is shown in Figure 4.1. The front page contained information about the project based around a series of question-and-answer sections: ‘What is the purpose of this site?’, ‘What are we asking you to do?’ and so on.

Entering the site beyond the front page led to the main skills pages, showing the ‘University of Sydney Science Graduate’ as a combination of the attributes of ‘Good World Citizen’, ‘Lifelong Learner’ and ‘Professional Scientist’. Each of these attributes was a combination of the different skills groups as shown on the ‘USyd Graduate’ storyboard. Clicking on the attributes provided a short information panel, and clicking on the name of a skill group navigated to the next level of the site. As noted above, most of these pages were left blank; only the Interpersonal Skills link led to further information.

The Interpersonal Skills pages show the skill group hierarchy, with the group comprised of the various higher-order skills, themselves comprised of combinations of background skills. Clicking on any of these linked to a definition of that skill. In addition the page contained links to a series of three ‘Examples’: illustrative descriptions of anonymous students’ activities and the various interpersonal skills these experiences help to develop.

From any of the above pages, a user was able to jump to the portfolio page, shown in the 'Portfolio' storyboard in the Appendix. Developing a portfolio of experiences and skill development was shown as a five-step process:

- Listing experiences prior to university
- Listing current experiences
- Creating records of experiences using the Record of Activity template
- Keeping a log of activities using the Log template
- Building a portfolio from the records, logs and collected evidence

Examples were provided of possible experiences and a Record of Activity. A sample log and portfolio were not provided for this trial, though a link was provided to a list of possible materials that might be included in a portfolio as evidence of skill development.

### ***Feedback***

Much of the feedback provided by the two students revolved around fairly minor changes to layout, wording and structure. On the whole, the students commented that the style and structure of the site were suitable, as was the general philosophy of the project — the site 'made sense' to them and they expected others would find it useful as well. They recommended that the design of the remainder of the skill pages continue in the same vein as the pilot site.

Both students again suggested that many students might not engage with the project easily, particularly in the earlier years of study. They both agreed that students would be attracted by a strong emphasis on employment and job skills.

### ***Other outcomes of the trial***

Both students in this trial completed a paper-based example of a Record of Activity and gave permission for this to be used as anonymous samples in the project if suitable. They were then invited to contribute more material in the form of lists of skill-developing activities from their own experiences, both prior to and during their university studies. One student agreed and also provided an example portfolio based on these activities.

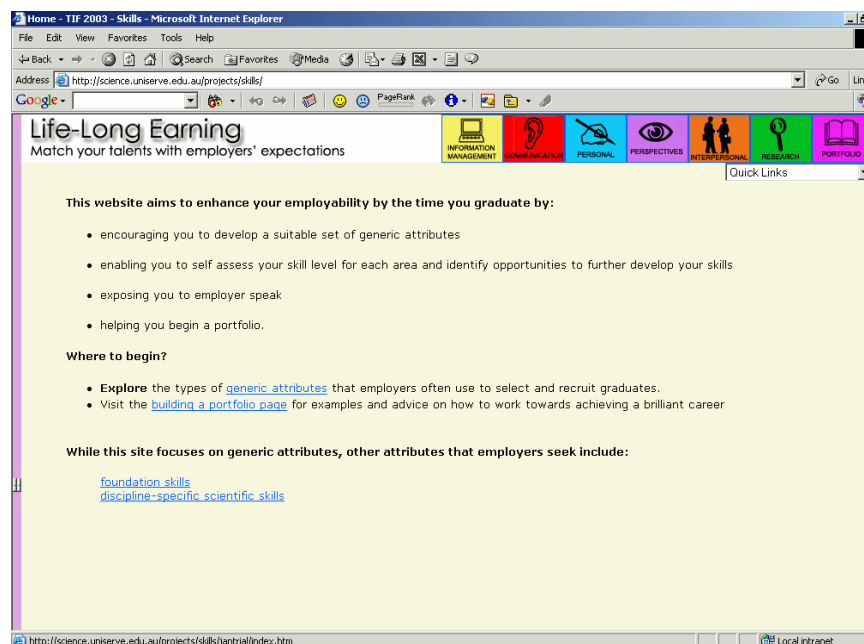
### ***Summary of the second preliminary trial***

Outcomes from this limited pilot suggested that the project was on the right track and that students understood the aims of the site. The two participants found no major difficulties with navigating through the pages or comprehending the information contained, though they gave considerable feedback on matters of language and style.

Despite only trialling the pilot web site with two students, we decided that the feedback received was sufficient for us to progress to a larger-scale trial in 2004.

## **Web site development**

Design of the actual web site commenced in January 2004. The creation of the web pages was outsourced to a Design PhD student who worked, with direction from the project group, on the site. During this period, material written in 2003 was revised and expanded by the group for inclusion in the site. This site was completed and ready for students to trial four months later in May 2004.



**Figure 4.2: The generic skills web site trialed by students in May 2004**

## May 2004 Web site Trial

In May 2004, second and third year undergraduate science students were invited to participate in a web site trial (of the site developed in January 2004). Fliers were posted around campus offering a \$20 Coop book voucher for web site trial participants who fitted the above criteria (see Appendix 4 for flier). Several second year science lecturers were also given overheads of the flier to display in their lectures.

In this trial we aimed to test the navigation, relevance and clarity of the developed web site. Students were asked to view and use the site to complete exercises and a questionnaire (see Appendix 4 for questionnaire) before attending one of the three, one-hour discussion groups held over three days.

A total of 17 students participated in the May trial and summaries of the questionnaire responses to various sections of the web site are given below.

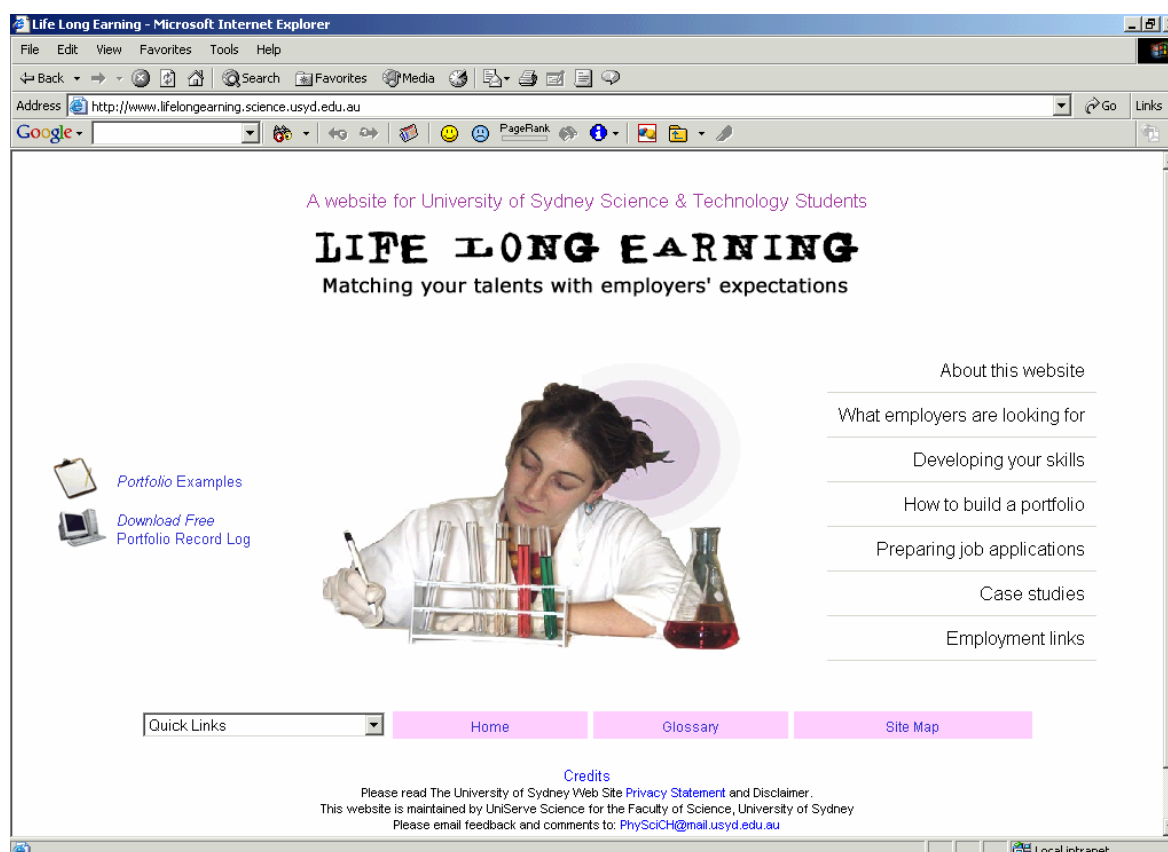
	<b>Summary of questionnaire responses</b>
<p><b>Home Page</b></p> <p><i>How would you use this site?</i></p>	<p>All participants gave accurate assessments of how to use this web site and generally believed this was clear from the introduction. However they suggested not to use terms like 'employer speak'. Participants suggested using a more eye catching design with pictures to entice viewers further.</p>
<p><b>Generic Attributes Page</b></p> <p><i>What are generic attributes, and what are some of the generic attributes of a science graduate?</i></p>	<p>Only a couple of participants correctly defined generic attributes as general traits, or general skills. Most left the definition blank; however, nearly all participants listed some generic attributes from the web page. Nearly all participants believed the information was easy to find, made sense and was useful but also believed the definitions were vague and abstract and the page needed to relate more to employability.</p>
<p><b>Skills Pages –(Communication)</b></p> <p><i>What are the background communication skills?</i></p>	<p>Only 5 participants correctly identified the background communication skills. The rest answered oral, verbal, non-verbal. This extra level of skill division seemed to be lost and created confusion. Nearly all participants believed the skill page(s) made sense and the information was useful but the majority believed the current delivery, through definitions, was not very useful and the language quite 'wordy'.</p>
<p><b>Portfolio –Building a Portfolio page</b></p> <p><i>What is the first step in building a portfolio?</i></p>	<p>Generally most participants found the information easy to find however a few students could not find this page at all. Navigation seemed to be an issue in the portfolio section. Participants found the information contained here one of the more useful parts of the web site and suggested that more specific examples would improve it.</p>
<p><b>Portfolio – Reflection Page</b></p> <p><i>What are some of the ways you can reflect on your skills?</i></p>	<p>Participants correctly identified the ways in which to reflect on their skills although many had trouble getting to this page. Most participants believed the information made sense and was useful but suggested including examples of how to gain skills in areas of identified weakness.</p>
<p><b>Portfolio –Putting in together</b></p> <p><i>List some things that Jane has put into her portfolio?</i></p>	<p>Participants had trouble finding the example CV and portfolio. This is further demonstrated by a significant proportion of participant answers mistaking the first list of activities you can put in your portfolio for the example portfolio. After searching for the example CV it is most likely only then, did they come across the example portfolio. Participants on the whole found the examples extremely useful and wanted more than one.</p>

In the discussion sessions the following suggestions and comments were often repeated by students in the three sessions:

- icon buttons in the navigation bar were confusing
- learning about ways to develop your skills is more useful than definitions of skills
- site should focus on building a portfolio which is useful to students rather than pages of text on generic skill.
- too many colours which also clashed, site would be better if it had a professional feel like USyd homepage and contain a few graphics
- use teasers – such as ‘click here for portfolio’ on home page and less text to draw people in
- useful to have definitions in a glossary as a supplementary guide instead of putting them upfront
- site should have more examples of CVs, portfolios, interactive case studies as these were the best part of the site
- should have site map
- should have employment links

The site was completely overhauled in response to the feedback we received. The web site structure was flattened to improve navigation. Pictures were added and a more ‘edgy’ design was used to appeal to students. The focus of the web site changed from an academic discussion on defining generic skills to ways in which students can use and develop generic skills to become more employable.

### *New improved site*



**Figure 4.3: New and improved web site developed in response to the May 2004 Trial.**

Participants of the May 2004 Trial were offered another \$20 Coop book voucher to provide feedback on the new web site by answering emailed questions about the new site’s navigation, clarity and relevance (see Appendix 4 for questions). Ten students responded to these

questions. The feedback on the new web site was overwhelmingly positive. Some of the most common comments were:

*The site was excellent with enough clear icons to toggle between pages. The site map was very useful for the impatient surfer. Quick links drop-down menu was excellent and convenient.*

*I strongly believe that this site is a lot more relevant than the last one. With the last one, I had trouble believing the information presented—it lacked real-world situations. However, I believe you have addressed this aspect well in the new web site.*

*[The two best features of this site are] the clear links to the PDF files of the various resumes. Great for the novice. The feel good image of this enhanced version.*

With this positive evaluation, our web site design phase was deemed complete and the site was ready to be launched for formal evaluation in a subset of second and third year units.

## Course launch and evaluation

At the beginning of semester two, 2004 coordinators and lecturers were approached to help launch the web site to students in the following selected units:

<b>Environmental Science</b>	<b>No. of enrolled students</b>
ENVI 1002 Geomorphic Environmental and Change	50
ENVI 2002 Physical Environmental Processes.	19
ENVI 3002 Environmental Assessment	19
ENVI 3004 Environmental Impact Assessment	7
<b>Marine Science</b>	
MARS 2002 Introductory Marine Science B	77
MARS 2004 Marine Techniques	20
MARS 3103 GIS Simulation Modelling	34
MARS 3104 Coastal Zone Management	40
MARS 3105 Coastal Oceanography & Sediment Dynamics	18
MARS 3106 Physical Marine Habitat	22
MARS 3102 Marine Ecology	5
<b>Psychology semester 2 units of study</b>	
PSYC 2113 Cognitive Processes and Social Psychology	552
PSYC 2114 Personality and Individual Differences	542
PSYC 3201 Statistics and Psychometrics	227
PSYC 3203 Abnormal Psychology	332
PSYC 3204 Behavioural Neuroscience	256
PSYC 3211 Psychological Assessment & Organisational	
PSYC 3214 Communication and Counselling	288
PSYC 3215 Cognitive Neuroscience and Neuropsychology	164
<b>Nutrition</b>	
NUTR 2902 Introductory Nutritional Science	42
NUTR 3902 Nutrition in Populations	

A survey (see Appendix 4) was forwarded to students in the above courses by email through course coordinators over weeks 6-11. There were 36 emailed responses with 9 out of 36 students indicating they had looked at the site (most only browsing to see what was in it, but also indicating that they found it useful). In week 12 a printed version of the above survey was given out to students in a PSYCH 2114 lecture and a total of 116 completed surveys were returned. Only 22 students out of the 116 surveyed indicated they had looked at the site. Of the 94 who had not yet looked at the site, most wrote that the reason for not looking was that they had never heard about the site. Two further stages of evaluation are planned to assess to what extent the project has successfully fulfilled its overall aims. The evaluation planned, will involve focus groups and postal surveys before the web site's final release to all undergraduates enrolled science and technology units of study next year.

## **Summary**

The feedback from students in the preliminary trials indicated that the overall objectives of the project were of value to students. Students did not respond well to the initial web site design created to deliver these objectives which was highly academic and teacher-centred. The student feedback was used to re-design the site and generic skills was tied to employability, which induced a stronger interest from students in taking an active role in developing their own generic skills. The student feedback on the new design was overwhelmingly positive, and respondents reiterated the comments from the preliminary trials on the value of such a site to undergraduate students.

## Chapter 5: Outputs

It was important for the team at the outset of this project to identify the expected outputs and to extrapolate the outcomes for the Faculty of Science, the College of Sciences and Technology and The University of Sydney.

The discernable outputs include:

- Skills matrix developed at the beginning (see Appendix 5)
- Skills definitions – that were turned into a glossary (see Appendix 5)
- Literature survey (treated in a separate chapter)
- Web site “Life Long Earning” for students
- Recommendations as to how to market this
- Dissemination of project to a wider audience

The skills matrix has been detailed in Chapter 2, the definitions that underpin the web site are included in the Appendix to this chapter and the literature survey is in Chapter 3.

**The web site** - <http://www.lifelongearning.science.usyd.edu.au> deserves a short description. The home page is in the Appendix to this chapter. On the home page students are provided with several options to explore:

***About this web site*** – this page encourages the students to investigate what is available, telling them that someday they will want a job and this site will help them to prepare for looking and applying for a job.

***What employers are looking for*** – this section gives them some insight into what employers are seeking and it reinforces the comments from us that generic skills are very important. Includes interviews with employers of graduates in the science, engineering and technology areas.

***Developing your skills*** – this section helps define the skills in the context of what employers are looking for. It leads students to in depth definitions of skills (if they need to go there).

***How to build a portfolio*** – this section shares ideas about portfolios, whether they are e-portfolios or the proverbial “shoe box” approach. It emphasise the need to collect records, reflect on whether you have developed all the skills required and how to update the portfolio over time. Contains example portfolios from students.

***Preparing job applications*** – this section demonstrates how to match portfolios to selection criteria and some example CVs.

***Case studies*** – this section presents examples of recent graduates and “their story”; uses question and answer presentations.

***Employment links*** – this section has a list of links to some employment opportunities (e.g. Jobs NSW at [jobs.nsw.gov.au](http://jobs.nsw.gov.au)).

In addition there is a glossary and site map accessible from each page of the site as well as a link to the home page.

## Marketing the site in the future

The marketing issue requires the involvement of more than the project team and needs to consider a number of avenues for disseminating the project web site. A logo has been developed for use in e-dissemination.



The logo is being added to unit of study WebCT sites by the College e-learning support team and from 2005 the addition of this logo will be an automatic part of the 'Application to Activate' QA process.

The following is a list, although not exhaustive, of avenues that should be considered for dissemination purposes:

- Include logo on MyUni page for all science students
- Produce a bookmark and poster of logo and web address
- Check with Science Marketing team to find out what is given out at enrolments, and include a bookmark with the logo and web address
- Add bookmark to Transition Workshop show bag
- Put up posters in strategic places
- Give the science societies (e.g. SciSoc, BiolSoc, GeoSoc etc.) with bookmarks to hand out at early society meetings
- Prepare coloured overheads of the poster information to give to lecturers to use at the beginning of semester 2 (noting that there is plenty of marketing in place for semester 1)

## Dissemination of the project

In addition to providing marketing materials the team has also taken opportunities to present seminars and have discussions with others about the site.

Peat, M., Fernandez, A., Stewart, C. & Taylor, C. (2003) Faculty of science Project: enhancing the employability of Science graduates by increasing the awareness of staff and students to the needs of the employers. Seminar to Science Librarians, August, Fisher Library.

Taylor, C., Peat, M., Stewart, C. & Fernandez, A. (2003) Enhancing the employability of Science graduates: a Faculty of Science Initiative. Poster at Graduates for the World: VC's teaching and learning showcase of scholarly reflection and Inquiry 5-6 November 2003, University of Sydney

Peat, M., Stewart, C., Taylor, C. & Merrett, D. (2004) Life Long Earning - enhancing the employability of graduates: increasing the awareness of staff and students to the needs of the employers. Poster at College of Sciences and Technology T&L Showcase, 3 November 2004, University of Sydney University

Taylor, C., Peat, M., & Stewart, C. (2004) Life Long Earning – the project. Seminar given by Charlotte Taylor in the Graduate Attributes Theme at the College of Sciences and Technology T&L Showcase, 3 November 2004, The University of Sydney

## **Chapter 6: Reflections and unfinished business**

### **Reflections**

When we first commenced this project, our understanding of generic skills and attributes had been formed from literature reviews and discussions with other educational researchers. We built a picture of generic skills – literally a map, as shown in Chapter 2 – that comprised a hierarchy with graduate attributes like citizenship, scholarship and life-long learner at the top, and skills groups such as communication skills and interpersonal skills below. This organisation led our initial planning for the project and we created a web site based on the skills map, focusing on educating students about the different skills and attributes they needed to develop throughout their studies and asking them to keep track of their development of these skills.

Through feedback on this draft stage of the online material we quickly realised we needed to dramatically adjust our perspective. The initial creation of a structured timeline for development and evaluation of the project allowed a number of staged opportunities for reflection. These occurred at a number of points when students were asked to provide feedback on the early stages of the development of skills materials and descriptions. The early web site reflected our conceptions as educators of generic skills, with skills and attributes at the core and information about careers and employment at the periphery. Our focus groups reminded us that we needed to approach generic skills from a student's perspective. They are less interested in learning about generic skills from an academic or theoretical point of view, more interested in information that will directly help them find a job or move into a career when they leave university.

Our reactions to this shift in viewpoint were varied. Some of us were initially reluctant to shift the focus away from the generic skills; might this perhaps diminish the academic quality of the information? Would a focus on jobs dilute other aspects of the generic skills map, such as becoming a good world citizen? These questions, while important, still reflected a teacher-centred viewpoint.

We recognised that the only way the web site would be attractive to students was if it presented information that they considered valuable. The generic skills matrix became an underlying layer of the material and its importance was emphasised through the employment and career focus. For example, interviews with employers clearly show that they look beyond discipline training in graduates; they desire communicators, leaders, team-players and initiative-takers.

As a result of exhaustive discussions at each stage, a key factor in the overall success of the final web site as a user-friendly student support 'mechanism' has been the team's willingness to document these reflective processes. Feedback, from presentations about the project and our reflections, has indicated that such soul searching is rarely documented, perhaps being viewed by some as a failing in a project. The reflection involved us in admitting mistakes or misconceptions, and in making quite drastic changes to viewpoints, plans and philosophies with regard to designing such a student-friendly web site.

The present version of the Life Long Learning web site reflects the shift from teacher-centred to student-centred learning. The positive feedback we have received from students and educators suggests the shift was the right one.

## **Unfinished Business**

Some areas of the skills development program were originally included in the planning phase but were either deemed irrelevant to the immediate process of developing the web site, or were seen as being separate projects to be investigated after the web site was in use. Such areas are still considered integral to the awareness program but generally require input from other sources, in particular academic staff developing curriculum.

### *Identification of skills areas in the curriculum*

This concept has been addressed at a preliminary level as part of the university's Graduate Attribute Working Party. A survey of all units of study in the university has been conducted in which academic coordinators were asked to indicate which of the University Generic attributes was being addressed during teaching and assessment in the unit. These data are now being used to link units covering similar areas in the skills spectrum, and also to identify gaps in the curriculum for a degree program where certain skills may not be addressed.

It was envisaged that this project could link in the future with the University project to provide examples to illustrate the linkage between the skill and curriculum activities. These examples could be used to assist staff and students to recognise, acknowledge and use the opportunities. Guidelines for helping staff to create or identify skill development opportunities for students within curricula could then be produced.

### *Recognising and measuring competence in skills development*

The development of these attributes and skills cannot occur in isolation and is seen to emanate from within any of the learning experiences the students encounter in their degree programs. Staged levels of competence that can be recognised and achieved during a degree program need to be defined for each attribute and skill. While using the web site, and reflecting on their progress, students will need to monitor their own competence, in attaining the skills, and developing the attributes. It is expected that levels of development for the attributes could fit a three-level scale, such as *unsatisfactory/satisfactory/outstanding*, while levels of competence in the skills could be stated as *unable to perform task x/able to perform task x/excels at task x*.

This area proves more difficult to address, since more detailed descriptors of attainment of different skills within the curriculum would be required.

## **End note**

As the web site is currently being used by students who are giving us very useful feedback. While informing others in the College of our developments, we are being asked how the site might be extended/modified/changed to also include the needs of students in the Faculties of Agriculture, Food & Natural Resources, Veterinary Science and Engineering. This is a pleasing outcome for the project team and for the Pro-Vice-Chancellor of the College of Sciences and Technology who has been so supportive of the development and whose idea it was in the first place to see if we could help science students see how best to develop life long learning skills and become life long earners!